TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.247

TEST REPORT

For

R9 Technology

17217 Waterview Parkway Suite 1.202Y, Dallas, Texas 75252, United States

FCC ID:2AQM2-G200

Report Type:	**Product Name:**
Original Report	Picogate

Report Number:	RDG190304002-00B
Report Date:	2019-04-23
Reviewed By:	Jerry Zhang EMC Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Picogate
EUT Model:		G200
Operation Frequency:		902.2-927.8 MHz
Maximum Peak Output Power (Conducted):		13.41 dBm
Modulation Type:		GFSK
Rated Input Voltage:		DC 12V from adapter
Adapter Information	**Model:**	GEO101U-120100
	Input:	AC 100-240V 50/60Hz 0.2A
	Output:	DC 12V 1A
External Dimension:		98.5mm(L)*90.5mm(W)*46.5mm(H)
Serial Number:		190304002
EUT Received Date:		2019.3.29

Note: the device contains 2.4G Module, FCC ID: ZAT26M1, and LTE Module, FCC ID: RI7XE866A1NA.

Objective

This report is prepared on behalf of *R9 Technology* 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 EUT compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements detailed in this test report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices" and KDB 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)

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier : CN0022.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The was a hopping transmitter, employes 129 hopping channels:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.2	66	915.2
2	902.4	67	915.4
3	902.6	68	915.6
~	~	~	~
~	~	~	~
63	914.6	128	927.6
64	914.8	129	927.8
65	915	/	/

Frequency 902.2 MHz, 915 MHz and 927.8 MHz were selected to test.

EUT Exercise Software

The worst condition (maximum power level) was configured by system default setting, the software ' teraterm-4.100.exe ' used for change test modes and channels.

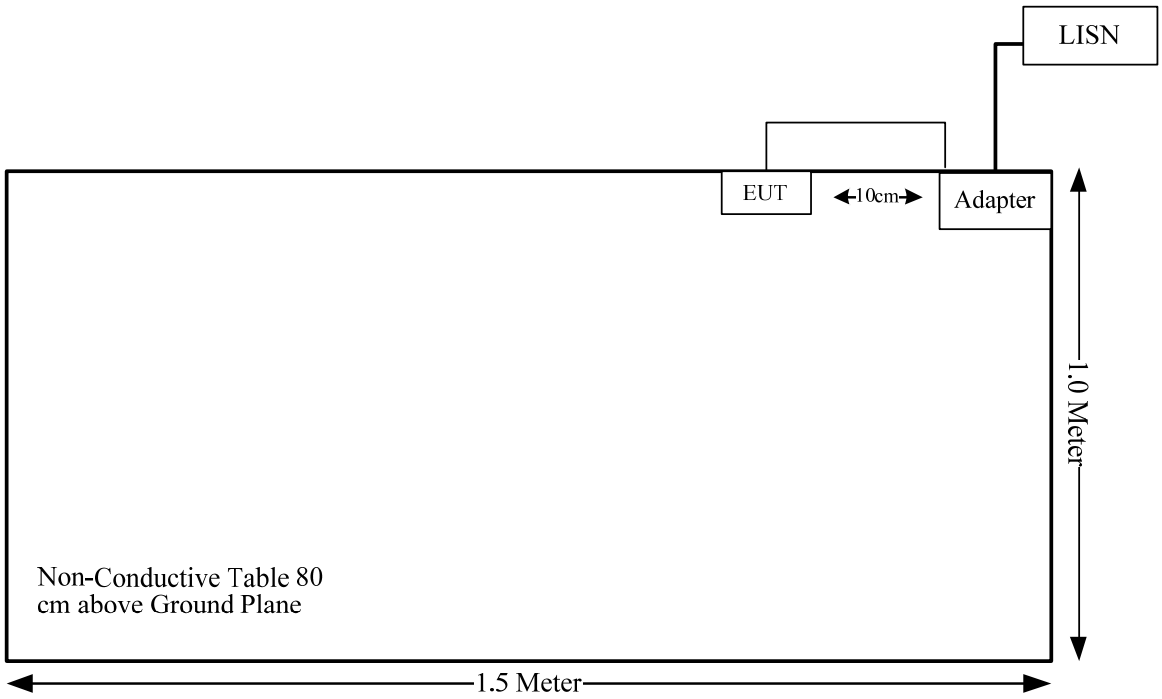
Equipment Modifications

No modification was made to the EUT.

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter cable	Yes	No	2.5	Adapter	EUT

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
FCC§15.203	Antenna Requirement	Compliance
FCC§15.207 (a)	Conducted Emissions	Compliance
FCC§15.205, §15.209, FCC §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(a)(1)(i)	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 (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/cm^2);
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);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

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)			
915MHz Radio	902.2-927.8	-2.2	0.60	14	25.12	20.00	0.003	0.60
BLE	2402-2480	1.256	1.34	5	3.16	20.00	0.0008	1.0
LTE band 2	1850-1910	0	1.00	24	251.19	20.00	0.0500	1.0
LTE band 4	1710-1755	0	1.00	24	251.19	20.00	0.0500	1.0
LTE band 12	699-716	0	1.00	24	251.19	20.00	0.0500	0.47

Note: the device contains 2.4G Module, FCC ID: ZAT26M1, and LTE Module, FCC ID:RI7XE866A1NA, The 915 MHz Radio, 2.4GHz module(BLE) and LTE module can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{915}/S_{limit-915}+ S_{2.4}/S_{limit-2.4}+ S_{LTE}/S_{limit-LTE}$

$=0.003/0.60+0.008/1.0+0.05/0.47$

$=0.12$

< 1.0

Result: The device meet FCC MPE at 20 cm distance

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 Information And Connector Construction

The EUT has an internal antenna permanently attached to the unit. And the antenna gain is -2.2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

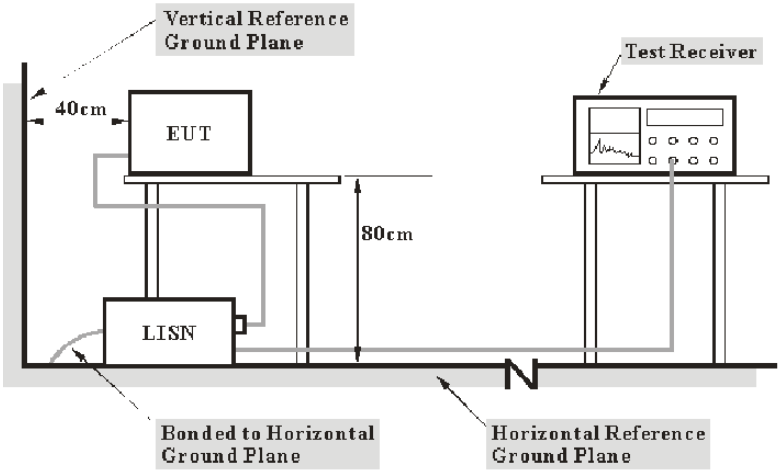
Result: Compliance.

