F2 Labs
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CERTIFICATION TEST REPORT

Manufacturer:	**EcoTech, LLC** **2675 Commerce Center Boulevard, Suite 101** **Bethlehem, Pennsylvania 18015 USA**
Applicant:	**Same as Above**
Product Name:	**AI Nero 7**
Product Description:	Pump for aquariums
Operating Voltage/Frequency:	120V/60 Hz
Model:	**Nero 7**
FCC ID:	**VKB271832**
Testing Commenced:	2022-11-22
Testing Ended:	2022-11-22
Summary of Test Results:	**In Compliance**

Rules:
- **FCC Part 15 Subpart C, Section 15.247**
- **FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards**
- **ANSI C63.10:2020**

Note: Test report reflects limited testing for PCII to add model to product family.

Evaluation Conducted by:

Julius Chiller, Senior Wireless Project Engineer

Report Reviewed by:

Ken Littell, Vice President of Operations

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1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

1.2 Measurement Procedure:

All measurements were performed according to ANSI C63.10 and recommended FCC procedure of measurement under Section 15.247 and in KDB558074. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor using a coverage factor of k=2. The Uncertainty for a laboratory is referred to as *U*lab. For Radiated and Conducted Emissions, the Expanded Uncertainty is compared to the *U*cispr values to determine if a specific margin is required to deem compliance.

*U*lab

Measurement Range	Combined Uncertainty	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	2.54	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66	3.32dB

*U*cispr

Measurement Range	Expanded Uncertainty
Radiated Emissions <1 GHz @ 3m	5.2dB
Radiated Emissions <1 GHz @ 10m	5.2dB
Radiated Emissions 1 GHz to 2.7 GHz	Under Consideration
Radiated Emissions 2.7 GHz to 18 GHz	Under Consideration
AC Power Line Conducted Emissions, 150kHz to 30 MHz	3.6dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	4.0dB

If *U*lab is less than or equal to *U*cispr, then:
- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If *U*lab is greater than *U*cispr in table 1, then:
- compliance is deemed to occur if no measured disturbance, increased by (*U*lab – *U*cispr), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by (*U*lab – *U*cispr), exceeds the disturbance limit.

Note: Only measurements listed in the tables above that relate to tests included in this Test Report are applicable.

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P29090-01E	First Issue	2022-12-12	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Radiated Spurious Emissions	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies

Modifications Made to the Equipment
No modifications were made to the EUT.

3 ENGINEERING STATEMENT

This report has been prepared on behalf of EcoTech, LLC to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.247 of the FCC Rules using ANSI C63.10 and KDB558074 standards. The test results found in this test report relate only to the items tested.

4 EUT INFORMATION AND DATA

4.1 Equipment Under Test:

Product: AI Nero 7
Model: Nero 7
Part No.: NX7
Serial Number: 64760069BARDC1
Firmware Version: 1.1.14-FCC
Software Version: 2.9
FCC ID: VKB271832

4.2 Trade Name:

EcoTech, LLC

4.3 Power Supply:

EA10625DR-240

4.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

4.5 Equipment Category:

DTS

4.6 Antenna:

Internal

4.7 Accessories:

N/A

4.8 Test Item Condition:

The equipment to be tested was received in good condition.

4.9 Testing Algorithm:

EUT was set to transmit a modulated signal at low, mid and high channel in the 2.4 GHz BT band during spurious emissions testing.

5 LIST OF MEASUREMENT INSTRUMENTATION

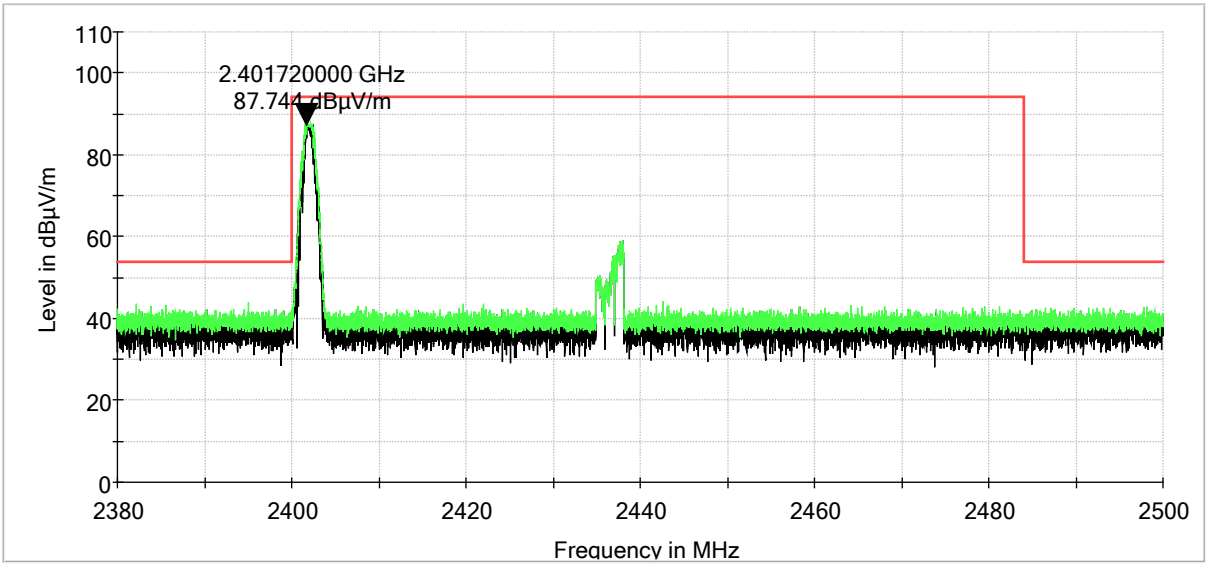
Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	Albatross Projects	B83117-DF435-T261	US140023	2022-12-31
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12
Pre-Amplifier	CL250	Com-Power	PAM-118A	18040011	2023-04-11
Pre-Amplifier	CL285	Com-Power	PAM-0207	322	2023-03-30
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2023-09-22
Horn Antenna	CL098	Emco	3115	9809-5580	2023-01-26
Amplifier w/Monopole & 18" Loop	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2023-10-20
Temp/Hum. Recorder	CL294	Thermpro	TP50	2	2023-04-15
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2023-07-30
Pre-Amplifier	CL189	Com-Power	PAM-840A	461303	2023-03-30
Software:	Tile Version 3.4.B.3			Software Verified: 2022-11-22	
Software:	EMC 32, Version 8.53.0			Software Verified: 2022-11-22	
Spectrum Analyzer	0204	Hewlett Packard	HP8591A	3149A02546	2023-03-29
Software:	EMC Analyzer 85712D Rev. A.00.01			Date Verified:	2022-11-22
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	2023-03-29
LISN	CL181	Com-Power	LI-125A	191226	2023-12-01
LISN	CL182	Com-Power	LI-125A	191225	2023-12-01
Temp/Hum. Recorder	CL232	Extech	445814	01	2023-05-19

