



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 15.247

TEST REPORT

For

Beijing COTX Networks Technologies Co. ,Ltd.

B218, block F, Wangjing, Wanke times center, Chaoyang District, Beijing

FCC ID: 2A2A2X3S

Report Type: Original Report	Product Name: cotx x3 hotspot
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	cotx x3 hotspot
EUT Model:	X3S
Operation Frequency:	902.3MHz~914.9MHz
Maximum Peak Output Power (Conducted):	19.44dBm
Modulation Type:	LoRa
Antenna Gain▲:	3.5 dBi
Rated Input Voltage:	DC 5V from DC Port
Serial Number:	DG1210824-36075E-RF-A1-S1
EUT Received Date:	2021.08.23
EUT Received Status:	Good

Objective

This report is prepared on behalf of **Beijing COTX Networks Technologies Co. ,Ltd.** 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, 15.207, 15.209 and 15.247 rules.

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 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

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

Test Facility

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

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

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

Declarations

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

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

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SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

Test Channel	Frequency (MHz)	Test Channel	Frequency (MHz)
0	902.3	32	908.7
1	902.5	33	908.9
2	902.7	34	909.1
~	~	~	~
~	~	~	~
~	~	~	~
~	~	~	~
29	908.1	61	914.5
30	908.3	62	914.7
31	908.5	63	914.9

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

EUT Exercise Software

The 'PUTTY' was used during test, which was provided by manufacturer. The maximum power level was configured by the software as below▲:

Channel	Test Frequency (MHz)	Power Level Setting
Low	902.3	26
Middle	908.5	26
High	914.9	26

Equipment Modifications

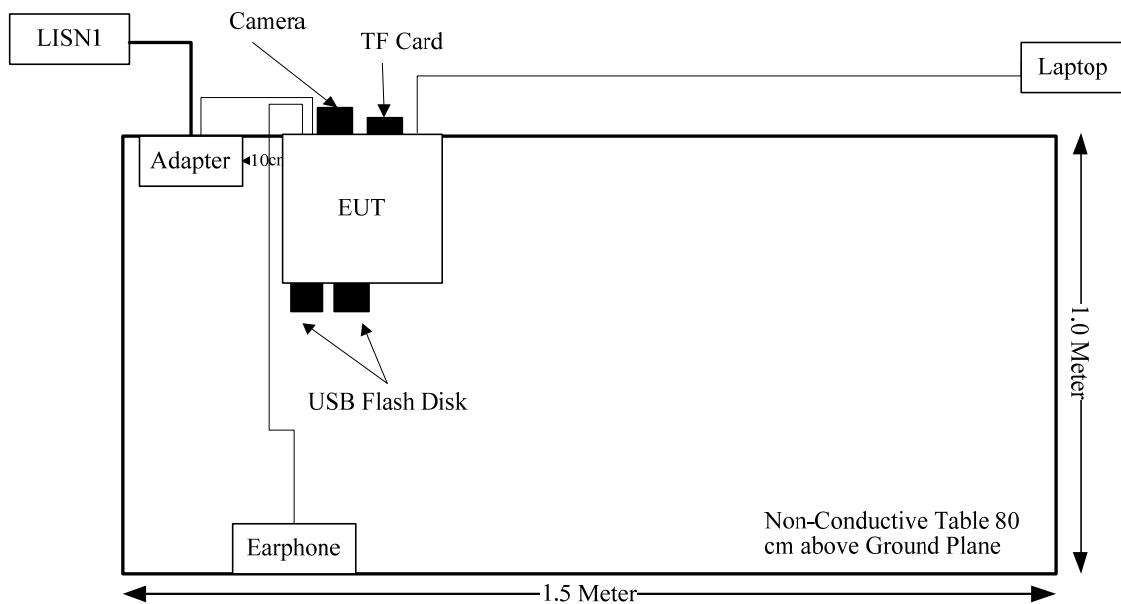
No modification was made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Hytera	Adapter	S010WU0500200	S010WU0500200
COTX	Camera	Un-known	SZGMA210604-21533E-RF-S2
DELL	Laptop	E6410	QDS-BRCM1017
Un-known	Earphone	Un-known	Earphone2
KINGSTON	U disk	32G	32G-1
KEYSIGHT	U disk	32G	32G-2
SANDISK	TF card	SDDR-C531	SDDR-C531-2

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter Cable	No	No	1.5	adapter	EUT
RJ45	No	No	10	EUT	Laptop
Earphone Cable	No	No	1.2	EUT	Earphone

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

Applicable Standard

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

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

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

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

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

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

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

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

Calculated Data:

Radio	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)			
Lora-DSS	902.3-914.9	3.5	2.24	20	100.00	20.00	0.04	0.60
Lora-DTS	923.3-927.5	3.5	2.24	26.5	446.68	20.00	0.20	0.62
BLE	2402-2480	3.5	2.24	2	1.58	20.00	0.0007	1.0
WLAN 2.4G	2412-2462	3.5	2.24	15	31.62	20.00	0.01	1.0
WLAN 5.8G	5725-5850	2.3	1.70	8	6.31	20.00	0.002	1.0

The WLAN 2.4G,5G or BLE can't transmit simultaneously, Wi-Fi/BLE can transmit simultaneously with Lora:

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

$$=S_{WLAN}/S_{limit-WLAN} + S_{Lora}/S_{limit-Lora}$$

$$=0.01/1+0.20/0.62$$

$$=0.33$$

$$< 1.0$$

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 Connector Construction

The EUT has one antenna arrangement for Wi-Fi/BLE and one antenna arrangement for Lora, use a unique type of connector to attach to the EUT. fulfill the requirement of this section. Please refer to the EUT photos.

Radios	Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency Range
Wi-Fi/BLE	Dipole	50	3.5 dBi/2.4~2.5GHz 2.3 dBi/5.725~5.85 GHz
Lora	Dipole	50	3.5 dBi/902~928 MHz

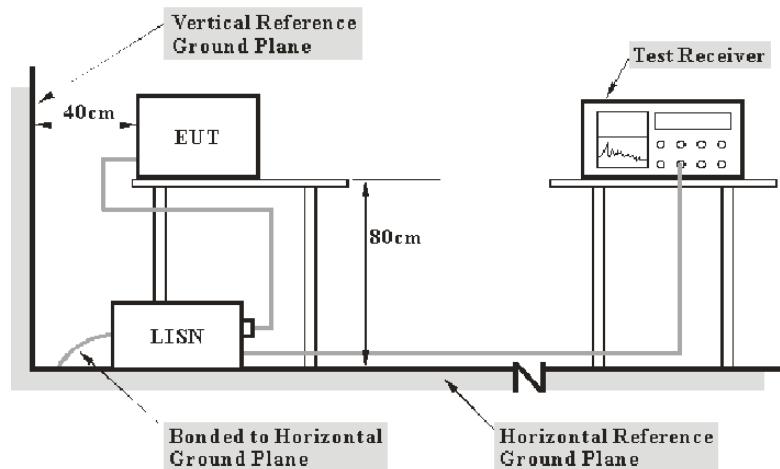
Result: Compliance.

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.

