

TEST REPORT

Applicant: IZZO GOLF, INC.

Address: 1635 Commons Parkway, Macedon, NY 14502, USA

Product Name: Launch Monitor

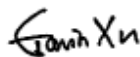
FCC ID: 2AOFL-LCH-MATI

Standard(s): 47 CFR Part 15, Subpart C(15.249)
ANSI C63.10-2013

Report Number: SZ1240304-10349E-RF-00A

Report Date: 2024/5/7

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



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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	SZ1240304-10349E-RF-00A	Original Report	2024/5/7

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Name:	Launch Monitor
EUT Model:	Lanuch Master
Operation Frequency:	24055 MHz
Modulation Type:	CW
Rated Input Voltage:	DC 6V From Battery
Serial Number:	2I73-1
EUT Received Date:	2024/3/6
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
IZZO GOLF, INC.	PCB	50	24~24.25GHz	6 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)/Rule(s)	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conduction Emissions	Not applicable*
15.205, §15.209, §15.249	Radiated Emissions	Compliant
§15.215 (c)	20 dB Bandwidth	Compliant
Not applicable*: EUT power by battery.		

3. DESCRIPTION OF TEST CONFIGURATION

3.1 EUT Operation Condition

The system was configured for testing in production version with highest transmitter activity (on time), which was provided by the manufacturer.

3.2 EUT Exercise Software

No software was used in test.

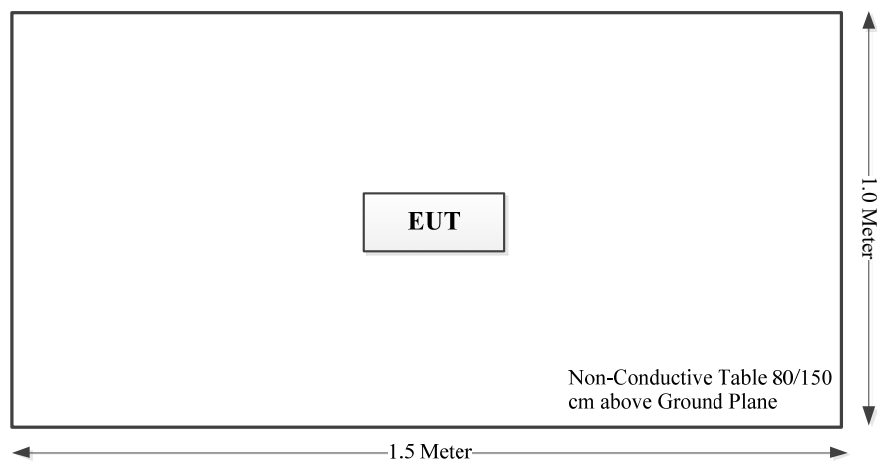
3.3 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

3.4 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

3.5 Block Diagram of Test Setup



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	$\pm 5\%$
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, 40~60G: 4.83dB, 60G~90G: 4.94dB, 90G~140G: 5.46dB, 140G~220G: 6.00dB, 220G~325G: 7.35dB
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 0.4\%$
AC Power Lines Conducted Emission	3.11 dB (150 kHz to 30 MHz)

4. REQUIREMENTS AND TEST RESULTS

4.1 AC Line Conducted Emissions

Not Applicable, the device was power by battery.

4.2 Radiated Emissions

4.2.1 Applicable Standard

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

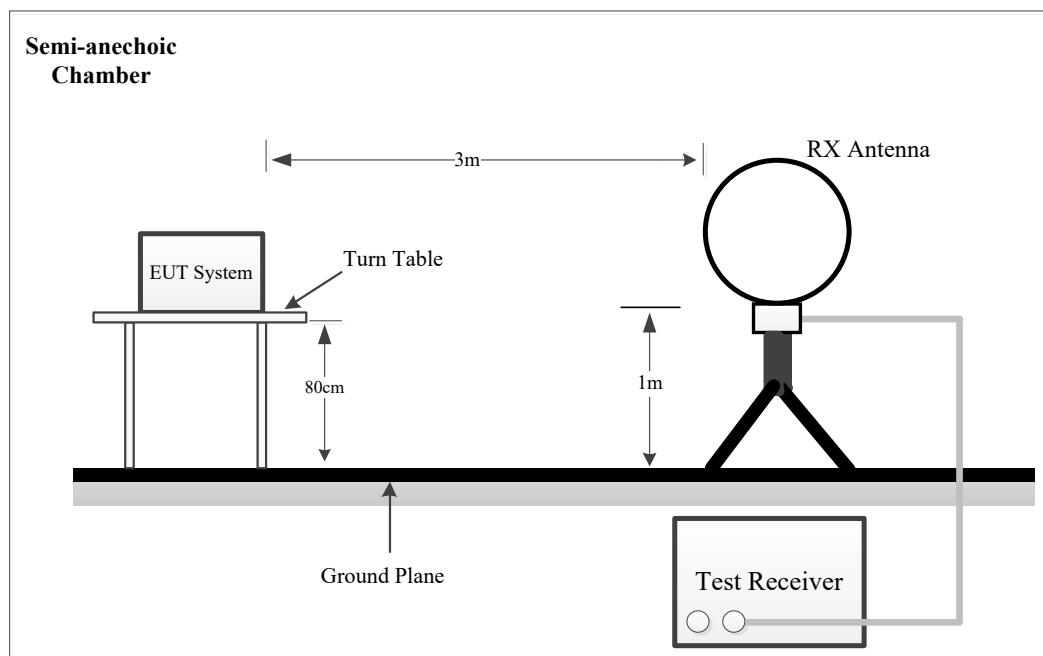
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