7 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

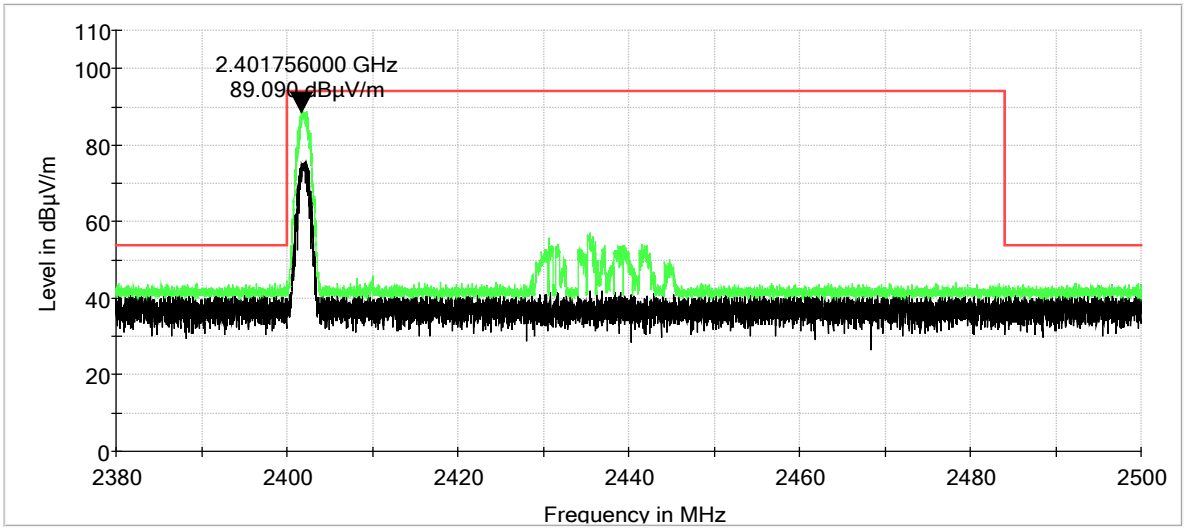
7.1 Test Data - Field Strength and Band Edge Measurements

Test Date(s):	2022-11-22	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	22.9ºC
Results:	Complies	**Relative Humidity:**	22%