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

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:

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV 216	101614	2020-09-12	2021-09-12
R&S	EMI Test Receiver	ESCI	101121	2021-07-06	2022-07-05
MICRO-COAX	Coaxial Cable	C-NJNJ-50	C-0200-01	2020-09-05	2021-09-05
R&S	Test Software	EMC32	Version 9.10.00	N/A	N/A

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

Test Data

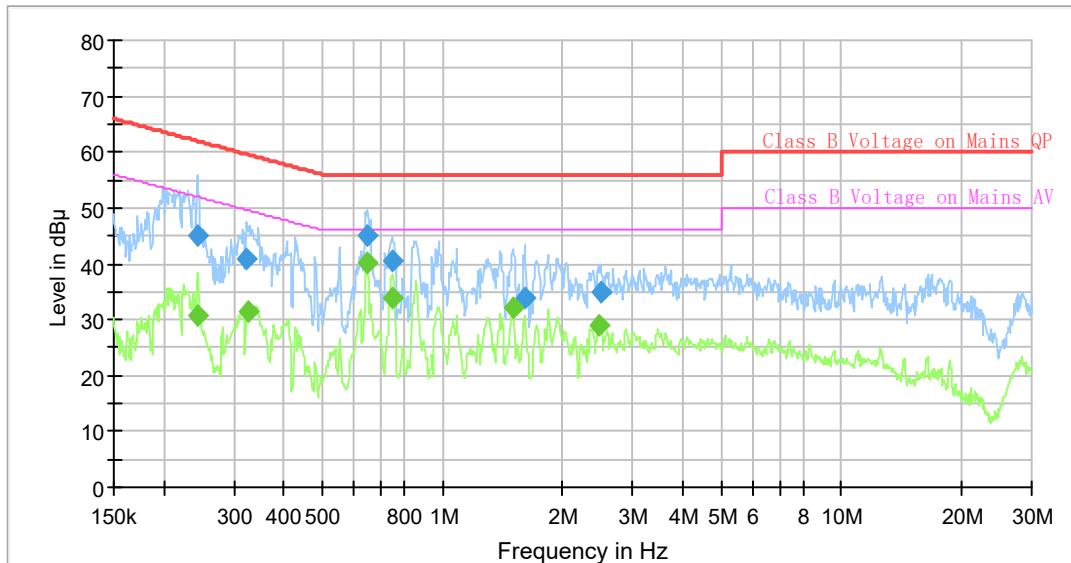
Environmental Conditions

Temperature:	26.7°C
Relative Humidity:	63%
ATM Pressure:	100.3kPa
Test by:	Walker Chen
Test Date:	2021-08-25

Test Result: Compliance

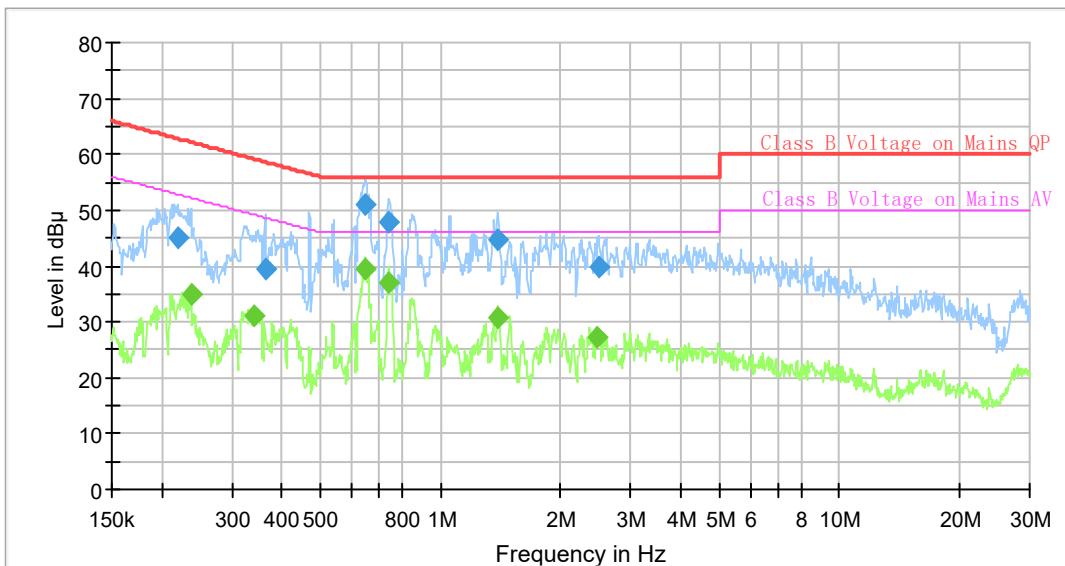
Test Mode: Transmitting

AC120V, 60 Hz, Line:



Final Result

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.242121	45.21	---	62.02	16.81	9.000	L1	9.6
0.244549	---	30.84	51.94	21.10	9.000	L1	9.6
0.323344	40.97	---	59.62	18.65	9.000	L1	9.6
0.326585	---	31.48	49.54	18.06	9.000	L1	9.6
0.646766	---	40.16	46.00	5.84	9.000	L1	9.6
0.650000	44.92	---	56.00	11.08	9.000	L1	9.6
0.747417	40.37	---	56.00	15.63	9.000	L1	9.7
0.751154	---	33.90	46.00	12.10	9.000	L1	9.7
1.502491	---	32.06	46.00	13.94	9.000	L1	9.7
1.611153	33.89	---	56.00	22.11	9.000	L1	9.7
2.461795	---	29.00	46.00	17.00	9.000	L1	9.7
2.486475	34.84	---	56.00	21.16	9.000	L1	9.7

AC120V, 60 Hz, Neutral:**Final_Result**

Frequency (MHz)	QuasiPeak (dB μV)	Average (dB μV)	Limit (dB μV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.219135	45.20	---	62.85	17.65	9.000	N	9.6
0.237339	---	35.05	52.19	17.14	9.000	N	9.6
0.339880	---	31.21	49.21	18.00	9.000	N	9.6
0.364460	39.41	---	58.63	19.22	9.000	N	9.6
0.650000	---	39.31	46.00	6.69	9.000	N	9.6
0.650000	50.91	---	56.00	5.09	9.000	N	9.6
0.743699	47.94	---	56.00	8.06	9.000	N	9.6
0.743699	---	36.95	46.00	9.05	9.000	N	9.6
1.394186	44.78	---	56.00	11.22	9.000	N	9.6
1.394186	---	30.71	46.00	15.29	9.000	N	9.6
2.474104	---	27.36	46.00	18.64	9.000	N	9.6
2.486475	39.99	---	56.00	16.01	9.000	N	9.6

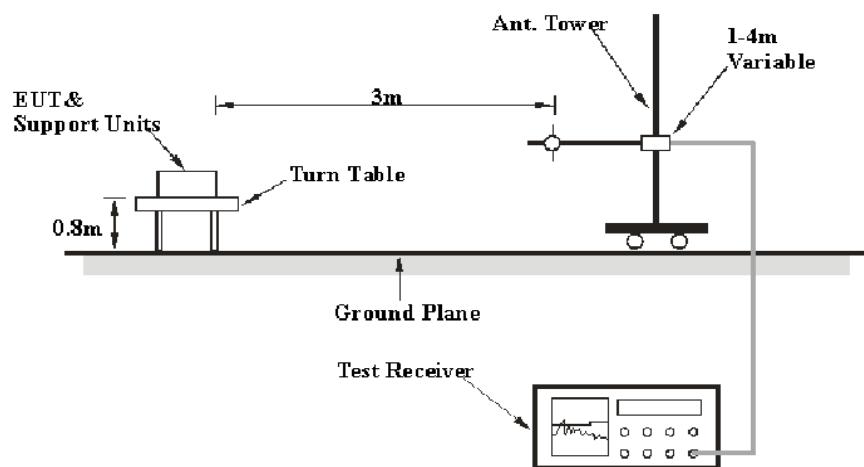
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

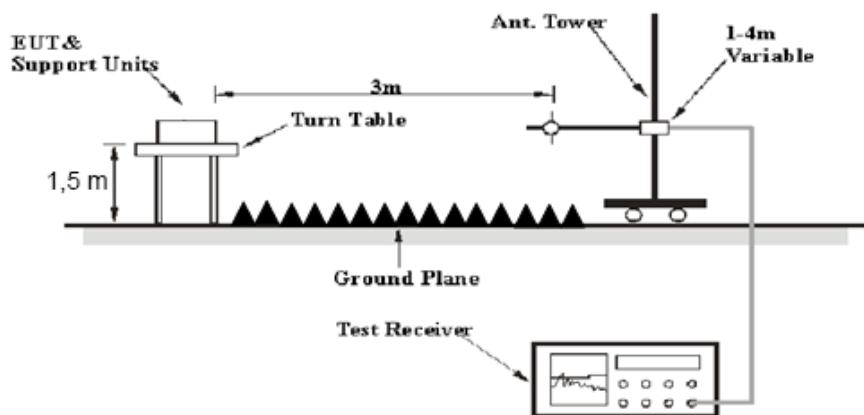
FCC §15.247 (d); §15.209; §15.205.