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 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

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

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

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

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

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
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	ESCI	101121	2019-03-23	2020-03-23

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

Test Data

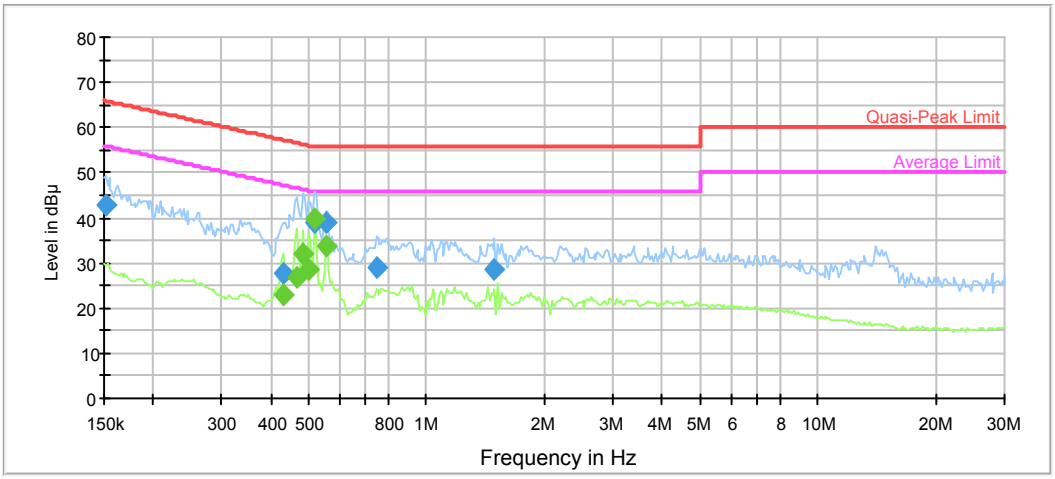
Environmental Conditions

Temperature:	25.6 °C
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Ade Xiao on 2019-03-28

Test Mode: *Transmitting*

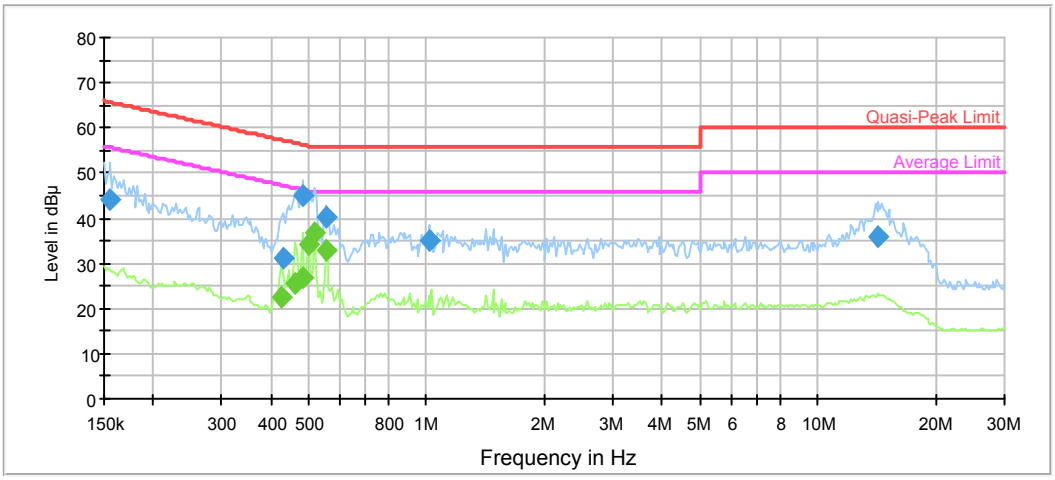
AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.151500	42.9	9.000	L1	11.2	23.0	65.9	Compliance
0.430682	27.8	9.000	L1	9.9	29.4	57.2	Compliance
0.515160	39.0	9.000	L1	9.9	17.0	56.0	Compliance
0.552321	39.1	9.000	L1	9.8	16.9	56.0	Compliance
0.744445	29.0	9.000	L1	9.8	27.0	56.0	Compliance
1.493925	28.7	9.000	L1	9.8	27.3	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.430682	23.1	9.000	L1	9.9	24.1	47.2	Compliance
0.466367	26.8	9.000	L1	9.9	19.8	46.6	Compliance
0.485304	32.0	9.000	L1	9.9	14.3	46.2	Compliance
0.500009	28.7	9.000	L1	9.9	17.3	46.0	Compliance
0.520311	39.8	9.000	L1	9.9	6.2	46.0	Compliance
0.552321	33.9	9.000	L1	9.8	12.1	46.0	Compliance

AC120V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.156091	44.3	9.000	N	11.1	21.4	65.7	Compliance
0.430682	31.2	9.000	N	9.9	26.0	57.2	Compliance
0.485304	44.7	9.000	N	9.9	11.5	56.2	Compliance
0.552321	40.1	9.000	N	9.8	15.9	56.0	Compliance
1.013434	34.9	9.000	N	9.8	21.1	56.0	Compliance
14.298179	35.9	9.000	N	9.9	24.1	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.426418	22.3	9.000	N	9.9	25.0	47.3	Compliance
0.461750	25.4	9.000	N	9.9	21.3	46.7	Compliance
0.480499	26.9	9.000	N	9.9	19.4	46.3	Compliance
0.500009	34.3	9.000	N	9.9	11.7	46.0	Compliance
0.520311	36.9	9.000	N	9.9	9.1	46.0	Compliance
0.552321	33.0	9.000	N	9.8	13.0	46.0	Compliance

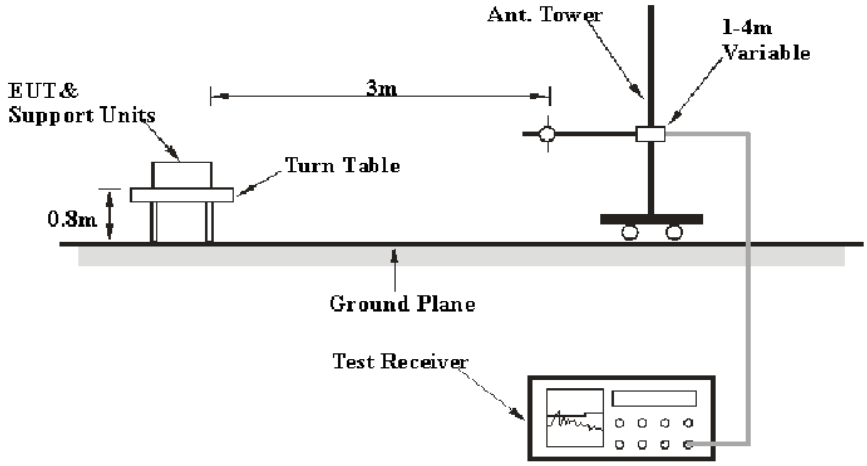
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

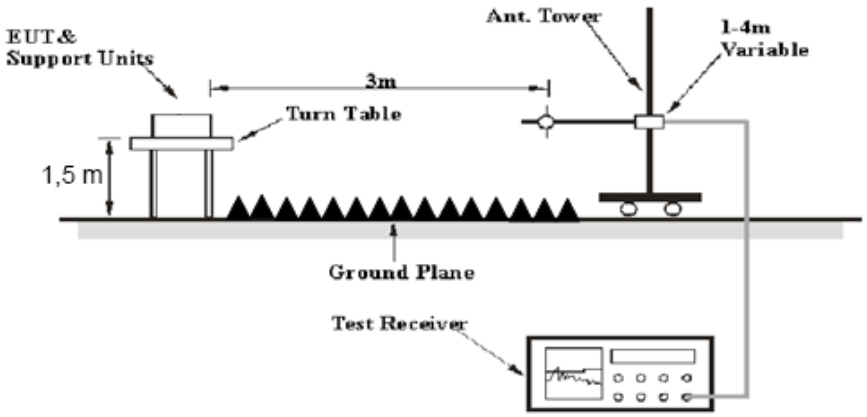
FCC §15.247 (d); §15.209; §15.205

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission Below 1GHz tests were performed in the 10 meters chamber test site, 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 external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 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.

