TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247

TEST REPORT

For

Badge Messenger, INC

11 Industrial Blvd, Sauk Rapids, Minnesota 56379 USA

FCC ID:2AUET-202018SRM

Report Type:	Product Name:
Original Report	Messenger

Report Number: RDG190813006-00B

Report Date: 2020-02-11

Reviewed By: Ivan Cao
Assistant 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:		Messenger
EUT Model:		SRM
Operation Frequency:		902.3MHz~914.9MHz
Rated Input Voltage:		DC 3.7V from battery or DC 5V from USB port
Adapter Information	**Model:**	YLJXA-T050020
	Input:	100-240Vac 50/60Hz 0.5A
	Output:	5.0Vdc,200 mA
Serial Number:		RDG190812006-RF-S1
EUT Received Date:		2019/8/13
EUT Received Status:		Good

Note: the device contains a certified tablet, FCC ID: 2AUET-191813SRM

Objective

This report is prepared on behalf of ***Badge Messenger, INC*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

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, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Part of system submittal with FCC ID: 2AUET-202018SRX.

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.

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

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.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.

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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This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk “★”.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The device was a hopping transmitter, employs 64 hopping channels:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	17	905.5	33	908.7	49	911.9
2	902.5	18	905.7	34	908.9	50	912.1
3	902.7	19	905.9	35	909.1	51	912.3
4	902.9	20	906.1	36	909.3	52	912.5
5	903.1	21	906.3	37	909.5	53	912.7
6	903.3	22	906.5	38	909.7	54	912.9
7	903.5	23	906.7	39	909.9	55	913.1
8	903.7	24	906.9	40	910.1	56	913.3
9	903.9	25	907.1	41	910.3	57	913.5
10	904.1	26	907.3	42	910.5	58	913.7
11	904.3	27	907.5	43	910.7	59	913.9
12	904.5	28	907.7	44	910.9	60	914.1
13	904.7	29	907.9	45	911.1	61	914.3
14	904.9	30	908.1	46	911.3	62	914.5
15	905.1	31	908.3	47	911.5	63	914.7
16	905.3	32	908.5	48	911.7	64	914.9

Frequency 902.3 MHz, 908.5 MHz and 914.9 MHz were selected to test.

EUT Exercise Software

No software was used in test, the test mode was changed by keys.

Equipment Modifications

No modification was made to the EUT.

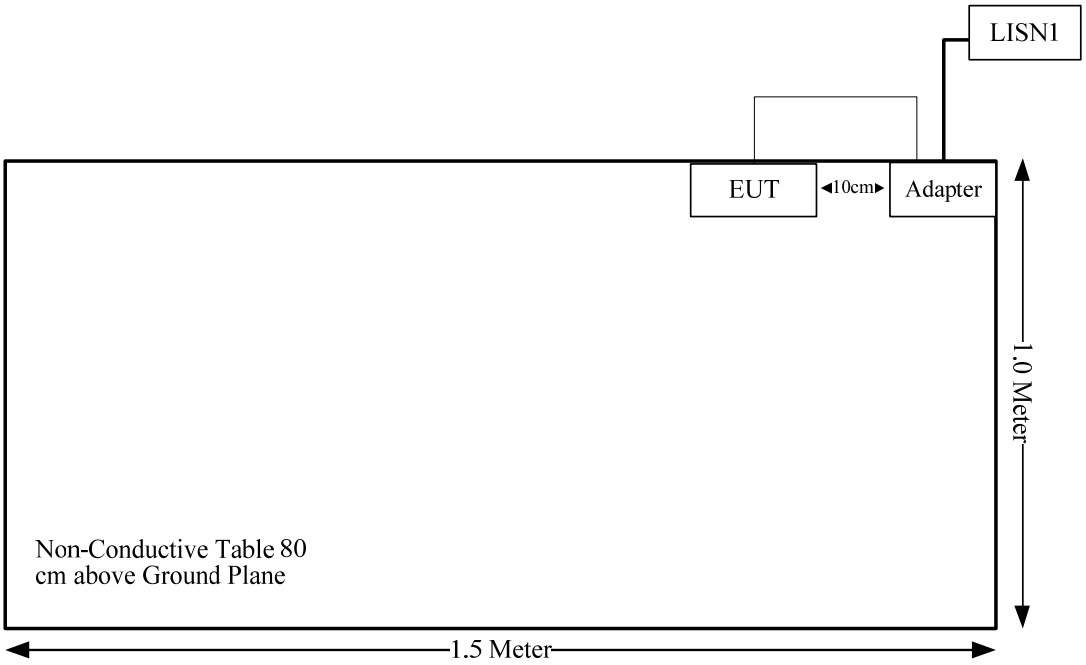
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Huawei	Adapter	HW-050200C3W	H333L5F4M06947

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
USB Cable	No	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
FCC §15.203	Antenna Requirement	Compliance
FCC §15.207 (a);	AC Line Conducted Emissions	Compliance
FCC §15.205, §15.209, §15.247(d);	Spurious Emissions	Compliance
FCC §15.247 (a)(1)	Emission Bandwidth	Compliance
FCC §15.247(a)(1)	Channel Separation Test	Compliance
FCC§15.247(f)	Time of Occupancy (Dwell Time)	Compliance
FCC§15.247(a)(1)(i)	Quantity of hopping channel Test	Compliance
FCC§15.247(b)(2)	Peak Output Power Measurement	Compliance
FCC§15.247(d)	Band Edges	Compliance
FCC§15.247(f)	PSD	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.

Measurement Result

Compliance, please refer to the SAR report: RDG190813006-20.

FCC §15.203- 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.

Antenna Connector Construction

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

Antenna Type	input impedance (Ohm)	Antenna Gain
PIFA	50	3.0 dBi

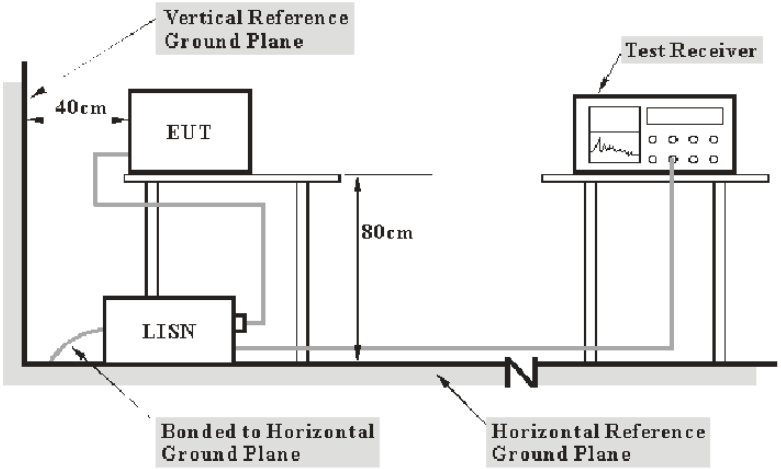
Result: Compliance.

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 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
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
R&S	Two-line V-network	ENV 216	101614	2019-09-12	2020-09-12
R&S	EMI Test Receiver	ESCI	101121	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

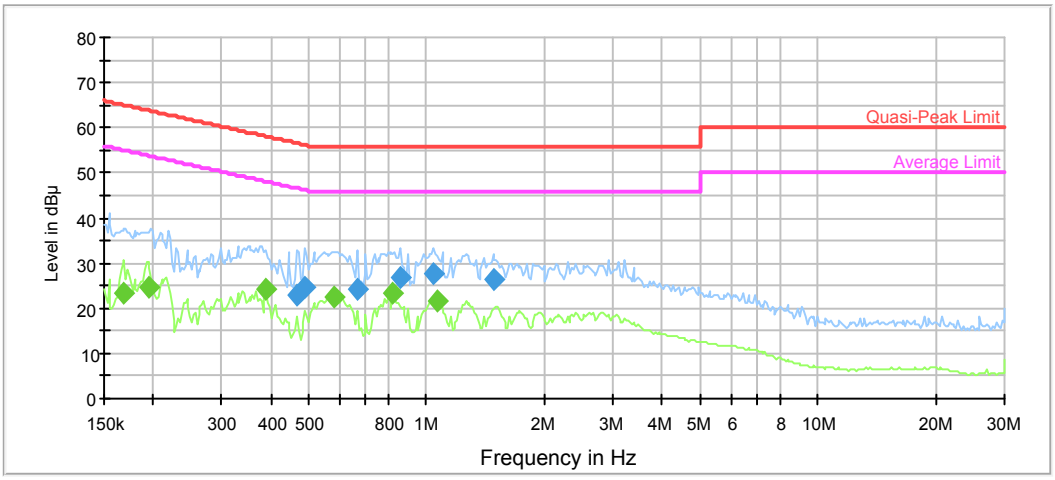
Environmental Conditions

Temperature:	28.2°C
Relative Humidity:	65%
ATM Pressure:	100.3 kPa
Test by:	Sky Lu
Test Date:	2019-09-16