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 A, 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 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
Radiation Below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-2	2020-08-25	2023-08-25
R&S	EMI Test Receiver	ESCI	100224	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2020-09-24	2021-09-24
Sonoma	Amplifier	310N	185914	2020-10-13	2021-10-13
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Radiation Above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Agilent	Spectrum Analyzer	E4440A	SG43360054	2021-07-22	2022-07-21
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2020-09-05	2021-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2020-09-05	2021-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
E-Microwave	Band-stop Filters	OBSF-902-928-D	OE02012122	2021-06-16	2022-06-15

*** 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:

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

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 Data

Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	26.8°C	27.8°C
Relative Humidity:	55 %	50 %
ATM Pressure:	100.6kPa	100.6kPa
Tester:	Johnson Huang	Joker Chen
Test Date:	2021-08-30	2021-08-30

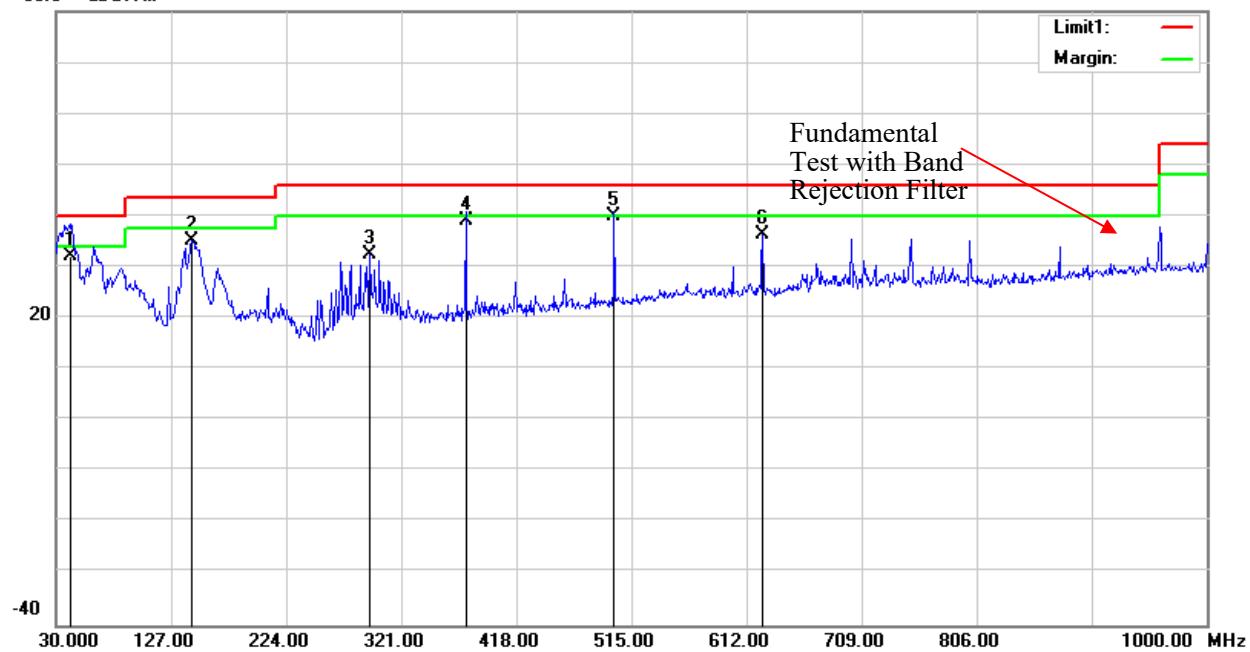
Test Result: Compliance, please Refer to the following data

Test Mode: Transmitting

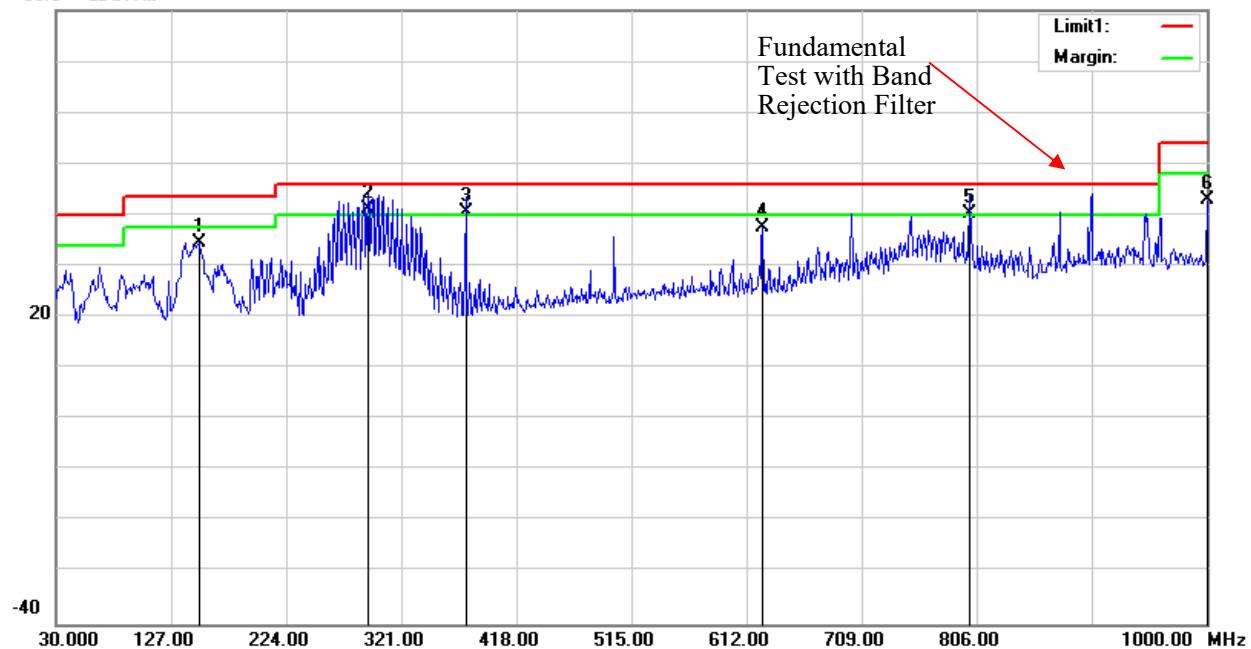
The WLAN 2.4G,5G or BLE can't transmit simultaneously, Wi-Fi/BLE can transmit simultaneously with Lora. Per pretest, no additional emission was created when simultaneous transmitting.