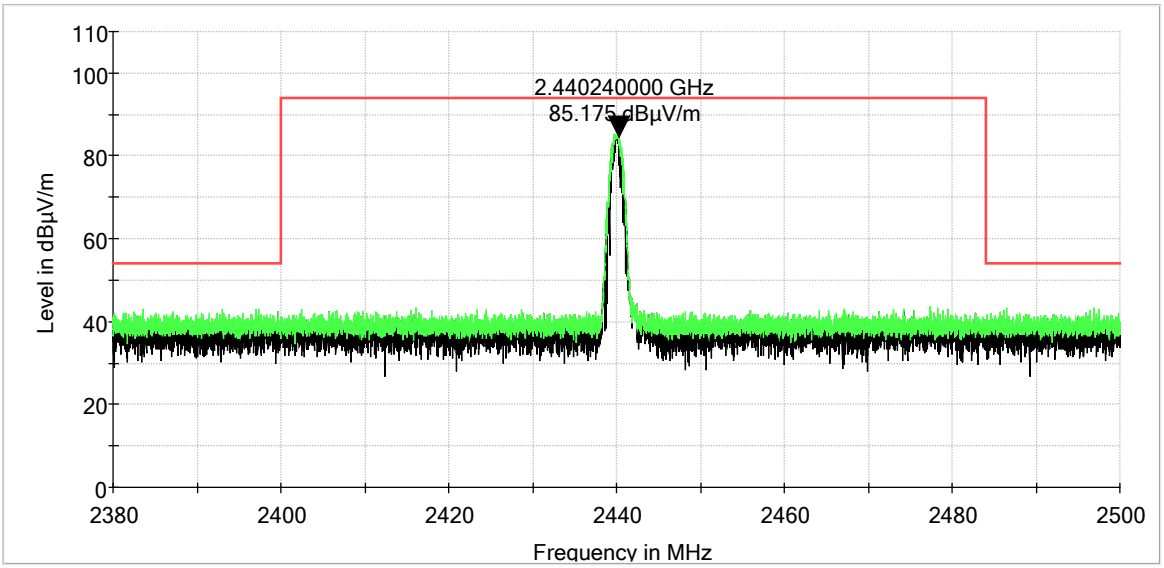
Band Edge, Low Channel, Vertical



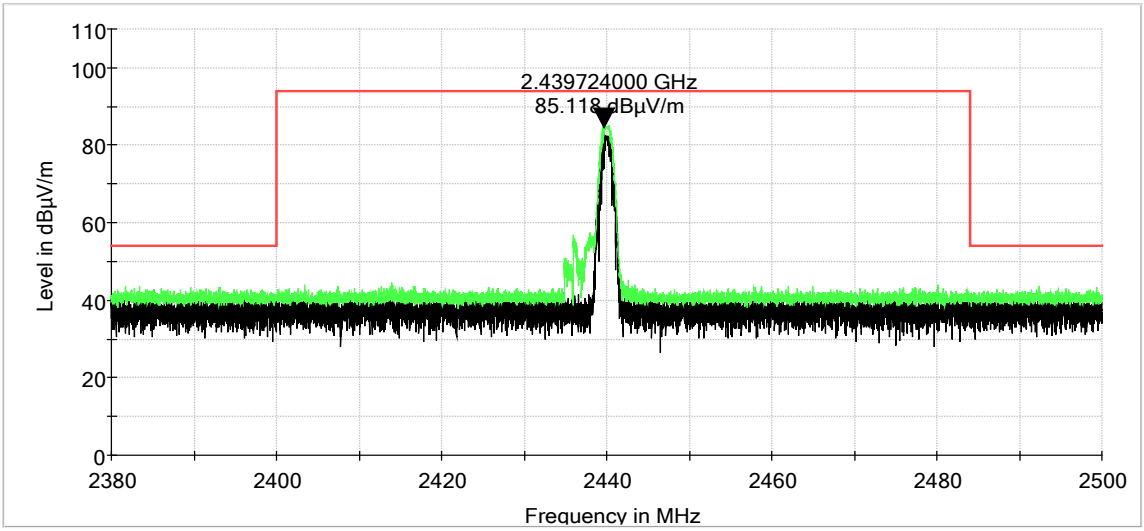
Band Edge, Low Channel, Horizontal



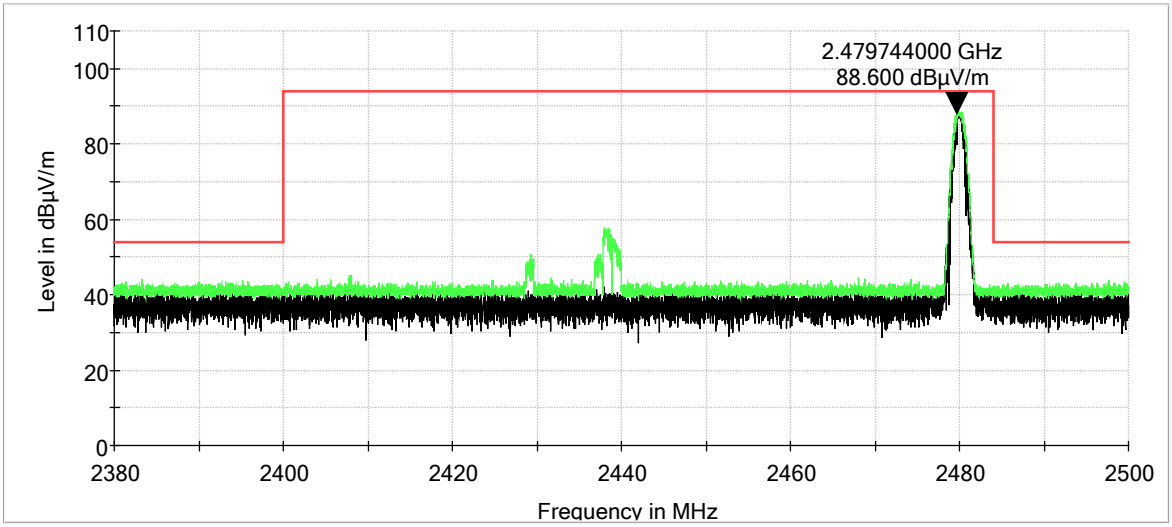
Band Edge, Mid Channel, Vertical



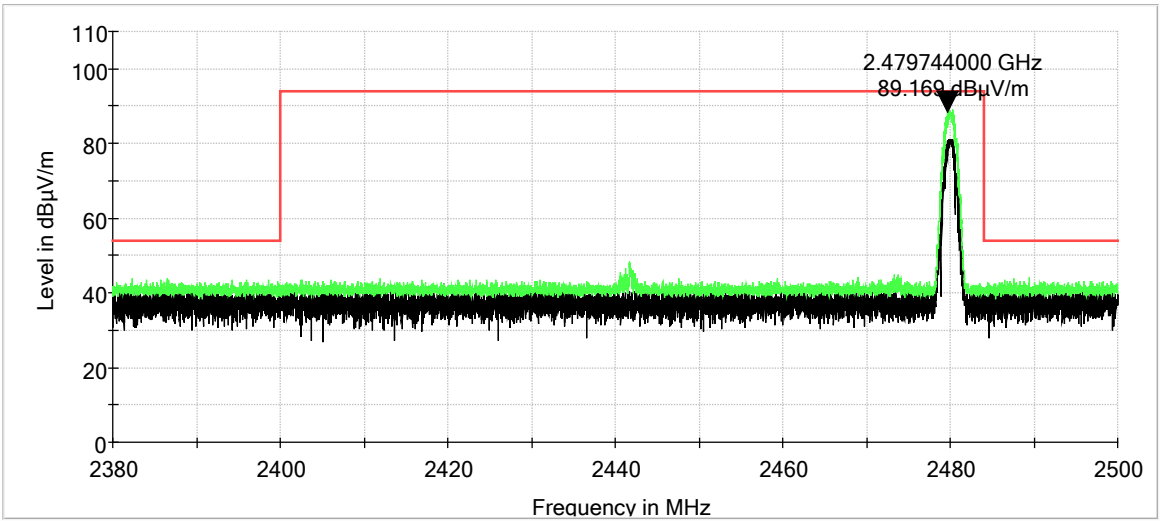
Band Edge, Mid Channel, Horizontal



Band Edge, High Channel, Vertical

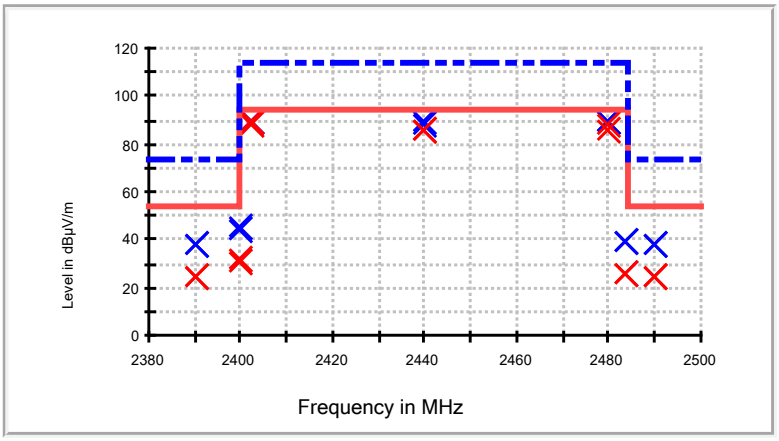


Band Edge, High Channel, Horizontal



Band Edge – Measurements

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/
2390.000000	37.6	24.7	1000.0	1000.000	150.0	H	49.0	-8.6	29.3	54.0
2390.000000	38.0	24.6	1000.0	1000.000	150.0	V	167.0	-8.6	29.4	54.0
2400.000000	44.8	31.7	1000.0	1000.000	150.0	V	167.0	-8.7	22.3	54.0
2400.000000	43.6	31.0	1000.0	1000.000	150.0	H	49.0	-8.7	23.0	54.0
2402.000000	89.3	87.8	1000.0	1000.000	150.0	H	49.0	-8.7	6.2	94.0
2402.000000	89.6	88.8	1000.0	1000.000	150.0	V	167.0	-8.7	5.2	94.0