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

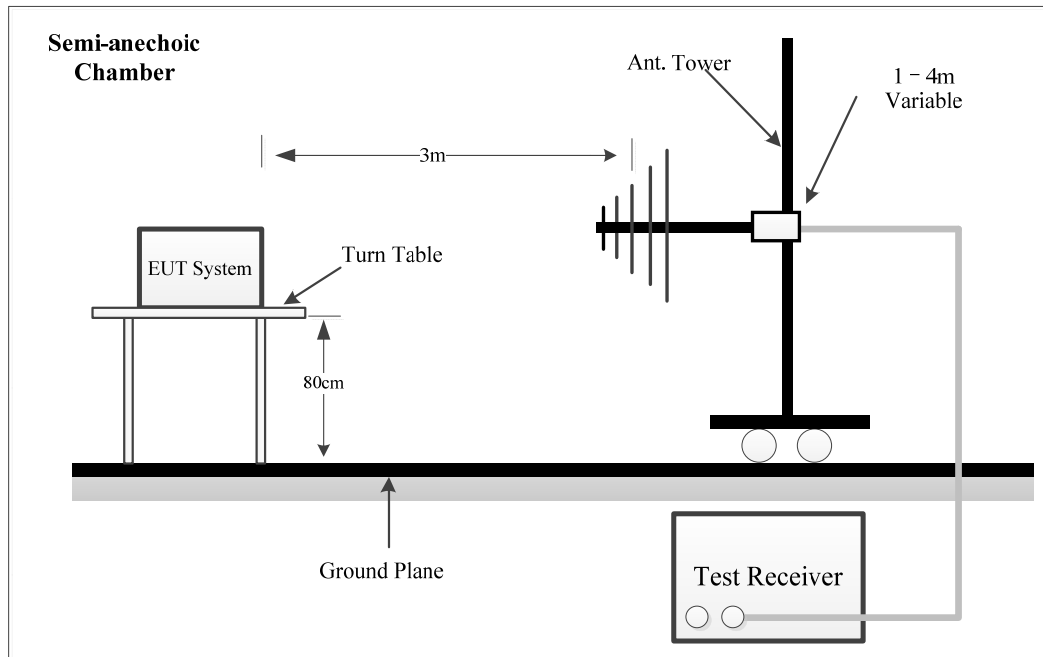
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

4.2.2 EUT Setup

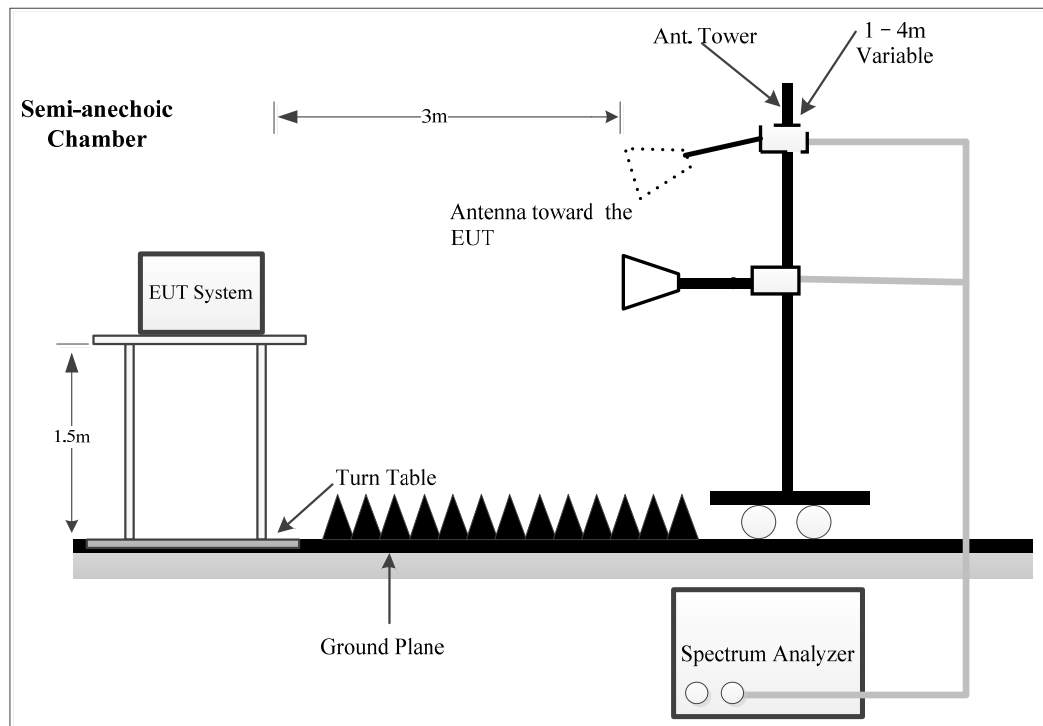
9kHz~30MHz:



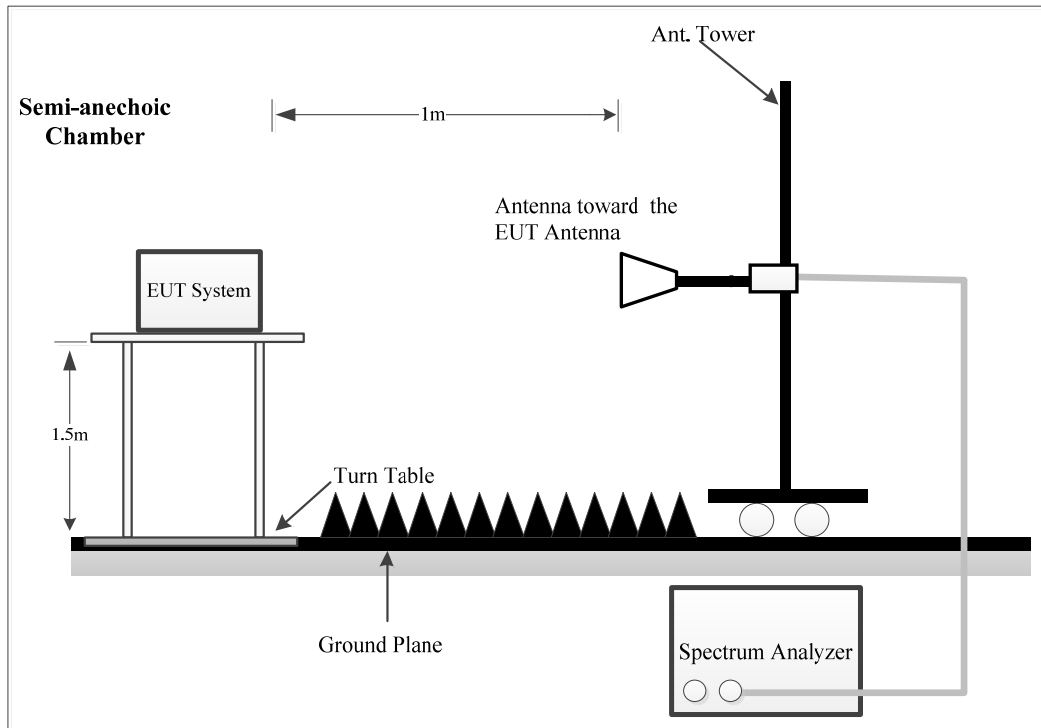
Below 1GHz:



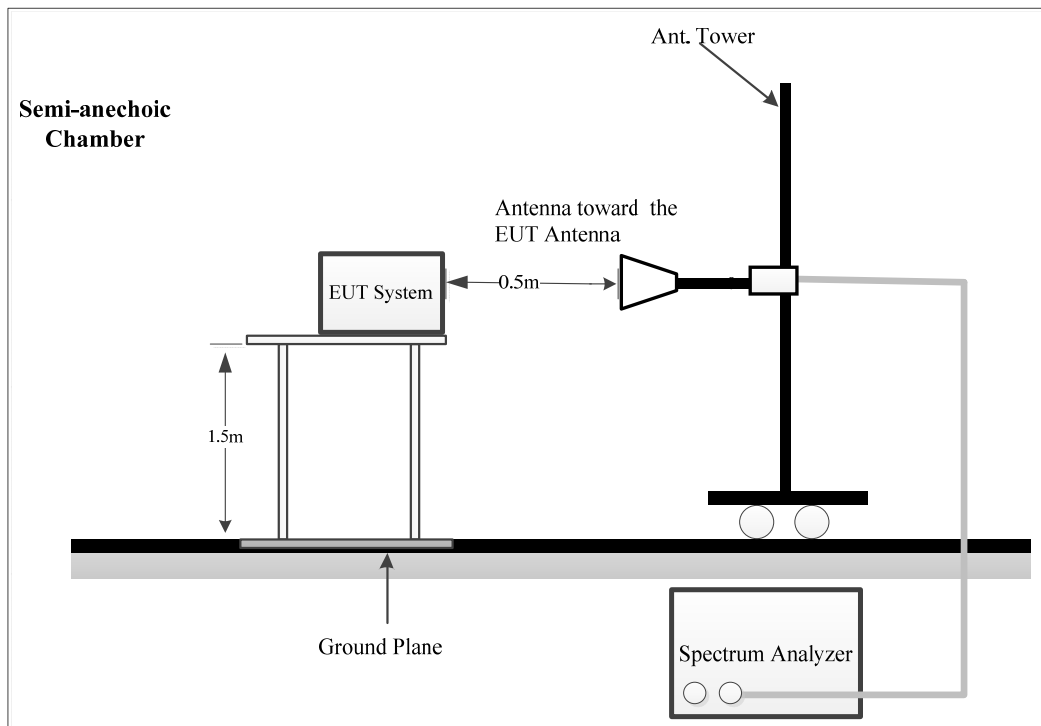
1GHz-40GHz:



40~90 GHz:



90~100 GHz:



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.

