NVLAP LAB CODE 600341-0

TEST REPORT

Applicant:	**Autel Robotics Co., Ltd.**
Address:	**601,701,801,901, Block B1, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong, 518055, China**
Product Name:	**Autel Alpha**
FCC ID:	**2AGNTMDH240958A**
Standard(s):	**47 CFR Part 15, Subpart C(15.255) ANSI C63.10-2020 +Cor.1-2023**
Report Number:	**2502P19097E-RF-00FA1M1**
Report Date:	**2025/2/27**

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:	**Pedro Yun**
Title:	**Project Engineer**
Approved By:	**Gavin Xu**
Title:	**RF Supervisor**

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CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	2502P19097E-RF-00FA1	Class II Permissive Change Report	2025/1/23
2.0	2502P19097E-RF-00FA1M1	Update the description of the SUMMARY section	2025/2/27

1. GENERAL INFORMATION

1.1 General Description of Equipment under Test

EUT Name:	Autel Alpha
EUT Model:	MDH
Operation Frequency Range:	Right Radar: 63.52-63.95GHz Left Radar: 63.07-63.50GHz Front Radar: 62.62-63.06GHz Rear Radar: 62.62-63.06GHz Top Radar: 61.78-62.30GHz Bottom Radar-Above 1meter: 61.78-63.20GHz Bottom Radar-Below 1meter: 61.77-62.31GHz
Maximum Peak EIRP:	Right Radar: 18.93 dBm Left Radar: 15.12 dBm Front Radar:14.97 dBm Rear Radar: 16.63 dBm Top Radar: 15.59 dBm Bottom Radar-Above 1meter: 15.10 dBm Bottom Radar-Below 1meter: 13.14 dBm
Modulation Type:	FMCW
Chirp Time▲:	20 μs
Emission Designator:	N0N
Rated Input Voltage▲:	DC 23.7V from battery
Serial Number:	2WZU-1
EUT Received Date:	2024/12/28
EUT Received Status:	Good

1.2 Accessory Information

Accessory Description	Manufacturer	Model	Parameters
Adapter	Shenzhen Esun Power Technology Co., Ltd	DF_CHARGER	Input: AC100-240V,50/60Hz,4.0A Output: 26.4V,7.0A Total Output Power:184.8W

1.3 Antenna Information Detail▲

Antenna Type	input impedance (Ohm)	Antenna Gain	Frequency Range
Microstrip Antenna	50	10dBi	60-64 GHz
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
§15.207(a)	AC Line Conducted Emissions	Not Applicable
§15.255(b)(3)	Peak EIRP and Transmitter Off-times	Compliant
§15.215, §15.255 (e)	Occupied Bandwidth	Compliant
§15.205, §15.209, §15.255(d)	Radiated Spurious Emissions	Compliant
§15.255 (f)	Frequency Stability	Compliant
§15.255 (a),(b),(h)	Operation Restriction And Group Installation	Compliant
§15.203	Antenna Requirement	Compliant
§2.1091	RF Exposure	Compliant

Note 1:
This is Class II permissive change application based on the original device, FCC ID: 2AGNTMDH240958A, which was granted on 2024/01/03. The changes based on original device as following:

1. Upgraded the radar software to reduce the Radar power and bandwidth.

Based on the above changes, the above applicable items were tested because of RF parameters changed.

Note 2:
Not applicable for AC Line Conducted Emissions, the EUT was 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. According to 15.31(c) and KDB 364244 D01 Meas 15.255 Radars v01, the device tested at Swept mode for FMCW modulation. The device was built in 6 radar modules, each module was tested separately except radiation emissions below 40GHz test simultaneously.

The EUT have 6 Radar modules operate on the frequency 60-64GHz:
Right Radar: 63.52-63.95GHz
Left Radar: 63.07-63.50GHz
Front Radar: 62.62-63.06GHz
Rear Radar: 62.62-63.06GHz
Top Radar: 61.78-62.30GHz
Bottom Radar-Above 1meter: 61.78-63.20GHz
Bottom Radar-Below 1meter: 61.77-62.31GHz

Note: for the bottom radar, according to the ground level above or below 1 meter, the system automatic changes the software.

3.2 EUT Exercise Software

No software was used in test. The EUT transmit when EUT was power up.

3.3 Support Equipment List and Details

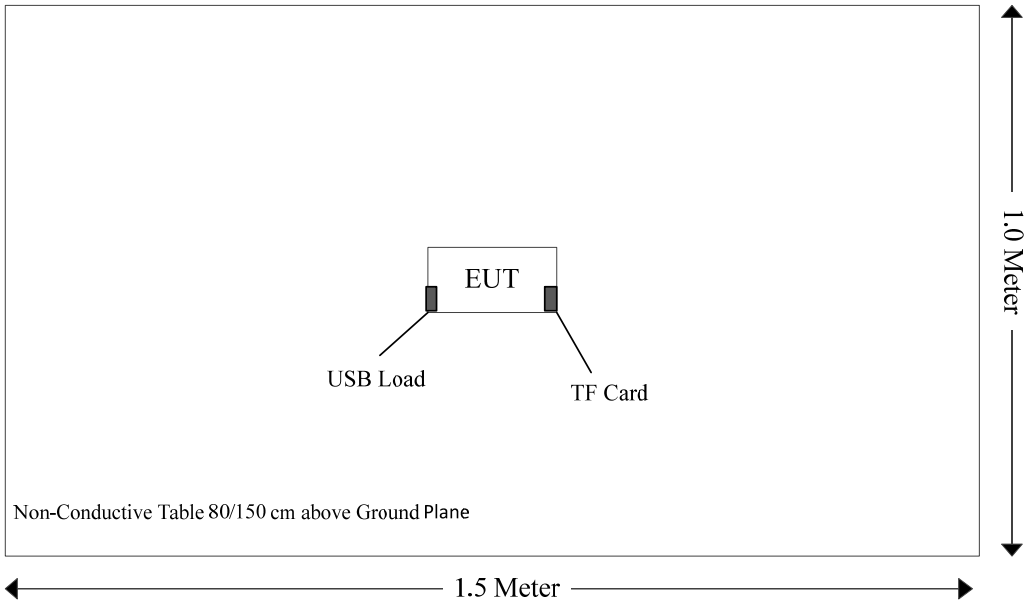
Manufacturer	Description	Model	Serial Number
Unknown	USB Load	Unknown	2WO3-4
SAMSUNG	Micro TF Card	MB-MC128H	MBMCDGVDACW-5

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

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 %
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
EIRP	4.94dB
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 TEST RESULTS

4.1 AC Line Conducted Emissions

Not Applicable, the device was powered by battery when operating.

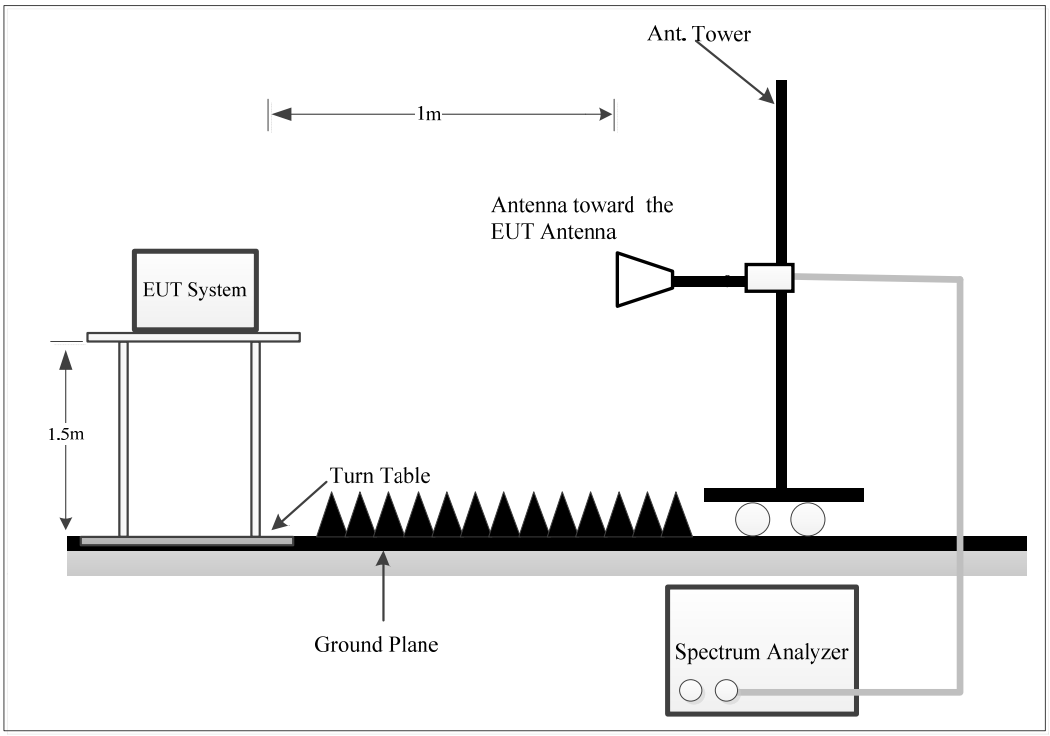
4.2 Peak EIRP And Transmitter Off-times

4.2.1 Applicable Standard

FCC §15.255(b)(3)

Field disturbance sensors/radar devices deployed on unmanned aircraft may operate within the frequency band 60 – 64 GHz, provided that the transmitter not exceed 20 dBm peak EIRP. The sum of continuous transmitter off-times of at least two milliseconds shall equal at least 16.5 milliseconds within any contiguous interval of 33 milliseconds. Operation shall be limited to a maximum of 121.92 meters (400 feet) above ground level.

4.2.2 EUT Setup



Place the measurement antenna at a measurement distance that is in the far-field of the measurement antenna, in the far-field of the EUT antenna. The EIRP test was performed at 1m distance, which was larger than the minimum test distance, please refer to section 4.4.4 for more detail.

4.2.3 Test Procedure

Refer to ANSI C63.10-2020 Clause 9.8

For radiated measurements:
1) Place the measurement antenna at a measurement distance that is in the far-field of the measurement antenna, in the far-field of the EUT antenna, and meets the measurement distance requirements for final radiated measurements as specified in 9.1.4.
2) Place the measurement antenna in the main beam of the EUT then maximize the fundamental emission using the procedures of 9.7, noting that multiple peaks can be found at different beam orientations and/or polarizations.
3) Correct the power reading from the spectrum analyzer for any external gain and/or attenuation between the measurement antenna and the spectrum analyzer. This is the power at the output of the measurement antenna
4) Calculate the EIRP from the power at the output of the measurement antenna using Equation (22), and then convert to linear form using Equation (24).

$$EIRP = 21.98 - 20\log(\lambda) + 20\log(d_{Meas}) + P - G \quad (22)$$

where

$EIRP$	is the equivalent isotropic radiated power, in dBm
λ	is the wavelength of the emission under investigation [300/f(MHz)], in m
d_{Meas}	is the measurement distance, in m
P	is the power measured at the output of the measurement antenna, in dBm
G	is the gain of the measurement antenna, in dBi

NOTE—The measured power P includes all applicable instrument correction factors up to the connection to the measurement antenna.

5) Where applicable, calculate conducted output power from the EIRP using Equation (27).

For FMCW emissions, the procedures in 4.1.5.2.8 and Annex L shall be used.