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	ESCI	100224	2018-12-10	2019-12-10
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-3	2017-07-21	2019-07-21
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
Sonoma	Amplifier	310N	185914	2018-10-13	2019-10-13
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-01-04	2020-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
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

*** 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

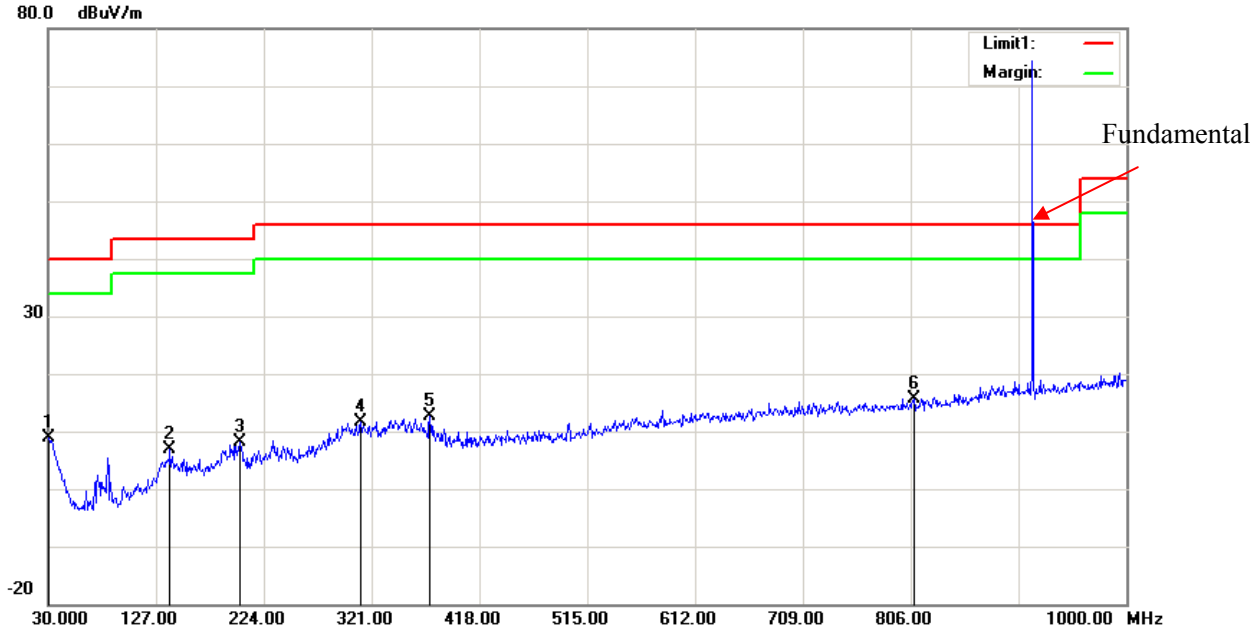
Temperature:	26.5~27.3°C
Relative Humidity:	50~53 %
ATM Pressure:	101.1~101.2 kPa

** The testing was performed by Vito Chen and Tyler Pan from 2019-03-18 to 2019-04-15.*

Test Mode: Transmitting

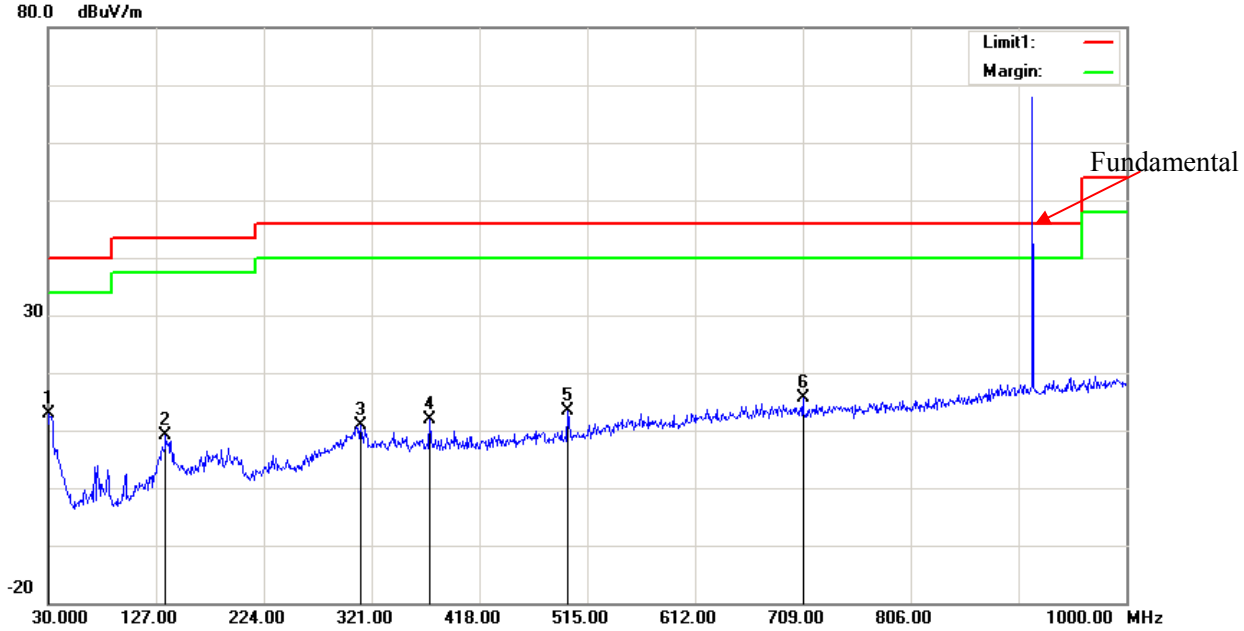
1)30MHz-1GHz(Middle channel was the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.0000	13.31	peak	-4.33	8.98	40.00	31.02
139.6100	16.37	peak	-9.57	6.80	43.50	36.70
202.6600	17.74	peak	-9.73	8.01	43.50	35.49
311.3000	18.63	peak	-7.06	11.57	46.00	34.43
373.3800	18.66	peak	-5.98	12.68	46.00	33.32
808.9100	14.46	peak	1.15	15.61	46.00	30.39

Vertical:

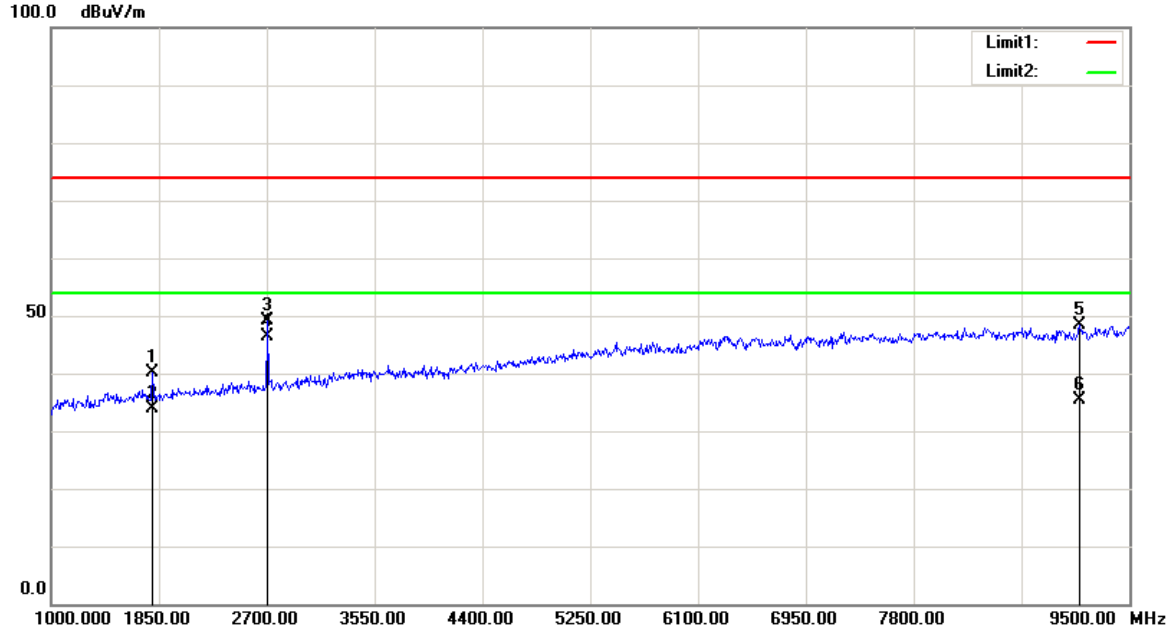


Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.9700	17.87	peak	-4.88	12.99	40.00	27.01
135.7300	18.82	peak	-9.59	9.23	43.50	34.27
311.3000	17.99	peak	-7.06	10.93	46.00	35.07
373.3800	17.76	peak	-5.98	11.78	46.00	34.22
497.5400	16.78	peak	-3.50	13.28	46.00	32.72
709.0000	15.57	peak	0.12	15.69	46.00	30.31