2440.000000	88.3	86.1	1000.0	1000.000	150.0	V	197.0	-8.8	7.9	94.0
2440.000000	88.8	85.1	1000.0	1000.000	150.0	H	23.0	-8.8	8.9	94.0
2480.000000	89.4	88.1	1000.0	1000.000	150.0	V	190.0	-8.8	5.9	94.0
2480.000000	89.0	85.6	1000.0	1000.000	150.0	H	82.0	-8.8	8.4	94.0
2483.500000	38.7	25.3	1000.0	1000.000	150.0	H	82.0	-8.7	28.7	54.0
2483.500000	38.7	25.7	1000.0	1000.000	150.0	V	190.0	-8.7	28.4	54.0
2490.000000	37.9	24.9	1000.0	1000.000	150.0	H	82.0	-8.7	29.1	54.0
2490.000000	37.8	24.9	1000.0	1000.000	150.0	V	190.0	-8.7	29.1	54.0



7.2 Test Data – Spurious Emissions

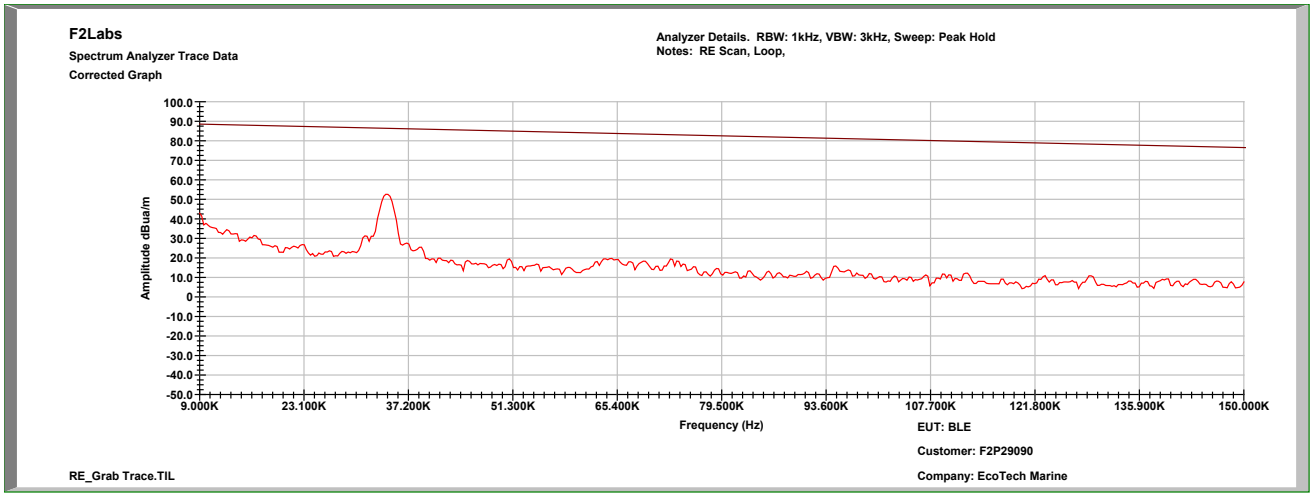
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions and three orthogonal positions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit. Frequencies were scanned from 9kHz to 1000 MHz and the highest emissions are presented.

