NVLAP TESTING
NVLAP LAB CODE 600341-0

BACL Bay Area Compliance Labs Corp.

TEST REPORT

Applicant: **shen zhen shi jia yun dian zi shang wu you xian gong si**

Address: **LongHuaQu GuanHuJieDao GuanChengSheQu GuanLanDaDao 396Hao MeiGuiYuan YiDanYuan 332 Shen Zhen China**

Product Name: **2.4GHz USB**

FCC ID: **2BFB6-FORCEONE41TX**

Standard(s): **47 CFR Part 15, Subpart C(15.247)**
ANSI C63.10-2013
KDB 558074 D01 15.247 Meas Guidance v05r02

Report Number: **2402S43771-RF-00A**

Report Date: **2024/5/3**

The above device has been tested and found compliant with the requirement of the relative standards by Bay Area Compliance Laboratories Corp. (Dongguan).

Reviewed By: Gavin Xu
Title: RF Engineer

Approved By: Ivan Cao
Title: EMC Manager

Bay Area Compliance Laboratories Corp. (Dongguan)
No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China
Tel: +86-769-86858888
Fax: +86-769-86858891
www.baclcorp.com.cn

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	2402S43771-RF-00A	Original Report	2024/5/3

1. GENERAL INFORMATION

1.1 General Description Of Equipment under Test

EUT Name:	2.4GHz USB
EUT Model:	ForceOne41TX
Operation Frequency:	2402-2480 MHz
Maximum Peak Output Power (Conducted):	1.28 dBm
Modulation Type:	GFSK
Rated Input Voltage:	DC 5V From USB Host
Serial Number:	2JJ7-2(For RF Conducted Test) 2JJ7-1(For Radiated Spurious Emissions and AC line Conducted Emission Test)
EUT Received Date:	2024/4/5
EUT Received Status:	Good

1.2 Accessory Information

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/

1.3 Antenna Information Detail▲

Antenna Manufacturer	Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain
Shenzhen Yonglian Wireless Technology Co., Ltd.	Chip	50	2.4~2.484GHz	3.5 dBi
The design of compliance with §15.203:				
☒ Unit uses a permanently attached antenna.				
☐ Unit uses a unique coupling to the intentional radiator.				
☐ Unit was professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.				

1.4 Equipment Modifications

No modifications are made to the EUT during all test items.

2. SUMMARY OF TEST RESULTS

Standard(s) Section	Test Items	Result
§15.207(a)	AC line conducted emissions	Compliant
§15.205, §15.209, §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	Minimum 6 dB Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.203	Antenna Requirement	Compliant
Note 1: For AC line conducted emissions, the maximum output power mode and channel was tested. Note 2: For Radiated Spurious Emissions 9kHz~ 1GHz, the maximum output power mode and channel was tested.		

3. DESCRIPTION OF TEST CONFIGURATION

3.1 Operation Frequency Detail

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
..	…	38	2478
19	**2440**	39	**2480**

3.2 EUT Operation Condition

The EUT was configured for testing in Engineering Mode, which was provided by the manufacturer.
The EUT configuration as below:

EUT Exercise Software:	FCC_assist_1.0.2.2		
The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer▲:			
Test Modes	Power Level Setting		
	Lowest	Middle	Highest
SRD	5	5	5

3.3 Support Equipment List and Details

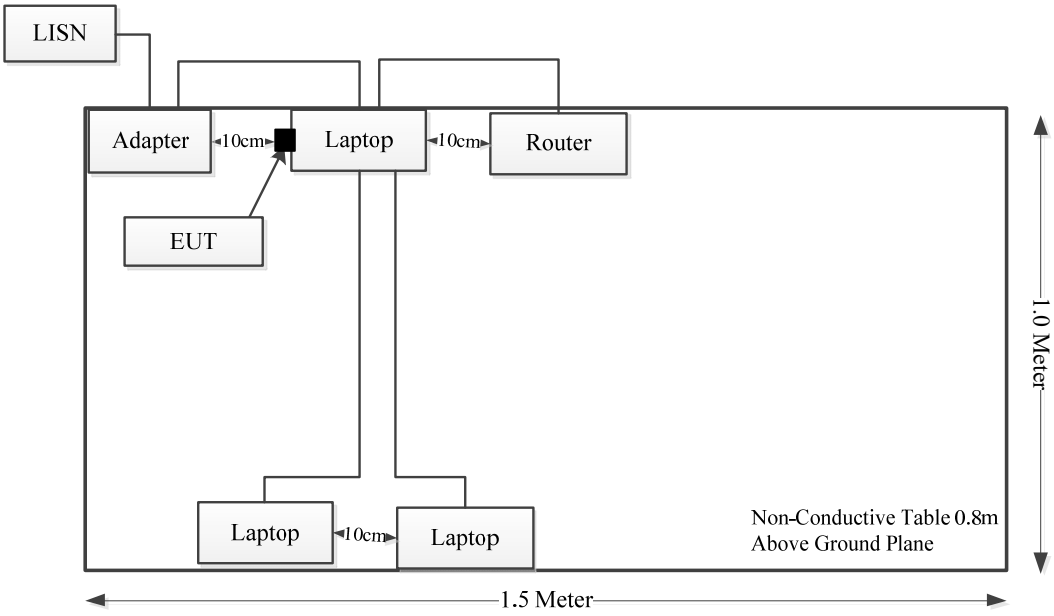
Manufacturer	Description	Model	Serial Number
Lenovo	Laptop	E450	PF-OMR8KV
Lenovo	Laptop	E480	PF-1QQYYP 19/06
Lenovo	Adapter	92P1109	11S92P1109Z1ZBTZ93A 6YG
ZIONCOM	Router	MB-R210-00	EMZBWR21103004
Dell	Keyboard	KB212-B	CN-0K6KPN-71616-24N-0658-A00
PHILIPS	Mouse	SPK7214	M214BQ210411113

3.4 Support Cable List and Details

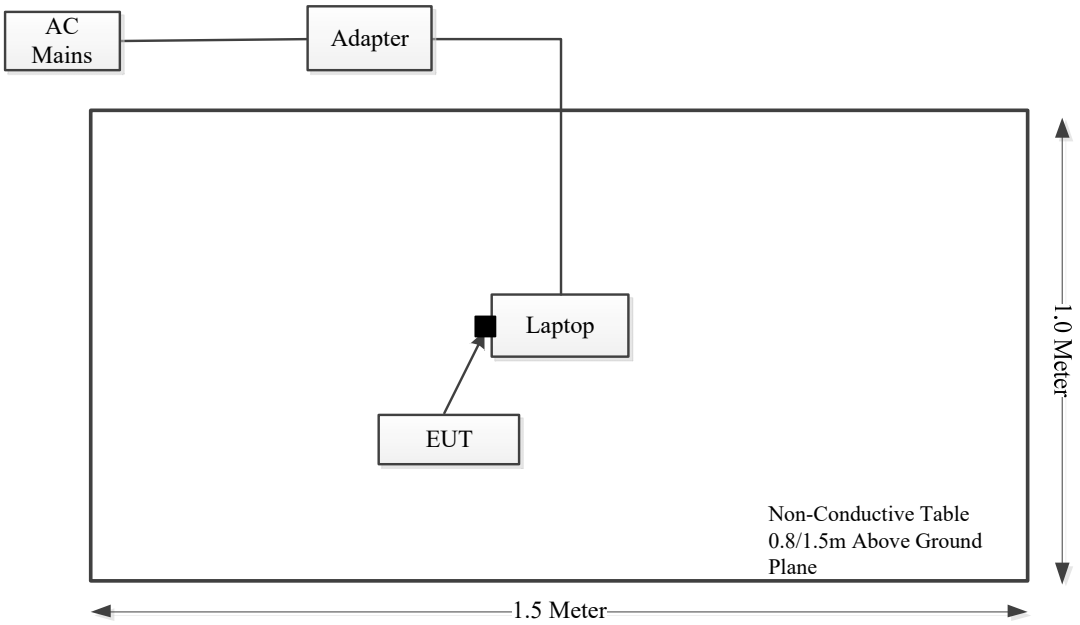
Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
DC Cable	NO	NO	1.5	Adapter	Laptop
Keyboard Cable	NO	NO	1.2	Laptop	Keyboard
Mouse Cable	NO	NO	1.2	Laptop	Mouse
RJ45 Cable	NO	NO	0.8	Laptop	Router

3.5 Block Diagram of Test Setup

AC Power Lines Conducted Emission:



Radiated Spurious Emissions:



3.6 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. : 829273, the FCC Designation No. : CN5044.