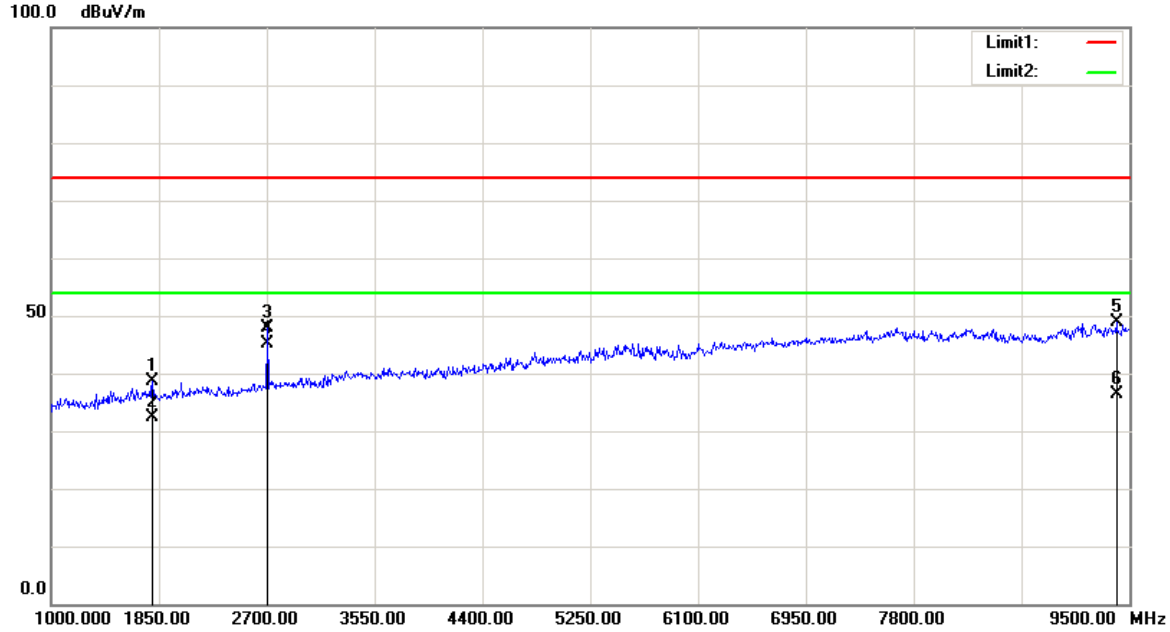
2) Fundamental, Bandedge, and above 1GHz:

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: 902.2 MHz									
902.20	75.40	QP	H	22.71	5.27	0.00	103.38	N/A	N/A
902.20	60.30	QP	V	22.71	5.27	0.00	88.28	N/A	N/A
902.00	28.89	QP	H	22.71	5.27	0.00	56.87	83.38	26.51
1804.40	47.80	PK	H	26.48	1.66	35.90	40.04	74.00	33.96
1804.40	41.59	AV	H	26.48	1.66	35.90	33.83	54.00	20.17
2706.60	54.57	PK	H	29.04	1.88	36.47	49.02	74.00	24.98
2706.60	51.83	AV	H	29.04	1.88	36.47	46.28	54.00	7.72
3608.80	45.69	PK	H	31.54	2.41	37.11	42.53	74.00	31.47
3608.80	33.21	AV	H	31.54	2.41	37.11	30.05	54.00	23.95
Middle Channel: 915 MHz									
915.00	75.50	QP	H	22.79	5.49	0.00	103.78	N/A	N/A
915.00	60.40	QP	V	22.79	5.49	0.00	88.68	N/A	N/A
1830.00	47.02	PK	H	26.59	1.66	35.95	39.32	74.00	34.68
1830.00	40.69	AV	H	26.59	1.66	35.95	32.99	54.00	21.01
2745.00	54.08	PK	H	29.18	1.91	36.51	48.66	74.00	25.34
2745.00	51.50	AV	H	29.18	1.91	36.51	46.08	54.00	7.92
3660.00	45.99	PK	H	31.65	2.50	37.06	43.08	74.00	30.92
3660.00	33.54	AV	H	31.65	2.50	37.06	30.63	54.00	23.37
High Channel: 927.8 MHz									
927.80	77.40	QP	H	22.87	5.37	0.00	105.64	N/A	N/A
927.80	64.10	QP	V	22.87	5.37	0.00	92.34	N/A	N/A
928.00	31.20	QP	H	22.87	5.37	0.00	59.44	85.64	26.20
1855.60	49.31	PK	H	26.69	1.66	36.00	41.66	74.00	32.34
1855.60	44.87	AV	H	26.69	1.66	36.00	37.22	54.00	16.78
2783.40	53.76	PK	H	29.32	1.94	36.55	48.47	74.00	25.53
2783.40	51.16	AV	H	29.32	1.94	36.55	45.87	54.00	8.13
3711.20	46.67	PK	H	31.76	2.57	37.02	43.98	74.00	30.02
3711.20	34.12	AV	H	31.76	2.57	37.02	31.43	54.00	22.57

