




RF Test Report

Test Report Number	SRF-23082361-LC-FCC-RF
FCC ID	CO6-A30C105
Applicant	SpotterRF, LLC
Applicant Address	720 Timpanogos Parkway, Orem, UT 84097, USA
Product Name	Ground Surveillance Radar
Model Name	A3000
Family Model (s)	GX1500, WX2000, C1200
Date of Receipt	09/20/23
Date of Test	10/26/2023 – 11/01/2023
Report Issue Date	12/04/2023
Test Standards	47 CFR Part 90
Test Result	PASS
	<p>Issued by:</p> <p>Vista Compliance Laboratories 1261 Puerta Del Sol, San Clemente, CA 92673 USA www.vista-compliance.com</p>
 <hr/> <p>Devin Tai (Test Engineer)</p>	 <hr/> <p>David Zhang (Technical Manager)</p>
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REVISION HISTORY

Report Number	Version	Description	Issued Date
SRF-23082361-LC-FCC-RF	01	Initial report	12/04/2023

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1 Test Summary

FCC Rules	Test Item	Test standard	Result
§2.1049	Occupied Bandwidth	47CFR Part 2, Part 90	Pass
§2.1046, §90.103 (c) §90.205 (s)	Maximum RF Power Output	47CFR Part 2, Part 90	Pass*
§15.247(e)	Unwanted Emissions Measurement at Antenna Port	47CFR Part 2, Part 90	Pass*
§2.1053, §90.210	Radiated Emissions & Unwanted Emissions	47CFR Part 2, Part 90	Pass
§2.1055, §90.213 (b)	Frequency Stability	47CFR Part 2, Part 90	Pass*
§1.1310, §2.1091	RF Exposure	47CFR Part 1, Part 2	Pass*

Note: The digital board design change, The RF board has not received any changes, but the overall bandwidth has been decreased by 10 MHz per channel. Only Occupied bandwidth and radiated spurious emission re-evaluated in this report, for other test result, please refer to original test report in the FCC filing (FCC ID: CO6-A30C105).

2 General Information

2.1 Applicant

Applicant	SpotterRF, LLC
Applicant address	720 Timpanogos Parkway, Orem, UT 84097, USA
Manufacturer	SpotterRF, LLC
Manufacturer Address	720 Timpanogos Parkway, Orem, UT 84097, USA

2.2 Product information

Product Name	Ground Surveillance Radar
Model Number	A3000
Family Models	GX1500, WX2000, C1200
Serial Number	SP35233
Frequency Band	10.00 GHz – 10.50 GHz
Type of modulation	Continuous Wave
Equipment Class	TNB - Licensed Non-Broadcast Station Transmitter
Antenna Information	Patch antenna / 13 dBi Gain
Clock Frequencies	N/A
Input Power	24VDC
Power Adapter Manufacturer/Model	Phoenix Contract: UNO-PS/1AC/24DC/30W PoE Injector: L-COM / BT-CAT5-P1
Power Adapter SN	2902991032113P0752
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	N/A
Additional Info	<p>A3000 is retested after product design change. The main changes are,</p> <ol style="list-style-type: none"> 1. Digital board changes <ol style="list-style-type: none"> a. Added alternate 13V switching regulator. b. Added alternate -5V switching regulator. c. Removed unused serial chip. d. Added ESD protection component. e. Added 3.3V switching regulator to replace obsolete ones. f. Added 1.8V linear regulator to replace obsolete ones. g. Removed unused voltage monitoring chip. 2. RF board changes <ol style="list-style-type: none"> a. The RF board has not received any hardware changes, but the overall bandwidth has been decreased by 10 MHz per channel. <p>Family models: GX1500, WX2000, C1200, physically same as A3000. Bandwidth is 30MHz. Radio is the same as A3000. Different model number is to reflect different application of the unit.</p>

2.3 Test standard and method

Test standard	47 CFR Part 15.249
Test method	KDB 971168 D01 Power Meas License Digital Systems v03r01 ANSI C63.26-2015 TIA-603-E

Lab performing tests	Vista Laboratories, Inc.
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.vista-compliance.com

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.5°C	58.2%	996 mbar

3 Modification of EUT / Deviations from Standards

N/A

4 Test Configuration and Operation

4.1 EUT Test Configuration

The EUT is powered by an external PoE injector. It is connected to a test laptop through an RJ45 cable and controlled through web portal for RF configuration and measurement.