Test Result: Compliance

Test Mode: *Transmitting*

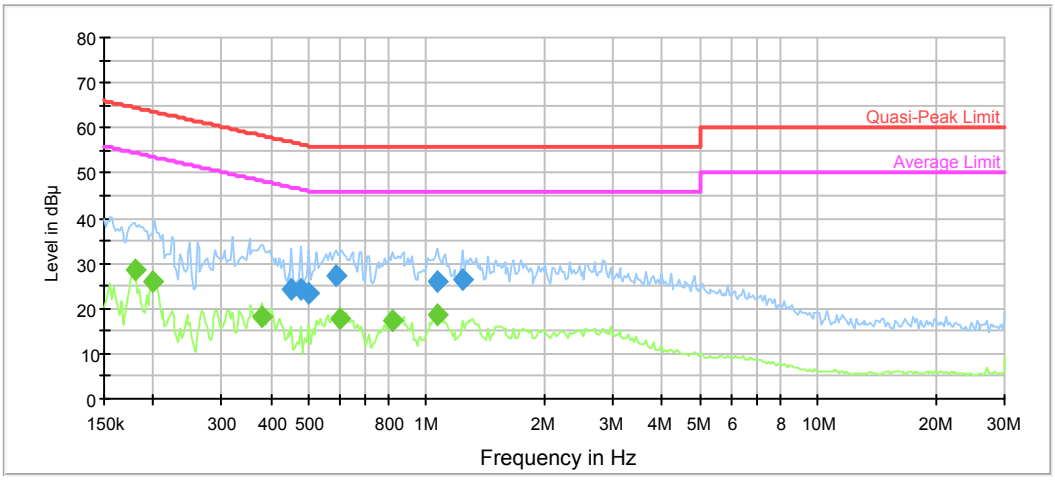
AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.466367	22.9	9.000	L1	9.9	33.7	56.6
0.490157	24.7	9.000	L1	9.9	31.5	56.2
0.667264	24.1	9.000	L1	9.8	31.9	56.0
0.855721	26.9	9.000	L1	9.8	29.1	56.0
1.044142	27.8	9.000	L1	9.8	28.2	56.0
1.479134	26.4	9.000	L1	9.8	29.6	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.169024	23.2	9.000	L1	10.9	31.8	55.0
0.194289	24.7	9.000	L1	10.7	29.2	53.9
0.389891	24.0	9.000	L1	10.0	24.1	48.1
0.580495	22.5	9.000	L1	9.8	23.5	46.0
0.822331	23.3	9.000	L1	9.8	22.7	46.0
1.065129	21.7	9.000	L1	9.8	24.3	46.0

AC120V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.452652	24.3	9.000	N	9.9	32.5	56.8
0.475741	24.1	9.000	N	9.9	32.3	56.4
0.500009	23.5	9.000	N	9.9	32.5	56.0
0.586300	27.2	9.000	N	9.8	28.8	56.0
1.065129	25.8	9.000	N	9.8	30.2	56.0
1.236582	26.4	9.000	N	9.8	29.6	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.179422	28.7	9.000	N	10.8	25.8	54.5
0.200176	26.1	9.000	N	10.6	27.5	53.6
0.378425	18.1	9.000	N	10.0	30.2	48.3
0.604065	17.9	9.000	N	9.8	28.1	46.0
0.822331	17.5	9.000	N	9.8	28.5	46.0
1.065129	18.6	9.000	N	9.8	27.4	46.0

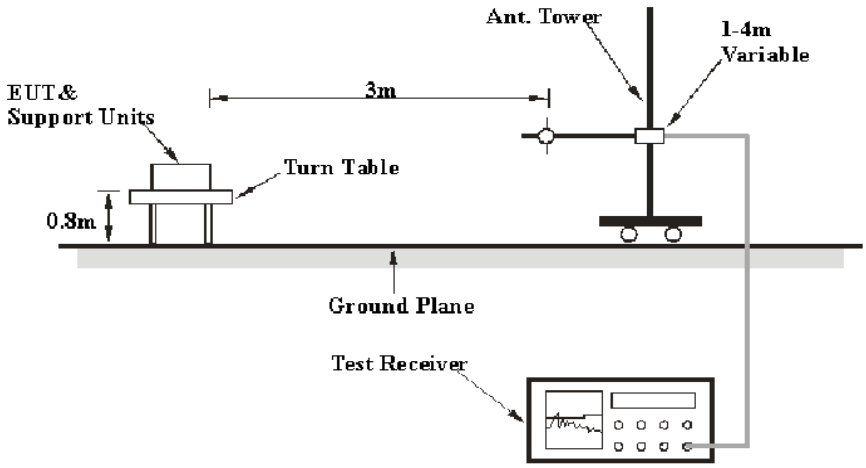
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

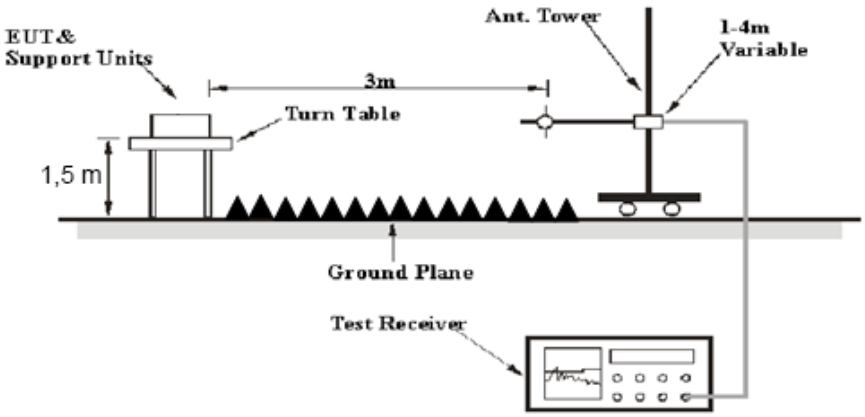
FCC §15.247 (d); §15.209; §15.205.

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 9.5 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.

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2019-09-12	2020-09-12
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	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05
E-Microwave	Band-stop Filters	OBSF-900-930-S	OE01602312	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).