4.2.4 Test Result

Serial Number:	2WZU-1	Test Date:	2025/1/14
Test Site:	Chamber B	Test Mode:	Transmitting
Tester:	Bill Yang	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	20~20.9	Relative Humidity: (%)	31~36	ATM Pressure: (kPa)	101.4~101.5

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Waveguide Mixer	11970V	2521A011767	2023/2/16	2026/2/15
Flann Micowave	Horn Antenna	861V/385	736	2023/2/27	2026/2/26
Resenberger	Coaxial Cable	LU7-022-1000	0031	2024/3/1	2025/2/28
Resenberger	Coaxial Cable	LU7-022-1000	0032	2024/3/1	2025/2/28
Agilent	Spectrum Analyzer	E4440A	MY44303352	2024/10/22	2025/10/21

** 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:

Chirps Correction Factor

Radar	Chirps Time (μs)	BW_{chirp} (MHz)	RBW (MHz)	Chirps Correction Factor (dB)
Right	20	423.16	1	9.73
Left	20	422.51	1	9.72
Front	20	423.91	1	9.74
Rear	20	423.02	1	9.73
Top	20	516.61	1	10.59
Bottom-above 1meter	35	1412.15	1	12.51
Bottom-below 1meter	20	521.51	1	10.63

Refer to ANSI C63.10-2020/cor 1-2023Annex L.1. The chirps correction factor was calculated using the formula:

$$\alpha = \frac{1}{\left(1+\left[\left(\frac{2\times\ln(2)}{\pi}\right)^2\times\left(\frac{BW_{Chirp}}{T_{Chirp}\times RBW^2}\right)^2\right]\right)^{0.25}}$$

where

α	is the reduction in amplitude
BW_{Chirp}	is the FMCW Chirp Bandwidth
T_{Chirp}	is the FMCW Chirp Time

EIRP:

Radar	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)	E-Field@1m (dBμV/m)	Chirps Correction Factor (dB)	EIRP (dBm)	Limit (dBm)
Right	71.51	PK	V	42.49	114.00	9.73	18.93	20.00
Left	67.78	PK	V	42.42	110.20	9.72	15.12	20.00
Front	67.68	PK	V	42.35	110.03	9.74	14.97	20.00
Rear	69.35	PK	V	42.35	111.70	9.73	16.63	20.00
Top	67.56	PK	V	42.23	109.80	10.59	15.59	20.00
Bottom-above 1meter	65.09	PK	V	42.30	107.39	12.51	15.10	20.00
Bottom-below 1meter	65.08	PK	V	42.23	107.31	10.63	13.14	20.00

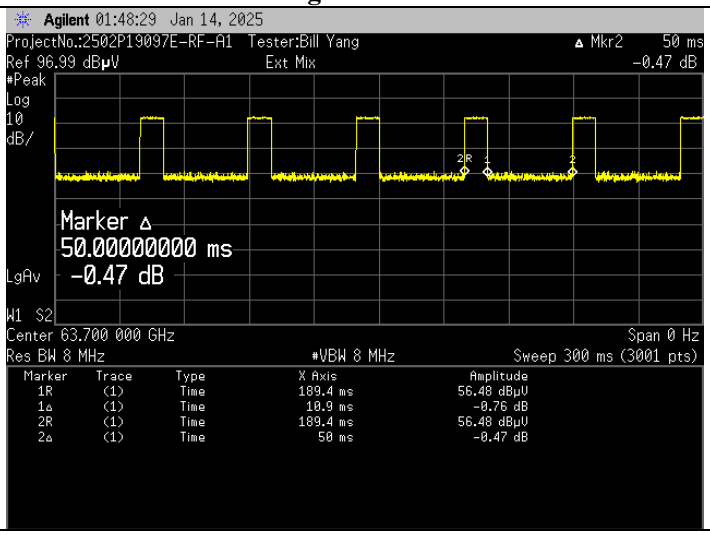
Factor = Antenna Factor
EIRP = Reading + Factor + 20log(Measurement distance) - 104.8
Measurement distance = 1m
The Mixers and it`s RF cables is compose a system for calibration.
The test data recorded was the maximum polarization.

Transmitter Off-times

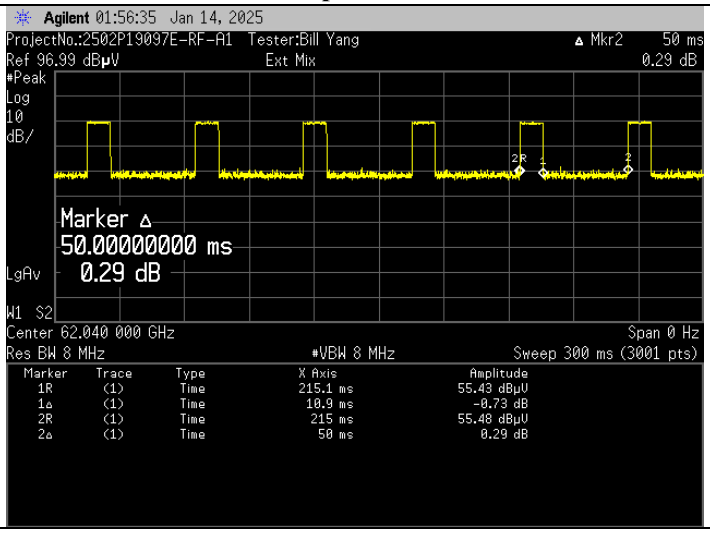
Radar	Transmitter On (ms)	Observation Time (ms)	Sum of continuous transmitter off-times (ms)	Limit (ms)
Right	10.9	33	22.1	⩾16.5
Left	10.9	33	22.1	⩾16.5
Front	10.9	33	22.1	⩾16.5
Rear	10.9	33	22.1	⩾16.5
Top	10.9	33	22.1	⩾16.5
Bottom-above 1meter	10.5	33	22.5	⩾16.5
Bottom-below 1meter	10.9	33	22.1	⩾16.5