For above 40GHz:

The antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations, at the distance of 1.0 m from 40 GHz to 90 GHz, and 0.5 m from 90 GHz to 100 GHz.

The radiated emission and out of band emission tests were performed in the 3 meters chamber, using the setup accordance with the ANSI C63.10-2013 The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

4.2.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9 kHz to 100 GHz.

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

9kHz-100GHz:

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
Above 1 GHz	PK	1MHz	3 MHz	/
	AV	1MHz	10 Hz	/

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.

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.

For above 40GHz:

External harmonic mixers are utilized. The antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations. The Mixers and it's RF cables is compose a system for calibration, the conversion factor was added into the test Spectrum Analyzer in testing.

The far-field boundary is given in ANSI C63.10-2013:

$$R_m = 2D^2 / \lambda$$

Where:

D is the largest dimension of the antenna aperture in m and

λ is the free-space wavelength in m at the frequency of measurement.

The minimum test distance for the frequency range 40GHz-100GHz determine as below:

Model	Frequency Range (GHz)	Largest Dimension of the Horn Antenna (mm)	Minimum Test Distance R_m (m)
M19RH	40-60	46.3	0.57
M12RH	60-90	30.02	0.36
M08RH	90-140	19.7	0.23

Note: the test distances used were 1.0 m from 40 GHz to 90 GHz, and 0.5 m from 90 GHz to 100GHz, it can be seen that the EUT was always in the Far-field of the Receive Antenna during all Radiated Emissions Tests.

4.2.5 Corrected Amplitude & Margin Calculation

For 9kHz~40GHz:

The basic equation is as follows:

Result = Reading + Factor

Factor = Antenna Factor + Cable Loss- Amplifier Gain

Note: the antenna JB3 was calibrated with 6dB Attenuator, the antenna factor includes the insertion loss of the Attenuator.

For 40-90GHz:

Test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m.

Distance extrapolation factor = $20 \log (\text{specific distance [3m]}/\text{test distance [1m]})$ dB= 9.54 dB.

For 90-100GHz:

Test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 0.5m.

Distance extrapolation factor = $20 \log (\text{specific distance [3m]}/\text{test distance [0.5m]})$ dB=15.56 dB.

For 40GHz-100GHz

Result = Reading + Factor-Distance extrapolation Factor

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

Serial Number:	2I73-1	Test Date:	Below 1GHz: 2024/3/29 Above 1GHz: 2024/4/25
Test Site:	Chamber 10, Chamber B	Test Mode:	Transmitting
Tester:	Joe Li, ColinYang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	23.9~24.6	Relative Humidity: (%)	54~65	ATM Pressure: (kPa)	100.8~100.9
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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	2026/9/6
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2023/2/22	2026/2/21
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-01 1302	2023/2/22	2026/2/21
Xinhang Macrowave	Coaxial Cable	XH750A-N/J-SMA/J-10M	20231117004 #0001	2023/11/17	2024/11/16
Xinhang Macrowave	Coaxial Cable	XH360A-2.92/J-2.92/J-6M-A	20231208001 #0001	2023/12/11	2024/12/10
AH	Preamplifier	PAM-0118P	469	2023/8/19	2024/8/18
AH	Preamplifier	PAM-1840VH	191	2023/9/7	2024/9/6
R&S	Spectrum Analyzer	FSV40	101944	2023/10/18	2024/10/17
OML	Waveguide Mixer	WR19/M19HWD	U60313-1	2023/2/16	2026/2/15
OML	Horn Antenna	M19RH	11648-01	2023/2/27	2026/2/26
OML	Waveguide Mixer	WR12/M12HWD	E60120-1	2023/2/16	2026/2/15
OML	Horn Antenna	M12RH	E60120-2	2023/2/27	2026/2/26
OML	Waveguide Mixer	WR08/M08HWD	F60313-1	2023/2/16	2026/2/15
OML	Horn Antenna	M08RH	F60313-2	2023/2/27	2026/2/26

* 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.