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

3.7 Measurement Uncertainty

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.

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	9kHz~30MHz: 3.3dB, 30MHz~200MHz: 4.55 dB, 200MHz~1GHz: 5.92 dB, 1GHz~6GHz: 4.98 dB, 6GHz~18GHz: 5.89 dB, 18GHz~26.5GHz:5.47 dB, 26.5GHz~40GHz:5.63 dB
Unwanted Emissions, conducted	±2.47 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.11 dB (150 kHz to 30 MHz)

4. REQUIREMENTS AND TEST PROCEDURES

4.1 AC Line Conducted Emissions

4.1.1 Applicable Standard

FCC§15.207(a).

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

	Conducted limit (dBµV)	
Frequency of emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

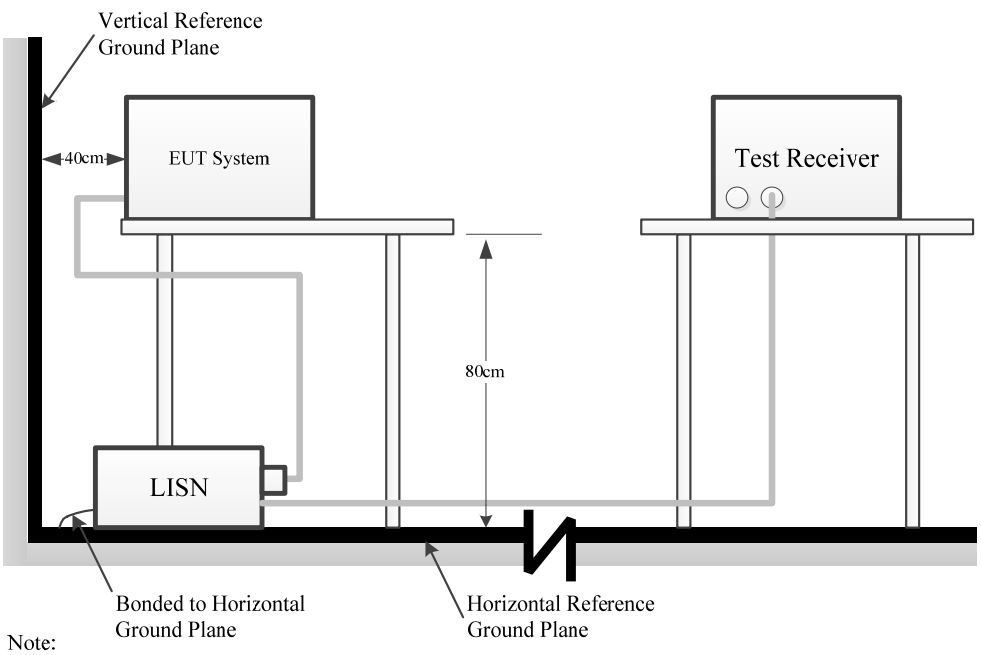
(1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtainig their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

4.1.2 EUT Setup



Note:
1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at least 80 cm from other units and oter 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 or EUT was connected to the main LISN with a 120 V/60 Hz AC power source.

4.1.3 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

4.1.4 Test Procedure

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.

4.1.5 Corrected Result & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor
Factor = attenuation caused by cable loss + voltage division factor of AMN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

4.1.6 Test Result

Please refer to section 5.1.

4.2 Radiation Spurious Emissions

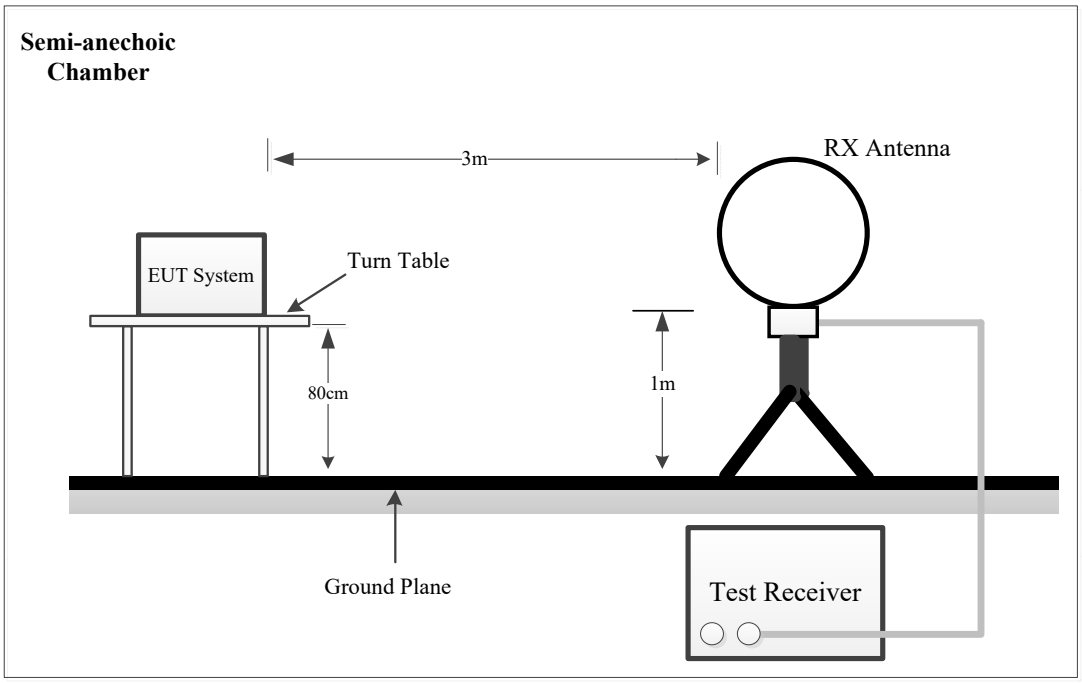
4.2.1 Applicable Standard

FCC §15.247 (d);

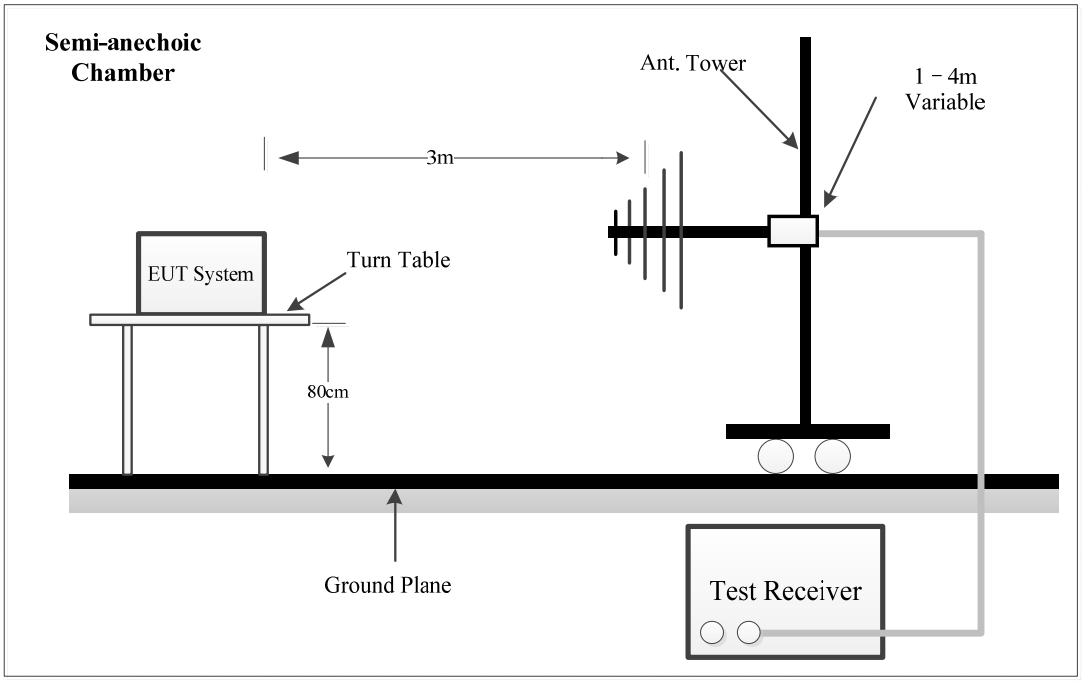
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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)).