The following software was used for testing and to monitor EUT performance.

Software	Description
EMISoft Vasona	EMC/RF Spurious emission test software used during testing
Firefox	Use webpage to access EUT UI page to send command

4.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
Laptop	Dell	LATITUDE E6440	FFF4JC2
PoE Injector	L-COM	BT-CAT5-P1	N/A
AC/DC Power supply	Phoenix Contract	UNO- PS/1AC/24DC/30W	2902991032113P0752

5 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
AC Conducted Emissions (150K-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB
Radiated Emission (above 40GHz)	±3.5 dB

6 Test Results

6.1 Occupied Bandwidth

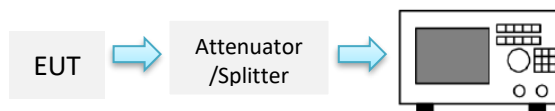
6.1.1 Requirement

Per § 2.1049, the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

Per § 90.209 (a), each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant.

In those cases, where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

6.1.2 Test setup



6.1.3 Test Procedure

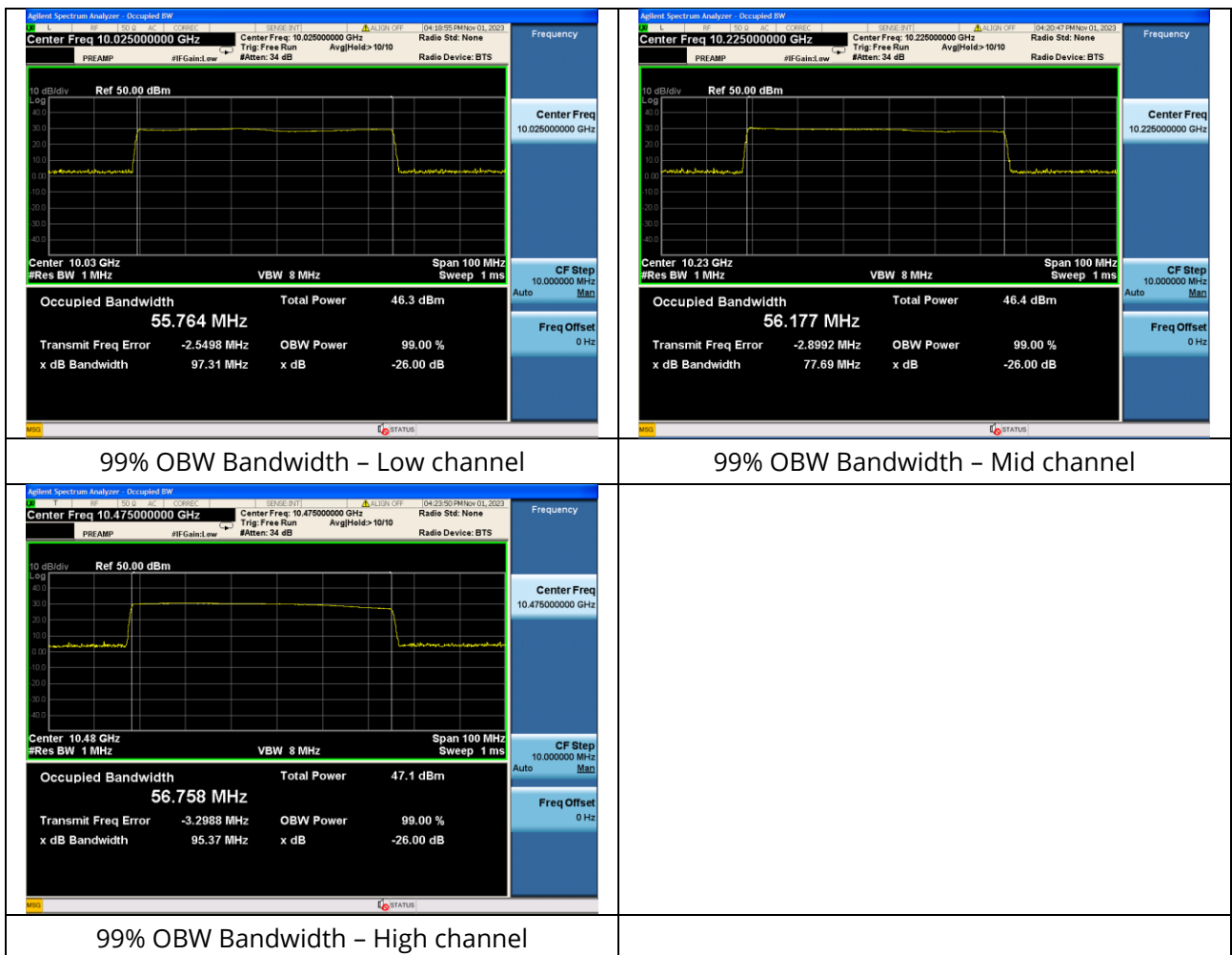
According to 971168 D01 Power Meas License Digital Systems v03r01 clause 9, ANSI C63.26-2015 clause 5.4.