Note: Sum of Continuous Transmitter Off-times= Observation Time(33ms) - Ton

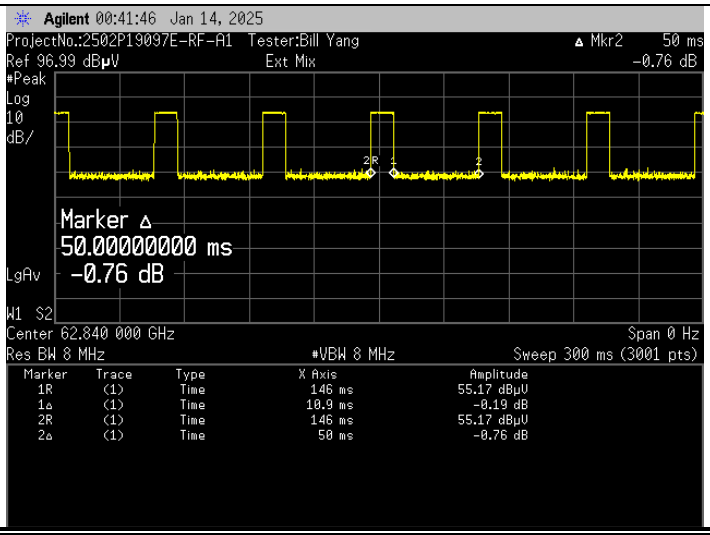
Right Radar



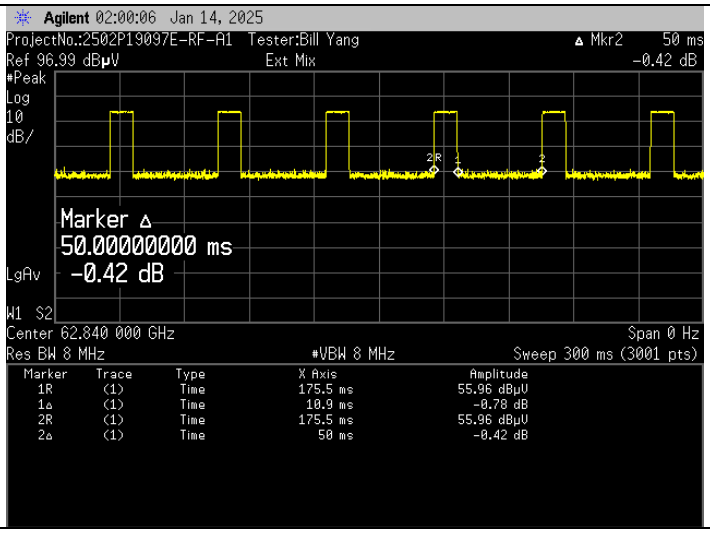
Top Radar



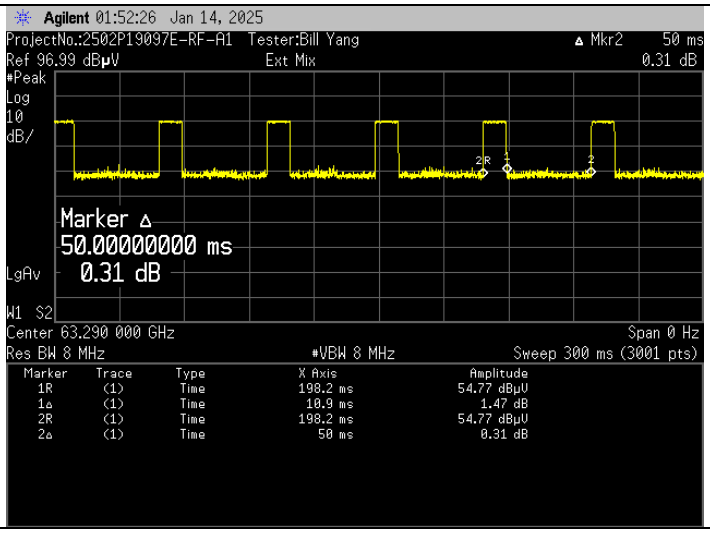
Front Radar



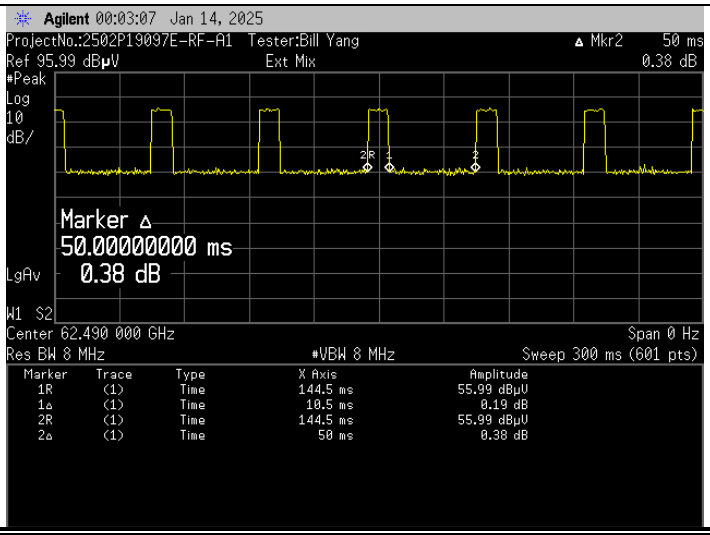
Rear Radar



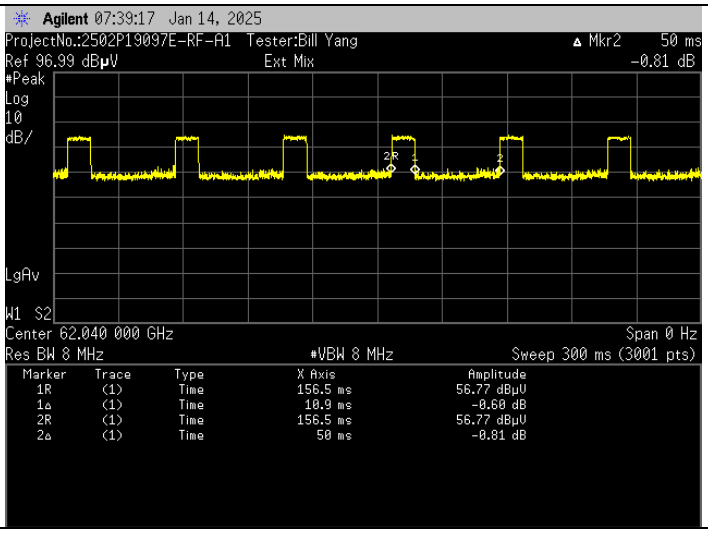
Left Radar



Bottom Radar-above 1meter



Bottom Radar-Below 1meter



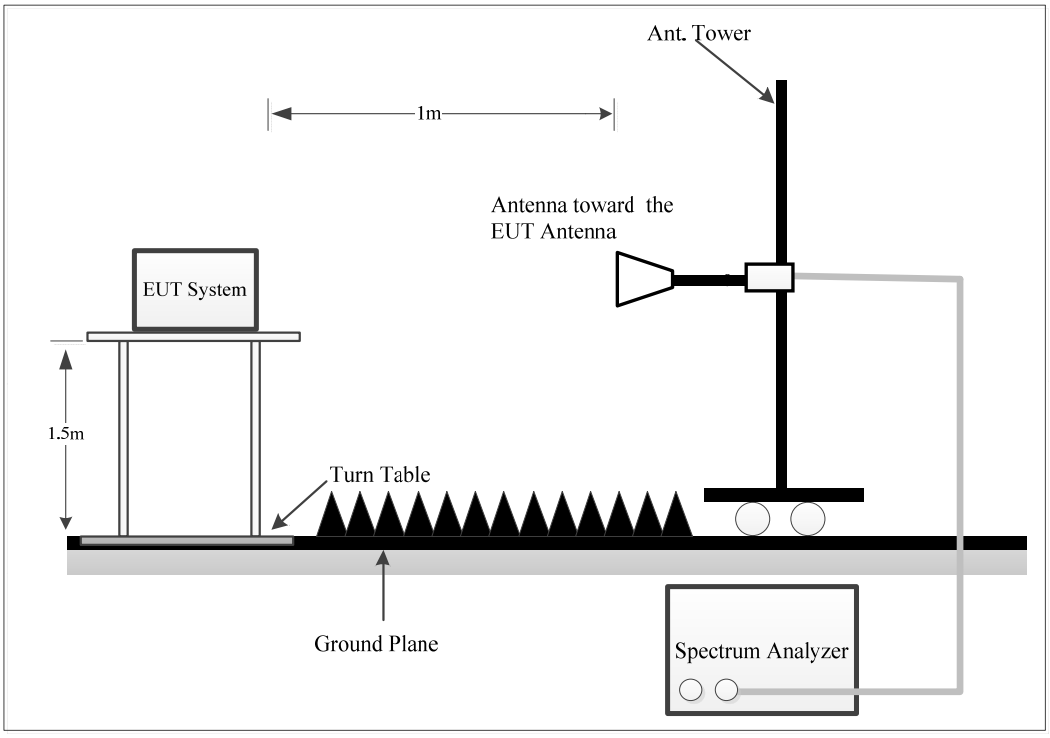
4.3 Emission Bandwidth:

4.3.1 Applicable Standard

KDB 364244 D01 Meas 15.255 Radars v01

For other than pulsed radar transmitters, the fundamental emission bandwidth is presumed to be "…*the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage β/2 of the total mean power of a given emission. Unless otherwise specified in an ITU–R Recommendation for the appropriate class of emission, the value of β/2 should be taken as 0.5%,"* as defined in §2.1(c) of the FCC rules. This is also known as the 99% occupied bandwidth (OBW).

4.3.2 EUT Setup



Place the measurement antenna in the main beam of the EUT then maximize the fundamental emission, noting that multiple peaks can be found at different beam orientations and/or polarizations.

4.3.3 Test Procedure

KDB 364244 D01 Meas 15.255 Radars v01

Clauses 9.3 and 9.4 of C63.10-2020 provide standardized procedures recognized by the FCC for measuring both the relative (-10 dB) bandwidth and the 99% OBW.

The occupied bandwidth (OBW) is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.
a) The following procedure shall be used for measuring 99% power bandwidth: Use the following spectrum analyzer settings:
1) Span equal to approximately 1.5 times the OBW, centered on the carrier frequency
2) RBW, prefer 1% to 5% of OBW, or a minimum of 1 MHz if this is not possible due to a large OBW
3) VBW approximately 3 × RBW
4) Set the reference level of the instrument as required to reduce the chance of the signal amplitude exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.1.6.
5) Sweep = No faster than coupled (auto) time.
6) Detector function = peak.
7) Trace = max-hold.
b) The EUT shall be transmitting at its maximum data rate. Allow the trace to stabilize.
c) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
d) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).
e) Repeat this test for each modulation scheme using the guidance of 5.6.2.1.

4.3.4 Test Data

Serial Number:	2WZU-1	Test Date:	2025/1/14
Test Site:	Chamber B	Test Mode:	Transmitting
Tester:	Bill Yang	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	20	Relative Humidity: (%)	31	ATM Pressure: (kPa)	101.5

Test Equipment List and Details:

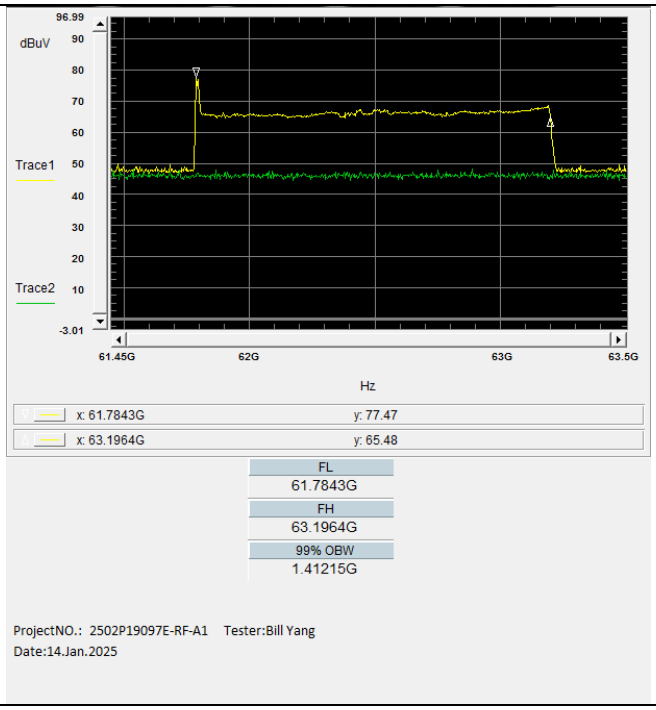
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Waveguide Mixer	11970V	2521A011767	2023/2/16	2026/2/15
Flann Micowave	Horn Antenna	861V/385	736	2023/2/27	2026/2/26
Agilent	Spectrum Analyzer	E4440A	MY44303352	2024/10/22	2025/10/21
Resenberger	Coaxial Cable	LU7-022-1000	0031	2024/3/1	2025/2/28
Resenberger	Coaxial Cable	LU7-022-1000	0032	2024/3/1	2025/2/28

** 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).*

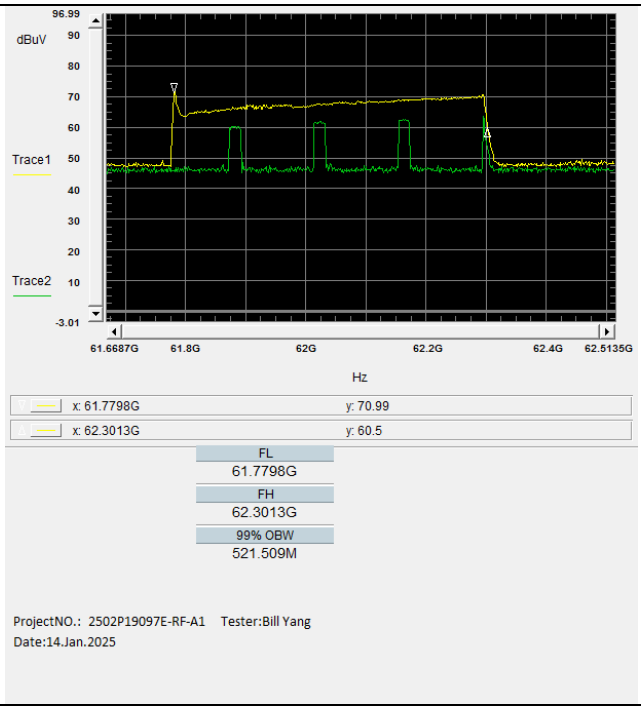
Test Data:

Radar	99% Occupied Bandwidth (MHz)	F_L (GHz)	Limit F_L (GHz)	F_H (GHz)	Limit F_H (GHz)
Bottom Radar-above 1meter	1412.15	61.7843	60	63.1964	64
Bottom Radar-below 1meter	521.509	61.7798	60	62.3013	64
Top	516.613	61.7818	60	62.2984	64
Front	423.909	62.6272	60	63.0511	64
Rear	423.024	62.6273	60	63.0504	64
Left	422.512	63.0771	60	63.4996	64
Right	423.161	63.5264	60	63.9495	64

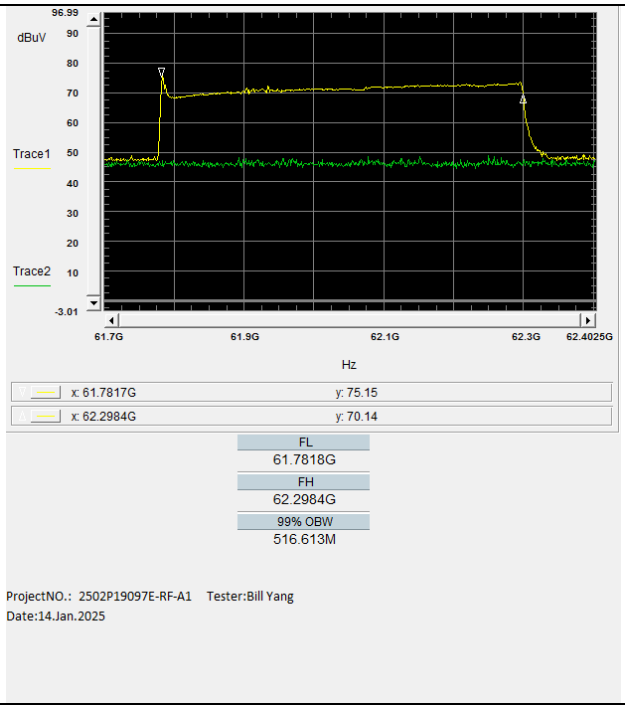
99% Occupied Bandwidth Bottom Radar-above 1meter