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

Horizontal:

80.0 dB μ V/m

Frequency (MHz)	Receiver Reading (dB μ V)	Detector	Correction Factor (dB/m)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
42.6100	43.29	QP	-10.99	32.30	40.00	7.70
144.4600	44.18	peak	-8.92	35.26	43.50	8.24
293.8400	40.13	peak	-7.67	32.46	46.00	13.54
375.3200	44.91	QP	-5.93	38.98	46.00	7.02
500.4500	43.39	QP	-3.45	39.94	46.00	6.06
625.5800	37.07	peak	-0.82	36.25	46.00	9.75

Vertical:80.0 dB μ V/m

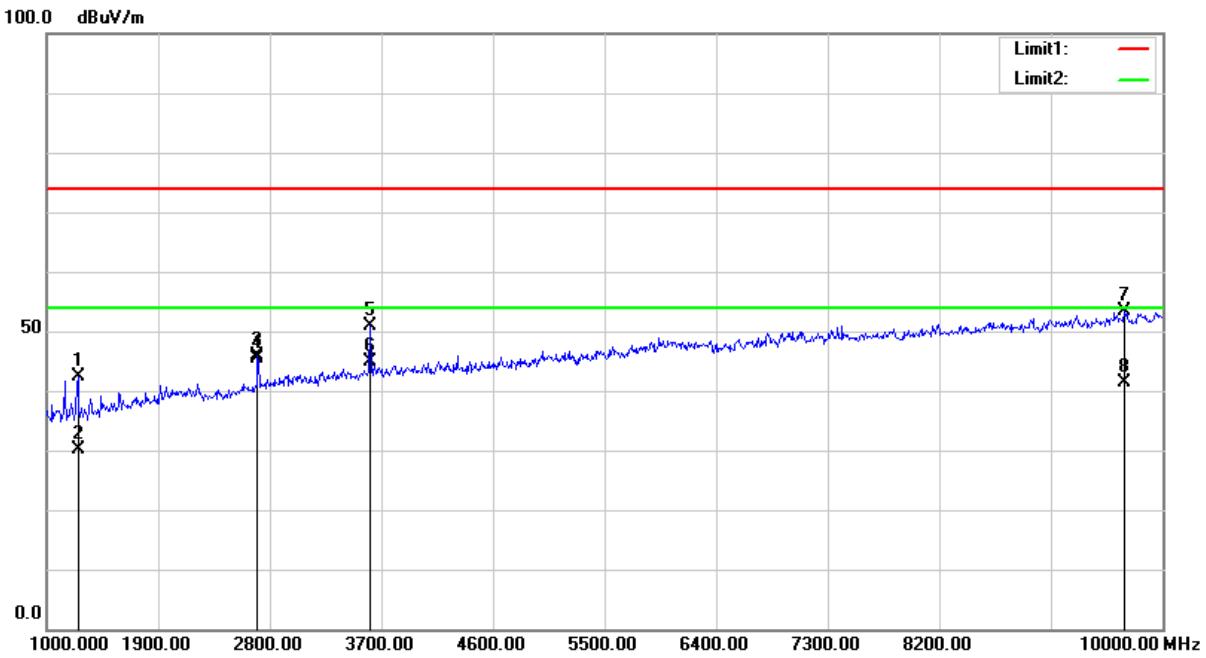
Frequency (MHz)	Receiver Reading (dB μ V)	Detector	Correction Factor (dB/m)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
150.2800	43.89	peak	-9.27	34.62	43.50	8.88
292.8700	48.87	QP	-7.80	41.07	46.00	4.93
375.3200	46.57	QP	-5.93	40.64	46.00	5.36
625.5800	38.36	peak	-0.82	37.54	46.00	8.46
800.1800	39.08	QP	1.14	40.22	46.00	5.78
1000.0000	37.56	peak	5.45	43.01	54.00	10.99

2) Bandedge, and above 1GHz:

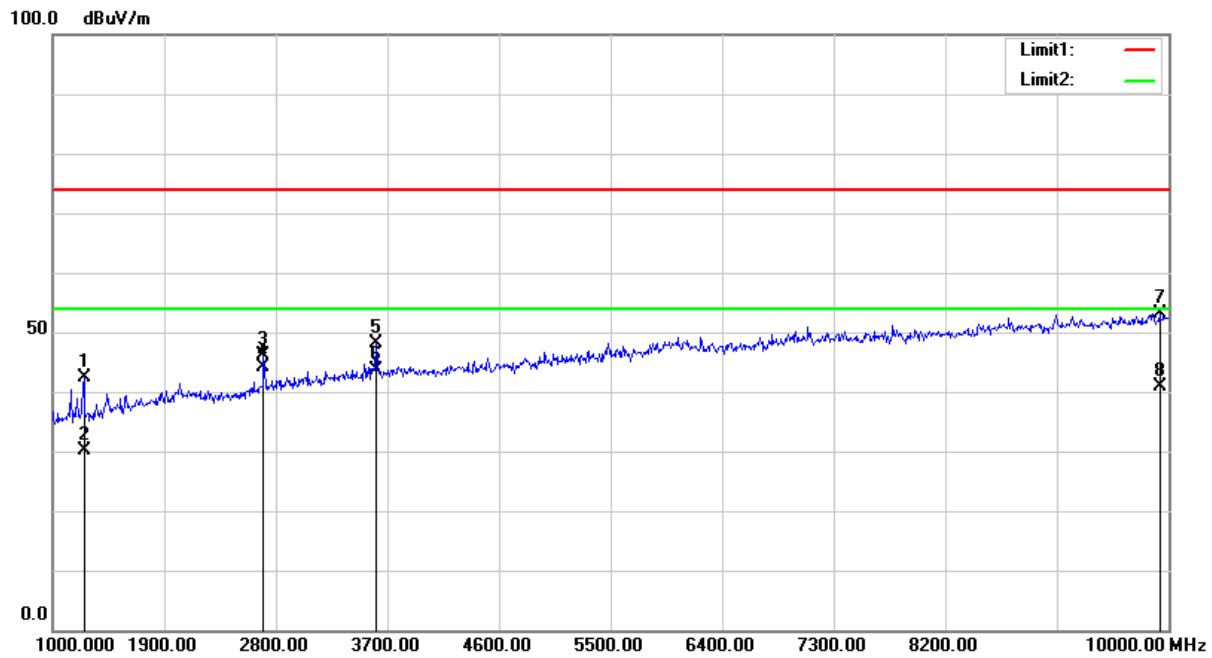
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 902.3MHz									
902.30	83.58	QP	V	21.42	2.00	0.00	107.00	N/A	N/A
902.30	78.95	QP	H	21.42	2.00	0.00	102.37	N/A	N/A
902.00	23.69	QP	V	21.42	2.00	0.00	47.11	87.00	39.89
1804.60	45.56	PK	V	26.32	3.05	27.82	47.11	74.00	26.89
1804.60	43.10	AV	V	26.32	3.05	27.82	44.65	54.00	9.35
2706.90	41.99	PK	V	29.09	3.58	27.88	46.78	74.00	27.22
2706.90	40.65	AV	V	29.09	3.58	27.88	45.44	54.00	8.56
3609.20	41.22	PK	V	31.48	4.26	26.70	50.26	74.00	23.74
3609.20	36.78	AV	V	31.48	4.26	26.70	45.82	54.00	8.18
Middle Channel: 908.5MHz									
908.50	83.69	QP	V	21.47	2.06	0.00	107.22	N/A	N/A
908.50	74.99	QP	H	21.47	2.06	0.00	98.52	N/A	N/A
1817.00	44.60	PK	V	26.39	3.03	27.82	46.20	74.00	27.80
1817.00	41.13	AV	V	26.39	3.03	27.82	42.73	54.00	11.27
2725.50	39.97	PK	V	29.16	3.60	27.88	44.85	74.00	29.15
2725.50	34.24	AV	V	29.16	3.60	27.88	39.12	54.00	14.88
3634.00	41.99	PK	V	31.55	4.20	26.72	51.02	74.00	22.98
3634.00	36.03	AV	V	31.55	4.20	26.72	45.06	54.00	8.94
High Channel: 914.9MHz									
914.90	84.95	QP	H	21.52	2.04	0.00	108.51	N/A	N/A
914.90	79.85	QP	V	21.52	2.04	0.00	103.41	N/A	N/A
928.00	16.26	QP	H	21.62	2.05	0.00	32.37	88.51	56.14
1829.80	42.58	PK	V	26.45	3.01	27.83	44.21	74.00	29.79
1829.80	40.25	AV	V	26.45	3.01	27.83	41.88	54.00	12.12
2744.70	38.24	PK	V	29.23	3.61	27.88	43.20	74.00	30.80
2744.70	36.85	AV	V	29.23	3.61	27.88	41.81	54.00	12.19
3659.60	40.58	PK	V	31.61	4.18	26.75	49.62	74.00	24.38
3659.60	35.85	AV	V	31.61	4.18	26.75	44.89	54.00	9.11