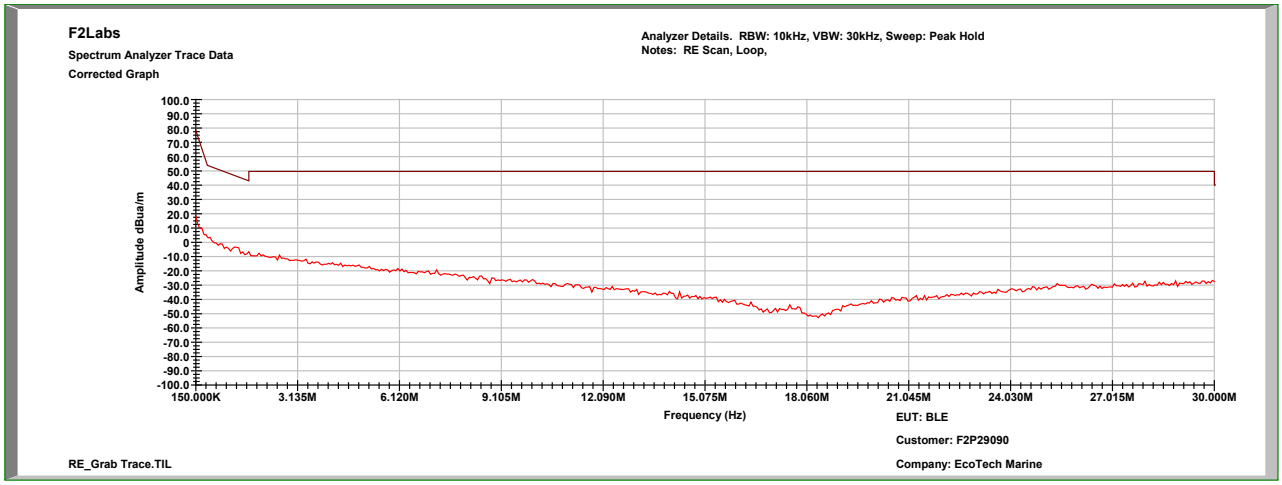
In the following plots, the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.

Test Date(s):	2022-11-22	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	22.9ºC
		Relative Humidity:	22%
Results:	Complies		

Characterization Scan, 0.009 MHz to 0.15 MHz (Loop Antenna)

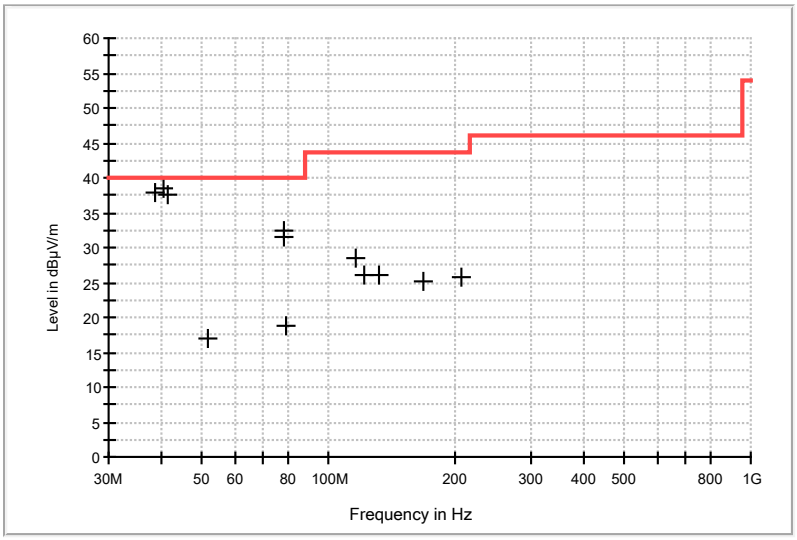


Characterization Scan, 0.15 MHz to 30 MHz (Loop Antenna)