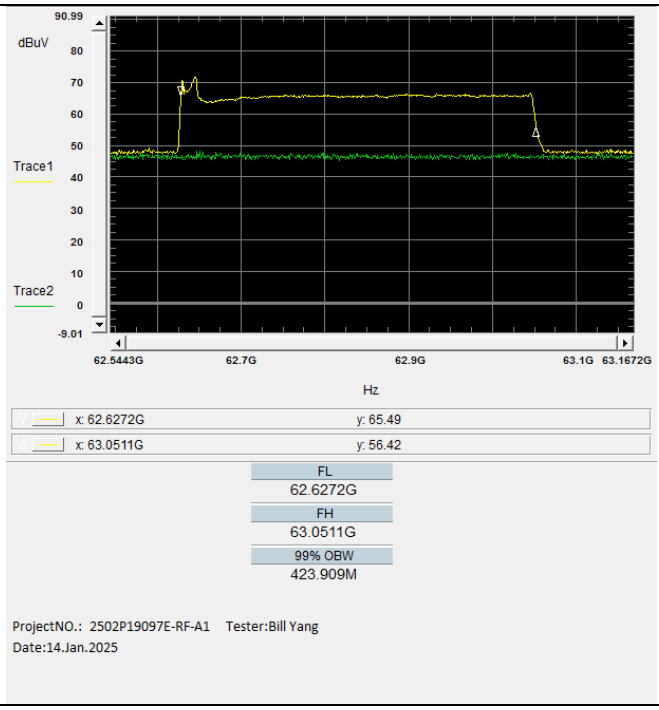
99% Occupied Bandwidth Bottom Radar-below 1meter



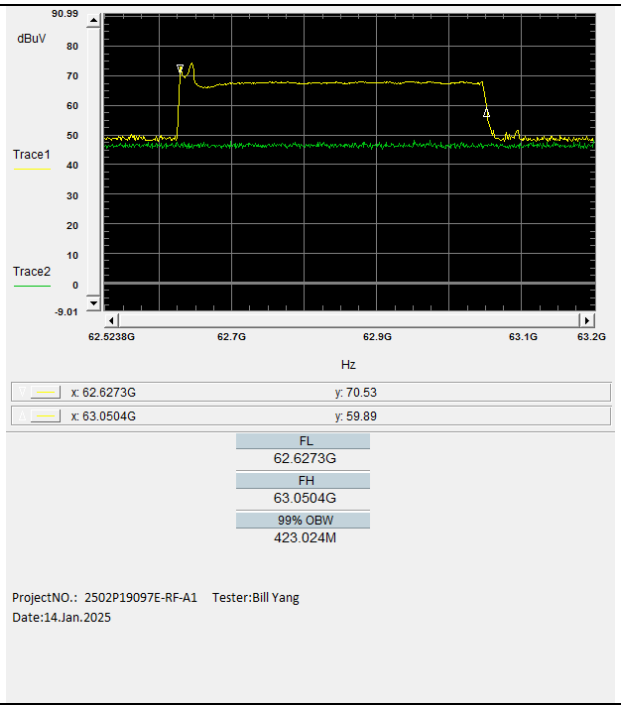
99% Occupied Bandwidth top



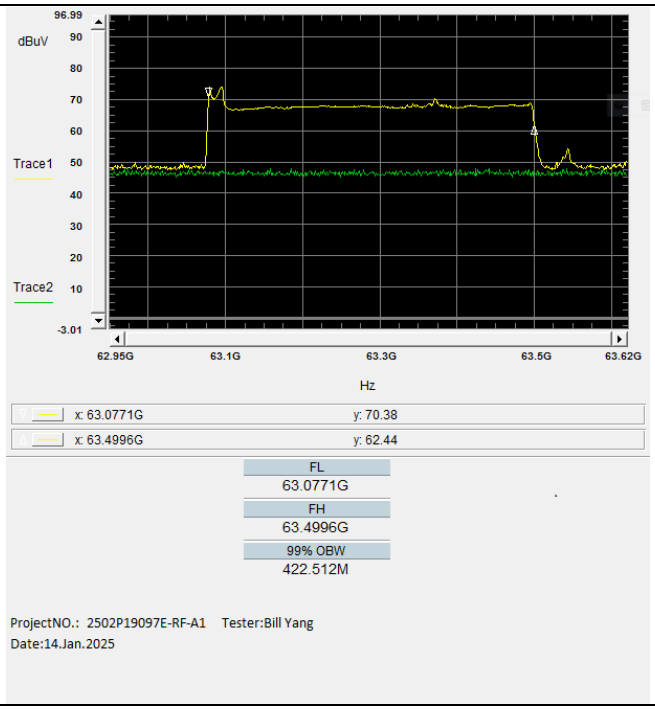
99% Occupied Bandwidth front



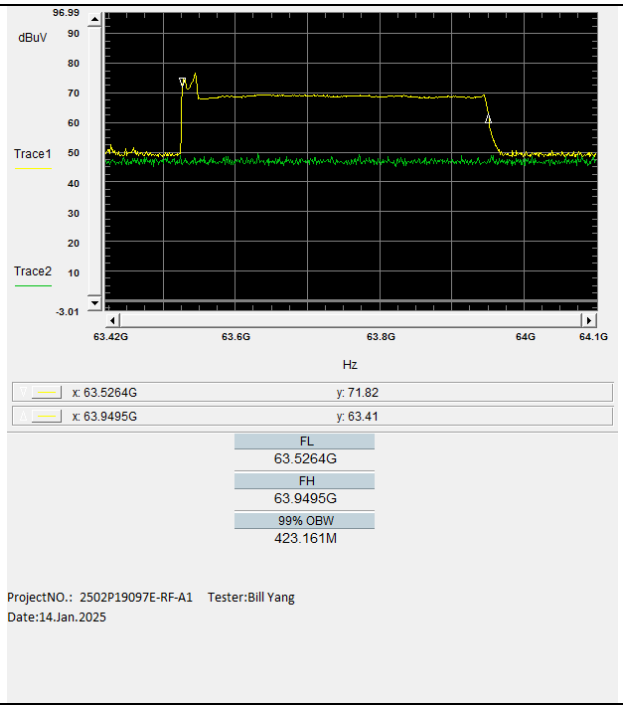
99% Occupied Bandwidth rear



99% Occupied Bandwidth left



99% Occupied Bandwidth right



4.4 Radiated Emissions

4.4.1 Applicable Standard

FCC §15.255(d)
Limits on spurious emissions:

(1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.

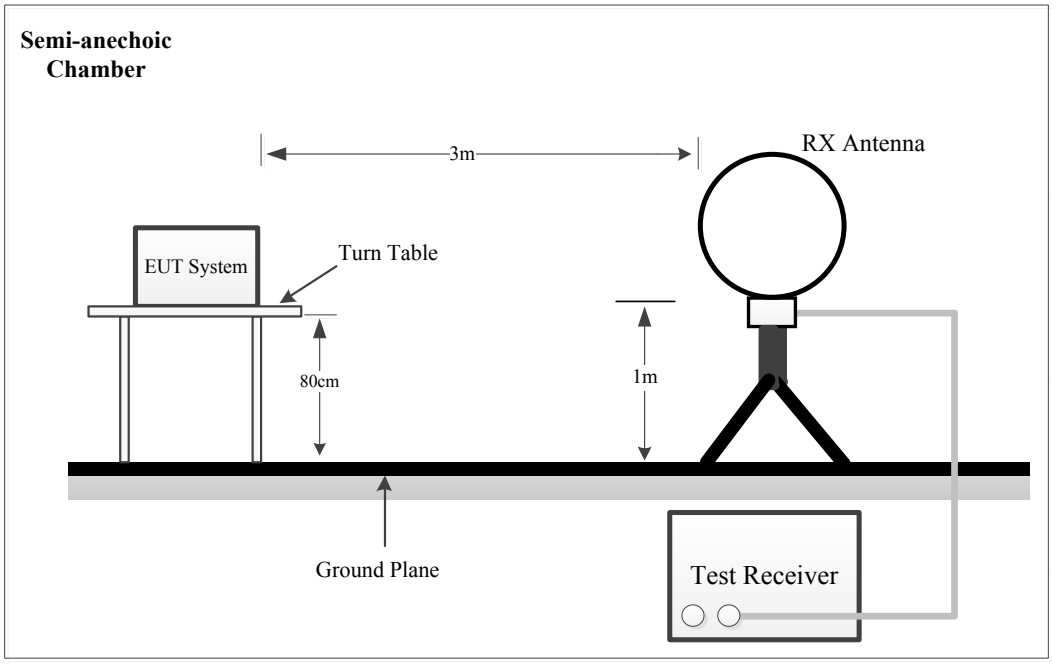
(2) Radiated emissions below 40 GHz shall not exceed the general limits in § 15.209.

(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm^2 at a distance of 3 meters.

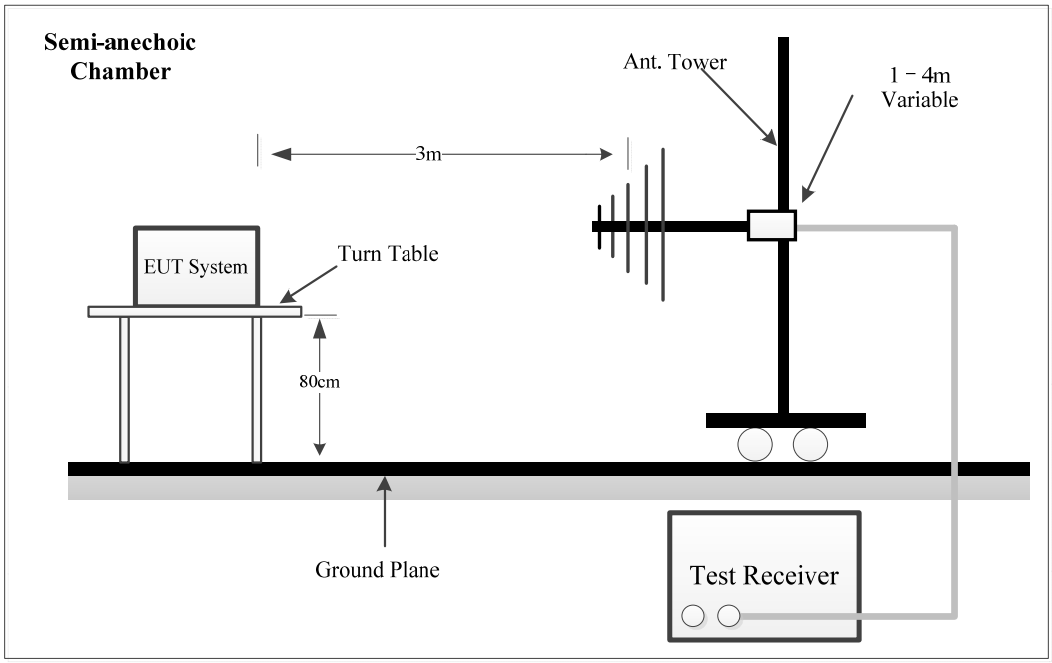
(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