4.2.2 EUT Setup

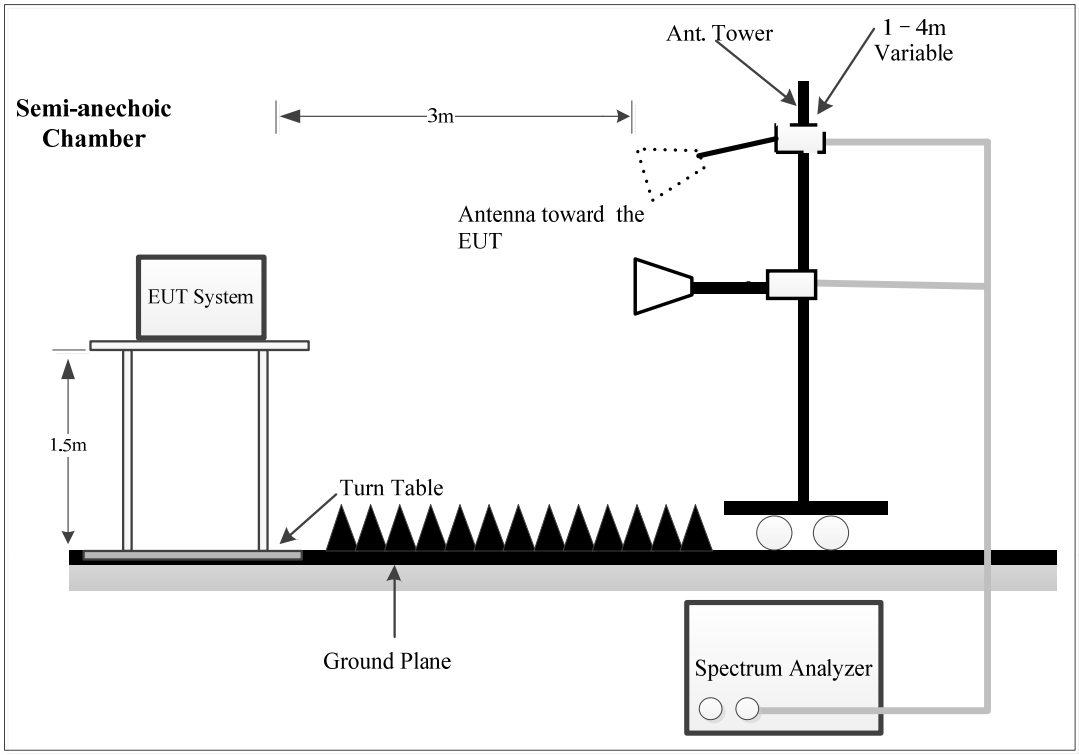
9kHz-30MHz:



30MHz~1GHz:



Above 1GHz:



The radiated emissions were performed in the 3 meters distance, 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.

For 9kHz-30MHz test, the lowest height of the magnetic antenna shall be 1 m above the ground and three antenna orientations (parallel, perpendicular, and ground-parallel) shall be measured.

4.2.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9kHz to 25 GHz.

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

9kHz-1000MHz:

Frequency Range	Measurement	RBW	Video B/W	IF B/W
9 kHz – 150 kHz	QP/AV	200 Hz	1 kHz	200 Hz
150 kHz – 30 MHz	QP/AV	9 kHz	30 kHz	9 kHz
30 MHz – 1000 MHz	PK	100 kHz	300 kHz	/
	QP	/	/	120 kHz

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	≥1/T

Note: T is minimum transmission duration

If the maximized peak measured value complies with under the QP limit more than 6dB, then it is unnecessary to perform an QP measurement.

If the maximized peak measured value complies with under the Average limit, then it is unnecessary to perform an Average measurement.

4.2.4 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 9 kHz-1 GHz except 9-90 kHz, 110-490 kHz, employing an average detector, peak and Average detection modes for frequencies above 1 GHz.

All emissions under the average limit and under the noise floor have not recorded in the report.

4.2.5 Corrected Result & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor
Factor = Antenna Factor + Cable Loss- Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

4.2.6 Test Result

Please refer to section 5.2.

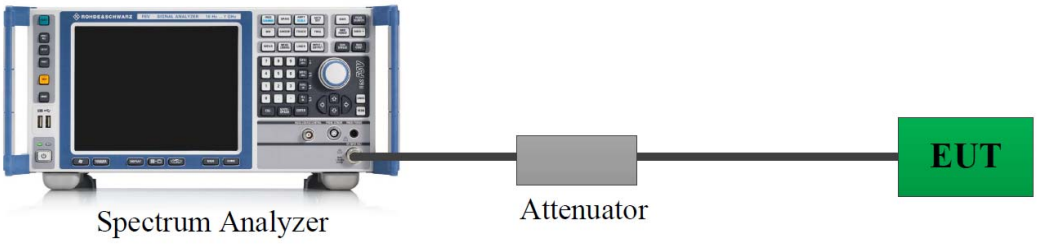
4.3 Minimum 6 dB Bandwidth

4.3.1 Applicable Standard

FCC §15.247 (a)(2)

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.3.2 EUT Setup



A short RF cable with low cable loss connected to the EUT antenna port, which was provided by manufacturer.

4.3.3 Test Procedure

According to ANSI C63.10-2013 Section 11.8

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.3.4 Test Result

Please refer to section 5.3.

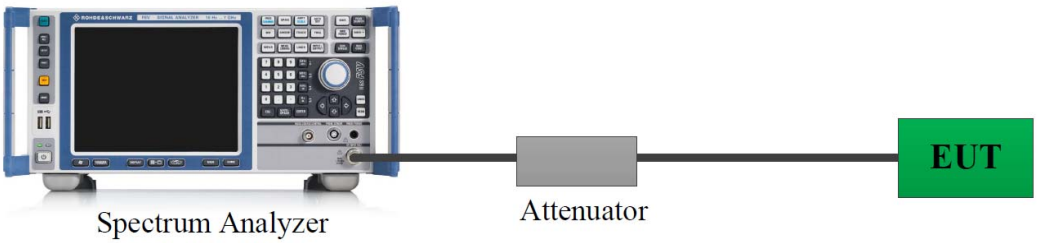
4.4 Maximum Conducted Output Power

4.4.1 Applicable Standard

FCC §15.247 (b)(3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

4.4.2 EUT Setup



A short RF cable with low cable loss connected to the EUT antenna port, which was provided by manufacturer. The cable loss of this RF cable was offset into the setting of test equipment, which was provided by manufacturer▲.

4.4.3 Test Procedure

According to ANSI C63.10-2013 Section 11.9.1.1

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:
a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

4.4.4 Test Result

Please refer to section 5.4.

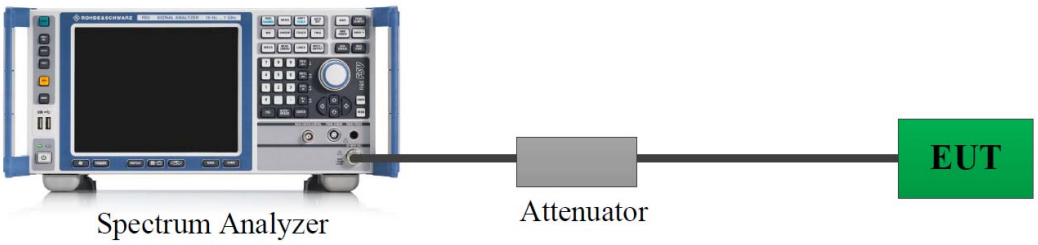
4.5 Maximum power spectral density

4.5.1 Applicable Standard

FCC §15.247 (e)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

4.5.2 EUT Setup



A short RF cable with low cable loss connected to the EUT antenna port, which was provided by manufacturer. The cable loss of this RF cable was offset into the setting of test equipment, which was provided by manufacturer▲.

4.5.3 Test Procedure

According to ANSI C63.10-2013 Section 11.10.2

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ [3 × RBW].
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

4.5.4 Test Result

Please refer to section 5.5.

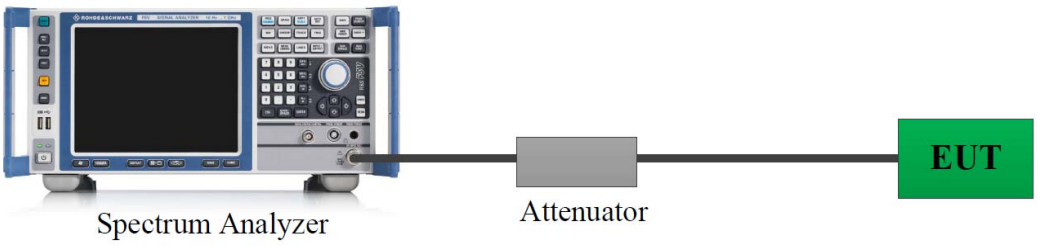
4.6 100 kHz Bandwidth of Frequency Band Edge

4.6.1 Applicable Standard

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)).