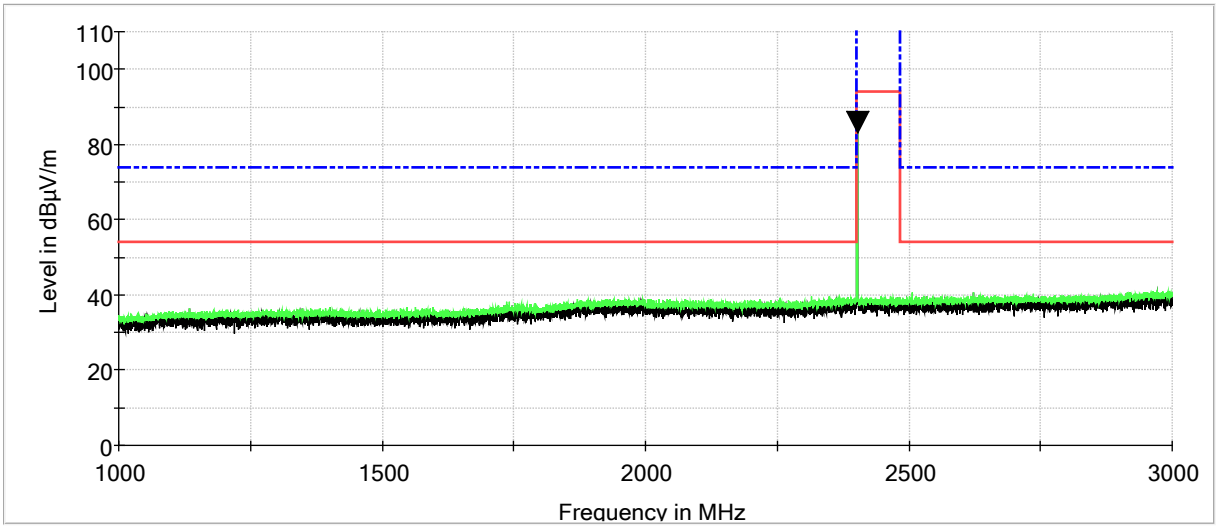


30 MHz to 1000 MHz

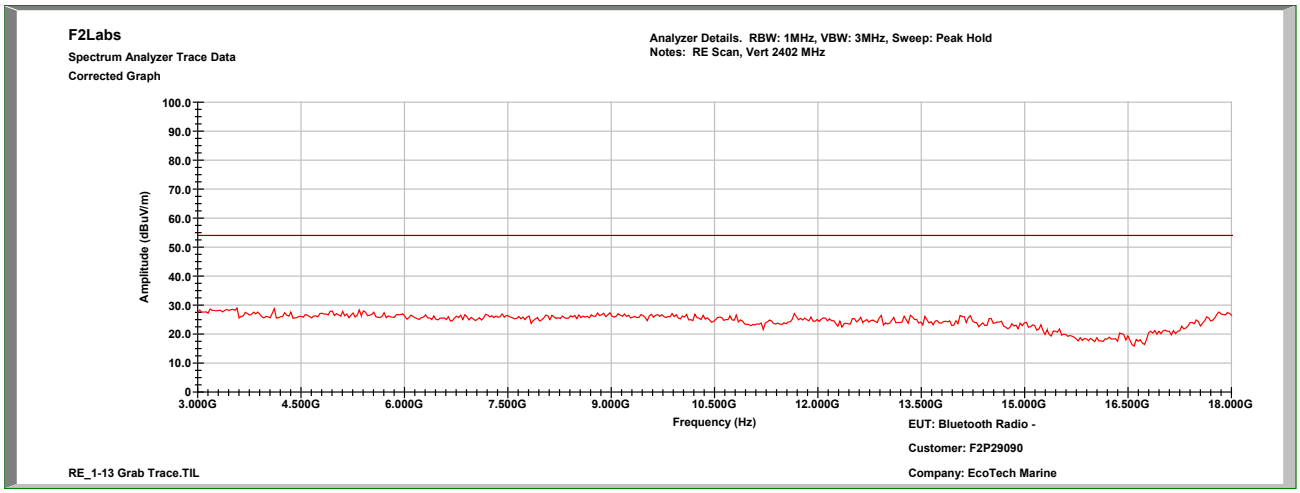
Frequency (MHz)	Antenna Polarization	Azimuth (degrees)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
38.720000	V	19.00	45.5	-7.8	37.70	40.0	-2.3
40.480000	V	50.00	47.7	-9.1	38.60	40.0	-1.4
41.440000	V	355.00	47.5	-9.8	37.70	40.0	-2.3
51.728000	V	28.00	31.6	-14.7	16.90	40.0	-23.1
77.724000	V	358.00	46.8	-14.4	32.40	40.0	-7.6
78.112000	V	332.00	46.1	-14.5	31.60	40.0	-8.4
79.276000	H	233.00	33.4	-14.6	18.80	40.0	-21.2
115.942000	V	36.00	37.2	-8.7	28.50	43.5	-15.0
121.180000	H	312.00	34.3	-8.2	26.10	43.5	-17.4
131.462000	H	251.00	34.2	-8.2	26.00	43.5	-17.5
167.934000	H	247.00	35.0	-9.7	25.30	43.5	-18.2
205.570000	H	340.00	36.3	-10.4	25.90	43.5	-17.6