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 Data

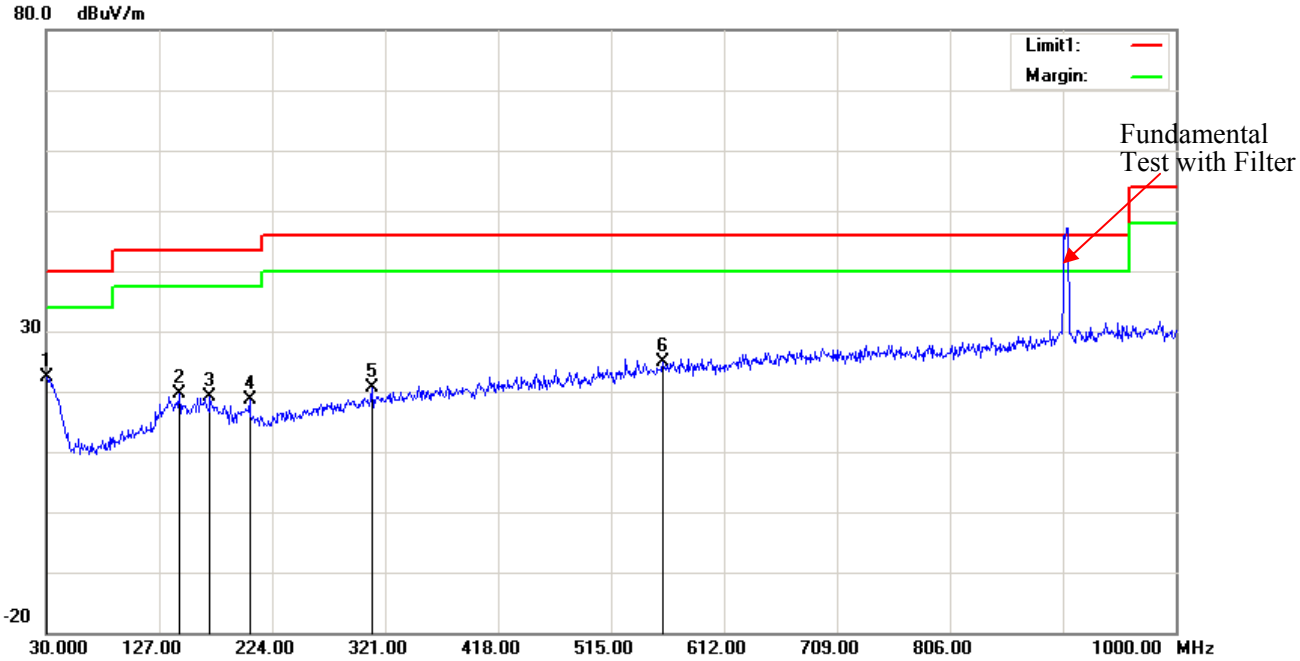
Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	27.5 °C	26.8 °C
Relative Humidity:	54%	51%
ATM Pressure:	100.8 kPa	100.7kPa
Tester:	Jackson Zhang	Lucy Lu
Test Date:	2019-08-30	2019-08-21

Test Mode: Transmitting

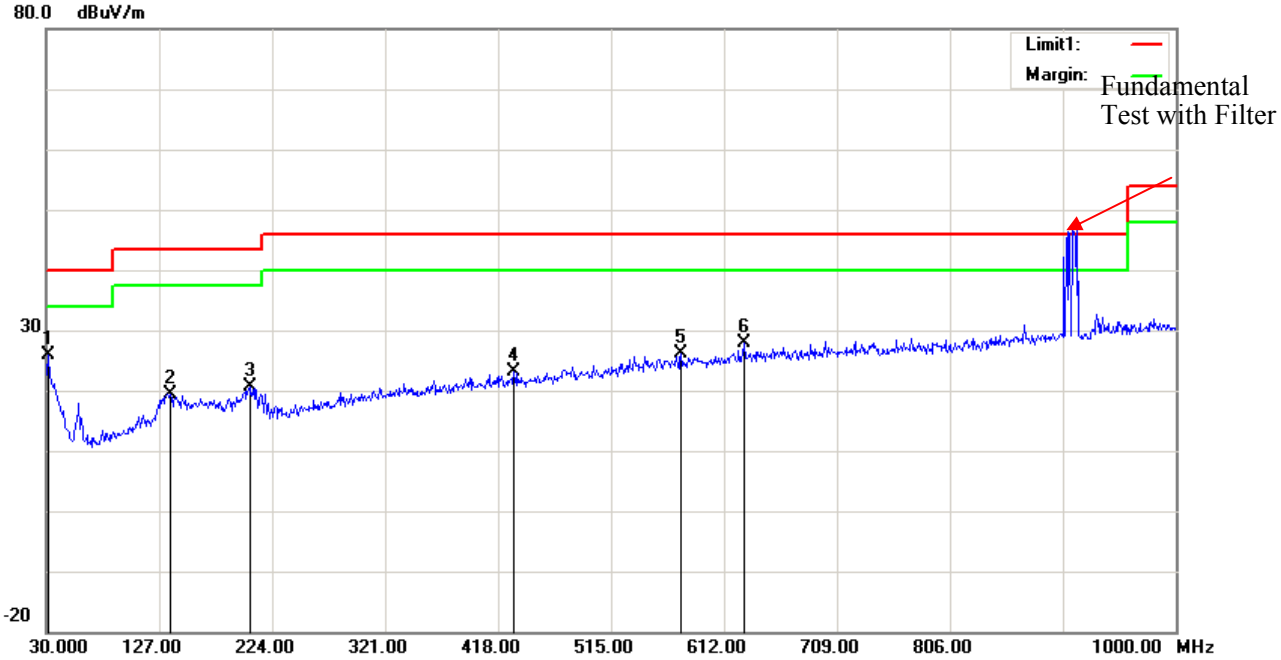
1)30MHz-1GHz(High channel was the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.9700	27.35	peak	-4.87	22.48	40.00	17.52
144.4600	28.57	peak	-9.04	19.53	43.50	23.97
170.6500	28.74	peak	-9.53	19.21	43.50	24.29
204.6000	29.11	peak	-10.56	18.55	43.50	24.95
309.3600	27.82	peak	-7.28	20.54	46.00	25.46
559.6200	26.47	peak	-1.62	24.85	46.00	21.15

Vertical:

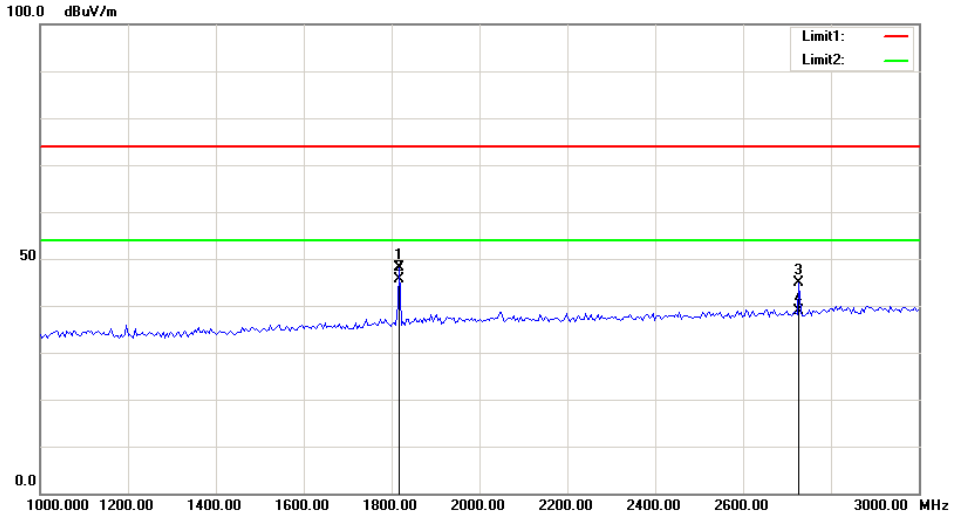


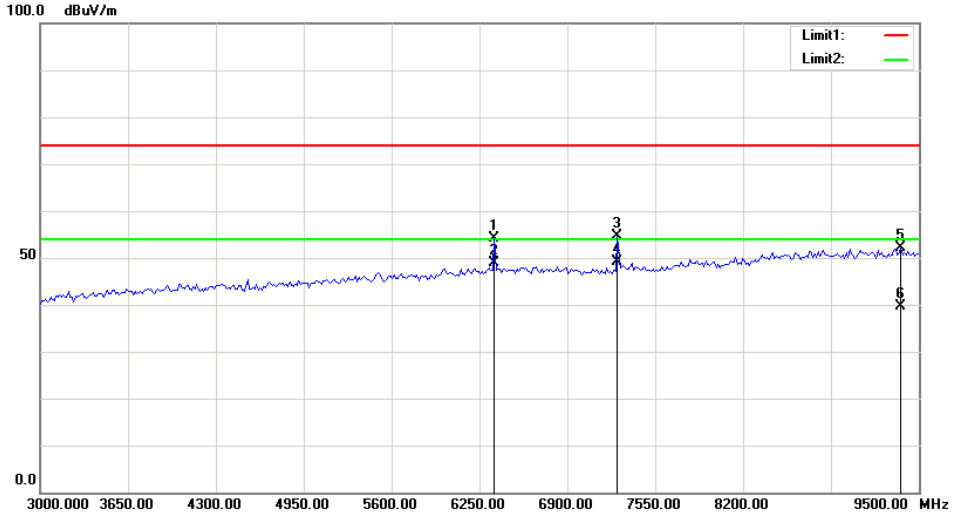
Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
31.9400	31.44	peak	-5.47	25.97	40.00	14.03
136.7000	28.65	peak	-9.23	19.42	43.50	24.08
204.6000	31.08	peak	-10.56	20.52	43.50	22.98
431.5800	27.80	peak	-4.79	23.01	46.00	22.99
575.1400	27.65	peak	-1.59	26.06	46.00	19.94
629.4600	28.76	peak	-0.92	27.84	46.00	18.16