Worst plots(Low channel)

Horizontal



Vertical



FCC §15.247(a) (1) - CHANNEL SEPARATION TEST**Applicable Standard**

According to FCC §15.247(a) (1)

Frequency hopping systems shall have hopping 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	ESR3	102724	2021-06-21	2022-06-20
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA20-2RN-2	OE0120328	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**

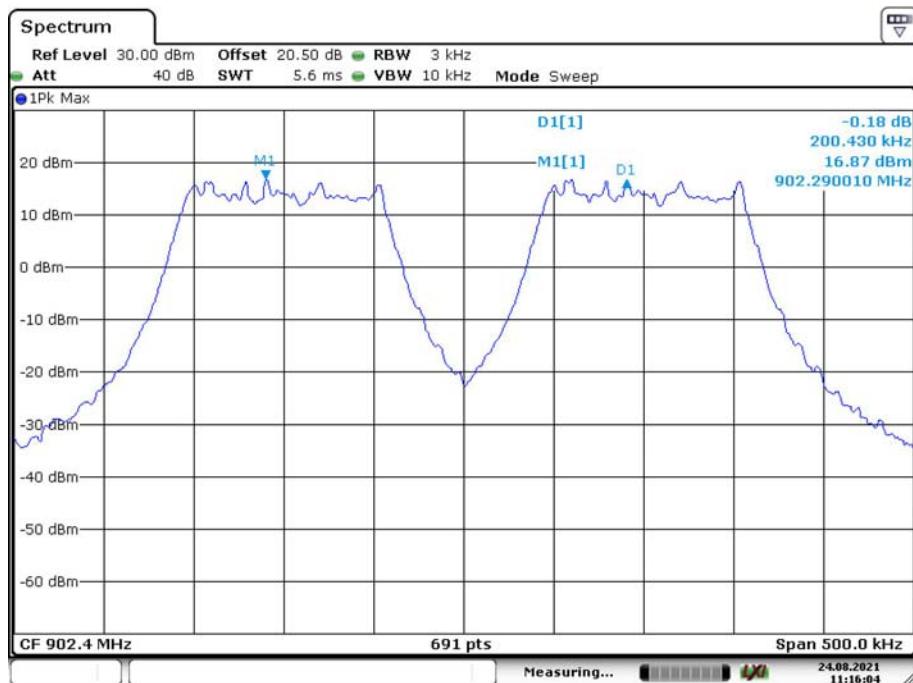
Temperature:	26.9~27°C
Relative Humidity:	65~70%
ATM Pressure:	100.1~100.5 kPa
Tester:	Jack Zhou
Test Date:	2021-08-24~2021-08-26

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

Test Mode: Transmitting

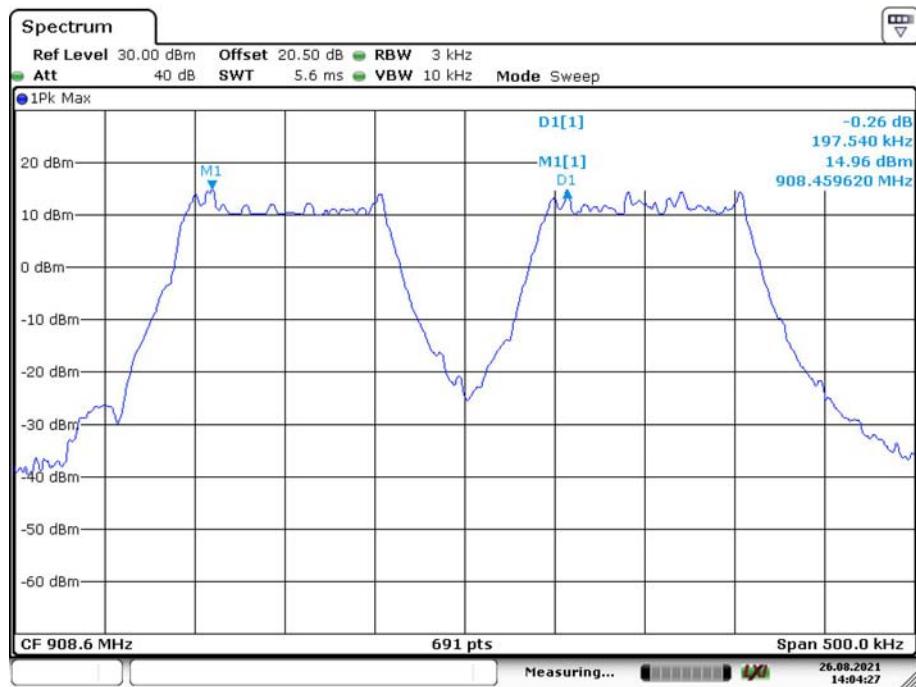
Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
Low	902.3	0.200	0.137
Middle	908.5	0.198	0.137
High	914.9	0.200	0.137

Low Channel



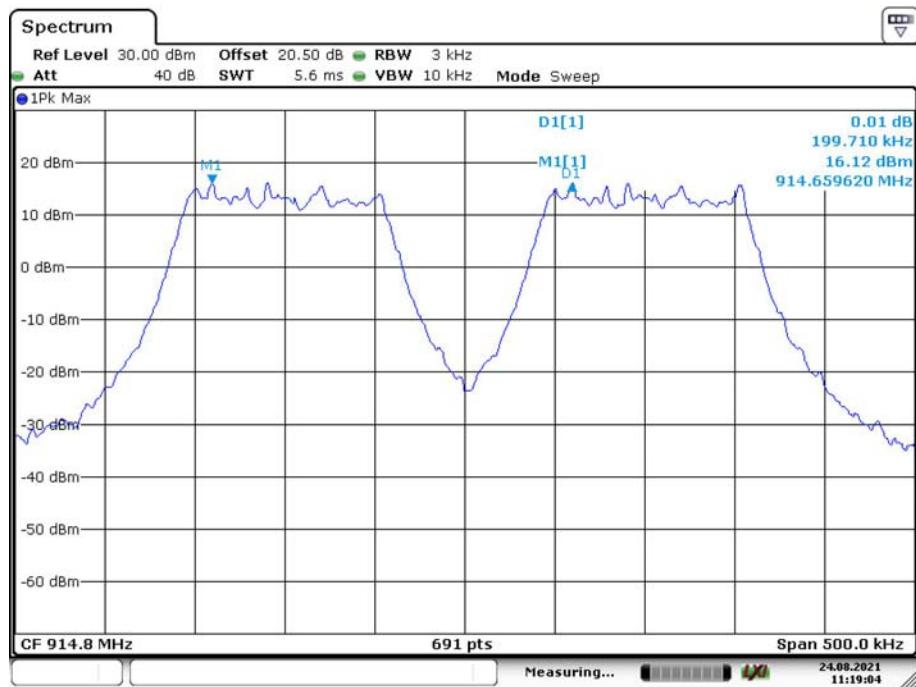
Date: 24.AUG.2021 11:16:05

Middle Channel



Date: 26.AUG.2021 14:04:27

High Channel



Date: 24.AUG.2021 11:19:05

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	EMI Test Receiver	ESR3	102724	2021-06-21	2022-06-20
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA20-2RN-2	OE0120328	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:	26.9~27°C
Relative Humidity:	65~70%
ATM Pressure:	100.1~100.5 kPa
Tester:	Jack Zhou
Test Date:	2021-08-24~2021-08-26