1. The spectrum analyser center frequency is set to the normal EUT channel center frequency. The frequency span for the spectrum analyser shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 x OBW is sufficient)
2. the normal If filter 3 dB bandwidth shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
3. Set the reference level of instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyser input mixer level for linear operation.
4. Set the detection mode to peak, and the trace to max-hold.
5. Use the spectrum analyser's measurement function to obtain 99% OBW result.

6.1.4 Test Result

Radio	Test Frequency (MHz)	Measured 99% Bandwidth (MHz)	Result
10 GHz Radar	10025	55.764	N/A
	10225	56.177	N/A
	10475	56.758	N/A

6.1.5 Test Plots



6.2 Radiated Spurious Emissions

6.2.1 Requirement

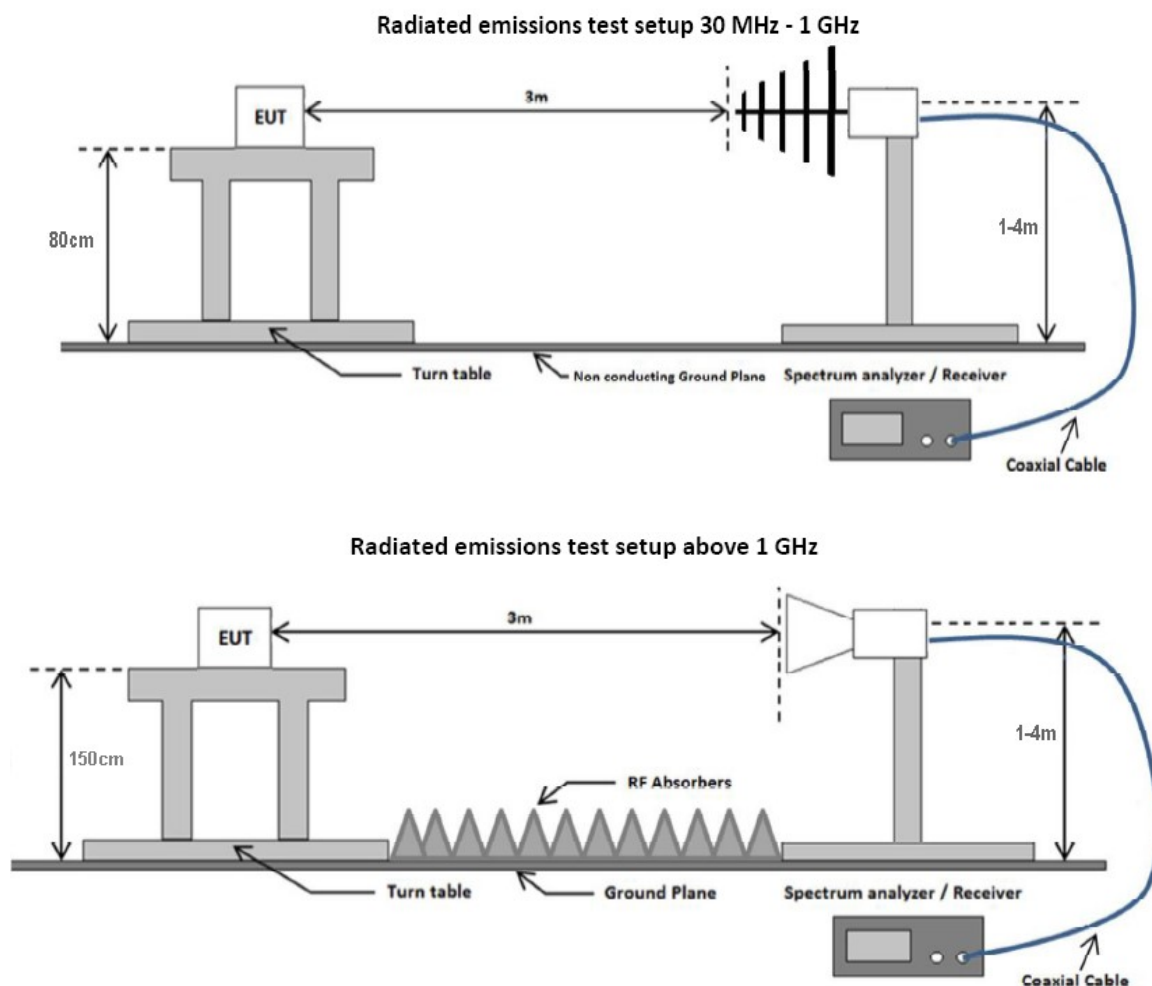
Per §2.1053 Field strength of spurious radiation is required.