4.6.2 EUT Setup



A short RF cable with low cable loss connected to the EUT antenna port, which was provided by manufacturer.

4.6.3 Test Procedure

According to ANSI C63.10-2013 Section 11.11

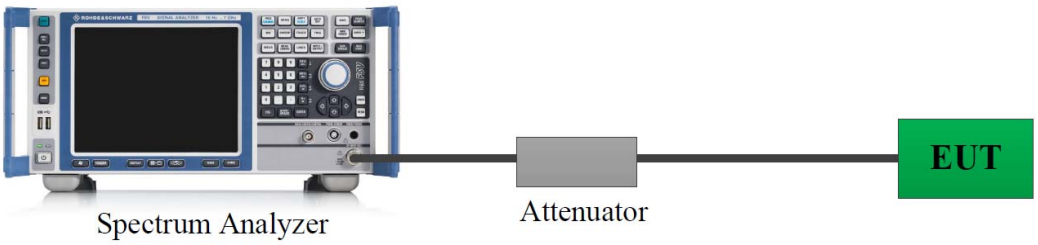
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

4.6.4 Test Result

Please refer to section 5.6.

4.7 Duty Cycle

4.7.1 EUT Setup



A short RF cable with low cable loss connected to the EUT antenna port, which was provided by manufacturer.

4.7.2 Test Procedure

According to ANSI C63.10-2013 Section 11.6

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:
1) Set the center frequency of the instrument to the center frequency of the transmission.
2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
3) Set VBW ≥ RBW. Set detector = peak or average.
4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if T ≤ 16.7 μs.)

4.7.3 Judgment

Report only, please refer to section 5.7.

4.8 Antenna Requirement

4.8.1 Applicable Standard

FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.8.2 Judgment

Compliant. Please refer to the Antenna Information detail in Section 1.3.

5. Test DATA AND RESULTS

5.1 AC Line Conducted Emissions

Serial Number:	2JJ7-1	Test Date:	2024/4/11
Test Site:	CE	Test Mode:	Transmitting
Tester:	Wright Lai	Test Result:	Pass

Environmental Conditions:

Temperature: (℃)	25.2	Relative Humidity: (%)	64	ATM Pressure: (kPa)	101.0

Test Equipment List and Details:

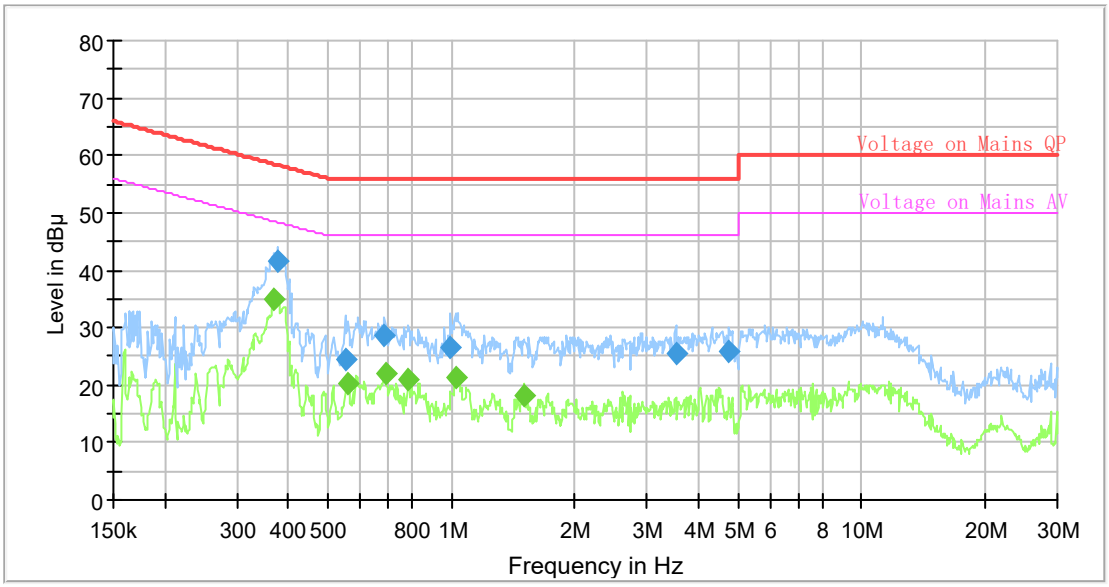
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	LISN	ENV216	101614	2023/10/18	2024/10/17
MICRO-COAX	Coaxial Cable	C-NJNJ-50	C-0200-01	2023/9/5	2024/9/4
R&S	EMI Test Receiver	ESCI	100035	2023/8/18	2024/8/17
R&S	Test Software	EMC32	V9.10.00	N/A	N/A

** 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:

Note: the maximum output power channel was tested.

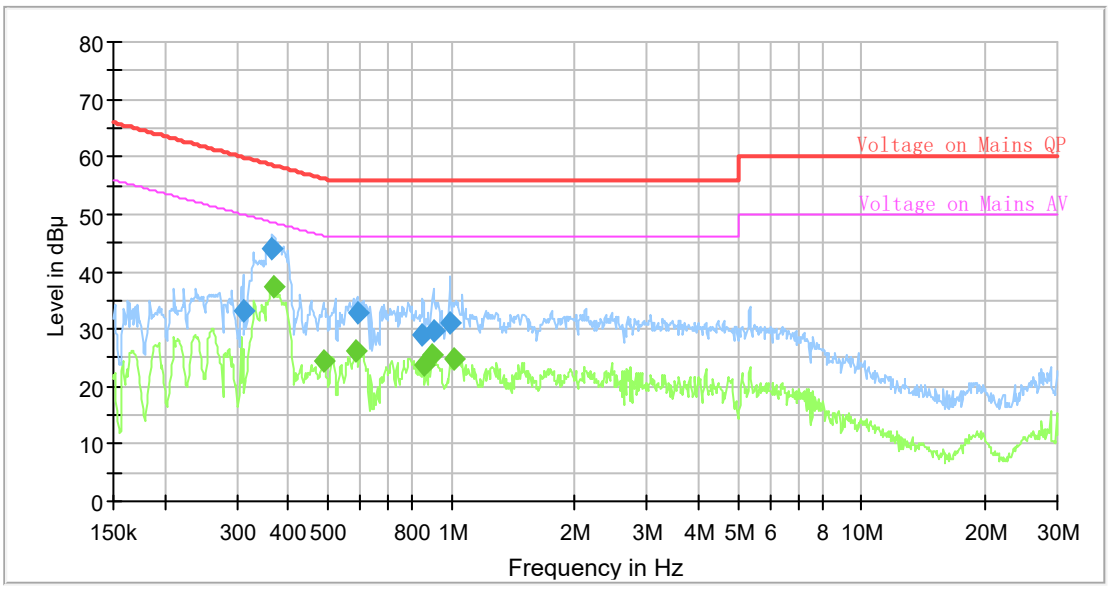
Project No:	2402S43771-RF
Test Engineer:	Wright Lai
Test Date:	2024-4-11
Port:	L
Test Mode:	Transmitting
Power Source:	AC 120V/60Hz
Note:	SRD High channel



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.369955	---	34.82	48.50	13.68	9.000	L1	10.8
0.377409	41.50	---	58.34	16.84	9.000	L1	10.8
0.551358	24.30	---	56.00	31.70	9.000	L1	10.8
0.559669	---	20.21	46.00	25.79	9.000	L1	10.8
0.686657	28.73	---	56.00	27.27	9.000	L1	10.9
0.690091	---	22.18	46.00	23.82	9.000	L1	10.9
0.785640	---	21.01	46.00	24.99	9.000	L1	10.9
0.998148	26.41	---	56.00	29.59	9.000	L1	10.9
1.028469	---	21.46	46.00	24.54	9.000	L1	10.8
1.502491	---	18.12	46.00	27.88	9.000	L1	10.8
3.525400	25.37	---	56.00	30.63	9.000	L1	10.8
4.755236	25.84	---	56.00	30.16	9.000	L1	10.8