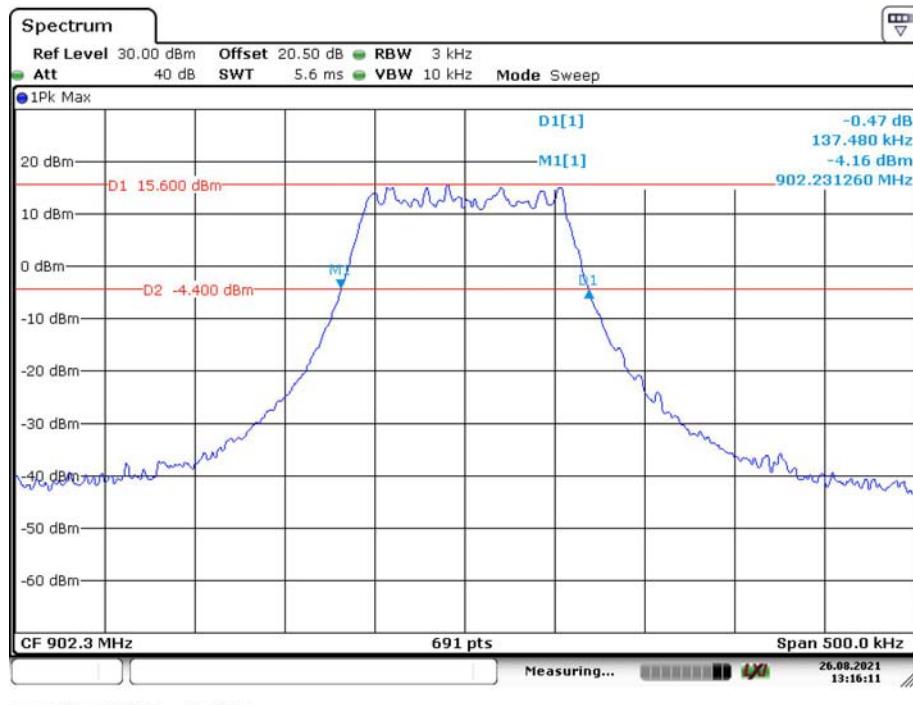
Test Result: Compliance. Please refer to following tables and plots

Test Mode: Transmitting

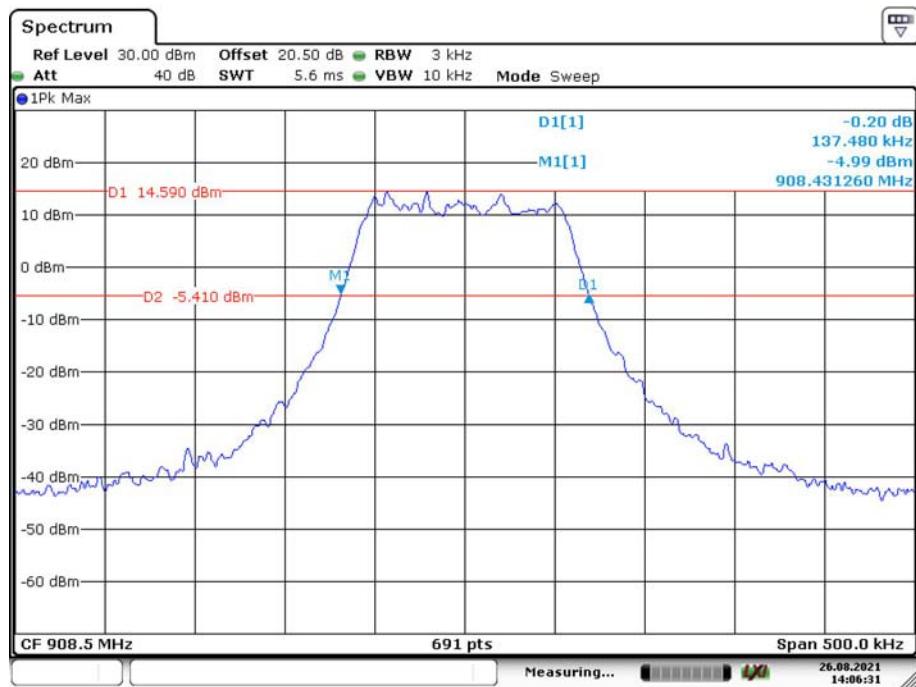
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	902.3	0.137
Middle	908.5	0.137
High	914.9	0.137

20dB Bandwidth:

Low Channel

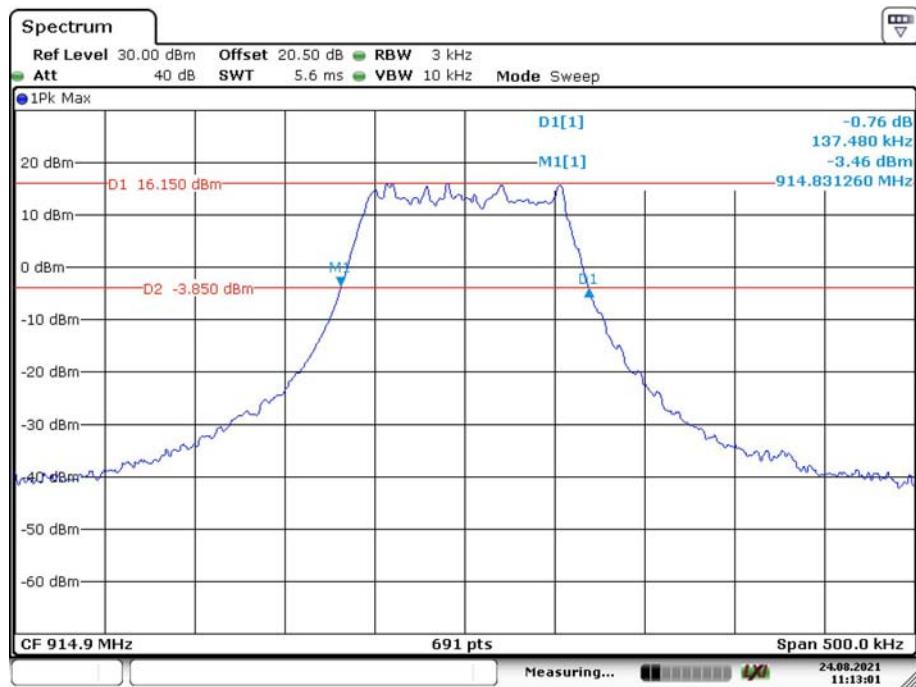


Middle Channel



Date: 26.AUG.2021 14:06:32

High Channel



Date: 24.AUG.2021 11:13:01

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	ESR3	102724	2021-06-21	2022-06-20
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA20-2RN-2	OE0120328	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