Per §90.210 Equipment shall meet the emission mask requirement defined under (c)

(c) Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: At least $83 \log(f_d/5)$ dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least $29 \log(f_d^2/11)$ dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log(P)$ dB.

6.2.2 Test setup



6.2.3 Test Procedure

According to 971168 D01 Power Meas License Digital Systems v03r01 clause 7, ANSI C63.26-2015 clause 5.5.

Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

Prescan Measurement

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

Final Measurement

1. Substitution method is used for final measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
2. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value "of step a.

Record the power level of S.G
3. EIRP = Output power level of S.G - TX cable loss + Antenna gain of substitution horn.
4. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,
$$\text{E.R.P power} = \text{E.I.P.R power} - 2.15\text{dBi.}$$
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

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6.2.4 Test Result

Test Standard:	47CFR Part 90	Mode:	Low CH – 10025MHz
Frequency Range:	30-60000MHz	Test Date:	10/26/2023 ~ 10/28/2023
Polarity:	Hor & Ver	Test Personnel:	Devin Tai
Remark:	N/A	Test Result:	Pass

Freq. (MHz)	Raw (dBm)	Correction factor	Level (dBm)	Meas. Type	Pol	Hgt (cm)	Limit (dBm)	Margin (dB)	Result
800.199	-58.1	14.6	-43.5	Peak	H	150	-13	-30.5	Pass
368.342	-51.5	6.9	-44.6	Peak	V	150	-13	-31.6	Pass
62.986	-48.7	-6.7	-55.4	Peak	V	150	-13	-42.4	Pass
975.267	-64.2	16.7	-47.5	Peak	H	150	-13	-34.5	Pass
5138.221	-97.4	54.5	-42.9	Peak	H	150	-13	-29.9	Pass
9775.645	-84.6	63	-21.6	Peak	V	150	-13	-8.6	Pass
34107.02	-41.9	17.1	-24.8	Peak	H	150	-13	-11.8	Pass

Test Standard:	47CFR Part 90	Mode:	Mid CH – 10250MHz
Frequency Range:	30-60000MHz	Test Date:	10/26/2023 ~ 10/28/2023
Polarity:	Hor & Ver	Test Personnel:	Devin Tai
Remark:	N/A	Test Result:	Pass