4.4.2 EUT Setup

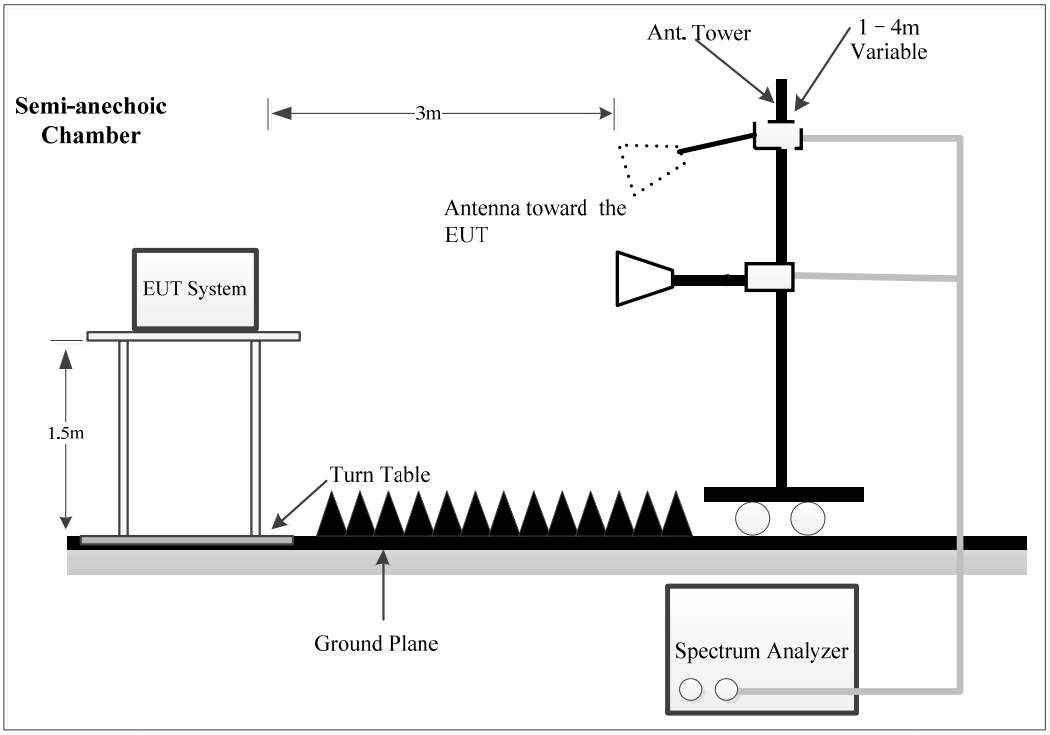
9kHz-30MHz:



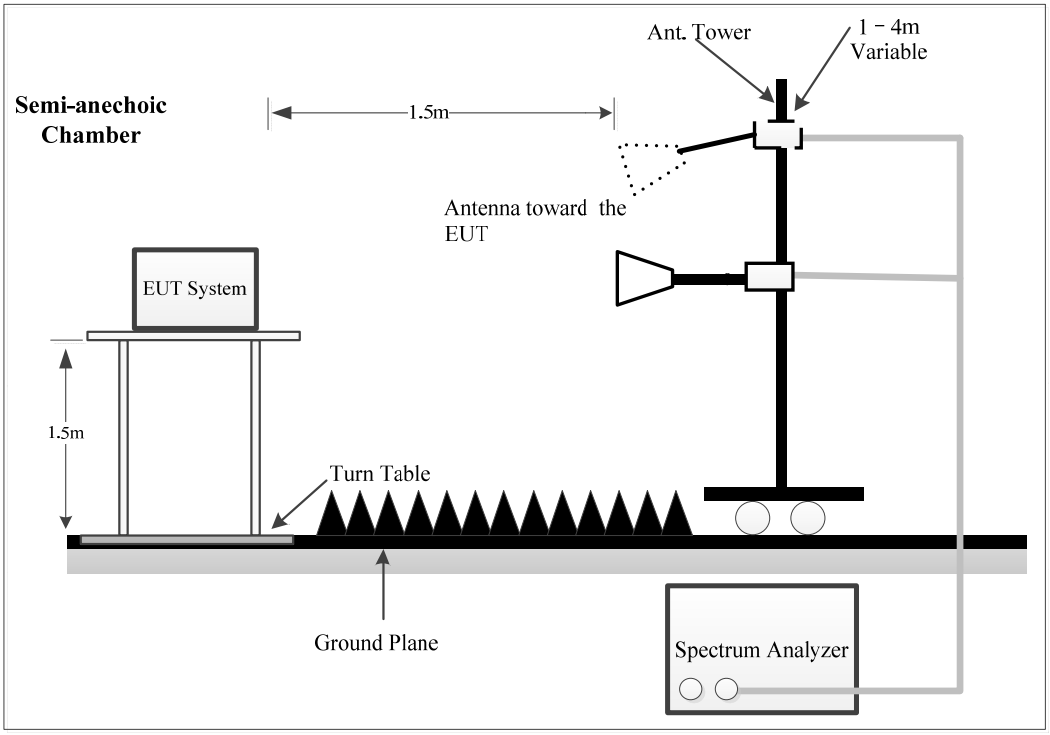
30MHz~1GHz:



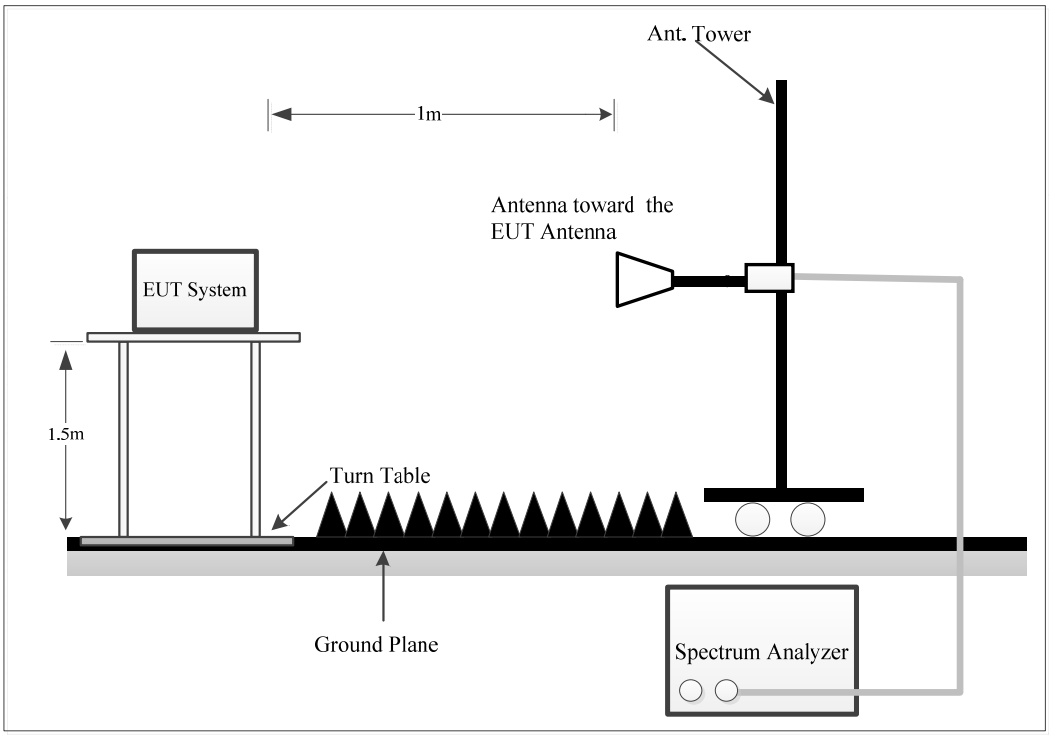
1~26.5 GHz:



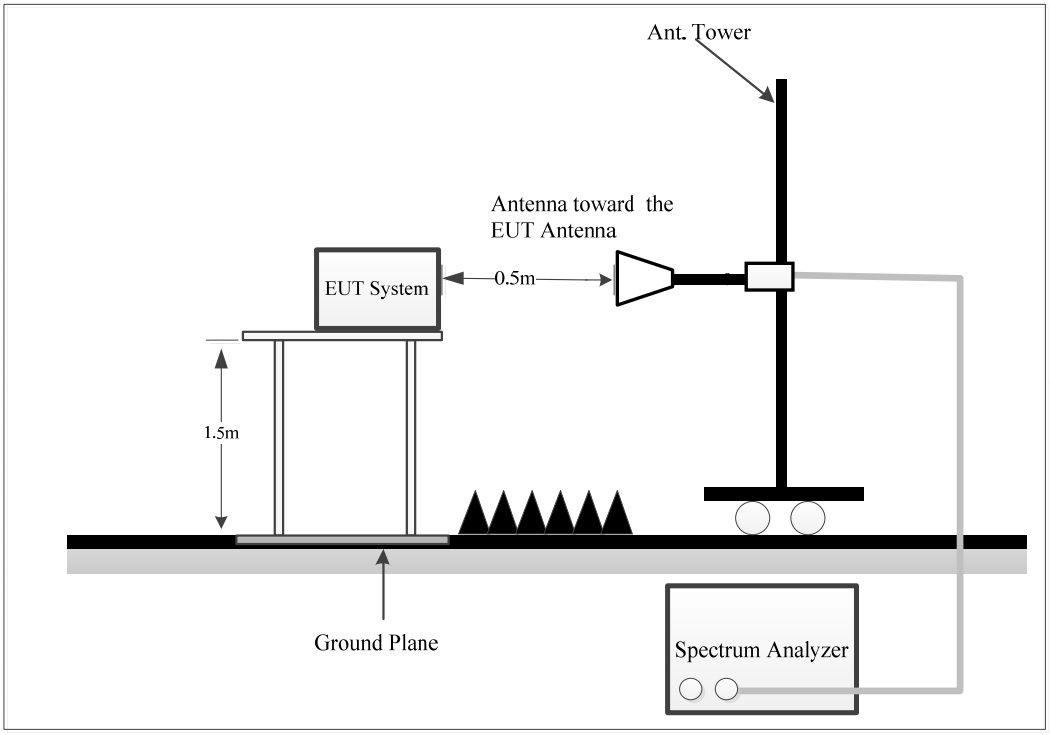
26.5~40 GHz:



40~90 GHz:



90~200 GHz:



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 200 GHz.

The radiated emission and out of band emission tests were performed in the 3 meters chamber, using the setup accordance with the ANSI C63.10-2020 The specification used was the FCC 15.209/15.205/15.255 limits.

4.4.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9 kHz to 200 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:
9kHz-1000MHz:

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

1-40GHz:
Pre-scan:

Frequency Range	Measurement	RBW	Video B/W	Detector
1-40 GHz	Peak	1MHz	3 MHz	PK
	AV	1MHz	5kHz	PK

Final measurement for emission identified during the pre-scan:

Frequency Range	Measurement	RBW	Video B/W	Detector
1-40 GHz	Peak	1MHz	3 MHz	PK
	AV	1MHz	10Hz	PK

Above 40GHz:

Frequency Range	Measurement	RBW	Video B/W	Detector
Above 40GHz	AV	1MHz	3MHz	AV

Note: Data was recorded in Quasi-peak detection mode for frequency range of 9 kHz-30MHz except 9 – 90 kHz, 110 – 490 kHz, employing an average detector.

4.4.4 Test Procedure

Refer to ANSI C63.10-2020 Clauses 9.10, and 9.11.

A Maximizing procedure was performed to ensure that the highest emissions from the EUT were actually measured in all of the Test Arrangements of the EUT and Local Support Equipment.