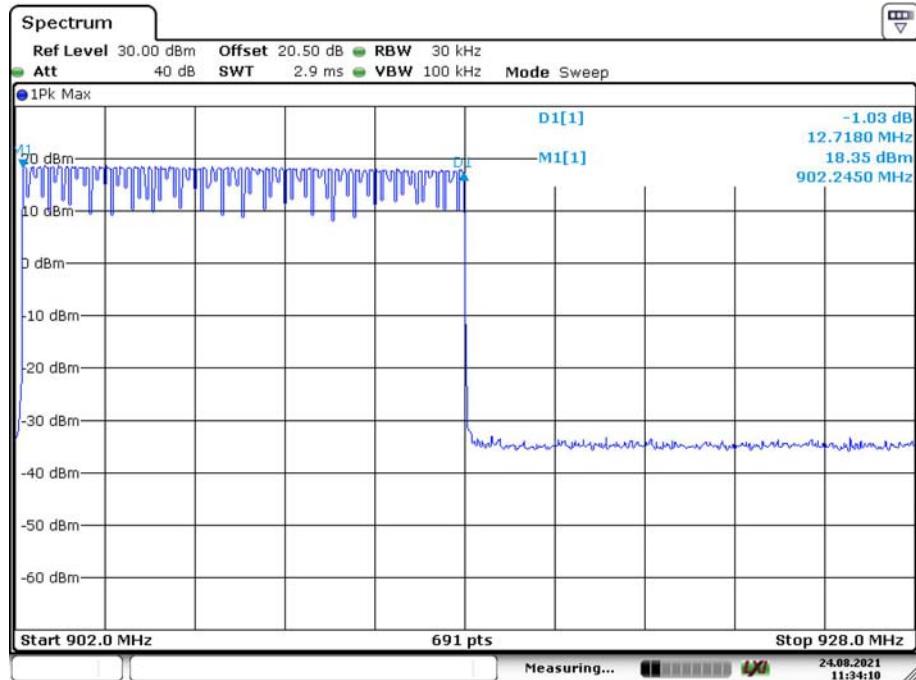
Temperature:	26.9~27°C
Relative Humidity:	65~70%
ATM Pressure:	100.1~100.5 kPa
Tester:	Jack Zhou
Test Date:	2021-08-24~2021-08-26

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

Test Mode: Transmitting

Frequency Range (MHz)	Number of Hopping Channel	Limit
902.3-914.9	64	≥ 50

Number of Hopping Channels



Date: 24.AUG.2021 11:34:10

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	EMI Test Receiver	ESR3	102724	2021-06-21	2022-06-20
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA20-2RN-2	OE0120328	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

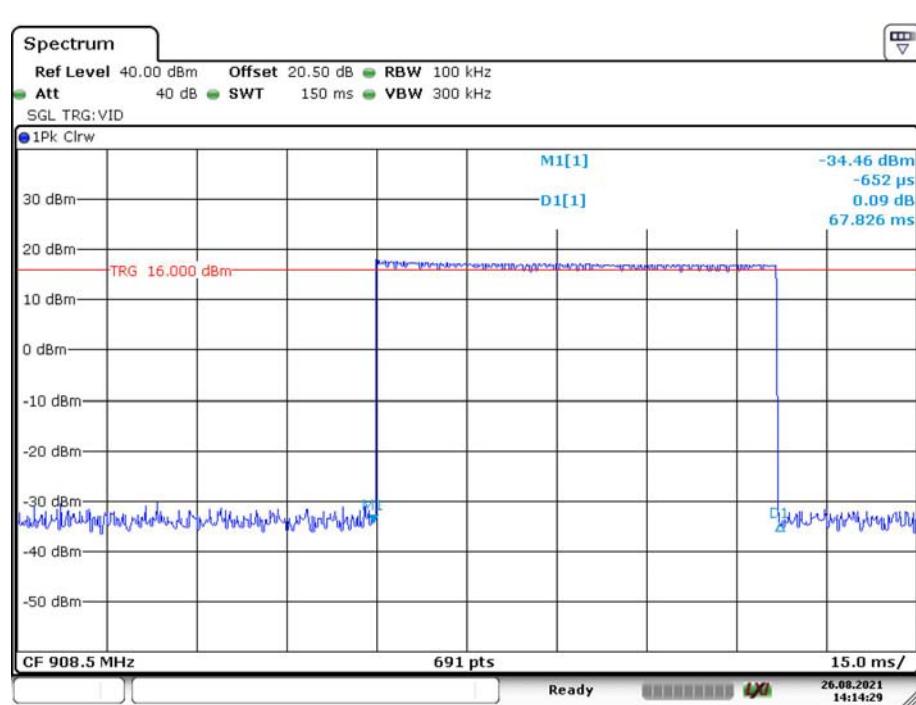
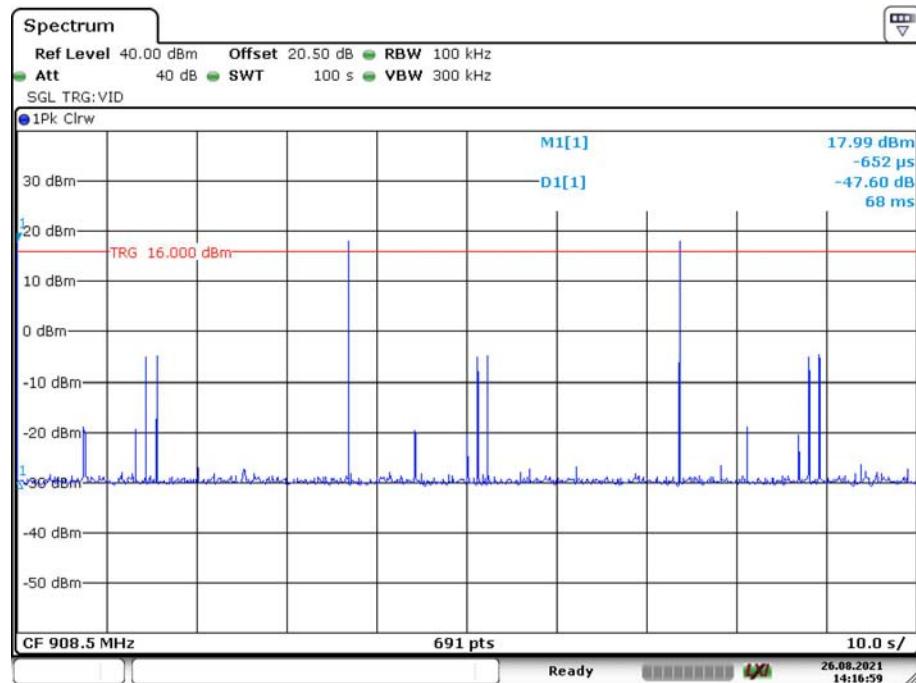
Temperature:	27°C
Relative Humidity:	70%
ATM Pressure:	100.5 kPa
Tester:	Jack Zhou
Test Date:	2021-08-26

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	67.826	20	1	0.0678	0.4	Compliance

Note:
Dwell time=Pulse width × hopping number per channel in Observed Period
Observed Period=20s

Middle Channel



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
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA20-2RN-2	OE0120328	Each time	N/A
Agilent	USB Wideband Power Sensor	U2022XA	MY5417006	2020-09-12	2021-09-12

* **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:	26.9~27°C
Relative Humidity:	65~70%
ATM Pressure:	100.1~100.5 kPa
Tester:	Jack Zhou
Test Date:	2021-08-24~2021-08-26

Test Result: Compliance.

Test Mode: Transmitting

Channel	Frequency (MHz)	Peak Conducted Output power (dBm)	Limit (dBm)
Low	902.3	19.09	30
Middle	908.5	18.74	30
High	914.9	19.44	30

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	ESR3	102724	2021-06-21	2022-06-20
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA20-2RN-2	OE0120328	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