Freq. (MHz)	Raw (dBm)	Correction factor	Level (dBm)	Meas. Type	Pol	Hgt (cm)	Limit (dBm)	Margin (dB)	Result
368.383	-52	6.9	-45.1	Peak	H	150	-13	-32.1	Pass
124.555	-55.1	-3.5	-58.6	Peak	H	150	-13	-45.6	Pass
206.117	-56.7	-0.8	-57.5	Peak	H	150	-13	-44.5	Pass
5239.273	-97.1	54.9	-42.2	Peak	V	150	-13	-29.2	Pass
5239.273	-97.3	54.9	-42.4	Peak	H	150	-13	-29.4	Pass
8702.864	-96.7	64.6	-32.1	Peak	V	150	-13	-19.1	Pass
32421.12	-34.43	14.7	-19.73	Peak	V	150	-13	-6.73	Pass

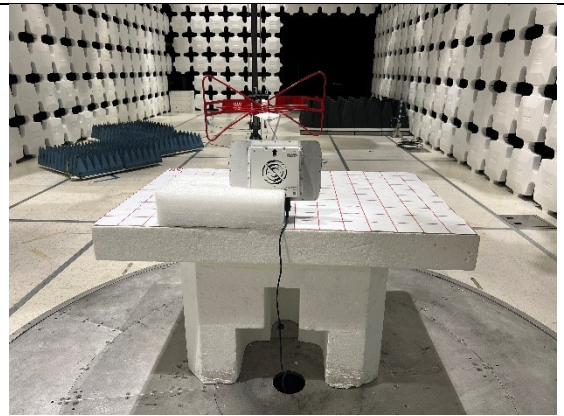
Test Standard:	47CFR Part 90	Mode:	High CH – 10475MHz
Frequency Range:	30-60000MHz	Test Date:	10/26/2023 ~ 10/28/2023
Polarity:	Hor & Ver	Test Personnel:	Devin Tai
Remark:	N/A	Test Result:	Pass

Freq. (MHz)	Raw (dBm)	Correction factor	Level (dBm)	Meas. Type	Pol	Hgt (cm)	Limit (dBm)	Margin (dB)	Result
450.087	-60.4	7.9	-52.5	Peak	V	150	-13	-39.5	Pass
800.169	-58.1	14.6	-43.5	Peak	H	150	-13	-30.5	Pass
374.363	-52.9	7.3	-45.6	Peak	V	150	-13	-32.6	Pass
5229.513	-86.4	54.8	-31.6	Peak	H	150	-13	-18.6	Pass
8738.852	-97.2	64.9	-32.3	Peak	H	150	-13	-19.3	Pass
23851.64	-38.55	13.2	-25.35	Peak	V	150	-13	-12.35	Pass
27724.8	-40.69	14.4	-26.29	Peak	V	150	-13	-13.29	Pass