Project No:	2402S43771-RF
Test Engineer:	Wright Lai
Test Date:	2024-4-11
Port:	N
Test Mode:	Transmitting
Power Source:	AC 120V/60Hz
Note:	SRD High channel



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.310696	33.32	---	59.95	26.63	9.000	N	10.8
0.366283	44.03	---	58.58	14.55	9.000	N	10.8
0.368114	---	37.28	48.54	11.26	9.000	N	10.8
0.486723	---	24.50	46.22	21.72	9.000	N	10.7
0.588291	---	26.20	46.00	19.80	9.000	N	10.7
0.591232	32.71	---	56.00	23.29	9.000	N	10.7
0.850904	29.08	---	56.00	26.92	9.000	N	10.8
0.855159	---	23.93	46.00	22.07	9.000	N	10.8
0.898892	---	25.44	46.00	20.56	9.000	N	10.8
0.903386	29.58	---	56.00	26.42	9.000	N	10.8
0.993182	31.09	---	56.00	24.91	9.000	N	10.8
1.018261	---	24.89	46.00	21.11	9.000	N	10.9

5.2 Radiation Spurious Emissions

Serial Number:	2JJ7-1	Test Date:	Below 1GHz: 2024/4/18 Above 1GHz: 2024/4/29
Test Site:	Chamber 10m, Chamber B	Test Mode:	Transmitting
Tester:	Zoo Zou, Nat Zhou	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	23.9~26.4	Relative Humidity: (%)	50~68	ATM Pressure: (kPa)	100.5~100.5

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
9kHz~1000MHz					
EMCO	Passive Loop Antenna	6512	9706-1206	2023/10/21	2026/10/20
Sunol Sciences	Hybrid Antenna	JB3	A060611-1	2023/9/6	2026/9/5
Narda	Coaxial Attenuator	779-6dB	04269	2023/9/6	2026/9/5
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2023/8/1	2024/7/31
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-04	2023/8/1	2024/7/31
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2023/8/1	2024/7/31
Sonoma	Amplifier	310N	185914	2023/8/1	2024/7/31
R&S	EMI Test Receiver	ESCI	101121	2023/10/18	2024/10/17
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2023/9/7	2024/9/6
R&S	Spectrum Analyzer	FSV40	101944	2023/10/18	2024/10/17
Xinhang Macrowave	Coaxial Cable	XH750A-N/J-SMA/J-10M	20231117004 #0001	2023/11/17	2024/11/16
Audix	Test Software	E3	191218 (V9)	N/A	N/A
AH	Preamplifier	PAM-0118P	469	2023/8/19	2024/8/18
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-03 1304	2023/2/22	2026/2/21
Xinhang Macrowave	Coaxial Cable	XH360A-2.92/J-2.92/J-6M-A	20231208001 #0001	2023/12/11	2024/12/10
AH	Preamplifier	PAM-1840VH	191	2023/9/7	2024/9/6
E-Microwave	Band Rejection Filter	OBSF-2400-2483.5-S	OE01601525	2024/2/21	2025/2/20
Micro-tronics	High Pass Filter	HPM50111	G217	2023/12/1	2024/11/30
** 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:

Please refer to the below table and plots.

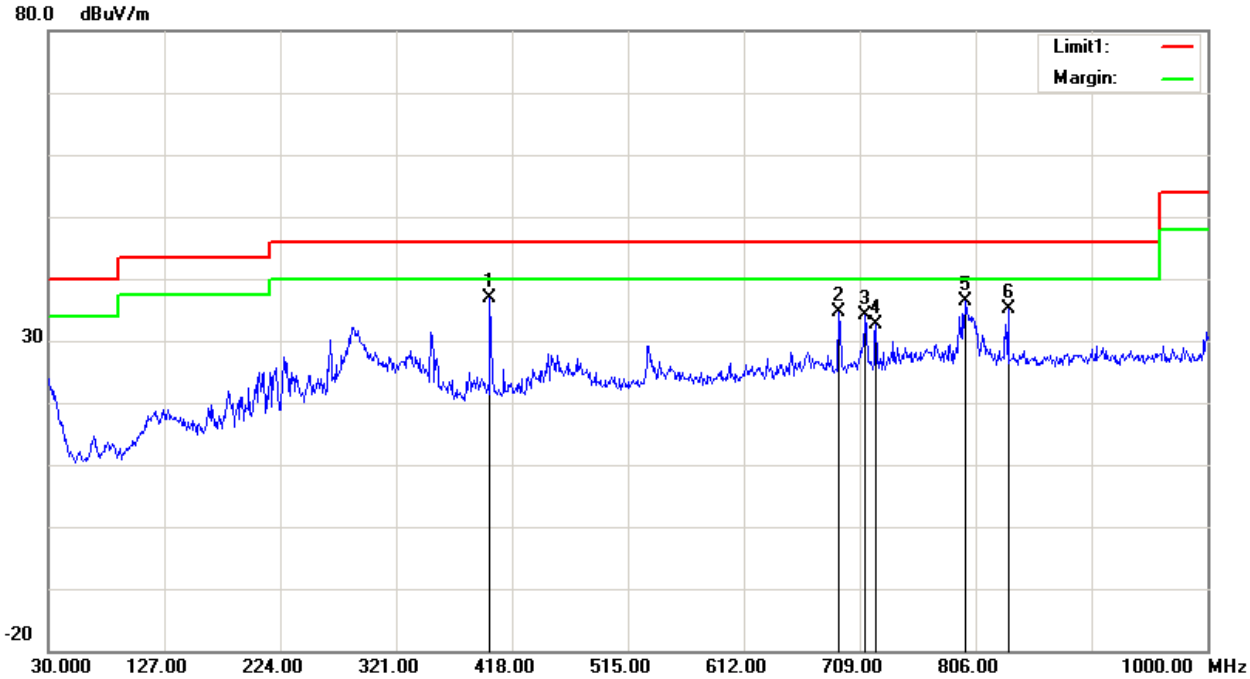
After pre-scan in the X, Y and Z axes of orientation, the worst case is below:

1) 9kHz~30MHz

SRD high channel was tested. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

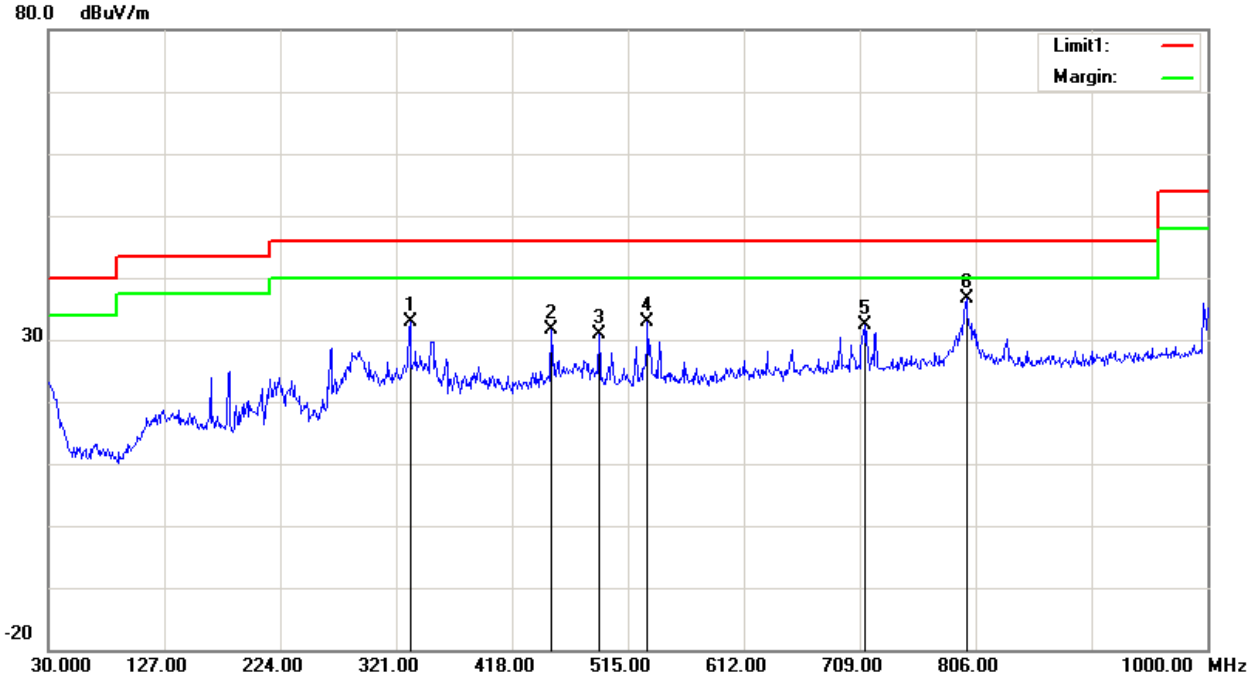
2) 30MHz-1GHz

Project No:	2402S43771-RF
Test Engineer:	Zoo Zou
Test Date:	2024-4-18
Polarization:	Horizontal
Test Mode:	Transmitting
Power Source:	AC 120V/60Hz
Note:	High Channel