Worst plots(Low channel)
Horizontal



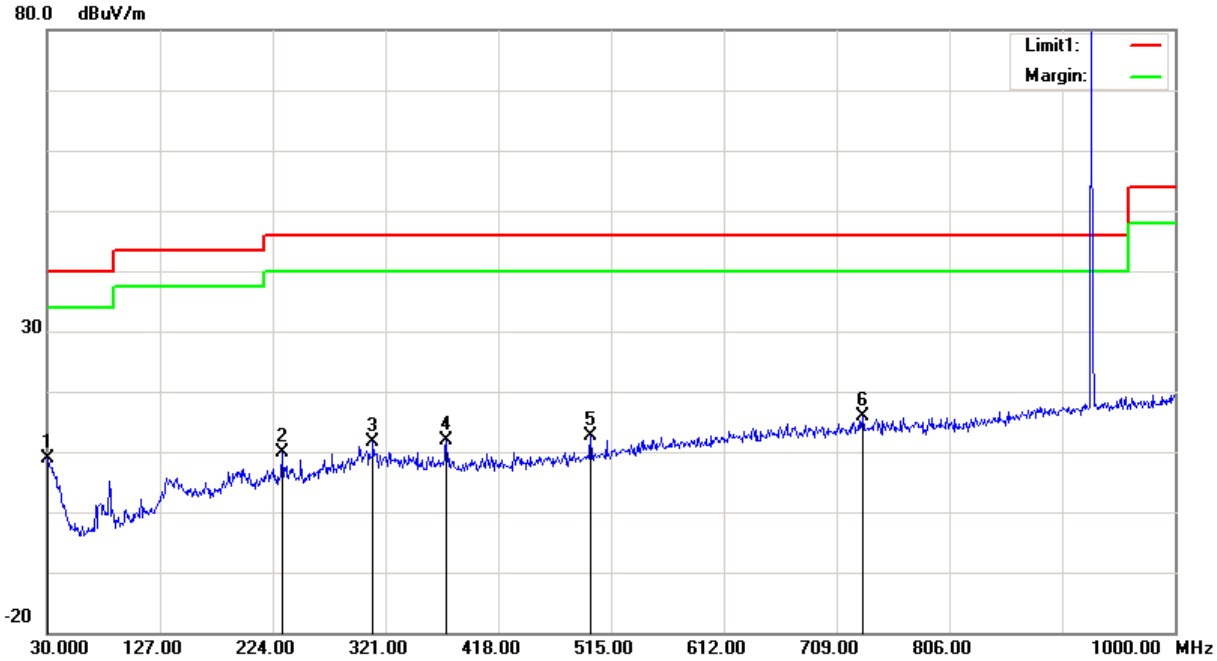
Vertical



Co-location Test

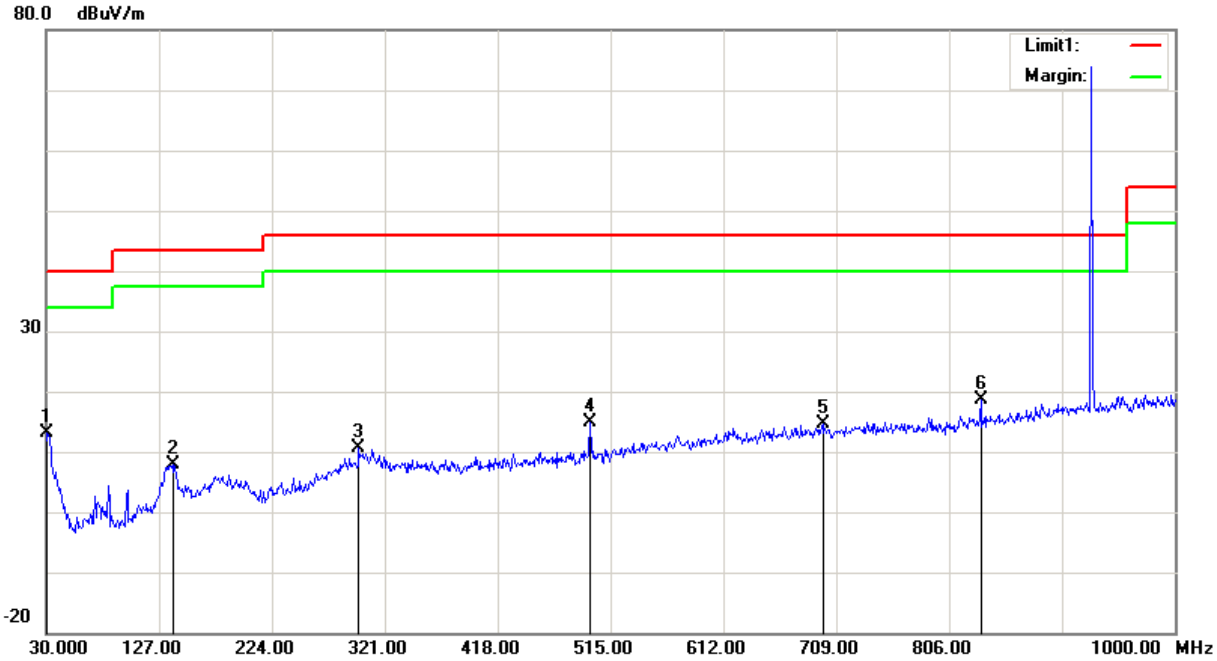
1)30MHz-1GHz(915MHz + BLE 2440MHz + LTE Band 2:1880 MHz was the worst)**:**

Horizontal



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.0000	13.30	peak	-4.33	8.97	40.00	31.03
231.7600	20.30	peak	-10.46	9.84	46.00	36.16
310.3300	18.75	peak	-7.03	11.72	46.00	34.28
373.3800	17.88	peak	-5.98	11.90	46.00	34.10
497.5400	16.10	peak	-3.50	12.60	46.00	33.40
731.3100	15.26	peak	0.71	15.97	46.00	30.03

Vertical



Frequency (MHz)	Receiver Reading (dBµV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.9700	18.10	peak	-4.88	13.22	40.00	26.78
138.6400	17.38	peak	-9.54	7.84	43.50	35.66
298.6900	18.15	peak	-7.51	10.64	46.00	35.36
497.5400	18.47	peak	-3.50	14.97	46.00	31.03
697.3600	14.38	peak	0.20	14.58	46.00	31.42
833.1600	16.90	peak	1.75	18.65	46.00	27.35

2) 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)					
915MHz + BLE 2440MHz + LTE Band 2:1880 MHz was the worst									
1525.00	52.40	PK	V	25.31	1.75	36.07	43.39	74.00	30.61
1525.00	40.84	AV	V	25.31	1.75	36.07	31.83	54.00	22.17
2795.00	48.24	PK	V	29.36	1.95	36.56	42.99	74.00	31.01
2795.00	38.13	AV	V	29.36	1.95	36.56	32.88	54.00	21.12
3355.00	49.64	PK	V	30.95	2.29	36.90	45.98	74.00	28.02
3355.00	37.96	AV	V	30.95	2.29	36.90	34.30	54.00	19.70
3965.00	43.85	PK	V	32.32	2.62	36.98	41.81	74.00	32.19
3965.00	31.77	AV	V	32.32	2.62	36.98	29.73	54.00	24.27
4270.00	49.74	PK	V	32.35	2.81	37.02	47.88	74.00	26.12
4270.00	41.23	AV	V	32.35	2.81	37.02	39.37	54.00	14.63
5795.00	43.02	PK	V	34.22	3.71	37.28	43.67	74.00	30.33
5795.00	32.84	AV	V	34.22	3.71	37.28	33.49	54.00	20.51
6760.00	47.63	PK	V	34.72	4.97	37.02	50.30	74.00	23.70
6760.00	39.74	AV	V	34.72	4.97	37.02	42.41	54.00	11.59

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	EMI Test Receiver	ESPI	100120	2018-12-11	2019-12-11
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 Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 10 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:	25.3 °C
Relative Humidity:	60 %
ATM Pressure:	100.3 kPa

** The testing was performed by Tiago Huang on 2019-03-22*

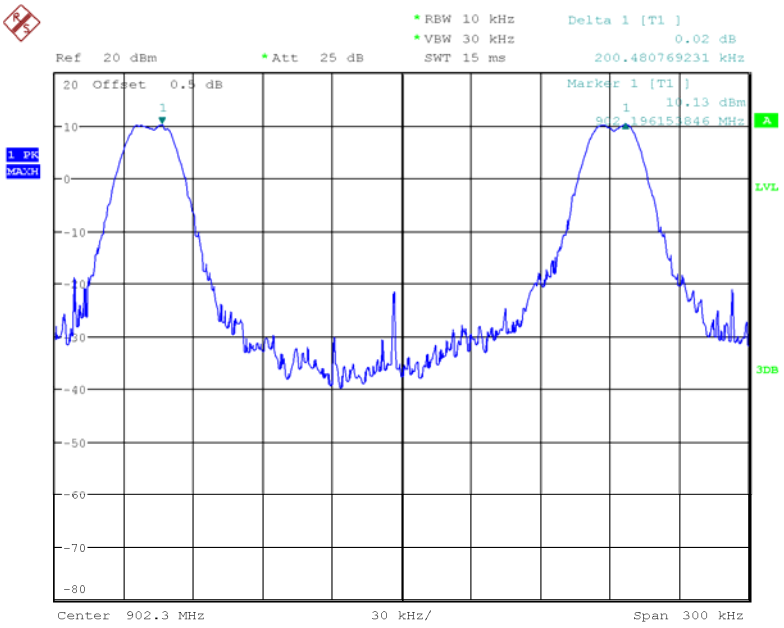
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

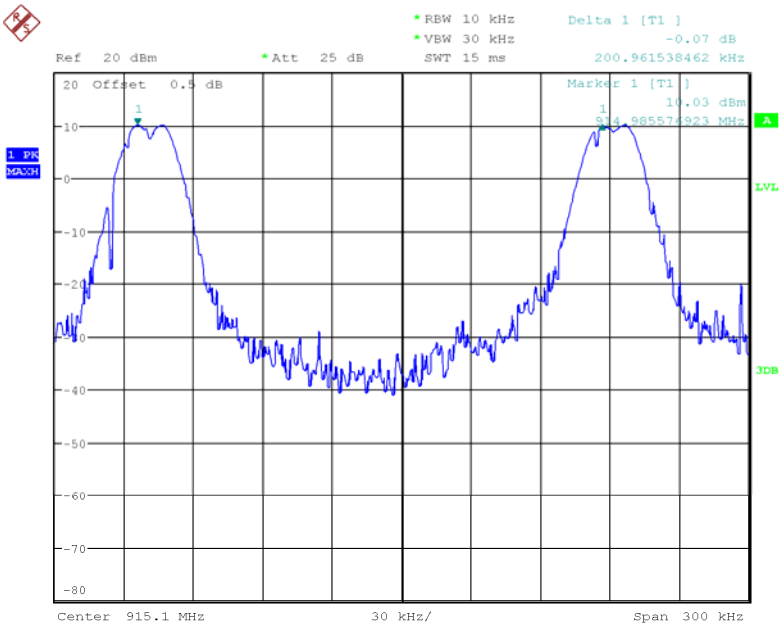
Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
Low	902.2	0.200	0.021
Middle	915	0.201	0.021
High	927.8	0.200	0.022