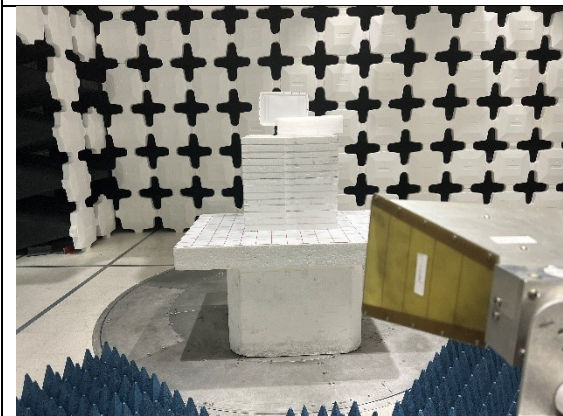
7 EUT and Test Setup Photos



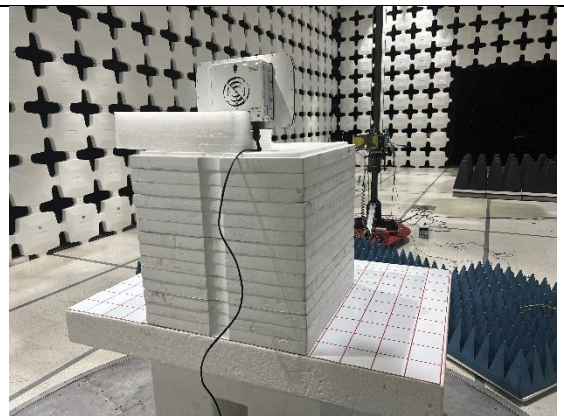
Radiated Emission-Below 1GHz-Front



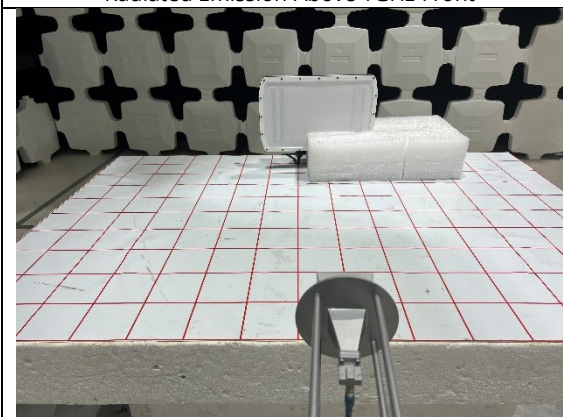
Radiated Emission-Below 1GHz-Back



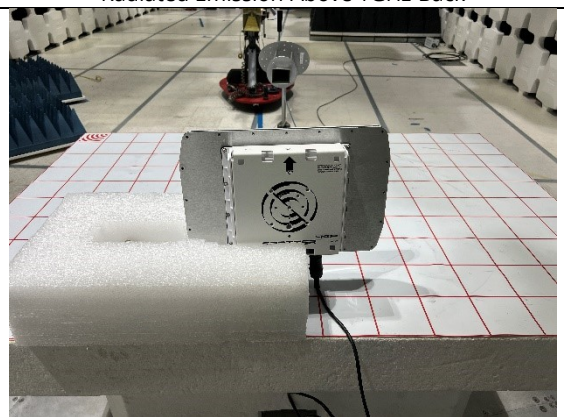
Radiated Emission-Above 1GHz-Front



Radiated Emission-Above 1GHz-Back



Radiated Emission-Above 18GHz-Front



Radiated Emission-Above 18GHz-Back

8 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/2022	10/18/2024
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A1)	N/A1)
Spectrum Analyzer	Keysight	N9020A	MY50110074	06/09/2023	06/09/2024
EMC Test Receiver	R&S	ESL6	100230	06/07/2023	06/07/2024
LISN (9KHz - 30MHz)	EMCO	3816/2	9705-1066	07/12/2023	07/12/2024
Bi-Log Antenna	ETS-Lindgren	3142E	217921	07/19/2023	07/19/2024
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	07/21/2023	07/21/2024
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	07/21/2023	07/21/2024
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	07/16/2023	07/16/2024
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	06/07/2023	06/07/2024
RF Attenuator	Pasternack	PE7005-3	VL061	07/16/2023	07/16/2024
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	07/16/2023	07/16/2024
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	06/09/2023	06/09/2024
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	07/16/2023	07/16/2024
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	07/16/2023	07/16/2024
RE test cable (>18GHz)	Sucoflex	104	344903/4	07/16/2023	07/16/2024
Pulse limiter	Com-Power	LIT-930A	531727	07/16/2023	07/16/2024
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	07/16/2023	07/16/2024
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	07/16/2023	07/16/2024
Vector Signal Generator	Keysight	N5182A	US47080548	06/07/2023	06/07/2024
RF Power Amplifier (80-1000MHz)	Ophir	5226FE	1013/1815	N/A	N/A
RF Power Amplifier (700-6000MHz)	Ophir	5293FE	1063/1815	N/A	N/A
Horn Antenna (1-18GHz)	FT-RF	HA-07M18G-NF	180010HA	N/A	N/A
Horn Antenna (40-60GHz)	OML.Inc	M19RH	19121801-19	07/16/2023	07/16/2024
Harmonic Mixer (40-60GHz)	OML.Inc	M19HWA	191213-1-19	07/16/2023	07/16/2024
Horn Antenna (60-90GHz)	OML.Inc	M12RH	19121801-12	07/16/2023	07/16/2024
Harmonic Mixer (60-90GHz)	OML.Inc	M12HWA	191213-1-12	07/16/2023	07/16/2024
Horn Antenna (90-140GHz)	OML.Inc	M08RH	19121801-08	07/16/2023	07/16/2024
Harmonic Mixer (90-140GHz)	OML.Inc	M08HWA	191213-1-08	07/16/2023	07/16/2024

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