No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	399.5700	43.97	peak	-6.99	36.98	46.00	9.02
2	691.5400	36.03	peak	-1.38	34.65	46.00	11.35
3	713.8500	35.14	peak	-0.96	34.18	46.00	11.82
4	722.5800	33.52	peak	-0.86	32.66	46.00	13.34
5	797.2700	36.00	peak	0.45	36.45	46.00	9.55
6	833.1600	34.14	peak	0.88	35.02	46.00	10.98

Project No:	2402S43771-RF
Test Engineer:	Zoo Zou
Test Date:	2024-4-18
Polarization:	Vertical
Test Mode:	Transmitting
Power Source:	AC 120V/60Hz
Note:	Low Channel



No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	332.6400	41.81	peak	-8.83	32.98	46.00	13.02
2	450.9800	37.12	peak	-5.43	31.69	46.00	14.31
3	490.7500	35.21	peak	-4.45	30.76	46.00	15.24
4	531.4900	36.74	peak	-3.97	32.77	46.00	13.23
5	712.8800	33.26	peak	-0.98	32.28	46.00	13.72
6	798.2400	36.23	peak	0.45	36.68	46.00	9.32

3) 1-25GHz:

SRD_low channel **Frequency 2402 MHz**

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB/m	dB	dB	dBµV/m	dBµV/m	dB
2390.00	26.11	PK	H	27.64	0.93	0.00	54.68	74.00	19.32
2390.00	15.86	AV	H	27.64	0.93	0.00	44.43	54.00	9.57
2390.00	26.37	PK	V	27.64	0.93	0.00	54.94	74.00	19.06
2390.00	16.25	AV	V	27.64	0.93	0.00	44.82	54.00	9.18
4804.00	54.64	PK	H	32.84	1.38	37.30	51.56	74.00	22.44
4804.00	50.76	AV	H	32.84	1.38	37.30	47.68	54.00	6.32
4804.00	54.04	PK	V	32.84	1.38	37.30	50.96	74.00	23.04
4804.00	49.86	AV	V	32.84	1.38	37.30	46.78	54.00	7.22
7206.00	52.26	PK	H	35.99	2.39	36.61	54.03	74.00	19.97
7206.00	47.31	AV	H	35.99	2.39	36.61	49.08	54.00	4.92
7206.00	52.17	PK	V	35.99	2.39	36.61	53.94	74.00	20.06
7206.00	48.81	AV	V	35.99	2.39	36.61	50.58	54.00	3.42

SRD_middle channel **Frequency 2440 MHz**

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB/m	dB	dB	dBµV/m	dBµV/m	dB
4880.00	54.33	PK	H	32.90	1.38	37.01	51.60	74.00	22.40
4880.00	51.04	AV	H	32.90	1.38	37.01	48.31	54.00	5.69
4880.00	53.47	PK	V	32.90	1.38	37.01	50.74	74.00	23.26
4880.00	46.61	AV	V	32.90	1.38	37.01	43.88	54.00	10.12
7320.00	52.13	PK	H	36.27	2.46	36.53	54.33	74.00	19.67
7320.00	48.01	AV	H	36.27	2.46	36.53	50.21	54.00	3.79
7320.00	52.68	PK	V	36.27	2.46	36.53	54.88	74.00	19.12
7320.00	48.21	AV	V	36.27	2.46	36.53	50.41	54.00	3.59

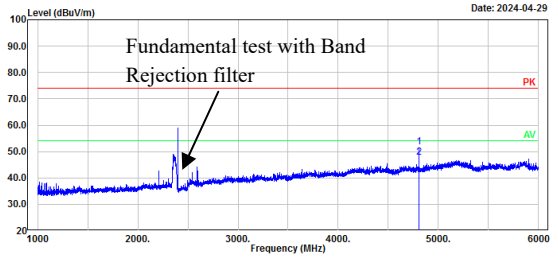
SRD_high channel **Frequency 2480 MHz**

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Detector	Polar	Factor					
MHz	dBµV	PK/QP/AV	H/V	dB/m	dB	dB	dBµV/m	dBµV/m	dB
2483.50	26.57	PK	H	28.03	0.92	0.00	55.52	74.00	18.48
2483.50	16.06	AV	H	28.03	0.92	0.00	45.01	54.00	8.99
2483.50	26.04	PK	V	28.03	0.92	0.00	54.99	74.00	19.01
2483.50	15.74	AV	V	28.03	0.92	0.00	44.69	54.00	9.31
4960.00	54.16	PK	H	32.97	1.42	36.71	51.84	74.00	22.16
4960.00	49.94	AV	H	32.97	1.42	36.71	47.62	54.00	6.38
4960.00	52.99	PK	V	32.97	1.42	36.71	50.67	74.00	23.33
4960.00	47.32	AV	V	32.97	1.42	36.71	45.00	54.00	9.00
7440.00	50.05	PK	H	36.56	2.53	36.45	52.69	74.00	21.31
7440.00	44.53	AV	H	36.56	2.53	36.45	47.17	54.00	6.83
7440.00	50.89	PK	V	36.56	2.53	36.45	53.53	74.00	20.47
7440.00	45.19	AV	V	36.56	2.53	36.45	47.83	54.00	6.17

Worst Channel Plots:

Low Channel, Horizontal

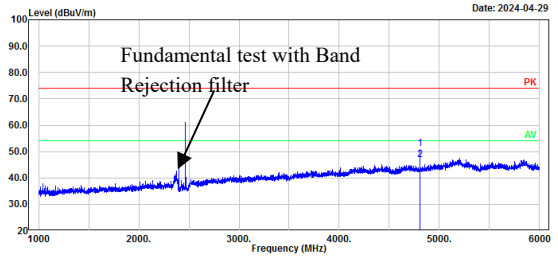
Project No.: 2402S43771-RF
Polarization: Horizontal
Test Mode: Transmitting
Note: SRD_low channel 2402MHz
Serial No.: 2JJ7-1
Tester: Nat Zhou



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	4804.00	54.64	-3.08	51.56	74.00	22.44	Peak
2	4804.00	50.76	-3.08	47.68	54.00	6.32	Average

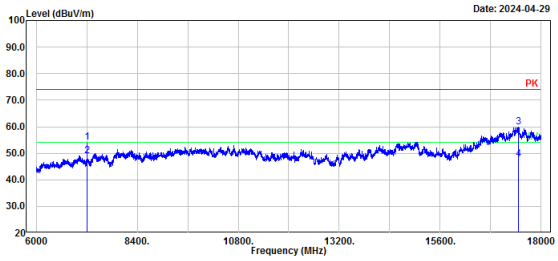
Low Channel, Vertical

Project No.: 2402S43771-RF
Polarization: Vertical
Test Mode: Transmitting
Note: SRD_low channel 2402MHz
Serial No.: 2JJ7-1
Tester: Nat Zhou



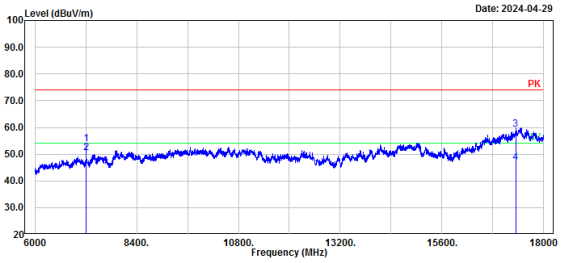
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	4804.00	54.04	-3.08	50.96	74.00	23.04	Peak
2	4804.00	49.86	-3.08	46.78	54.00	7.22	Average

Project No.: 2402S43771-RF
Polarization: Horizontal
Test Mode: Transmitting
Note: SRD_low channel 2402MHz
Serial No.: 2JJ7-1
Tester: Nat Zhou