Low Channel



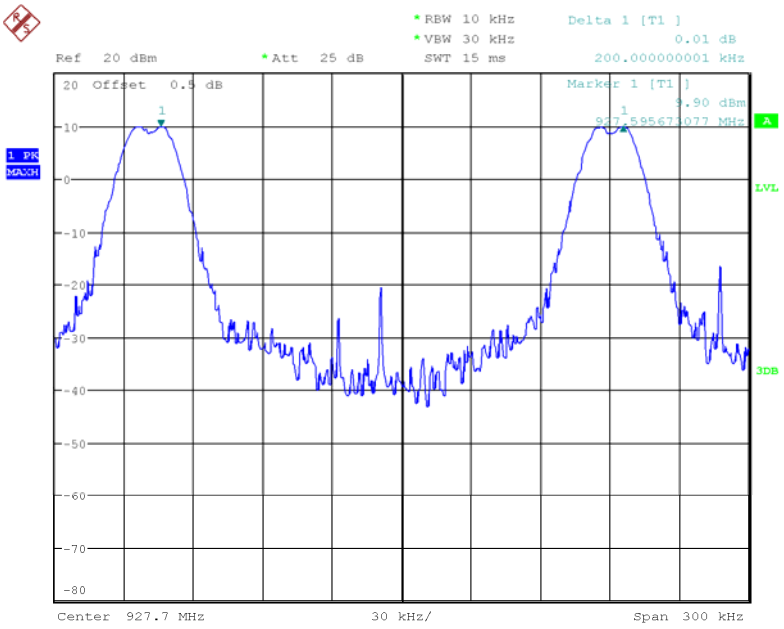
Date: 22.MAR.2019 22:01:00

Middle Channel



Date: 22.MAR.2019 22:03:04

High Channel



Date: 22.MAR.2019 22:04:53

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

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 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2018-12-11	2019-12-11
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:	25.3 °C
Relative Humidity:	60 %
ATM Pressure:	100.3 kPa

** The testing was performed by Tiago Huang on 2019-03-22*

Test Result: Compliance.

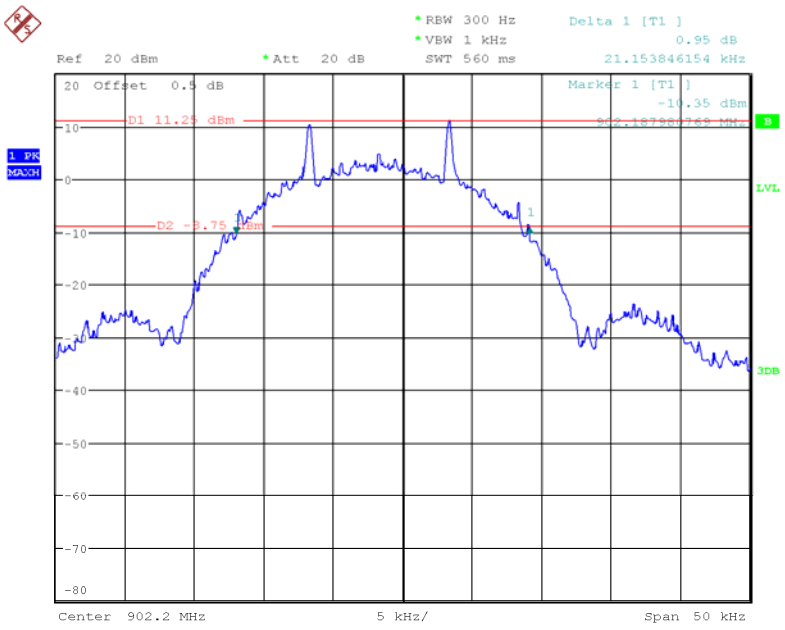
Please refer to following tables and plots

Test Mode: Transmitting

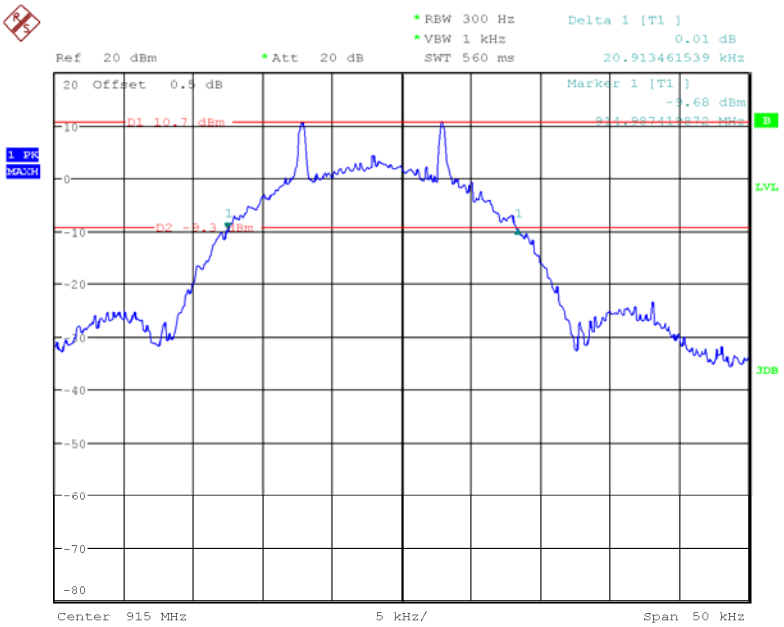
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	902.2	0.021
Middle	915	0.021
High	927.8	0.022

20dB Bandwidth:

Low Channel

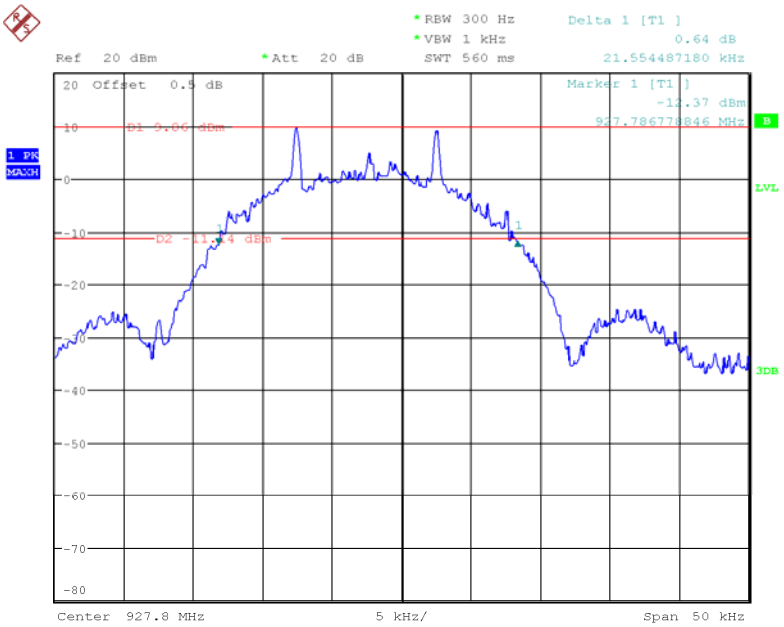


Middle Channel



Date: 22.MAR.2019 19:59:34

High Channel



Date: 22.MAR.2019 20:17:45

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	EMI Test Receiver	ESPI	100120	2018-12-11	2019-12-11
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:	25.3 °C
Relative Humidity:	60 %
ATM Pressure:	100.3 kPa