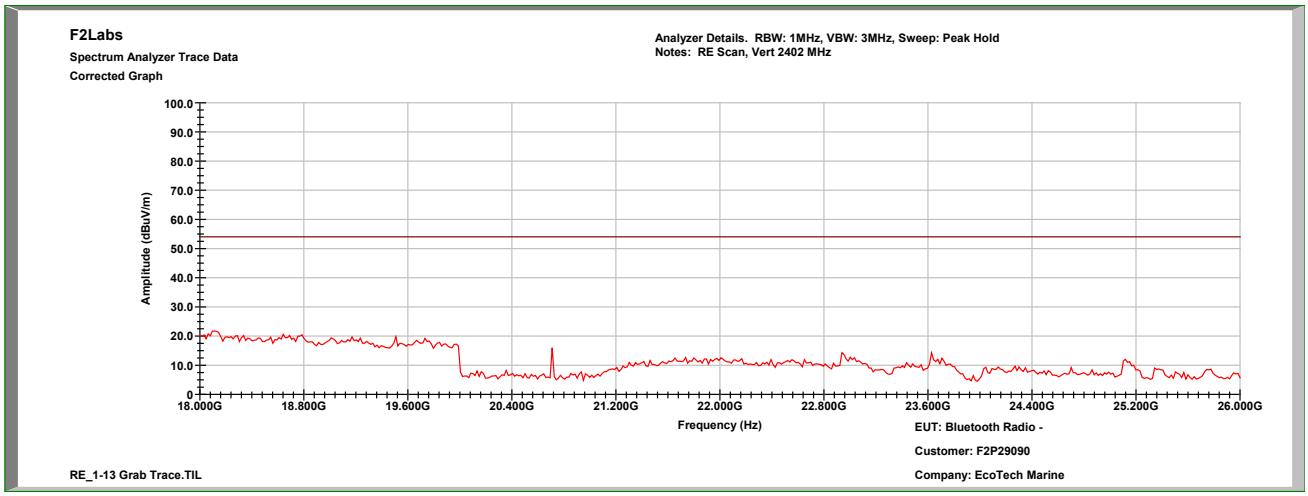
Characterization Scan, 1 GHz to 3 GHz, Vertical



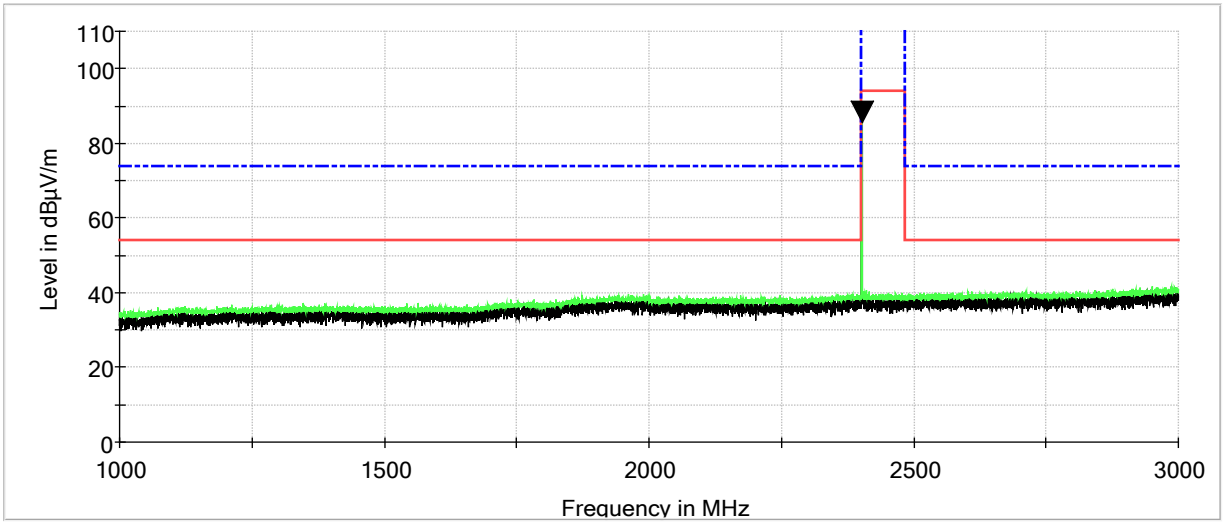
Characterization Scan, 3 GHz to 18 GHz, Vertical



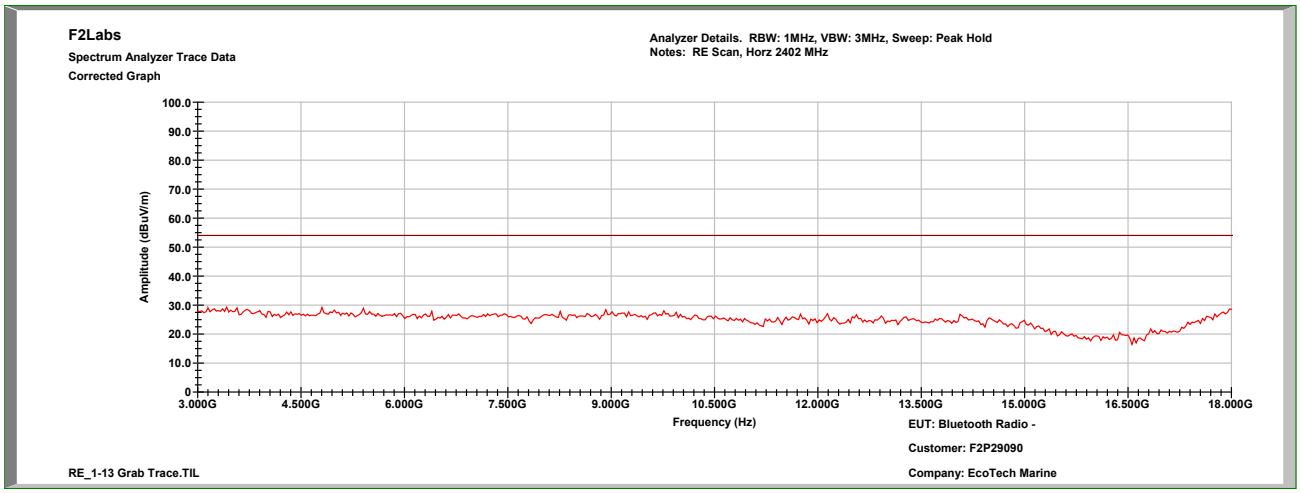
Characterization Scan, 18 GHz to 26 GHz, Vertical