All emissions under the average limit and under the noise floor have not recorded in the report.
According to C63.10, the 26.5-40GHz test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m

Distance extrapolation factor =20 log (specific distance [3m]/test distance [1.5m]) dB= 6.0 dB

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 C63.10-2020:

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

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-200GHz 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	0.86
861/385	50-75	43.7	0.95
M12RH	60-90	30.02	0.54
M08RH	90-140	19.7	0.36
M05RH	140-220	12.5	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 200GHz, it can be seen that the EUT was always in the Far-field of the Receive Antenna during all Radiated Emissions Tests.

4.4.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

For 9kHz-26.5GHz:
Result = Reading + Factor

For 26.5GHz-40GHz
Result = Reading + Factor-Distance extrapolation Factor

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

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

4.4.6 Test Data

Serial Number:	2WZU-1	Test Date:	Below 1GHz: 2025/1/13&2025/1/22 Above 1GHz: 2025/1/14
Test Site:	Chamber10m, Chamber B	Test Mode:	Transmitting
Tester:	Zoo Zou, Bill Yang	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	19.4~21.1	Relative Humidity: (%)	31~38	ATM Pressure: (kPa)	101.2~101.8

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
9kHz~1000MHz					
EMCO	Passive Loop Antenna	6512	9706-1206	2023/10/25	2026/10/24
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	2024/7/1	2025/6/30
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-04	2024/7/1	2025/6/30
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2024/7/1	2025/6/30
Sonoma	Amplifier	310N	185914	2024/8/26	2025/8/25
R&S	EMI Test Receiver	ESCI	100224	2024/8/26	2025/8/25
Audix	Test Software	E3	191218 V9	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	2024/11/17	2025/11/16
Xinhang Macrowave	Coaxial Cable	XH360A-2.92/J-2.92/J-6M-A	20231208001 #0001	2024/12/9	2025/12/8
AH	Preamplifier	PAM-0118P	469	2024/4/15	2025/4/14
AH	Preamplifier	PAM-1840VH	191	2024/9/5	2025/9/4
R&S	Spectrum Analyzer	FSV40	101944	2024/9/6	2025/9/5
Audix	Test Software	E3	191218 (V9)	N/A	N/A
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

OML	Waveguide Mixer	WR05/M05HWD	G60106-1	2023/2/16	2026/2/15
OML	Horn Antenna	M05RH	G60106-2	2023/2/27	2026/2/26
Resenberger	Coaxial Cable	LU7-022-1000	0031	2024/3/1	2025/2/28

** 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).*

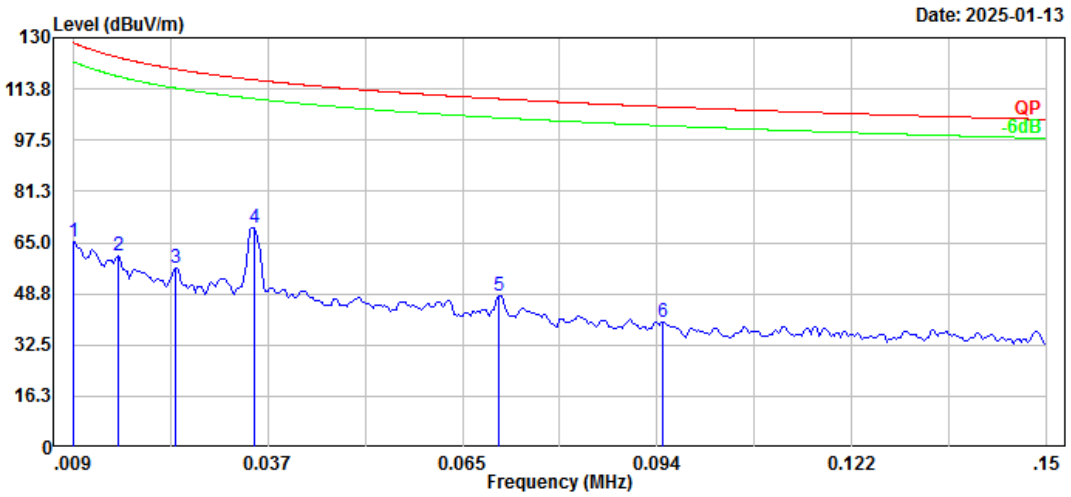
Test Data:

Please refer to the below table and plots.

1) 9kHz~30MHz(All Radar Modules transmit simultaneously)

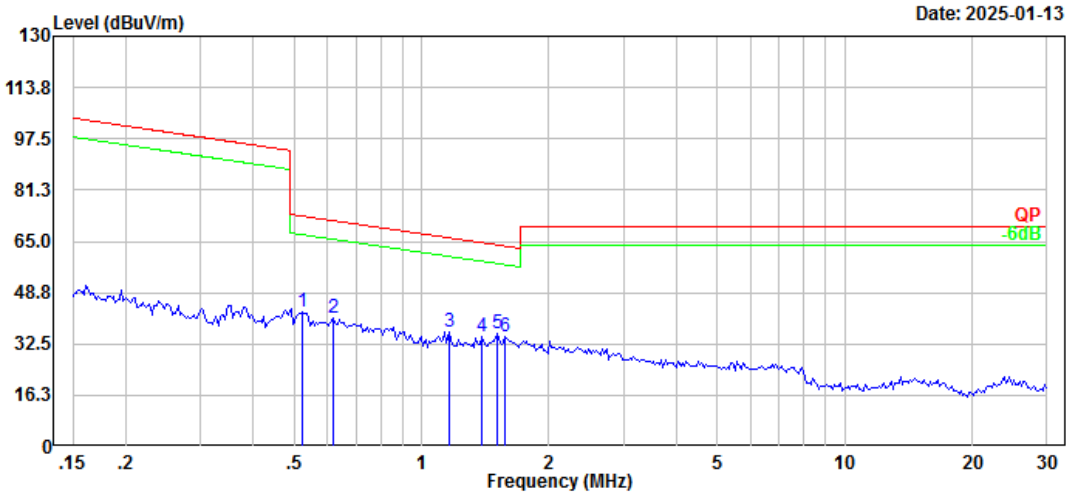
Three antenna orientations (parallel, perpendicular, and ground-parallel) was measured, the worst orientations was below:

```
Project No.: 2502P19097E-RF-A1          Serial No.: 2WZU-1
Polarization: Parallel                      Tester: Zoo Zou
   Test Mode: Transmitting
        Note:
               RBW:300Hz VBW:1kHz
```



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	0.009	12.00	53.24	65.24	128.52	63.28	Peak
2	0.015	9.32	51.31	60.63	123.80	63.17	Peak
3	0.024	7.96	49.05	57.01	120.02	63.01	Peak
4	0.035	23.22	46.62	69.84	116.67	46.83	Peak
5	0.071	7.70	40.46	48.16	110.61	62.45	Peak
6	0.094	3.27	36.36	39.63	108.10	68.47	Peak

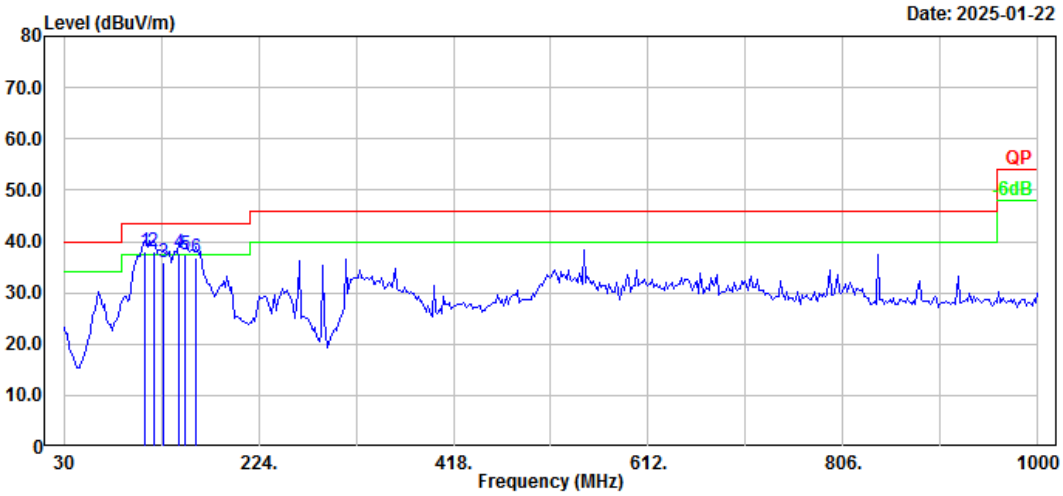
Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Parallel Tester: Zoo Zou
Test Mode: Transmitting
Note:
RBW:10kHz VBW:30kHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	0.524	19.37	23.28	42.65	73.21	30.56	Peak
2	0.621	18.50	22.25	40.75	71.71	30.96	Peak
3	1.160	20.32	15.85	36.17	66.16	29.99	Peak
4	1.388	20.13	14.83	34.96	64.56	29.60	Peak
5	1.511	21.52	14.29	35.81	63.81	28.00	Peak
6	1.577	20.76	13.99	34.75	63.43	28.68	Peak

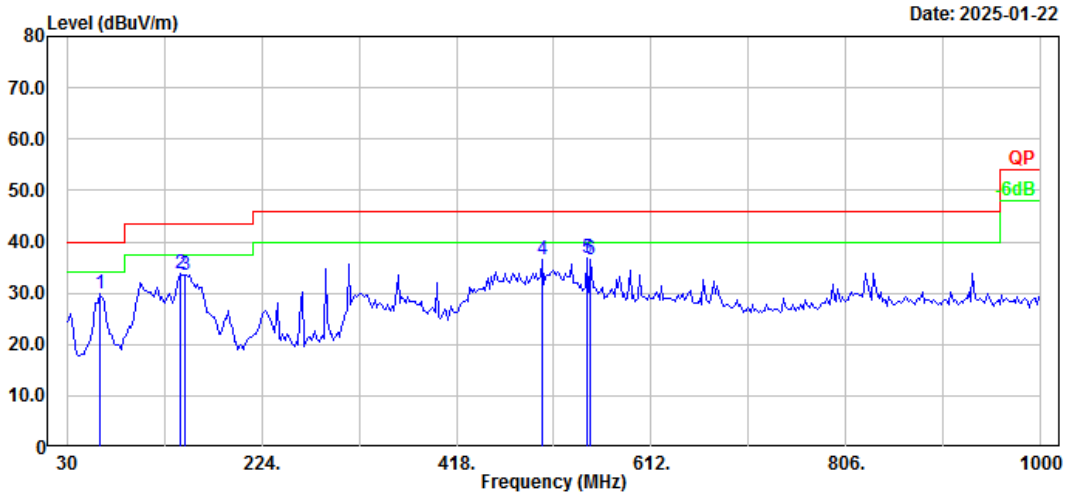
2) 30MHz-1GHz(All Radar Modules transmit simultaneously)

Project No.: 2502P19097E-RF-A1 Serial No.: 2WO3-1
Polarization: Horizontal Tester: Zoo Zou
Test Mode: Transmitting
Note:
RBW:100kHz VBW:300kHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	111.48	49.30	-11.15	38.15	43.50	5.35	QP
2	119.24	48.10	-10.05	38.05	43.50	5.45	QP
3	128.94	45.89	-9.86	36.03	43.50	7.47	QP
4	144.46	48.50	-10.73	37.77	43.50	5.73	QP
5	150.28	48.60	-11.06	37.54	43.50	5.96	QP
6	161.92	48.20	-11.27	36.93	43.50	6.57	QP