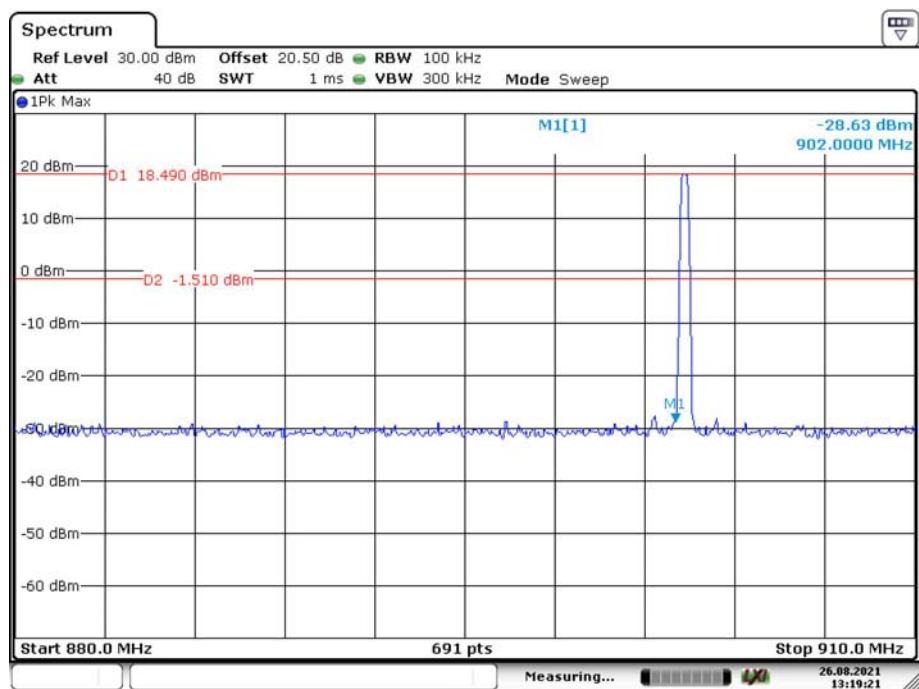
Environmental Conditions

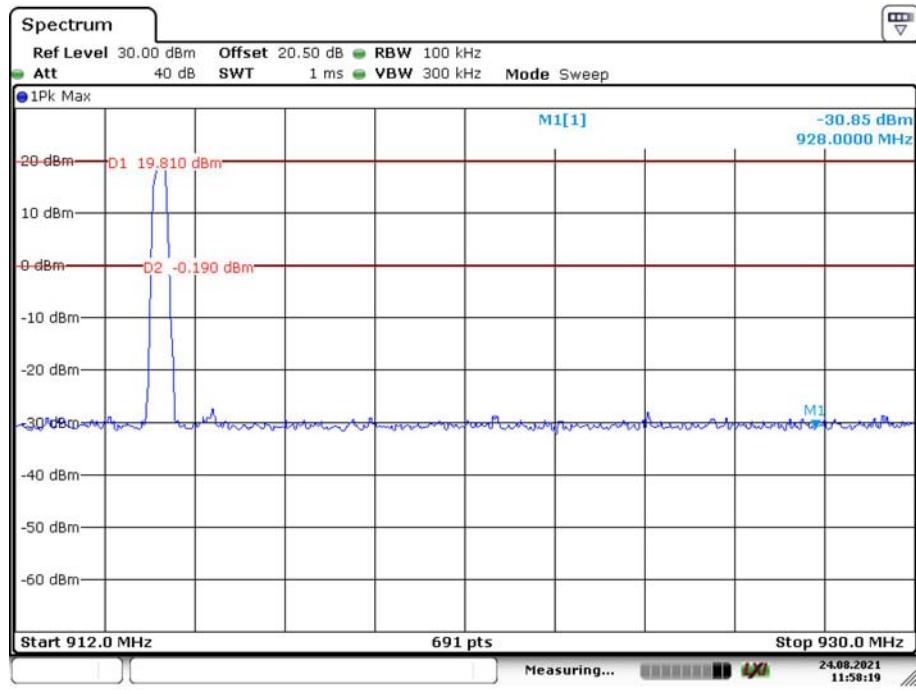
Temperature:	26.9~27°C
Relative Humidity:	65~70%
ATM Pressure:	100.1~100.5 kPa
Tester:	Jack Zhou
Test Date:	2021-08-24~2021-08-26

Test Result: Compliance

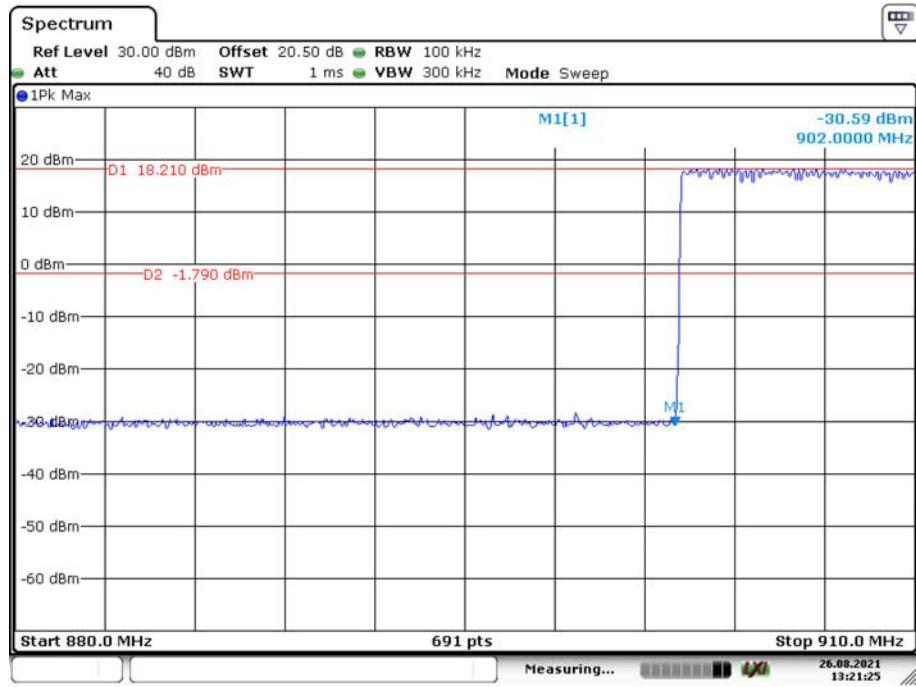
Single mode:

Band Edge, Left Side

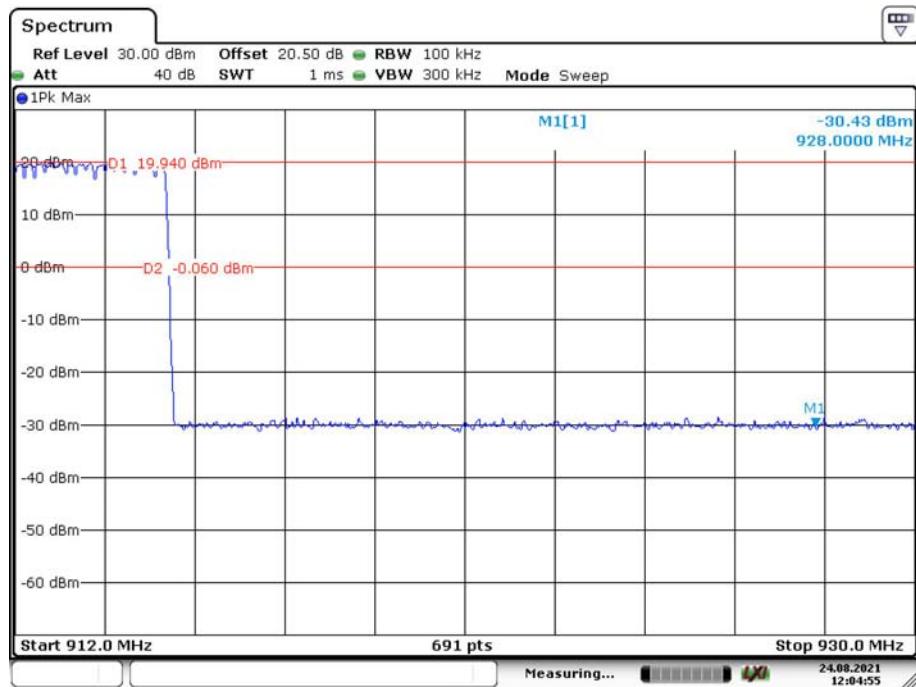


Band Edge, Right Side

Date: 24.AUG.2021 11:58:19

*Hopping mode:***Band Edge, Left Side**

Date: 26.AUG.2021 13:21:26

Band Edge, Right Side

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