2) Bandedge, and above 1GHz:

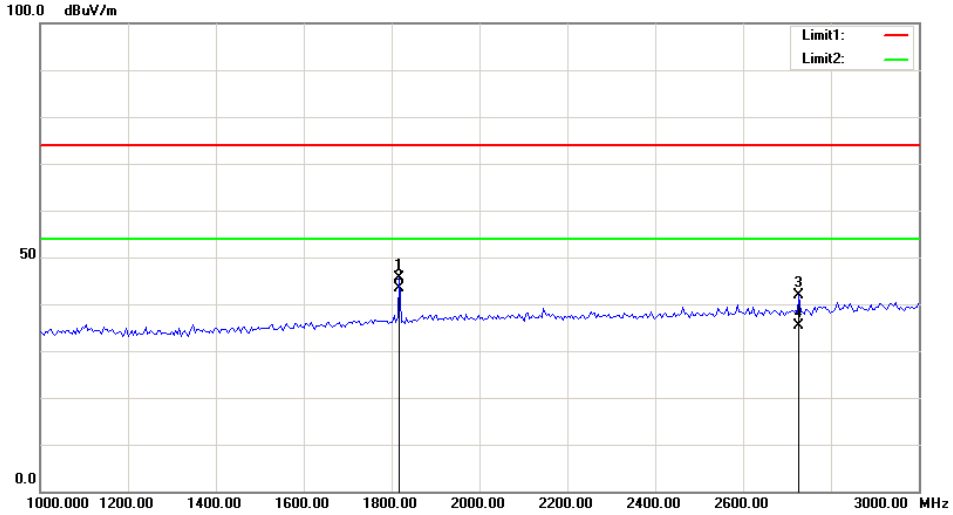
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 902.3MHz									
902.30	66.40	QP	H	22.71	5.27	0.00	94.38	N/A	N/A
902.30	78.10	QP	V	22.71	5.27	0.00	106.08	N/A	N/A
902.00	17.63	QP	V	22.71	5.27	0.00	45.61	46.00	0.39
1804.60	55.34	PK	H	26.48	1.66	35.90	47.58	74.00	26.42
1804.60	53.10	AV	H	26.48	1.66	35.90	45.34	54.00	8.66
2706.90	50.23	PK	H	29.04	1.88	36.47	44.68	74.00	29.32
2706.90	44.62	AV	H	29.04	1.88	36.47	39.07	54.00	14.93
3609.20	45.85	PK	H	31.54	2.41	37.11	42.69	74.00	31.31
3609.20	33.41	AV	H	31.54	2.41	37.11	30.25	54.00	23.75
6316.10	52.24	PK	H	34.24	4.41	37.17	53.72	74.00	20.28
6316.10	46.98	AV	H	34.24	4.41	37.17	48.46	54.00	5.54
7218.40	50.92	PK	H	35.77	4.80	37.25	54.24	74.00	19.76
7218.40	44.65	AV	H	35.77	4.80	37.25	47.97	54.00	6.03
Middle Channel: 908.5MHz									
908.50	78.08	QP	H	22.75	5.33	0.00	106.16	N/A	N/A
908.50	74.30	QP	V	22.75	5.33	0.00	102.38	N/A	N/A
1817.00	55.67	PK	H	26.53	1.66	35.92	47.94	74.00	26.06
1817.00	53.45	AV	H	26.53	1.66	35.92	45.72	54.00	8.28
2725.50	50.16	PK	H	29.11	1.89	36.49	44.67	74.00	29.33
2725.50	44.77	AV	H	29.11	1.89	36.49	39.28	54.00	14.72
3634.00	45.16	PK	H	31.59	2.45	37.09	42.11	74.00	31.89
3634.00	32.89	AV	H	31.59	2.45	37.09	29.84	54.00	24.16
6359.50	52.63	PK	H	34.23	4.49	37.14	54.21	74.00	19.79
6359.50	47.21	AV	H	34.23	4.49	37.14	48.79	54.00	5.21
7268.00	51.52	PK	H	35.90	4.71	37.31	54.82	74.00	19.18
7268.00	45.70	AV	H	35.90	4.71	37.31	49.00	54.00	5.00
High Channel: 914.9 MHz									
914.90	66.60	QP	H	22.79	5.49	0.00	94.88	N/A	N/A
914.90	77.90	QP	V	22.79	5.49	0.00	106.18	N/A	N/A
928.00	15.30	QP	V	22.87	5.37	0.00	43.54	46.00	2.46
1829.80	54.98	PK	H	26.59	1.66	35.95	47.28	74.00	26.72
1829.80	53.08	AV	H	26.59	1.66	35.95	45.38	54.00	8.62
2744.70	50.47	PK	H	29.18	1.91	36.51	45.05	74.00	28.95
2744.70	44.82	AV	H	29.18	1.91	36.51	39.40	54.00	14.60
3659.60	45.52	PK	H	31.65	2.50	37.06	42.61	74.00	31.39
3659.60	33.10	AV	H	31.65	2.50	37.06	30.19	54.00	23.81
6404.30	52.28	PK	H	34.22	4.57	37.12	53.95	74.00	20.05
6404.30	46.87	AV	H	34.22	4.57	37.12	48.54	54.00	5.46
7319.20	51.06	PK	H	36.03	4.62	37.37	54.34	74.00	19.66
7319.20	45.18	AV	H	36.03	4.62	37.37	48.46	54.00	5.54

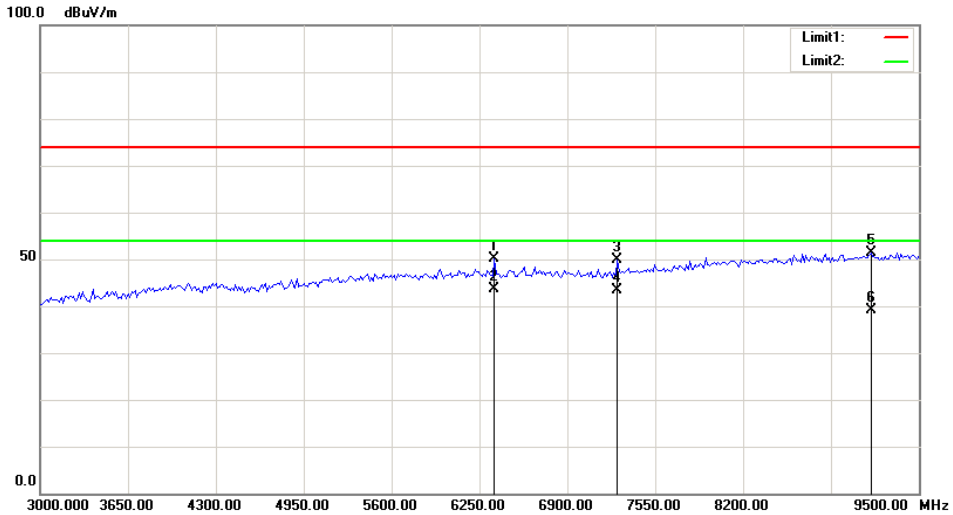
Worst plots(High channel)
Horizontal





Vertical


100.0 dBuV/m
Limit1:
Limit2:
50
0.0
1
3
1000.000 1200.00 1400.00 1600.00 1800.00 2000.00 2200.00 2400.00 2600.00 3000.00 MHz


100.0 dBuV/m
Limit1:
Limit2:
50
0.0
1
3
5
6
3000.000 3650.00 4300.00 4950.00 5600.00 6250.00 6900.00 7550.00 8200.00 9500.00 MHz

FCC §15.247(a) (1) - CHANNEL SEPARATION TEST

Applicable Standard

According to FCC §15.247(a) (1)

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0012/04	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 Procedure