Project No.: 2502P19097E-RF-A1 Serial No.: 2WO3-1
Polarization: Vertical Tester: Zoo Zou
Test Mode: Transmitting
Note:
RBW:100kHz VBW:300kHz

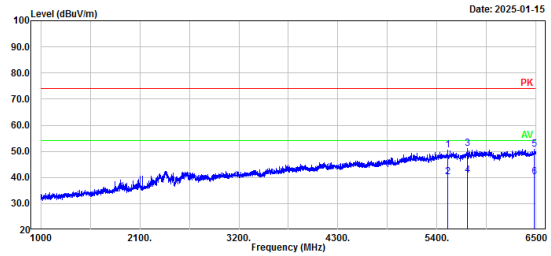


No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	62.98	46.46	-16.56	29.90	40.00	10.10	Peak
2	142.52	44.57	-10.61	33.96	43.50	9.54	Peak
3	148.34	44.61	-10.96	33.65	43.50	9.85	Peak
4	503.36	40.75	-4.22	36.53	46.00	9.47	Peak
5	547.98	40.30	-3.47	36.83	46.00	9.17	Peak
6	551.86	39.85	-3.41	36.44	46.00	9.56	Peak

2) 1GHz-40GHz(All Radar Modules transmit simultaneously):

Horizontal

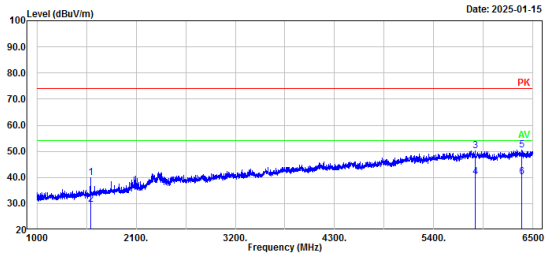
Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Horizontal Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	5516.60	51.76	-1.21	50.55	74.00	23.45	Peak
2	5516.60	41.52	-1.21	40.31	54.00	13.69	Average
3	5737.70	51.86	-0.71	51.15	74.00	22.85	Peak
4	5737.70	41.58	-0.71	40.87	54.00	13.13	Average
5	6478.00	50.80	-0.14	50.66	74.00	23.34	Peak
6	6478.00	40.37	-0.14	40.23	54.00	13.77	Average

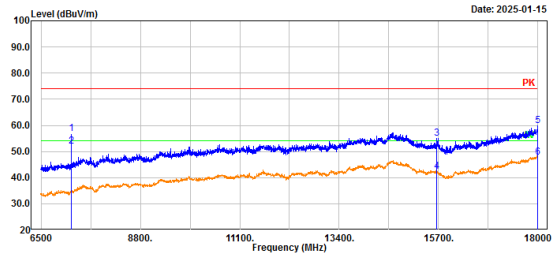
Vertical

Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Vertical Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz



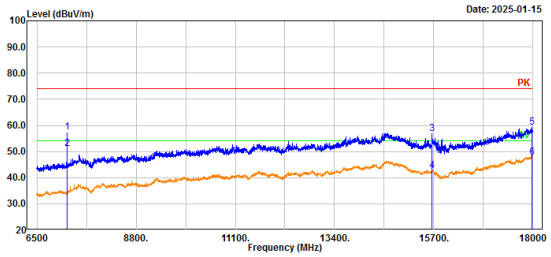
No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	1594.00	53.34	-13.47	39.87	74.00	34.13	Peak
2	1594.00	43.16	-13.47	29.69	54.00	24.31	Average
3	5857.60	50.72	-0.56	50.16	74.00	23.84	Peak
4	5857.60	40.84	-0.56	40.28	54.00	13.72	Average
5	6375.70	50.63	-0.25	50.38	74.00	23.62	Peak
6	6375.70	40.44	-0.25	40.19	54.00	13.81	Average

Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Horizontal Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz Ave:RBW:1MHz,VBW:5kHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	7200.00	60.67	-3.82	56.85	74.00	17.15	Peak
2	7200.00	55.85	-3.82	52.03	54.00	1.97	Average
3	15662.00	51.49	3.59	55.08	74.00	18.92	Peak
4	15662.00	38.67	3.59	42.26	54.00	11.74	Average
5	17988.80	48.44	11.33	59.77	74.00	14.23	Peak
6	17988.80	36.59	11.33	47.92	54.00	6.08	Average

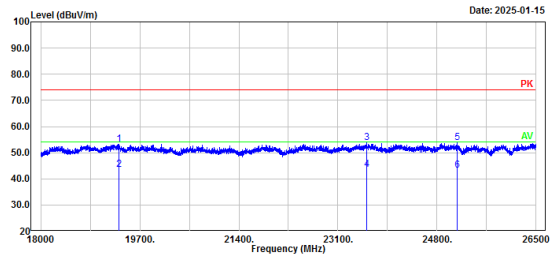
Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Vertical Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz Ave:RBW:1MHz,VBW:5kHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	7200.00	61.16	-3.82	57.34	74.00	16.66	Peak
2	7200.00	54.93	-3.82	51.11	54.00	2.89	Average
3	15662.00	53.14	3.59	56.73	74.00	17.27	Peak
4	15662.00	38.94	3.59	42.53	54.00	11.47	Average
5	17980.40	47.87	11.30	59.17	74.00	14.83	Peak
6	17980.40	36.57	11.30	47.87	54.00	6.13	Average

Horizontal

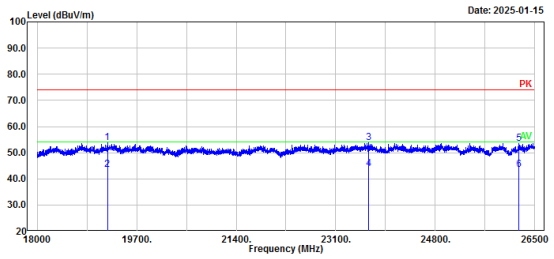
Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Horizontal Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	19343.00	47.37	5.97	53.34	74.00	20.66	Peak
2	19343.00	37.64	5.97	43.61	54.00	10.39	Average
3	23589.60	45.05	8.72	53.77	74.00	20.23	Peak
4	23589.60	34.91	8.72	43.63	54.00	10.37	Average
5	25150.20	43.99	9.70	53.69	74.00	20.31	Peak
6	25150.20	33.69	9.70	43.39	54.00	10.61	Average

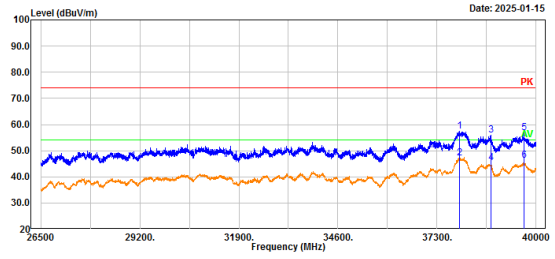
Vertical

Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Vertical Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz



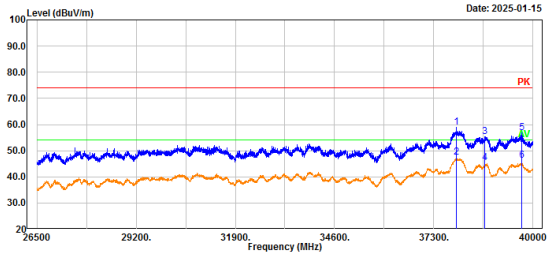
No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	19200.20	47.73	6.04	53.77	74.00	20.23	Peak
2	19200.20	37.60	6.04	43.64	54.00	10.36	Average
3	23662.70	45.18	8.73	53.91	74.00	20.09	Peak
4	23662.70	35.05	8.73	43.78	54.00	10.22	Average
5	26229.70	42.70	10.95	53.65	74.00	20.35	Peak
6	26229.70	32.62	10.95	43.57	54.00	10.43	Average

Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Horizontal Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz Ave:RBW:1MHz,VBW:5kHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	37907.50	45.84	11.48	57.32	74.00	16.68	Peak
2	37907.50	35.73	11.48	47.21	54.00	6.79	Average
3	38776.90	44.94	10.94	55.88	74.00	18.12	Peak
4	38776.90	34.50	10.94	45.44	54.00	8.56	Average
5	39662.50	45.44	11.27	56.71	74.00	17.29	Peak
6	39662.50	34.96	11.27	46.23	54.00	7.77	Average

Project No.: 2502P19097E-RF-A1 Serial No.: 2WZU-1
Polarization: Vertical Tester: Nat Zhou
Test Mode: Transmitting
Note:
Peak:RBW:1MHz,VBW:3MHz Ave:RBW:1MHz,VBW:5kHz



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	37910.20	47.42	11.50	58.92	74.00	15.08	Peak
2	37910.20	35.83	11.50	47.33	54.00	6.67	Average
3	38690.50	44.39	11.03	55.42	74.00	18.58	Peak
4	38690.50	34.38	11.03	45.41	54.00	8.59	Average
5	39684.10	45.66	11.29	56.95	74.00	17.05	Peak
6	39684.10	35.04	11.29	46.33	54.00	7.67	Average

3) 40GHz-200GHz:

Right Radar **63.7 GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.300	53.20	H	38.84	82.50	47.17	90.00
40.650	53.26	V	38.89	82.61	48.38	90.00
90.620	52.69	H	45.18	82.31	45.15	90.00
90.314	53.12	V	45.14	82.70	49.39	90.00
140.320	50.83	H	48.91	84.18	69.45	90.00
140.630	51.02	V	48.92	84.38	72.72	90.00

Left Radar **63.2 GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.460	53.10	H	38.86	82.42	46.31	90.00
40.650	53.42	V	38.89	82.77	50.19	90.00
90.342	52.77	H	45.15	82.36	45.67	90.00
90.325	53.34	V	45.15	82.93	52.08	90.00
140.530	50.01	H	48.92	83.37	57.63	90.00
140.420	50.25	V	48.91	83.60	60.77	90.00

Front Radar **62.8 GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.520	54.10	H	38.87	83.43	58.43	90.00
40.770	53.68	V	38.91	83.05	53.54	90.00
90.500	52.09	H	45.17	81.70	39.23	90.00
90.240	52.91	V	45.14	82.49	47.06	90.00
140.250	50.56	H	48.90	83.90	65.11	90.00
140.460	50.69	V	48.91	84.04	67.24	90.00

Rear Radar **62.8 GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.620	53.05	H	38.89	82.40	46.10	90.00
40.390	53.36	V	38.85	82.67	49.05	90.00
90.510	52.41	H	45.17	82.02	42.23	90.00
90.621	53.32	V	45.18	82.94	52.20	90.00
140.360	50.47	H	48.91	83.82	63.92	90.00
140.710	50.85	V	48.92	84.21	69.93	90.00

Top Radar **62** **GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.501	54.12	H	38.87	83.45	58.70	90.00
40.813	53.88	V	38.92	83.26	56.19	90.00
90.660	52.75	H	45.19	82.38	45.88	90.00
90.510	53.21	V	45.17	82.82	50.78	90.00
140.150	50.59	H	48.90	83.93	65.56	90.00
140.530	50.67	V	48.92	84.03	67.09	90.00

Bottom Radar-above 1meter **62.4** **GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.860	53.61	H	38.92	82.99	52.80	90.00
40.570	53.39	V	38.88	82.73	49.73	90.00
90.450	52.34	H	45.16	81.94	41.46	90.00
90.360	53.54	V	45.15	83.13	54.53	90.00
140.660	50.25	H	48.92	83.61	60.91	90.00
140.810	50.63	V	48.93	84.00	66.63	90.00

Bottom Radar-below 1meter **62** **GHz**

Frequency (GHz)	Receiver Reading (dBμV)	Polar (H/V)	Factor (dB/m)	Field Strength (dBμV/m)	Power Density (pW/cm^2)	Limit (pW/cm^2)
40.725	53.17	H	38.90	82.53	47.50	90.00
40.210	52.95	V	38.82	82.23	44.33	90.00
90.810	52.68	H	45.21	82.33	45.36	90.00
90.170	53.07	V	45.13	82.64	48.71	90.00
140.570	50.09	H	48.92	83.45	58.70	90.00
140.650	50.33	V	48.92	83.69	62.04	90.00

Note:
Factor = Antenna Factor
Field Strength = Reading + Factor + 20log(d_{Meas}/$d_{SpecLimit}$)
d_{Meas} is the measurement distance, in m
$d_{SpecLimit}$ is the distance specified by the limit, in m

$$PD = \frac{E_{SpecLimit}^2}{377}$$

where

PD is the power density at the distance specified by the limit, in W/m^2
$E_{SpecLimit}$ is the field strength at the distance specified by the limit, in V/m

The Specified distance is 3m.