** The testing was performed by Tiago Huang on 2019-03-22*

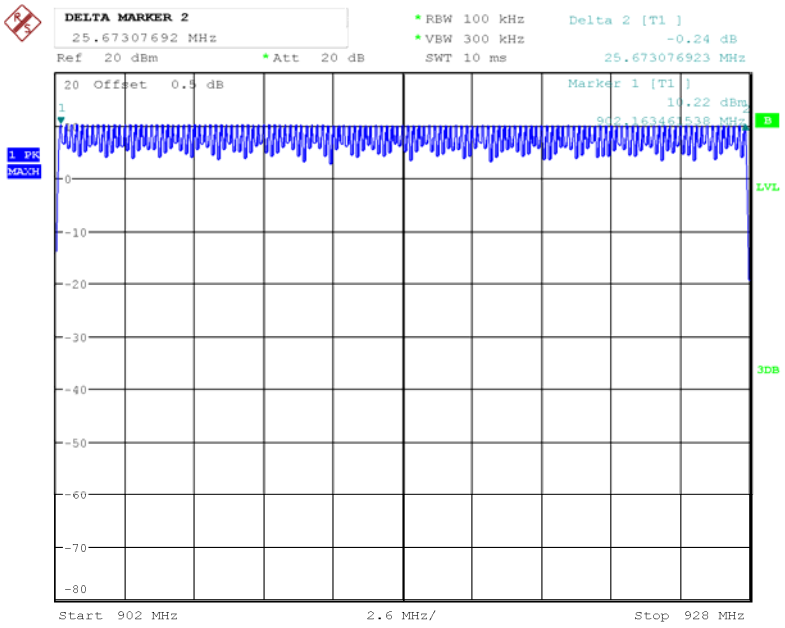
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

Frequency Range (MHz)	Number of Hopping Channel	Limit
902-928	129	≥50

Number of Hopping Channels



Date: 22.MAR.2019 20:56:33

FCC §15.247(a) (1) (i) - TIME OF OCCUPANCY (DWELL TIME)

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

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	EMI Test Receiver	ESPI	100120	2018-12-11	2019-12-11
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

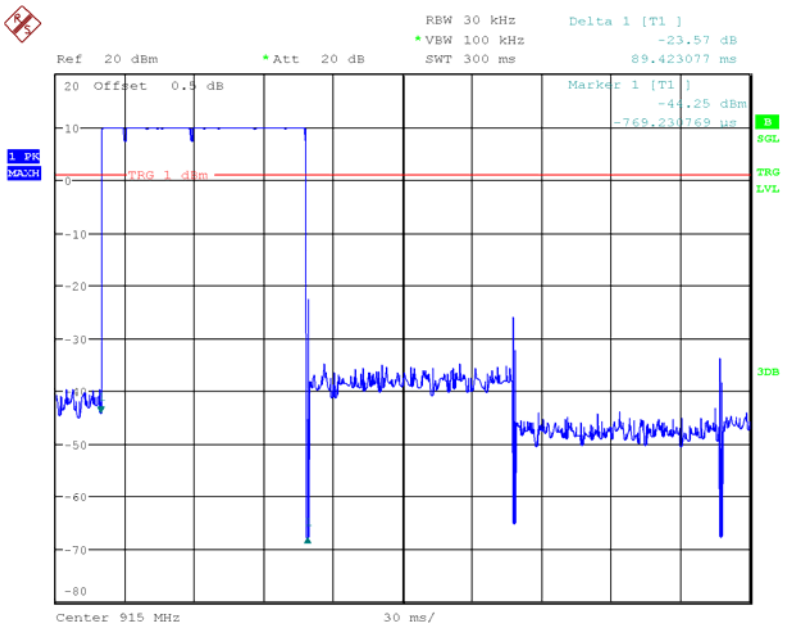
Temperature:	25.3 °C
Relative Humidity:	60 %
ATM Pressure:	100.3 kPa

** The testing was performed by Tiago Huang on 2019-03-22*

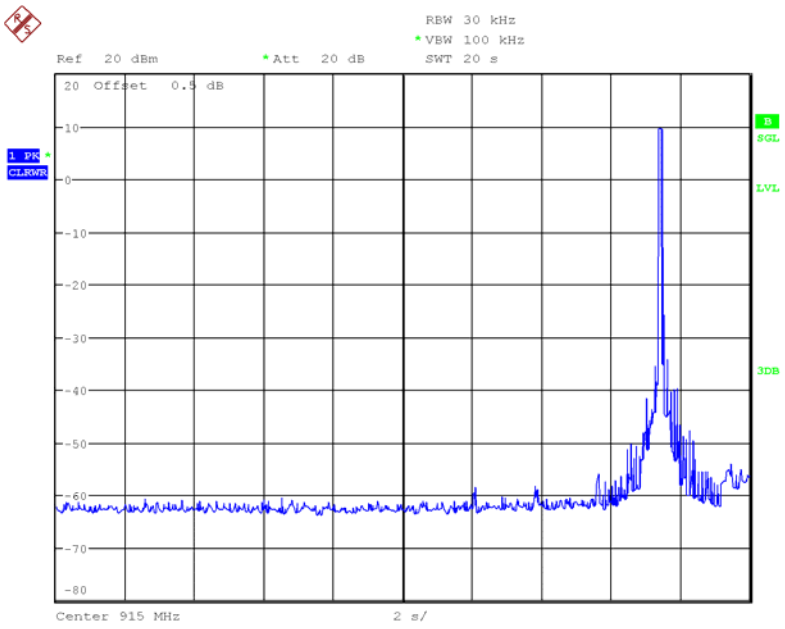
Test Mode: Transmitting

Channel	Frequency (MHz)	Pulse Width (ms)	Real Observed Period(s)	Hopping number in Observed Period	Dwell Time (s)	Limit (s)	Result
Middle	915.0	89.423	20	1	0.089423	0.4	Compliance
Note: Dwell time=Pulse width × hopping number per channel in Observed Period Observed Period=20s							

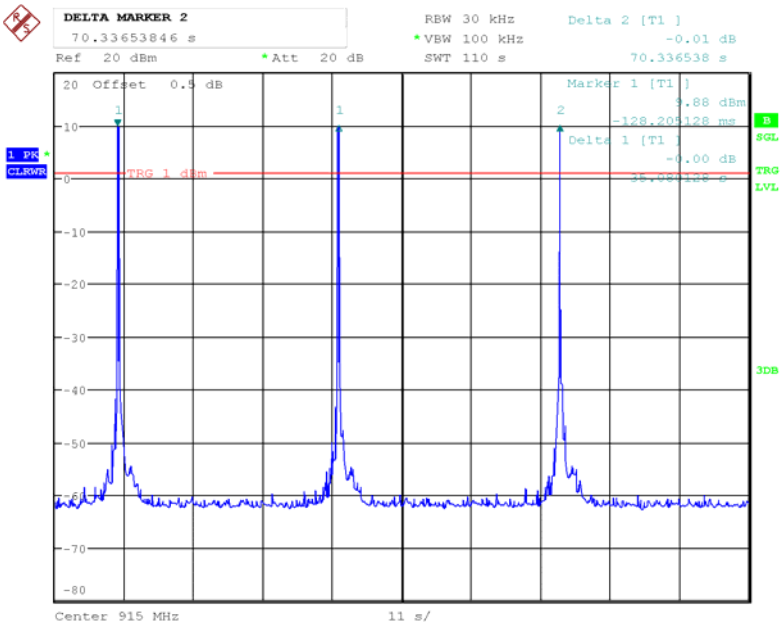
Middle Channel



Date: 22.MAR.2019 21:06:55



Date: 22.MAR.2019 21:12:36



Date: 22.MAR.2019 22:44:24

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:	25.3 °C
Relative Humidity:	60 %
ATM Pressure:	100.3 kPa

** The testing was performed by Tiago Huang on 2019-03-22*

Test Result: Compliance.