1. Set the EUT in transmitting mode, spectrum RBW was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

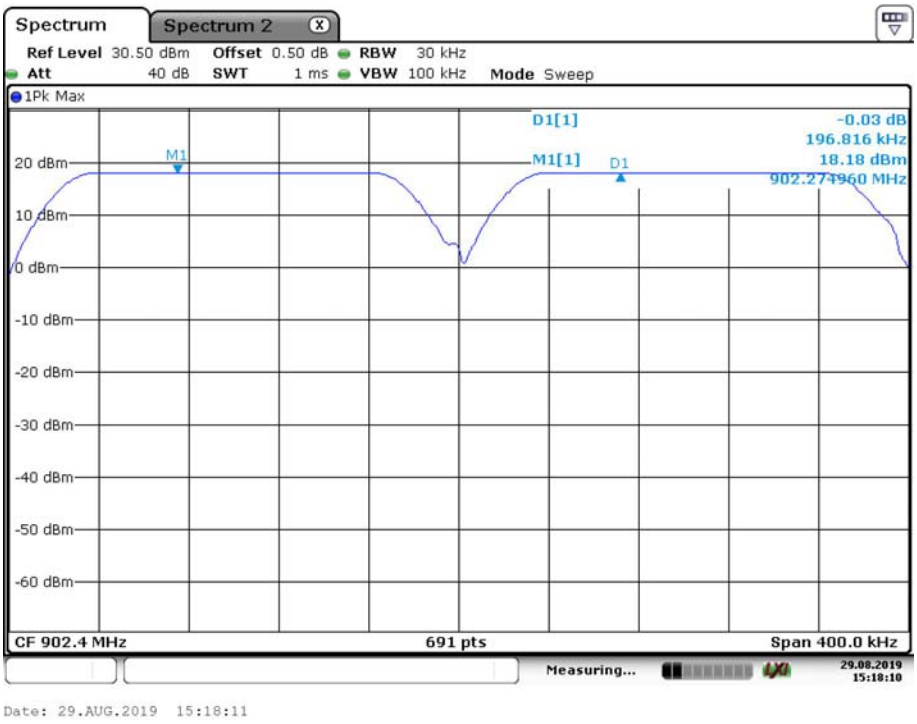
Temperature:	28.3C
Relative Humidity:	55
ATM Pressure:	100.4 kPa
Tester:	Lily Xie
Test Date:	2019-08-29

Test Result: Compliance.
Please refer to following tables and plots

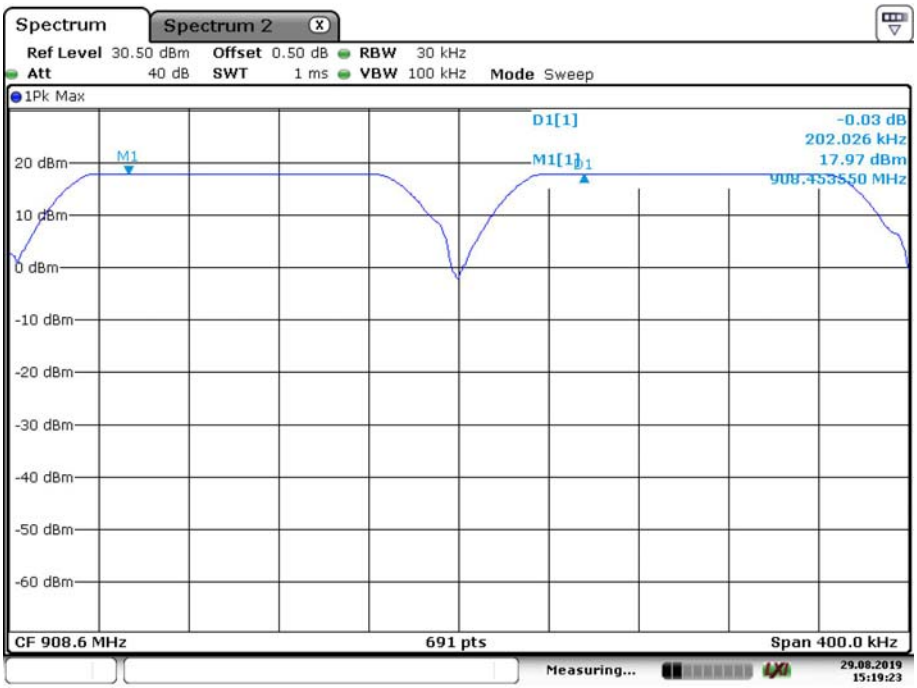
Test Mode: Transmitting

Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
Low	902.3	0.197	0.139
Middle	908.5	0.202	0.140
High	914.9	0.202	0.138

Low Channel

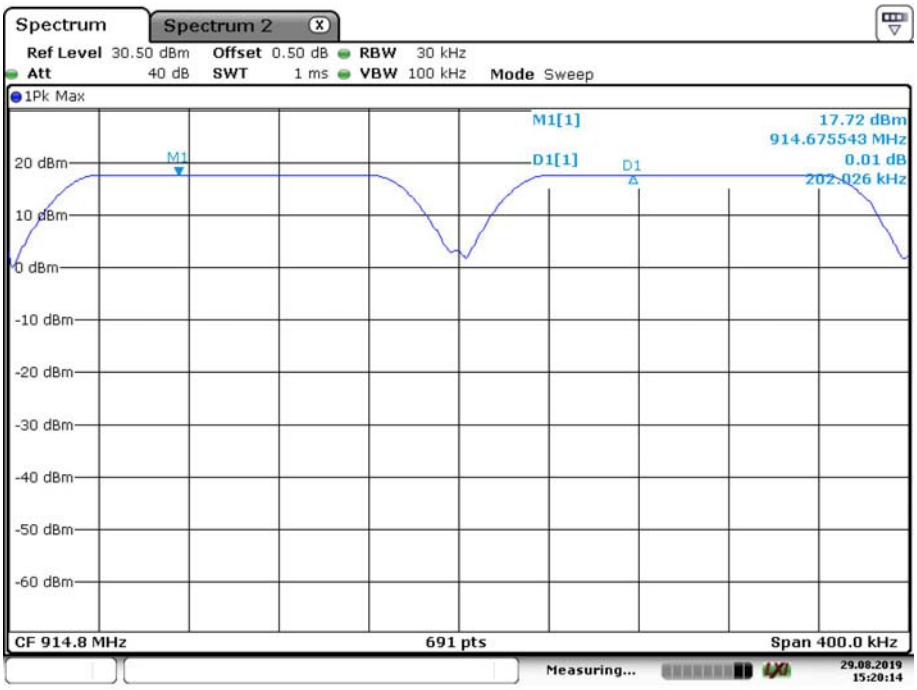


Middle Channel



Date: 29.AUG.2019 15:19:24

High Channel



Date: 29.AUG.2019 15:20:14

FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

Applicable Standard

According to FCC §15.247(a) (1)

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

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 on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.
5. Use Occupied bandwidth test function, measure the 99% Occupied bandwidth.
6. 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	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0012/04	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:	28.3C
Relative Humidity:	55
ATM Pressure:	100.4 kPa
Tester:	Lily Xie
Test Date:	2019-08-29

Test Result: Compliance.

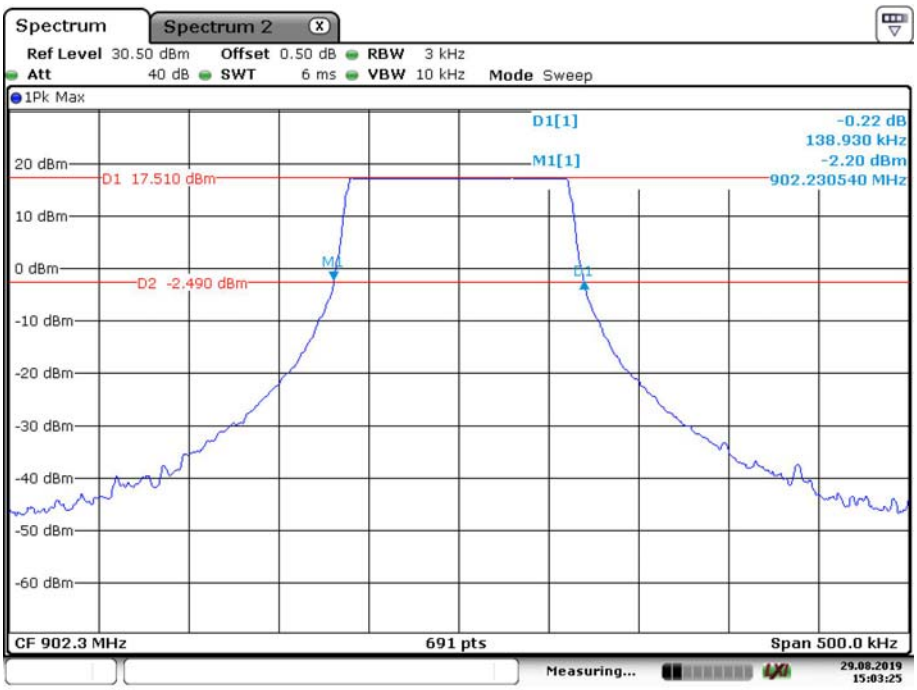
Please refer to following tables and plots

Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	20 dB Bandwidth Limits (MHz)
Low	902.3	0.139	0.126	≤0.25
Middle	908.5	0.140	0.126	≤0.25
High	914.9	0.138	0.126	≤0.25

20dB Bandwidth:

Low Channel



Date: 29.AUG.2019 15:03:26

Middle Channel

Date: 29.AUG.2019 15:04:39

High Channel

Date: 29.AUG.2019 15:05:43

99% Occupied bandwidth:

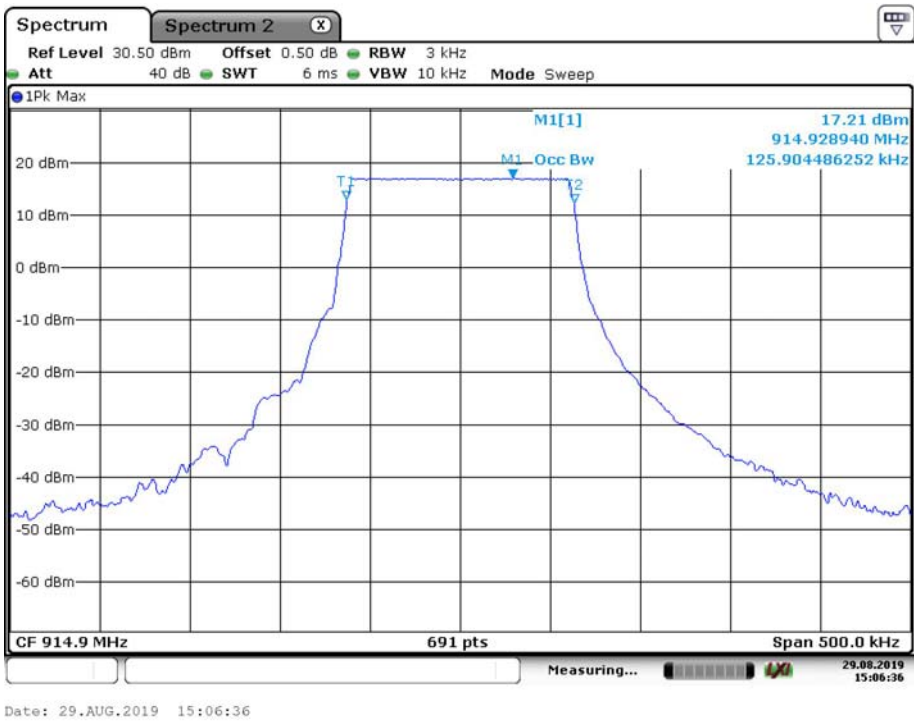
Low Channel

Date: 29.AUG.2019 15:07:27

Middle Channel

Date: 29.AUG.2019 15:06:59

High Channel



FCC §15.247(a) (1) (i) - QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

According to FCC §15.247(a) (1) (i)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the Max-Hold function record the Quantity of the channel.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	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:	28.3C
Relative Humidity:	55
ATM Pressure:	100.4 kPa
Tester:	Lily Xie
Test Date:	2019-08-29

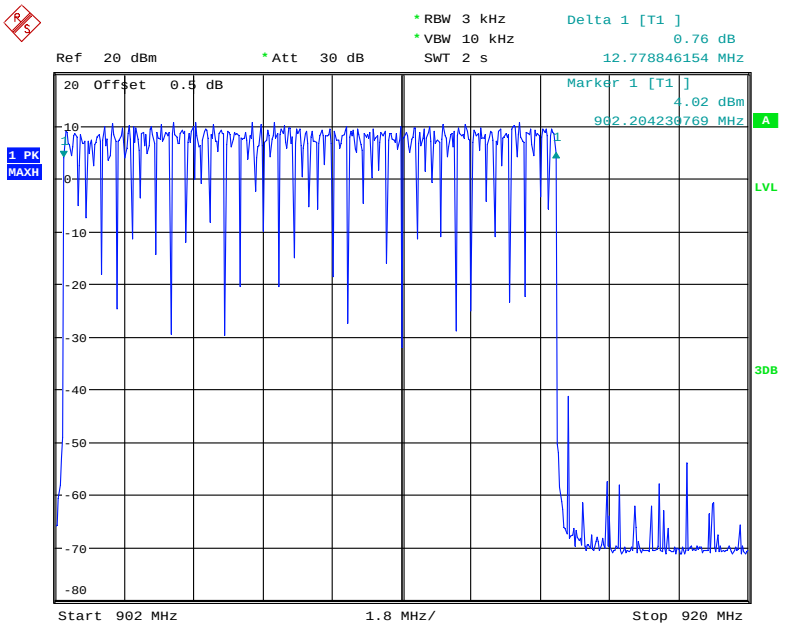
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

Frequency Range (MHz)	Number of Hopping Channel	Limit
902-928	64	≥50

Number of Hopping Channels



Date: 12.FEB.2020 16:47:12

FCC §15.247(f) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

According to FCC §15.247
(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

The EUT was worked in channel hopping; the time of single pulses was tested.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2019-01-09	2020-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	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

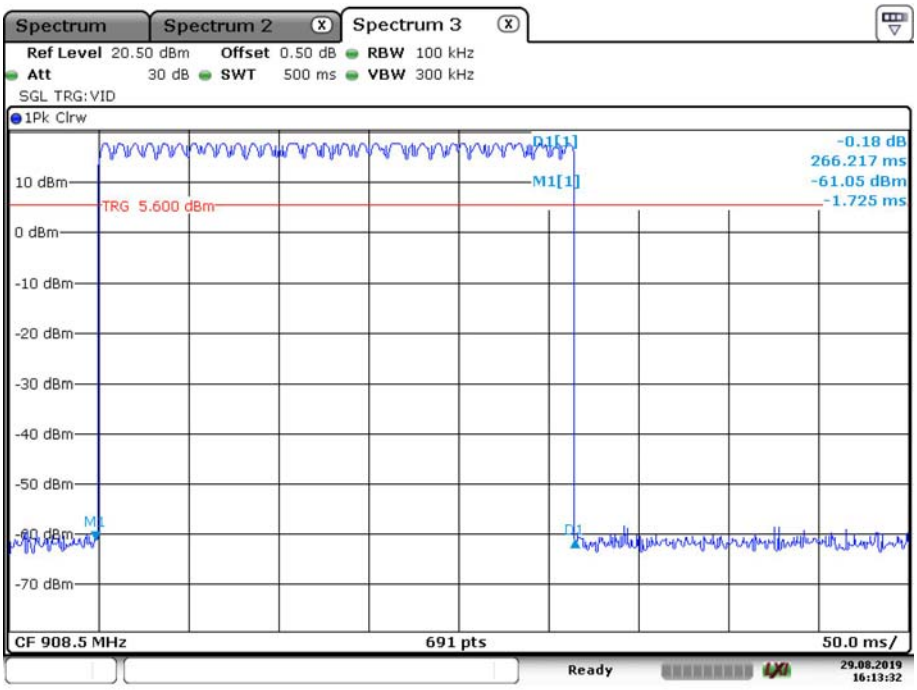
Environmental Conditions

Temperature:	28.3C
Relative Humidity:	55
ATM Pressure:	100.4 kPa
Tester:	Lily Xie
Test Date:	2019-08-29