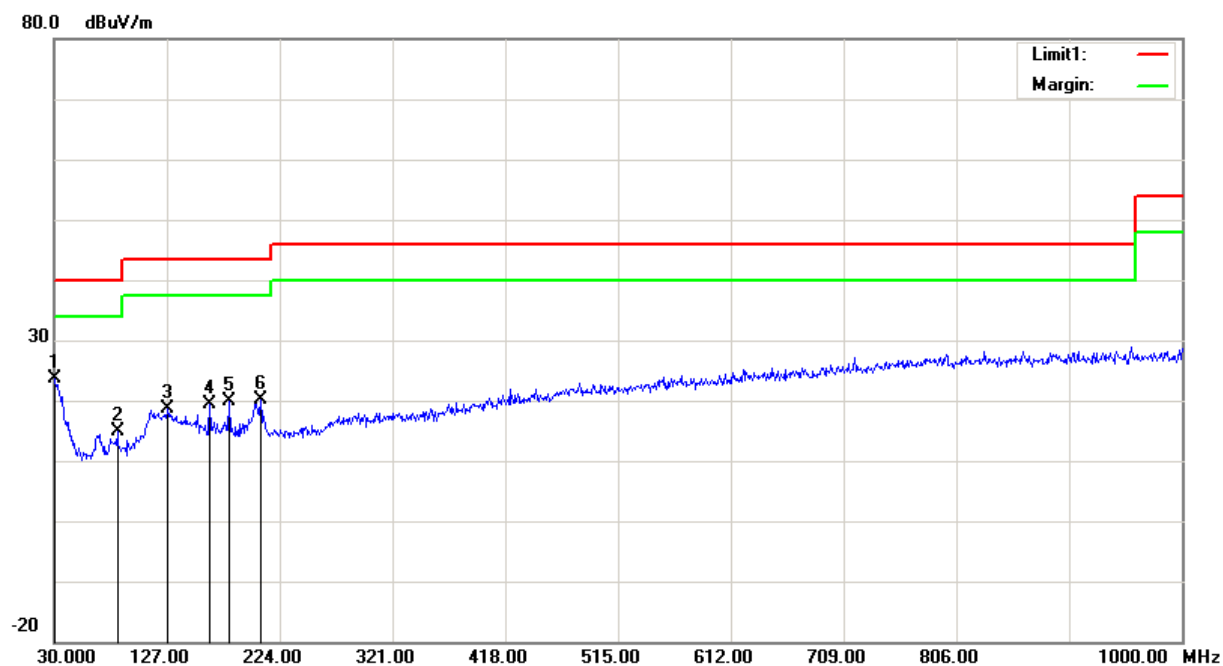
After pre-scan in the X, Y and Z axes of orientation, the worst case is below:

1) 9kHz~30MHz

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

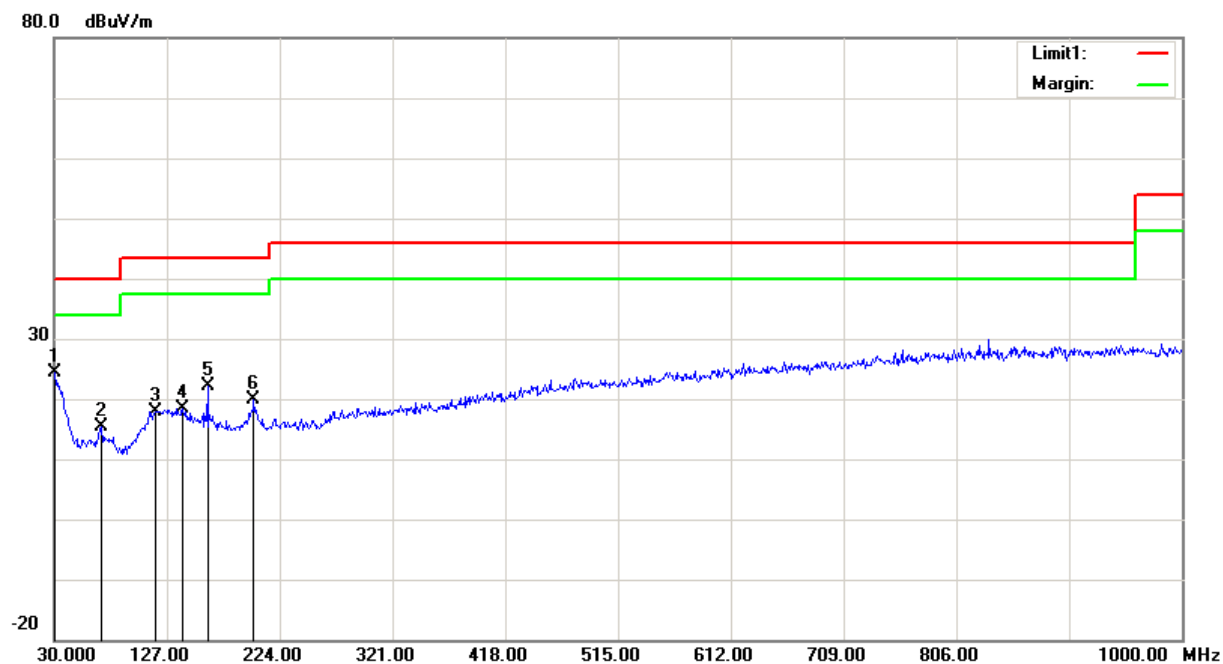
2) 30MHz-1GHz

Project No: SZ1240304-10349E-RF
Test Engineer: Joe Li
Test Date: 2024/3/29
Polarization: Horizontal
Test Mode: Transmitting
Power Source: DC 6V