Test Mode: Transmitting

Channel	Frequency (MHz)	Peak Conducted Output power (dBm)	Peak Conducted Output power Limit (dBm)
Low	902.2	13.41	30
Middle	915	13.08	30
High	927.8	12.86	30

Note: The data above was tested in conducted mode, the antenna gain is -2.2dBi.

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	EMI Test Receiver	ESPI	100120	2018-12-11	2019-12-11
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

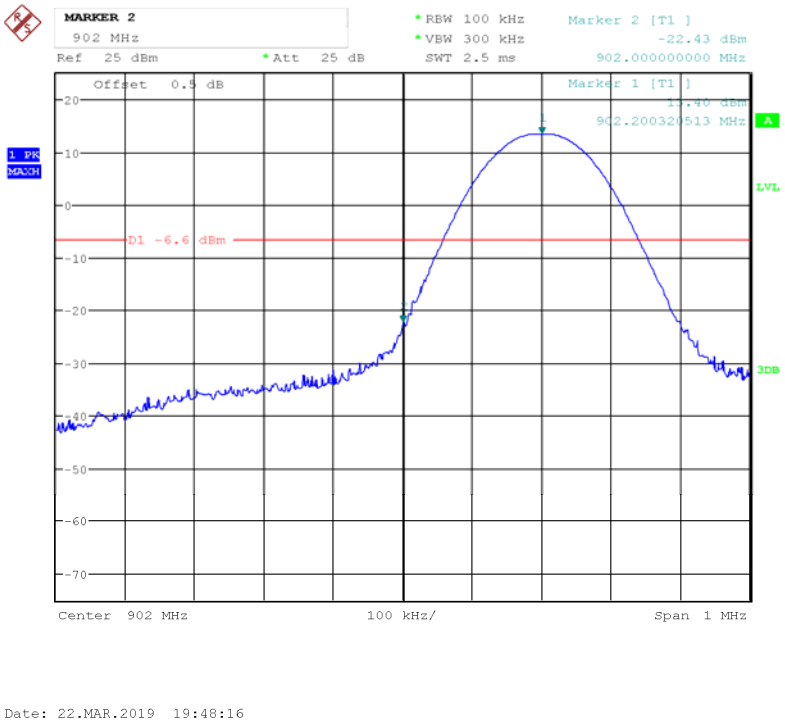
Temperature:	25.3 °C
Relative Humidity:	60 %
ATM Pressure:	100.3 kPa

** The testing was performed by Tiago Huang on 2019-03-22*

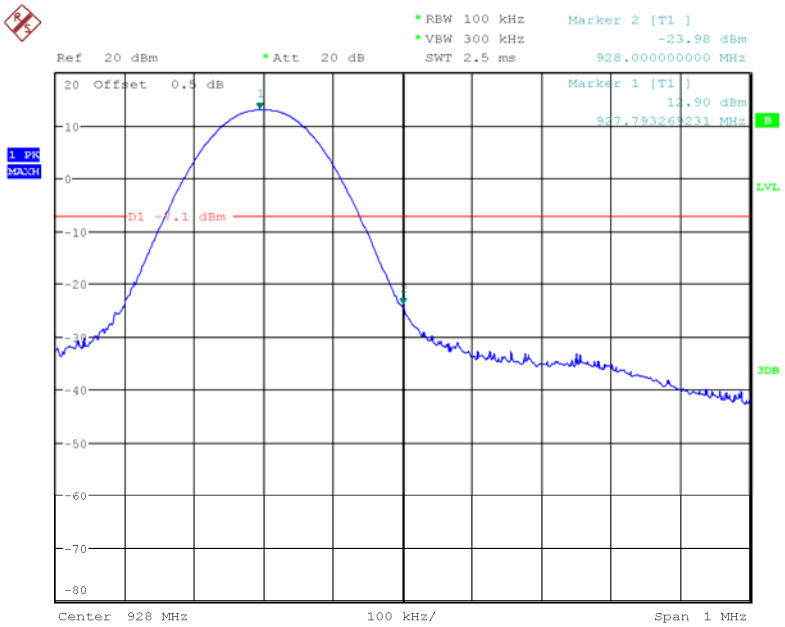
Test Result: Compliance

Single mode:

Band Edge, Left Side



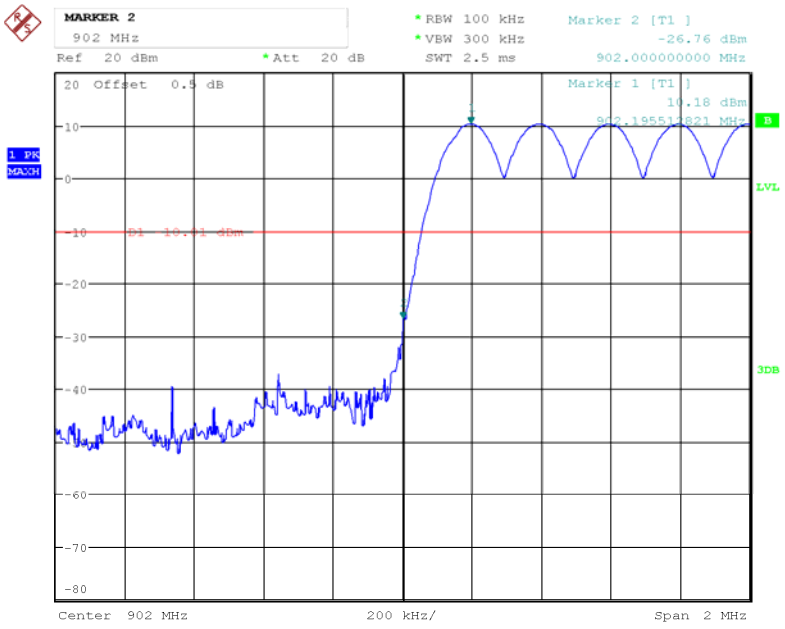
Band Edge, Right Side



Date: 22.MAR.2019 20:20:11

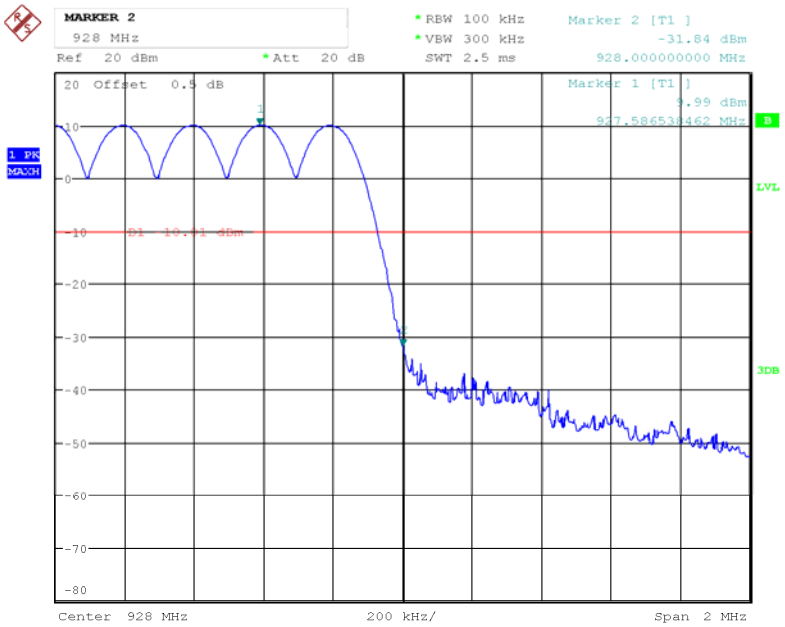
Hopping mode:

Band Edge, Left Side



Date: 22.MAR.2019 20:42:01

Band Edge, Right Side



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