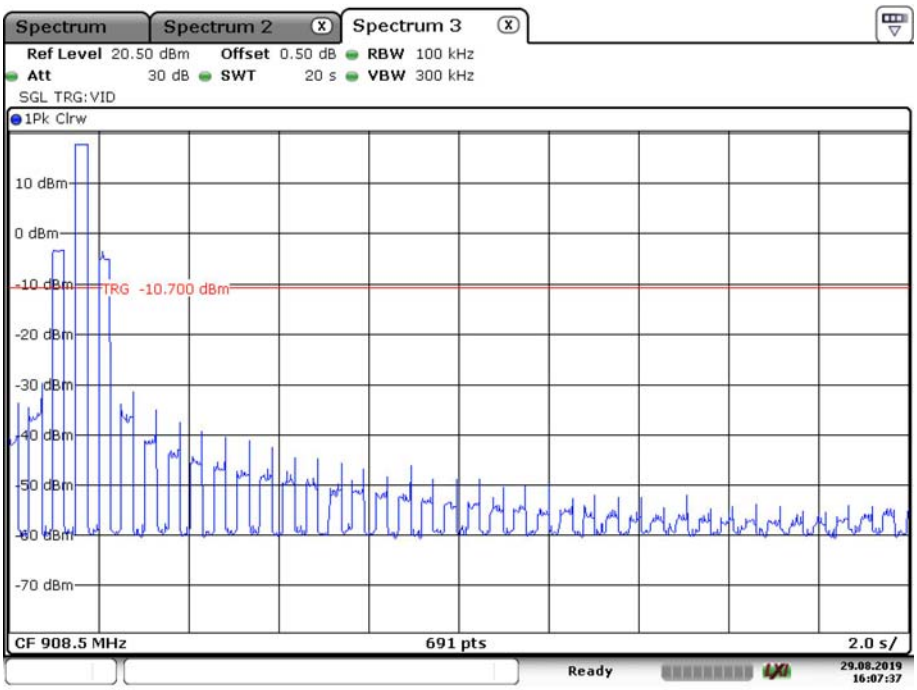
Test Mode: Transmitting

Channel	Frequency (MHz)	Pulse Width (ms)	Real Observed Period(s)	Hopping number in Observed Period	Dwell Time (s)	Limit (s)	Result
Middle	908.5	266.217	20	1	0.266	0.4	Compliance
Note: Dwell time=Pulse width × hopping number per channel in Observed Period Observed Period=20s							

Middle Channel



Date: 29.AUG.2019 16:13:33



Date: 29.AUG.2019 16:07:38

FCC §15.247(b) (2) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to FCC §15.247(b)(2)

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one 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	C0010/02	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:	28.3C
Relative Humidity:	55
ATM Pressure:	100.4 kPa
Tester:	Lily Xie
Test Date:	2019-08-29

Test Result: Compliance.

Test Mode: Transmitting

Channel	Frequency (MHz)	Peak Conducted Output power (dBm)	Peak Conducted Output power Limit (dBm)
Low	902.3	17.34	30
Middle	908.5	17.18	30
High	914.9	17.26	30

Note: The data above was tested in conducted mode, the antenna gain is 3.0dBi, meet the EIRP limit of ISED.

FCC §15.247(d) - BAND EDGES TESTING

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)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW/ VBW of spectrum analyzer to 100/300 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	2019-01-09	2020-01-09
R&S	Spectrum Analyzer	FSU 26	200256	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	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

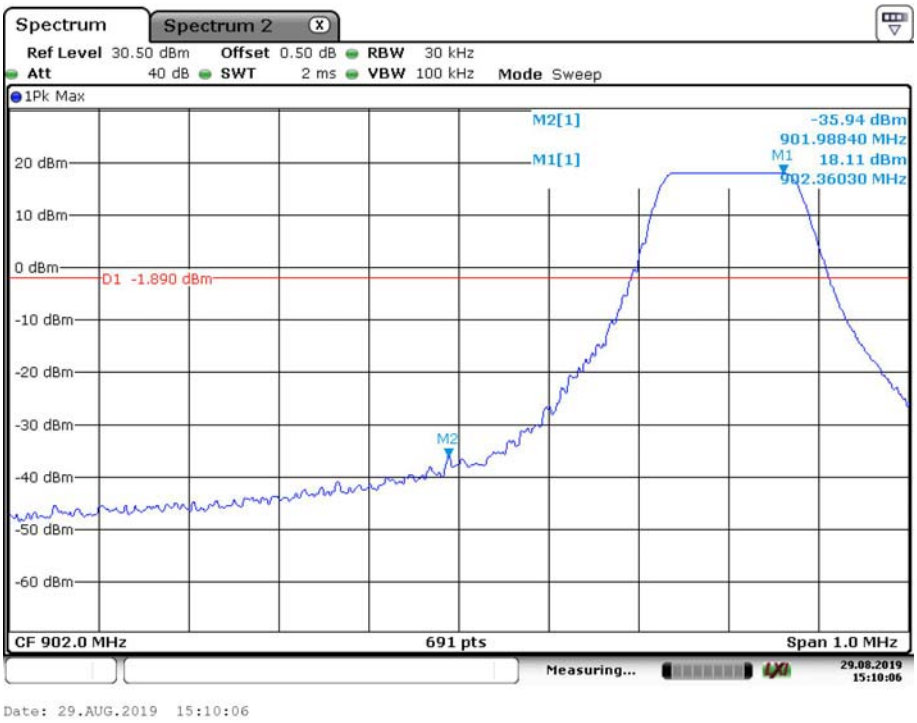
Environmental Conditions

Temperature:	21.7~28.3℃
Relative Humidity:	55~71%
ATM Pressure:	100.4~102.4 kPa
Tester:	Lily Xie
Test Date:	2019-08-29~2020.02.12

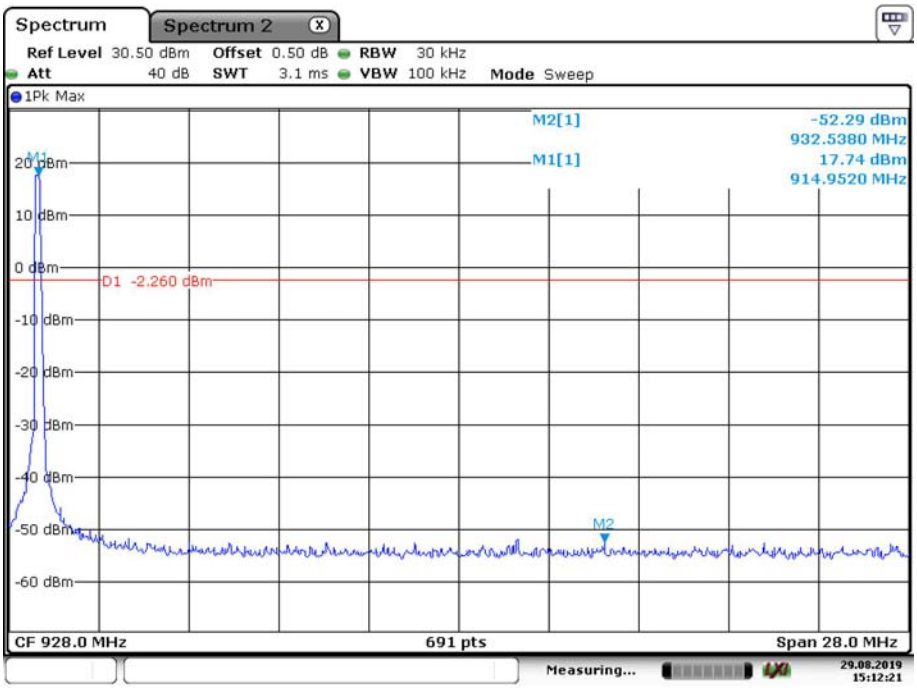
Test Result: Compliance

Single mode:

Band Edge, Left Side



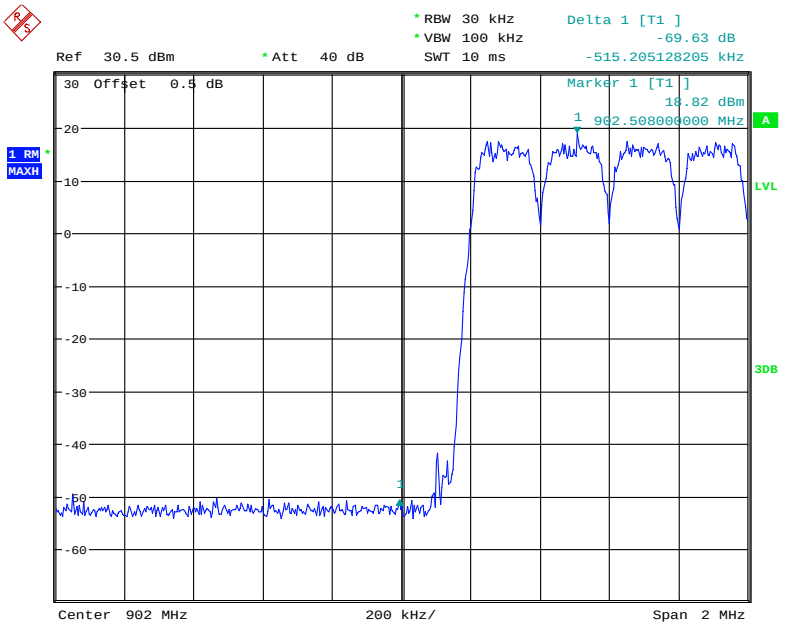
Band Edge, Right Side



Date: 29.AUG.2019 15:12:21

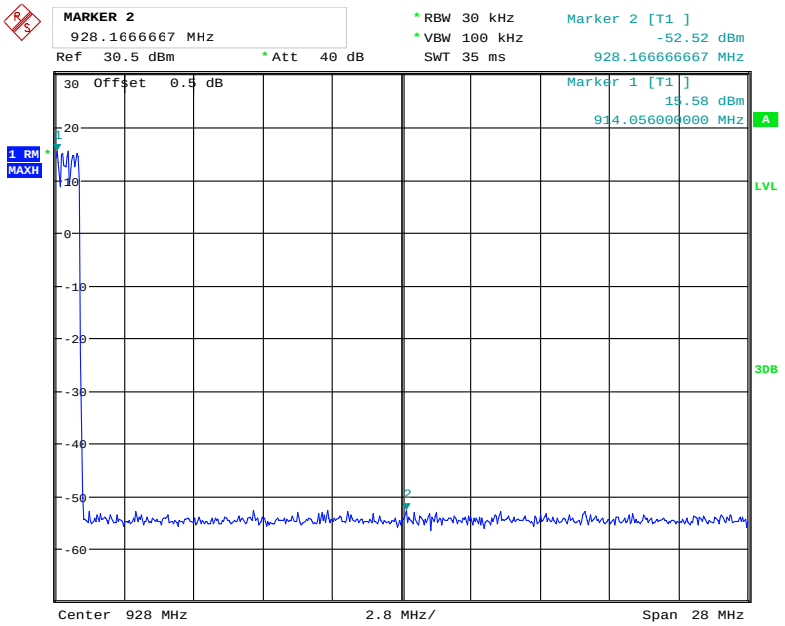
Hopping mode:

Band Edge, Left Side



Date: 12.FEB.2020 15:48:02

Band Edge, Right Side



Date: 12.FEB.2020 15:54:55

FCC §15.247(f) - POWER SPECTRAL DENSITY

Applicable Standard

According to FCC §15.247
(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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	FSP 38	100478	2019-05-09	2020-05-09
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

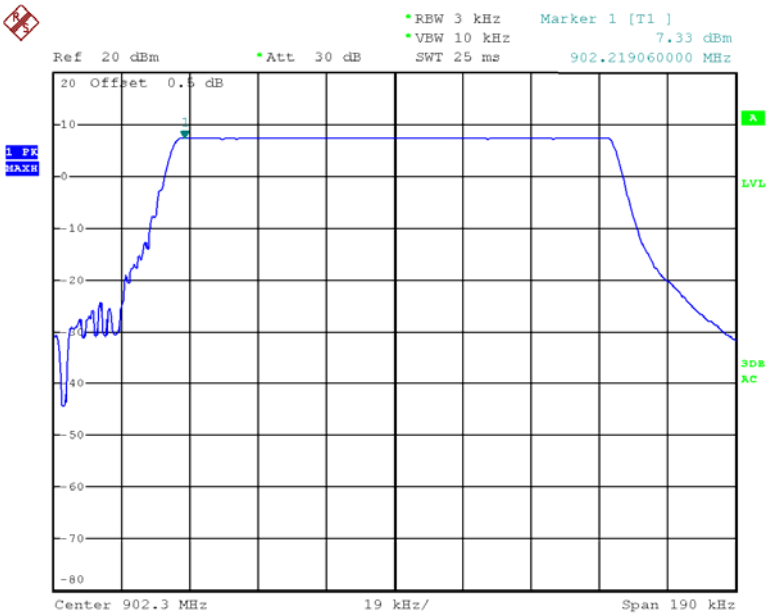
Temperature:	23°C
Relative Humidity:	55%
ATM Pressure:	101.4kPa
Tester:	Severn Zhu
Test Date:	2020-05-28

Test Result: Compliance, *please refer to the following table and plots*

Test Mode: Transmitting

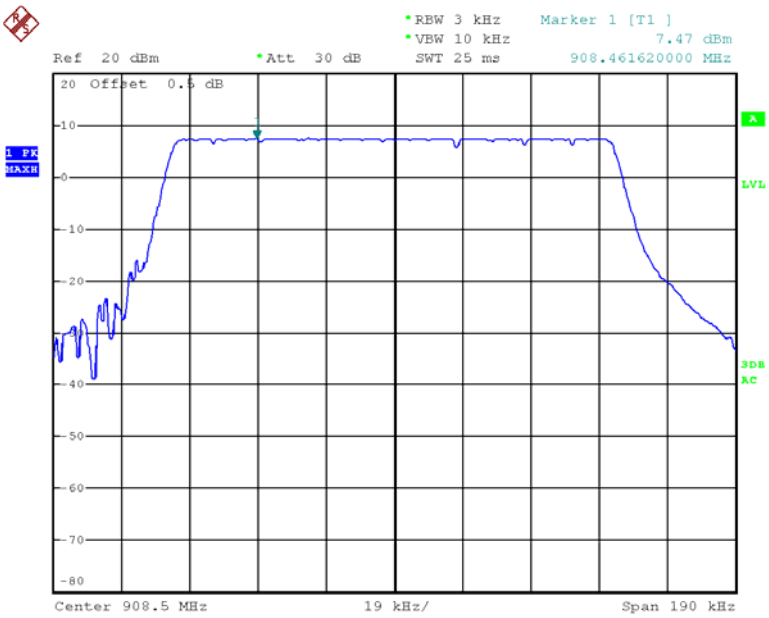
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Low	902.3	7.33	8
Middle	908.5	7.47	
High	914.9	7.33	

Low



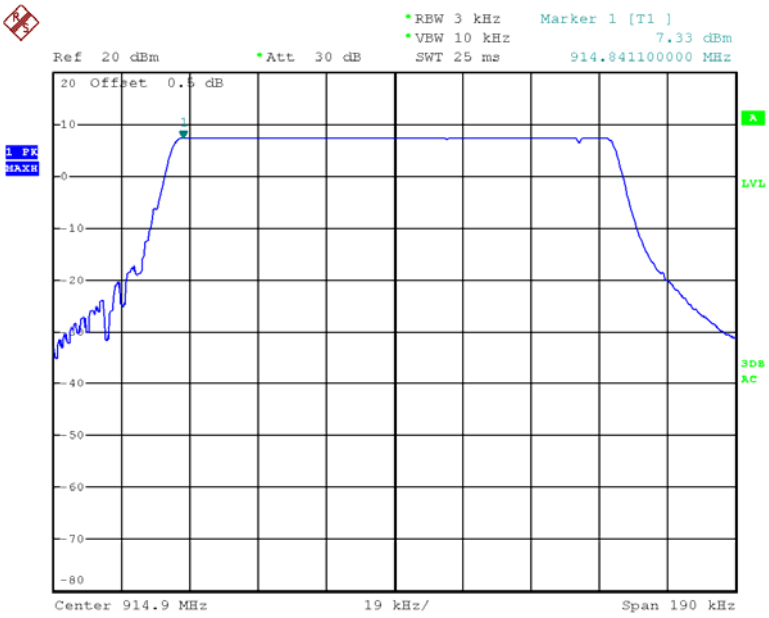
Date: 28.MAY.2020 19:01:09

Middle



Date: 28.MAY.2020 18:51:55

High



Date: 28.MAY.2020 19:06:15

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