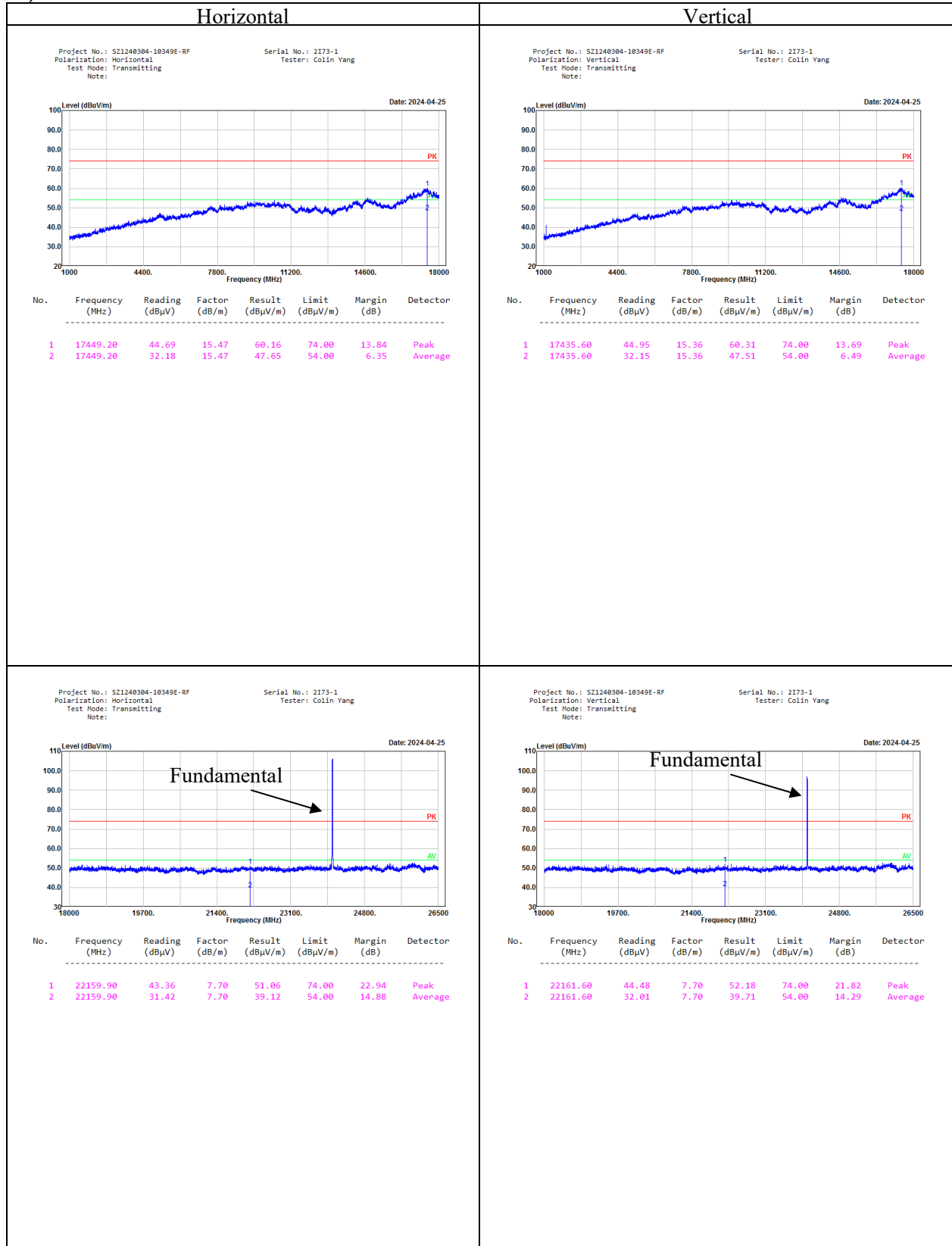
No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected dB/m	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	30.0000	27.48	peak	-3.80	23.68	40.00	16.32
2	84.3200	31.63	peak	-16.72	14.91	40.00	25.09
3	127.9700	28.23	peak	-9.64	18.59	43.50	24.91
4	163.8600	30.75	peak	-11.35	19.40	43.50	24.10
5	180.3500	32.30	peak	-12.33	19.97	43.50	23.53
6	207.5100	32.33	peak	-12.28	20.05	43.50	23.45

Project No: SZ1240304-10349E-RF
Test Engineer: Joe Li
Test Date: 2024/3/29
Polarization: Vertical
Test Mode: Transmitting
Power Source: DC 6V



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.9700	28.65	peak	-4.31	24.34	40.00	15.66
2	70.7400	31.58	peak	-16.27	15.31	40.00	24.69
3	117.3000	28.10	peak	-10.16	17.94	43.50	25.56
4	140.5800	28.96	peak	-10.52	18.44	43.50	25.06
5	161.9200	33.37	peak	-11.15	22.22	43.50	21.28
6	201.6900	31.46	peak	-11.69	19.77	43.50	23.73

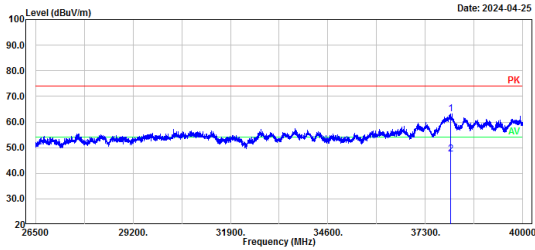
3) 1-40GHz:



Horizontal

Project No.: SZ1240304-10349E-RF
Polarization: Horizontal
Test Mode: Transmitting
Note:

Serial No.: 2173-1
Tester: Colin Yang

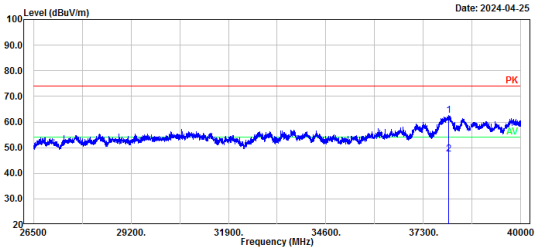


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	37993.90	45.15	17.91	63.06	74.00	10.94	Peak
2	37993.90	29.66	17.91	47.57	54.00	6.43	Average

Vertical

Project No.: SZ1240304-10349E-RF
Polarization: Vertical
Test Mode: Transmitting
Note:

Serial No.: 2173-1
Tester: Colin Yang



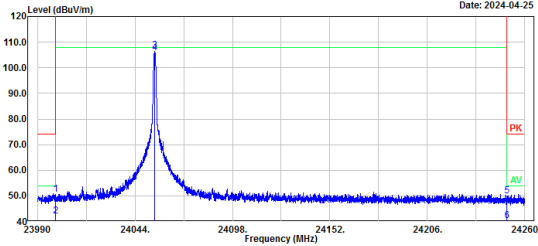
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	38002.00	44.50	17.93	62.43	74.00	11.57	Peak
2	38002.00	29.44	17.93	47.37	54.00	6.63	Average

Fundamental And Bandedge, Horizontal

Project No.: SZ1240304-10349E-RF
Polarization: Horizontal
Test Mode: Transmitting
Note:

Serial No.: 2173-1
Tester: Colin Yang

Date: 2024-04-25



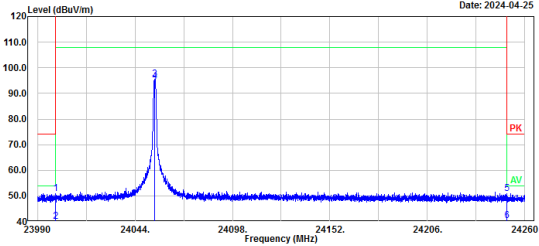
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	24000.00	41.66	8.76	50.42	74.00	23.58	Peak
2	24000.00	33.24	8.76	42.00	54.00	12.00	Average
3	24054.84	97.81	8.79	106.60	127.96	21.36	Peak
4	24054.84	97.10	8.79	105.89	107.96	2.07	Average
5	24250.00	41.16	8.92	50.08	74.00	23.92	Peak
6	24250.00	31.23	8.92	40.15	54.00	13.85	Average

Fundamental And Bandedge, Vertical

Project No.: SZ1240304-10349E-RF
Polarization: Vertical
Test Mode: Transmitting
Note:

Serial No.: 2173-1
Tester: Colin Yang

Date: 2024-04-25



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	24000.00	42.00	8.76	50.76	74.00	23.24	Peak
2	24000.00	31.35	8.76	40.11	54.00	13.89	Average
3	24054.84	86.88	8.79	95.67	127.96	32.29	Peak
4	24054.84	85.92	8.79	94.71	107.96	13.25	Average
5	24250.00	41.81	8.92	50.73	74.00	23.27	Peak
6	24250.00	31.48	8.92	40.40	54.00	13.60	Average

3) 40-100GHz:

Frequency (GHz)	Receiver		Polar (H/V)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector					
Test Frequency:24.055GHz							
48.110	45.26	PK	H	40.06	75.78	87.96	12.18
48.110	33.21	AV	H	40.06	63.73	67.96	4.23
48.110	46.56	PK	V	40.06	77.08	87.96	10.88
48.110	33.44	AV	V	40.06	63.96	67.96	4.00
72.165	43.26	PK	H	43.81	77.53	87.96	10.43
72.165	30.00	AV	H	43.81	64.27	67.96	3.69
72.165	43.74	PK	V	43.81	78.01	87.96	9.95
72.165	30.49	AV	V	43.81	64.76	67.96	3.20

Result = Reading + Factor- Distance extrapolation Factor

For 40-90GHz:

Distance extrapolation Factor =20 log (specific distance [3m]/test distance [1m]) dB= 9.54 dB

For 90-100GHz:

Distance extrapolation Factor =20 log (specific distance [3m]/test distance [0.5m]) dB= 15.56 dB