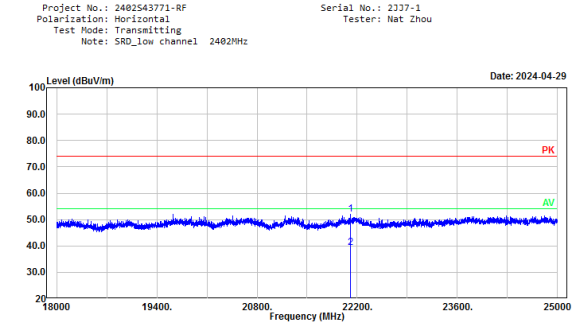
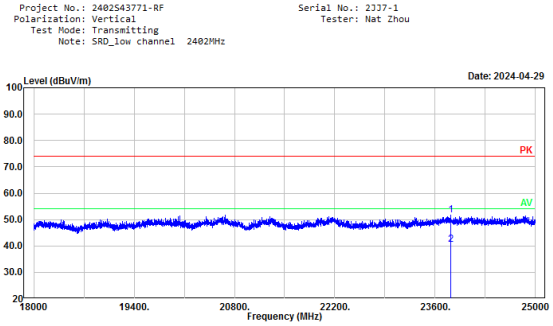


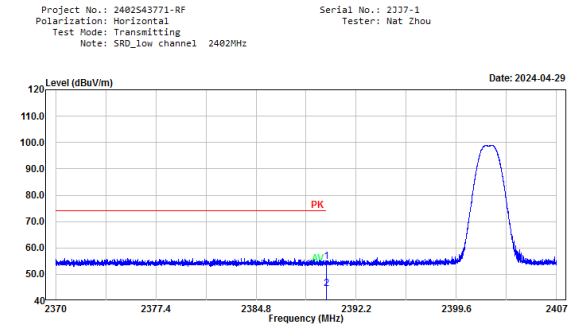
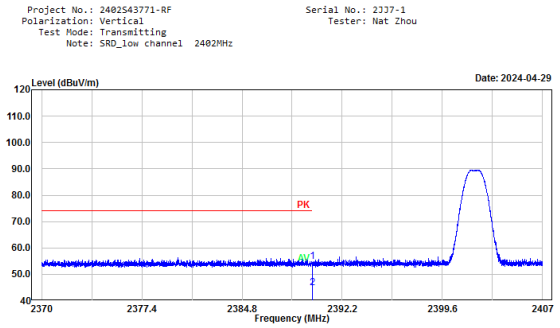
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7206.00	52.26	1.77	54.03	74.00	19.97	Peak
2	7206.00	47.31	1.77	49.08	54.00	4.92	Average
3	17462.40	44.26	15.57	59.83	74.00	14.17	Peak
4	17462.40	32.14	15.57	47.71	54.00	6.29	Average

Project No.: 2402S43771-RF
Polarization: Vertical
Test Mode: Transmitting
Note: SRD_low channel 2402MHz
Serial No.: 2JJ7-1
Tester: Nat Zhou



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7206.00	52.17	1.77	53.94	74.00	20.06	Peak
2	7206.00	48.81	1.77	50.58	54.00	3.42	Average
3	17335.20	44.81	14.56	59.37	74.00	14.63	Peak
4	17335.20	32.36	14.56	46.92	54.00	7.08	Average

Horizontal	Vertical
 No. Frequency (MHz) Reading (dBµV) Factor (dB/m) Result (dBµV/m) Limit (dBµV/m) Margin (dB) Detector 1 22103.40 43.87 8.14 52.01 74.00 21.99 Peak 2 22103.40 31.13 8.14 39.27 54.00 14.73 Average	 No. Frequency (MHz) Reading (dBµV) Factor (dB/m) Result (dBµV/m) Limit (dBµV/m) Margin (dB) Detector 1 23812.80 41.94 9.68 51.62 74.00 22.38 Peak 2 23812.80 30.74 9.68 40.42 54.00 13.58 Average

Low Channel, Bandedge, Horizontal	Low Channel, Bandedge, Vertical
 No. Frequency (MHz) Reading (dBμV) Factor (dB/m) Result (dBμV/m) Limit (dBμV/m) Margin (dB) Detector 1 2390.00 26.11 28.57 54.68 74.00 19.32 Peak 2 2390.00 15.86 28.57 44.43 54.00 9.57 Average	 No. Frequency (MHz) Reading (dBμV) Factor (dB/m) Result (dBμV/m) Limit (dBμV/m) Margin (dB) Detector 1 2390.00 26.37 28.57 54.94 74.00 19.06 Peak 2 2390.00 16.25 28.57 44.82 54.00 9.18 Average

5.3 6 dB Emission Bandwidth

Serial No.:	2JJ7-2	**Test Date:**	2024/4/10
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Alice Tan	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	25.9	**Relative Humidity: (%)**	44	**ATM Pressure: (kPa)**	101.1

Test Equipment List and Details:

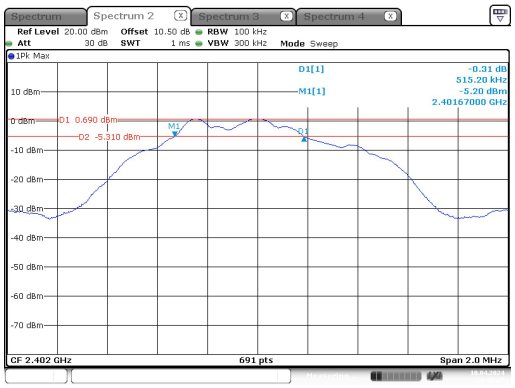
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101589	2023/10/18	2024/10/17
Eastsheep	Coaxial Attenuator	5W-N-JK-6G-10dB	F-08-EM488	2023/9/10	2024/9/9

** 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:

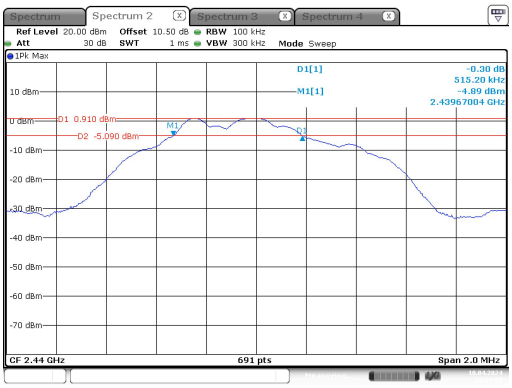
Mode	Value (MHz)	Limit (MHz)	Result
Low	0.515	0.5	Pass
Mid	0.515	0.5	Pass
High	0.515	0.5	Pass

Low



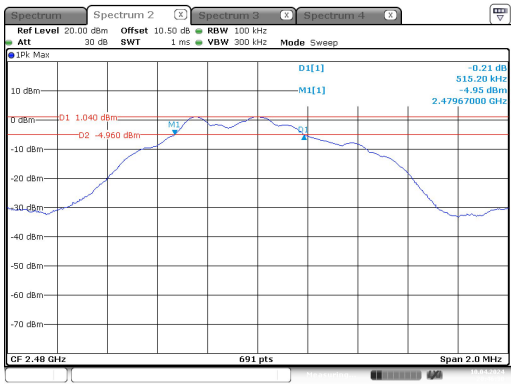
ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:40:27

Mid



ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:35:05

High



ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:46:30

5.4 Maximum Conducted Output Power

Serial No.:	2JJ7-2	**Test Date:**	2024/4/10
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Alice Tan	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	25.9	**Relative Humidity: (%)**	44	**ATM Pressure: (kPa)**	101.1

Test Equipment List and Details:

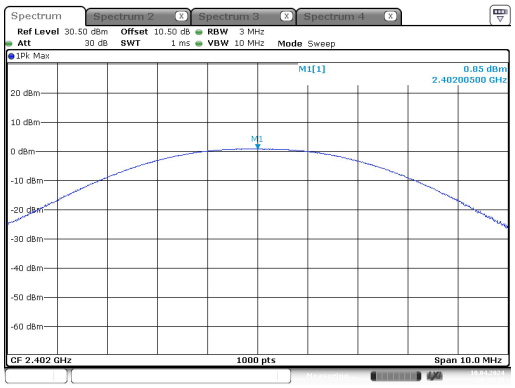
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101589	2023/10/18	2024/10/17
Eastsheep	Coaxial Attenuator	5W-N-JK-6G-10dB	F-08-EM488	2023/9/10	2024/9/9