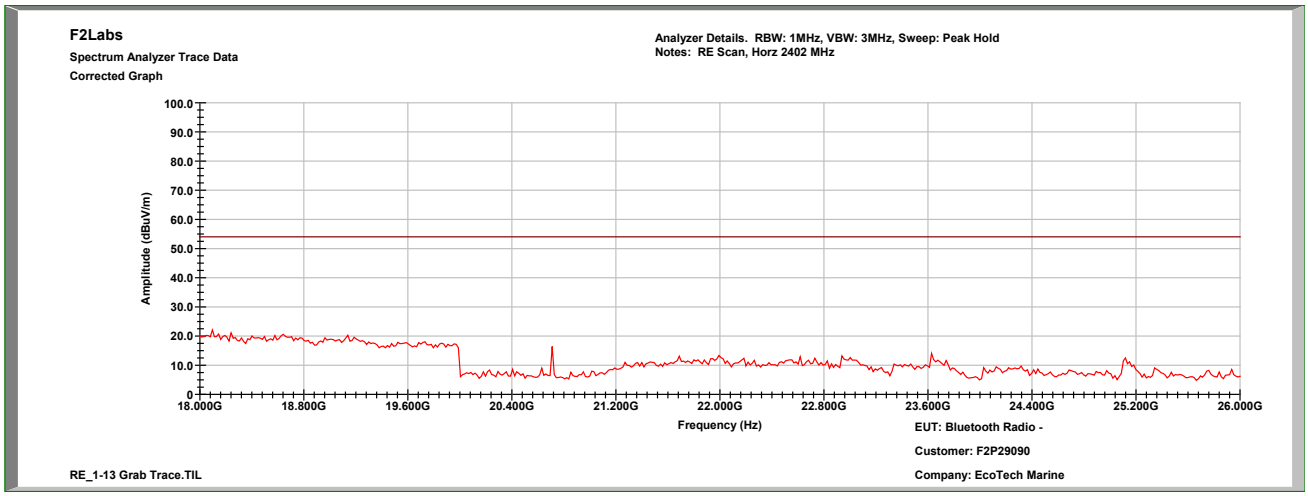
Characterization Scan, 1 GHz to 3 GHz, Horizontal



Characterization Scan, 3 GHz to 18 GHz, Horizontal

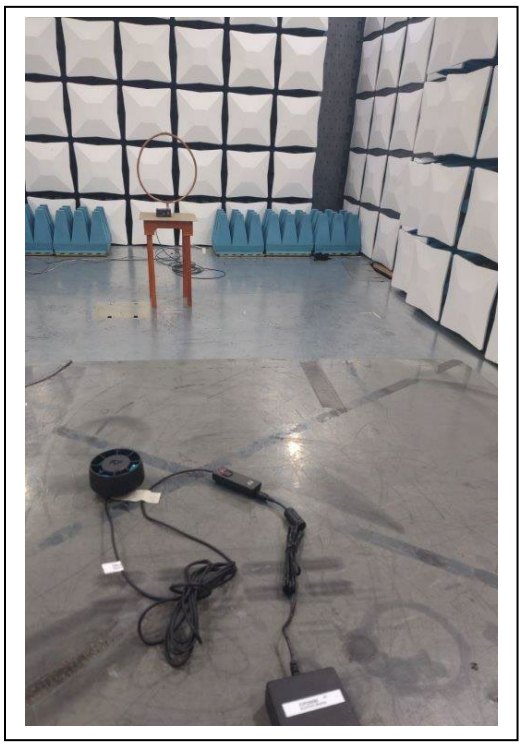


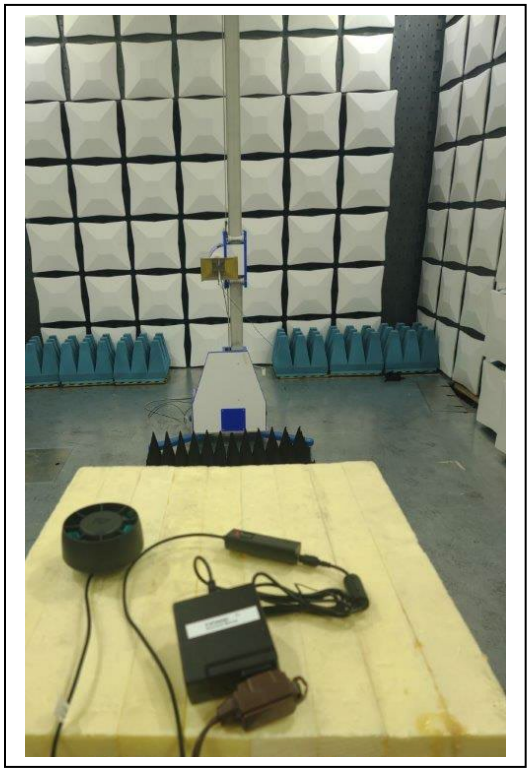
Characterization Scan, 18 GHz to 26 GHz, Horizontal



8 PHOTOGRAPHS

Radiated Spurious Emissions: 0.009 MHz to 30 MHz



Radiated Spurious Emissions: 30 MHz to 1000 MHz

Radiated Spurious Emissions: 1 GHz to 26 GHz