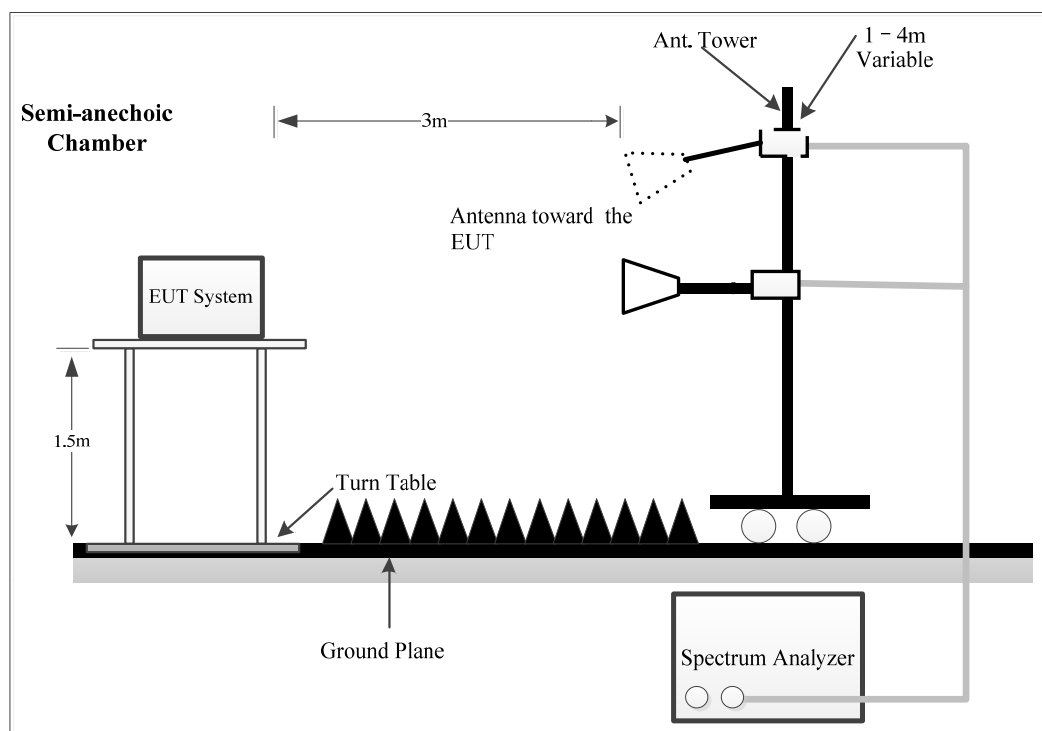
4.3 20 dB Emission Bandwidth

4.3.1 Applicable Standard

FCC §15.215

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

4.3.2 EUT Setup



4.3.3 Test Procedure

According to ANSI C63.10-2013 Section 6.9.2

- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, unless otherwise specified by the applicable requirement.
- Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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 20 dB relative to the maximum level measured in the fundamental emission.

4.3.4 Test Result

Serial No.:	2I73-1	Test Date:	2024/4/25
Test Site:	Chamber B	Test Mode:	Transmitting
Tester:	Bill Yang	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	24.6	Relative Humidity: (%)	65	ATM Pressure: (kPa)	100.9
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Test Equipment List and Details:

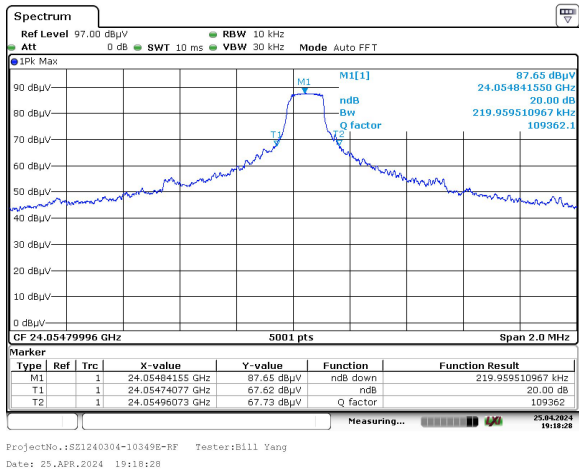
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2023/2/22	2026/2/21
AH	Preamplifier	PAM-1840VH	191	2023/9/7	2024/9/6
Xinhang Macrowave	Coaxial Cable	XH360A-2.92/J-2.92/J-6M-A	20231208001 #0001	2023/12/11	2024/12/10
R&S	Spectrum Analyzer	FSV40	101944	2023/10/18	2024/10/17

* 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:

20 dB Bandwidth (MHz)	F _L (MHz)	F _L Limit (MHz)	F _H (MHz)	F _H Limit (MHz)
0.220	24054.74	24000	24054.96	24250

20 dB Bandwidth



4.4 Antenna Requirement

4.4.1 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.

4.4.2 Judgment

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

APPENDIX A - EUT PHOTOGRAPHS

Please refer to the attachment SZ1240304-10349E-RF-EXP EUT EXTERNAL PHOTOGRAPHS and SZ1240304-10349E-RF-INP EUT INTERNAL PHOTOGRAPHS

APPENDIX B - TEST SETUP PHOTOGRAPHS

Please refer to the attachment SZ1240304-10349E-RF-00A-TSP TEST SETUP PHOTOGRAPHS.

APPENDIX C - RF EXPOSURE EVALUATION

Maximum Permissible Exposure (MPE)

Applicable Standard

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.

Procedure

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);

Measurement Result

Frequency (GHz)	Peak EIRP including Tune-up Tolerance		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBm)	(mW)			
24.055	12	15.85	20	0.003	1.0
Fundamental field strength is 106.6BμV/m @ 3m = 11.4 dBm(13.8mW) EIRP. EIRP(dBm)=Field Strength of Fundamental(dBuV/m)-95.2 (dB)					

Note:

The Peak EIRP including Tune-up Tolerance provide by manufacturer.

Result: The device meet FCC MPE at 20 cm distance.

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