** 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:

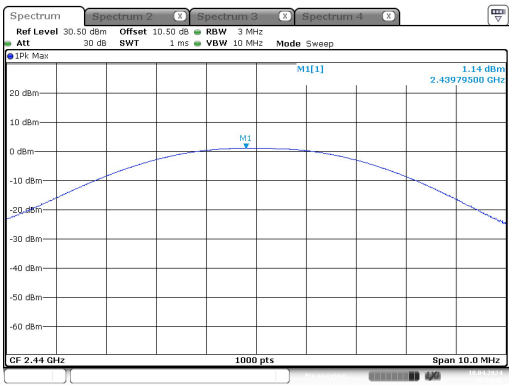
Mode	Value (dBm)	Limit (dBm)	Result
Low	0.85	30.00	Pass
Mid	1.14	30.00	Pass
High	**1.28**	30.00	Pass

Low



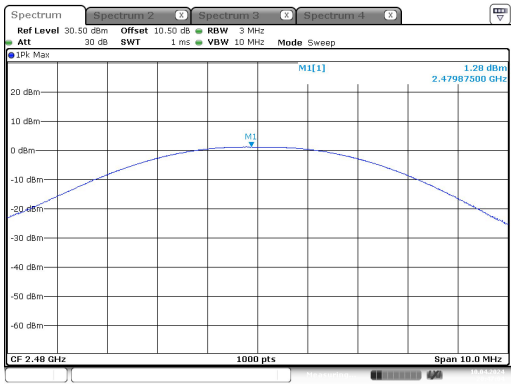
ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:39:19

Mid



ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:33:42

High



ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:47:04

5.5 Maximum power spectral density

Serial No.:	2JJ7-2	**Test Date:**	2024/4/10
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Alice Tan	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	25.9	**Relative Humidity: (%)**	44	**ATM Pressure: (kPa)**	101.1

Test Equipment List and Details:

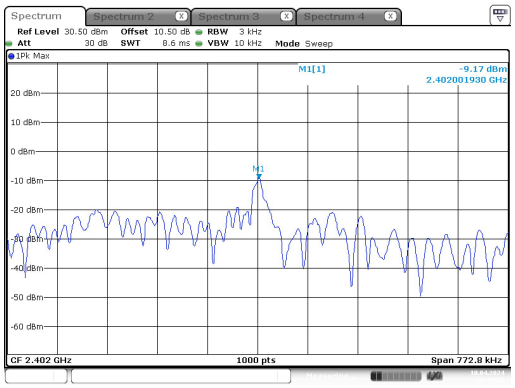
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101589	2023/10/18	2024/10/17
Eastsheep	Coaxial Attenuator	5W-N-JK-6G-10dB	F-08-EM488	2023/9/10	2024/9/9

** 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:

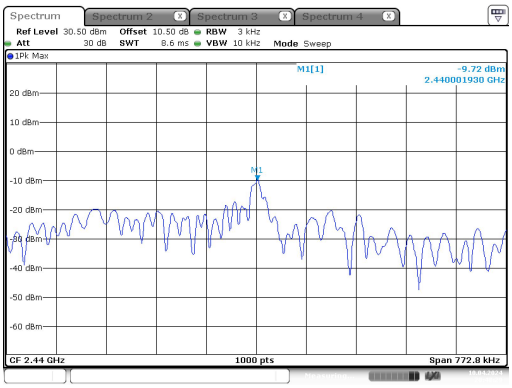
Mode	Value (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low	-9.17	8.00	Pass
Mid	-9.72	8.00	Pass
High	-8.7	8.00	Pass

Low



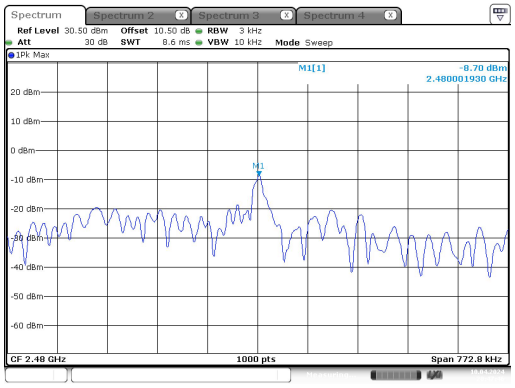
ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:48:58

Mid



ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:48:29

High



ProjectNo.:2402S43771 Tester:Alice Tan
Date: 10.APR.2024 20:47:46

5.6 100 kHz Bandwidth of Frequency Band Edge

Serial No.:	2JJ7-2	**Test Date:**	2024/4/10
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Alice Tan	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	25.9	**Relative Humidity: (%)**	44	**ATM Pressure: (kPa)**	101.1

Test Equipment List and Details:

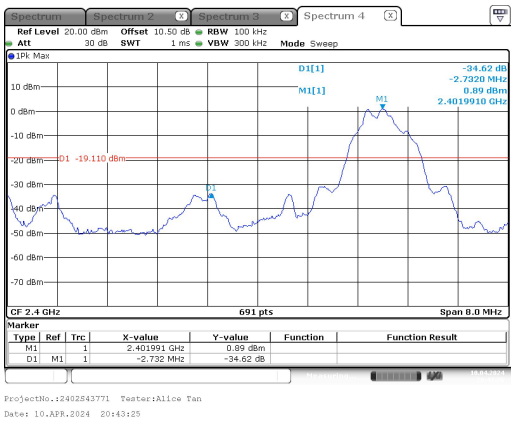
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101589	2023/10/18	2024/10/17
Eastsheep	Coaxial Attenuator	5W-N-JK-6G-10dB	F-08-EM488	2023/09/10	2024/09/09

** 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).*

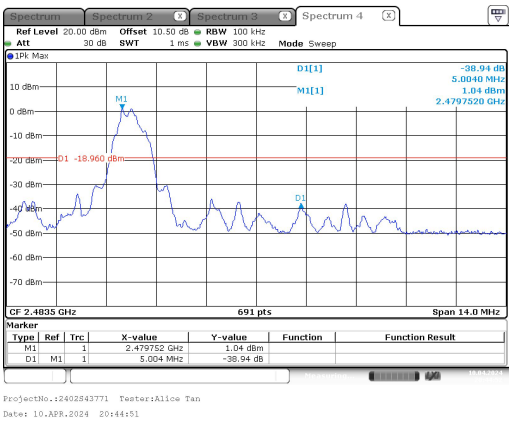
Test Data:

Please refer to the below plots:

Low



High



5.7 Duty Cycle

Serial No.:	2JJ7-2	**Test Date:**	2024/4/10
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Alice Tan	**Test Result:**	/

Environmental Conditions:

Temperature: (℃)	25.9	**Relative Humidity: (%)**	44	**ATM Pressure: (kPa)**	101.1

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101589	2023/10/18	2024/10/17
Eastsheep	Coaxial Attenuator	5W-N-JK-6G-10dB	F-08-EM488	2023/09/10	2024/09/09

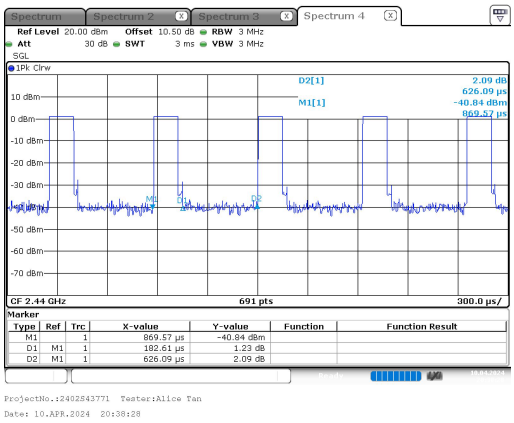
** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Mode	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)	1/T (Hz)	VBW Setting (kHz)
Mid	0.183	0.626	29.23	5464	10

Duty Cycle = Ton/(Ton+Toff)*100%

Mid



APPENDIX A - EUT PHOTOGRAPHS

Please refer to the attachment 2402S43771-RF-EXP EUT EXTERNAL PHOTOGRAPHS and 2402S43771-RF-INP EUT INTERNAL PHOTOGRAPHS

APPENDIX B - TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2402S43771-RF-00A-TSP TEST SETUP PHOTOGRAPHS.

APPENDIX C - RF EXPOSURE EVALUATION

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.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The max conducted power including tune-up tolerance is 2.0 dBm (1.58mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
=1.58/5*(√2.480) = 0.5< 3.0

Note: the max conducted power including tune-up tolerance was declared by manufacturer.
Result: Compliant. The stand-alone SAR evaluation is not necessary.

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