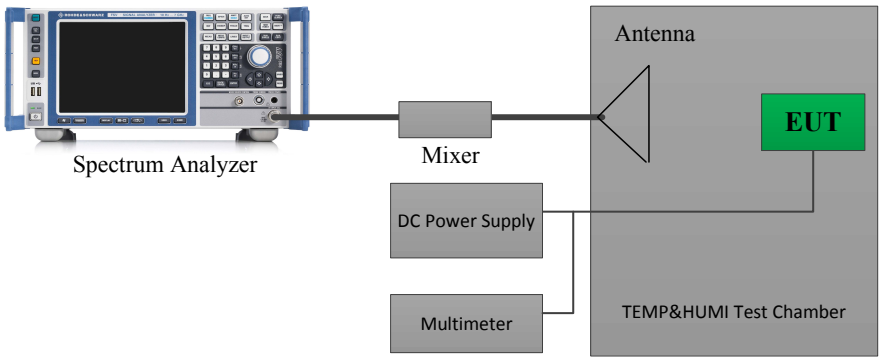
4.5 Frequency Stability

4.5.1 Applicable Standard

FCC §15.255(f)

(f) Frequency stability. Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

4.5.2 EUT Setup Block Diagram



4.5.3 Test Procedure

Refer to ANSI C63.10-2020 Clauses 9.5.

The following procedure shall be used for determining frequency stability of millimeter-wave systems:

a) Arrange EUT and test equipment as shown in Figure 21. Some temperature chambers have a window or other opening that permits locating the receive antenna outside the chamber.

b) With the EUT at ambient temperature (approximately 25 °C) and voltage source set to the EUT nominal operating voltage (100%), record the spectrum mask of the EUT emission on the spectrum analyzer.

c) Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask.

d) Set the power supply to 100% nominal setting, and raise EUT operating temperature to 50 °C. Record the frequency excursion of the EUT emission mask.

e) Repeat step d) at each 10 °C increment down to −20 °C.

4.5.3 Test Result

Serial Number:	2WZU-1	Test Date:	2025/1/14
Test Site:	RF	Test Mode:	Transmitting
Tester:	Bill Yang	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	20.9	Relative Humidity: (%)	36	ATM Pressure: (kPa)	101.4

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Waveguide Mixer	11970V	2521A011767	2023/2/16	2026/2/15
Flann Micowave	Horn Antenna	861V/385	736	2023/2/27	2026/2/26
Agilent	Spectrum Analyzer	E4440A	MY44303352	2024/10/22	2025/10/21
Resenberger	Coaxial Cable	LU7-022-1000	0031	2024/3/1	2025/2/28
Resenberger	Coaxial Cable	LU7-022-1000	0032	2024/3/1	2025/2/28
BACL	TEMP&HUMI Test Chamber	BTH-150-40	30173	2024/9/6	2025/9/5
All-sun	Clamp Meter	EM305A	8348897	2024/8/16	2025/8/15
TDK-Lambda	DC Power Supply	Z+60-14	F-08-EM038-1	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:

Right Radar

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	63.5262	63.9497	60	64
-10	23.70	63.5260	63.9494	60	64
0	23.70	63.5262	63.9495	60	64
10	23.70	63.5262	63.9496	60	64
20	23.70	63.5264	63.9495	60	64
30	23.70	63.5265	63.9496	60	64
40	23.70	63.5261	63.9494	60	64
50	23.70	63.5263	63.9497	60	64
20	22.44	63.5266	63.9499	60	64
20	30.36	63.5263	63.9495	60	64

Left

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	63.0775	63.4998	60	64
-10	23.70	63.0771	63.4995	60	64
0	23.70	63.0774	63.4997	60	64
10	23.70	63.0772	63.4994	60	64
20	23.70	63.0771	63.4996	60	64
30	23.70	63.0772	63.4996	60	64
40	23.70	63.0770	63.4994	60	64
50	23.70	63.0777	63.4998	60	64
20	22.44	63.0775	63.4993	60	64
20	30.36	63.0778	63.4999	60	64

Front

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	62.6275	63.0514	60	64
-10	23.70	62.6270	63.0514	60	64
0	23.70	62.6277	63.0516	60	64
10	23.70	62.6273	63.0512	60	64
20	23.70	62.6272	63.0511	60	64
30	23.70	62.6277	63.0516	60	64
40	23.70	62.6274	63.0513	60	64
50	23.70	62.6274	63.0514	60	64
20	22.44	62.6272	63.0510	60	64
20	30.36	62.6270	63.0511	60	64

Rear

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	62.6272	63.0501	60	64
-10	23.70	62.6274	63.0503	60	64
0	23.70	62.6270	63.0503	60	64
10	23.70	62.6276	63.0507	60	64
20	23.70	62.6273	63.0504	60	64
30	23.70	62.6276	63.0502	60	64
40	23.70	62.6273	63.0501	60	64
50	23.70	62.6277	63.0500	60	64
20	22.44	62.6274	63.0503	60	64
20	30.36	62.6278	63.0509	60	64

Top

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	61.7815	62.2989	60	64
-10	23.70	61.7816	62.2989	60	64
0	23.70	61.7814	62.2984	60	64
10	23.70	61.7816	62.2982	60	64
20	23.70	61.7818	62.2984	60	64
30	23.70	61.7814	62.2982	60	64
40	23.70	61.7811	62.2988	60	64
50	23.70	61.7817	62.2986	60	64
20	22.44	61.7814	62.2989	60	64
20	30.36	61.7816	62.2983	60	64

Bottom Radar-Above 1meter

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	61.7844	63.1965	60	64
-10	23.70	61.7845	63.1963	60	64
0	23.70	61.7846	63.1962	60	64
10	23.70	61.7847	63.1966	60	64
20	23.70	61.7843	63.1964	60	64
30	23.70	61.7840	63.1963	60	64
40	23.70	61.7842	63.1961	60	64
50	23.70	61.7845	63.1966	60	64
20	22.44	61.7844	63.1967	60	64
20	30.36	61.7845	63.1962	60	64

Bottom Radar-below 1meter

Temperature	Voltage	Frequency (GHz)			
℃	V_{DC}	f_L	f_H	f_L Limit	f_H Limit
-20	23.70	61.7744	62.3024	60	64
-10	23.70	61.7786	62.3034	60	64
0	23.70	61.7756	62.3011	60	64
10	23.70	61.7722	62.3045	60	64
20	23.70	61.7798	62.3013	60	64
30	23.70	61.7723	62.3018	60	64
40	23.70	61.7758	62.3034	60	64
50	23.70	61.7762	62.3043	60	64
20	20.15	61.7788	62.3018	60	64
20	27.26	61.7792	62.3240	60	64

Note: The Voltage range was declared by manufacturer▲.

4.6 Operation Restriction and Group Installation

4.6.1 Applicable Standard

§15.255 (a) General. Operation under the provisions of this section is not permitted for equipment used on satellites.

§15.255 (b) Operation on aircraft. Operation on aircraft is permitted under the following conditions:

(1) When the aircraft is on the ground.

(2) While airborne, only in closed exclusive on-board communication networks within the aircraft, with the following exceptions:

(i) Equipment shall not be used in wireless avionics intra-communication (WAIC) applications where external structural sensors or external cameras are mounted on the outside of the aircraft structure.

(ii) Except as permitted in paragraph (b)(3) of this section, equipment shall not be used on aircraft where there is little attenuation of RF signals by the body/fuselage of the aircraft.

(iii) Field disturbance sensor/radar devices may only operate in the frequency band 59.3–71.0 GHz while installed in passengers' personal portable electronic equipment (e.g., smartphones, tablets) and shall comply with paragraph (b)(2)(i) of this section, and relevant requirements of paragraphs (c)(2) through (c)(4) of this section.

(3) Field disturbance sensors/radar devices deployed on unmanned aircraft may operate within the frequency band 60–64 GHz, provided that the transmitter not exceed 20 dBm peak EIRP. The sum of continuous transmitter off-times of at least two milliseconds shall equal at least 16.5 milliseconds within any contiguous interval of 33 milliseconds. Operation shall be limited to a maximum of 121.92 meters (400 feet) above ground level.

§15.255 (h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

4.6.2 Result

15.255(a), the device is a unmanned aircraft. Not used on satellites.

15.255(b)(1), the Radar Operation on aircraft when the aircraft is on the ground.

15.255(b)(2), not applicable, the device is a unmanned aircraft.

15.255(b)(3), Operation be limited to a maximum of 121.92 meters (400 feet) above ground level. Please refer to the user manual.

§15.255 (h), No equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

4.7 Antenna Requirement

4.7.1 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 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.

4.7.2 Judgment

Please refer to the Antenna Information detail in Section 1.3.

EXHIBIT A - EUT PHOTOGRAPHS

Please refer to the attachment 2502P19097E-RF-EXP EUT external photographs.

EXHIBIT B - TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2502P19097E-RF-00FA1-TSP test setup photographs.

EXHIBIT C – RF EXPOSURE EVALUATION

Applicable Standard

According to 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/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

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

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

Calculation formula

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

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

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

Calculated Data:

Operation Modes	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)			
SRD 900MHz	904-926	2.38	1.73	28	630.96	20.00	0.2172	0.6
SRD 2.4G	2403.5-2475.5	4.01	2.52	29	794.33	20.00	0.3981	1.0
SRD 5.2G	5154-5246	3.31	2.14	18	63.10	20.00	0.0269	1.0
SRD 5.8G	5728-5847	3.35	2.16	29	794.33	20.00	0.3419	1.0
Radar 60G	60000-64000	10	10.00	10	10.00	20.00	0.0199	1.0

For Simultaneous transmission:

SRD and 6 Radars can transmit simultaneously:

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

$= S_{SRD} / S_{limit\text{-}SRD} + S_{Radar\ 60G} / S_{limit\text{-}Radar\ 60G} * 6$

$=0.3981/1.0+0.0199/1 * 6$

$=0.52$

Result: Compliant. The device compliant Simultaneous transmission at 20cm distances.

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