F2 Labs
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Middlefield, Ohio 44062
United States of America
www.f2labs.com

CERTIFICATION TEST REPORT

Manufacturer:	**Aventusoft, LLC.** **3651 FAU Boulevard, Suite 400** **Boca Raton, FL 33431 USA**
Applicant:	**Same as Above**
Product Description:	The HEMOTAG® Cardiac Monitoring System (CMS) acquires and reports single channel ECG data and vibrational waveforms produced by the heart contractions and transmitted to the chest wall.
Operating Voltage/Freq. of EUT During Testing:	Battery-Operated (Internal, Rechargeable)
Equipment Under Test:	**Hemotag™ System** Trade Name: Aventusoft, LLC. Model: **HT-101**
FCC ID:	**2AQS4-HT101**
Testing Commenced:	2023-02-08
Testing Ended:	2023-02-09
Summary of Test Results:	**In Compliance** The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Standards:

- **FCC Part 15 Subpart C, Section 15.249**
- **FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations**
- **FCC15.207 - Conducted Limits**
- **FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards**

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 15.249. 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	2.54dB	5.07dB
Radiated Emissions <1 GHz @ 10m	2.55 dB	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81 dB	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55 dB	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38 dB	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66 dB	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
F2P24564C-05E	First Issue	2023-02-09	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
99% Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
-20dB Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
Field Strength of Emissions	CFR 47 Part 15.249(a)(d)	Complies
Variation of the Input Power	CFR 47 Part 15.31(e)	Complies*
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

**Requirements of 15.31 were met by using fully charged batteries.*

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	Low Channel 2402 MHz	Mid Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength of Fundamental	90.3 dBµV/m, 32.7 mV/m	89.4 dBµV/m, 29.5 mV/m	88.4 dBµV/m, 26.3 mV/m
Average Limit for Fundamental	50 millivolts/meter (93.97 dBµV/m)	50 millivolts/meter (93.97 dBµV/m)	50 millivolts/meter (93.97 dBµV/m)
Peak Field Strength of Fundamental	91.3 dBµV/m 36.7 mV/m	90.4dBµV/m 33.1 mV/m	89.4dBµV/m 29.5 mV/m
Peak Limit for Fundamental	113.97 dBµV/m	113.97 dBµV/m	113.97 dBµV/m
-20dB Occupied Bandwidth	1.225 MHz	1.201 MHz	1.201 MHz
99% Occupied Bandwidth (MHz)	1.081 MHz	1.057 MHz	1.065 MHz

4 ENGINEERING STATEMENT

This report has been prepared on behalf of Aventusoft, LLC. to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.249 of the FCC Rules using ANSI C63.10:2013 standard. The test results found in this test report relate only to the items tested.

5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: Hemotag™ System
Model: HT-101
Serial No.: JEC8
Firmware: HT-FW-D03.00
Hardware: 2001-2003 Rev B
FCC ID: 2AQS4-HT101

5.2 Trade Name:

Aventusoft, LLC.

5.3 Power Supply:

Internal Rechargeable Battery

5.4 Applicable Rules:

CFR 47, Part 15.249, subpart C

5.5 Antenna:

Monopole

5.6 Accessories:

N/A

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was set up in a normal operating mode. Device was transmitting in low, mid and high channels (2402 MHz, 2440 MHz & 2480 MHz).

6 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	2023-08-22
Temp/Hum. Recorder	CL294	Thermpro	TP50	2	2023-04-15
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12
Horn Antenna	CL098	Emco	3115	9809-5580	2024-01-19
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2023-07-30
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2023-12-16
Preamplifier	CL285	A.H. Systems, Inc.	PAM-0207	322	2023-03-30
Active 18” Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2023-10-23
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2023-09-22
Software:	Tile Version 3.4.B.3			Software Verified: 2023-02-08	
Software:	EMC 32, Version 8.53.0			Software Verified: 2023-02-08	
Spectrum Analyzer	0204	Hewlett Packard	HP8591A	3149A02546	2023-03-29
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	2023-03-29
Software:	Tile Version 3.4.B.3.			Software Verified: 2023-02-08	
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	2023-04-18

7 FCC PART 15.215(e), OCCUPIED BANDWIDTH

7.1 Requirements:

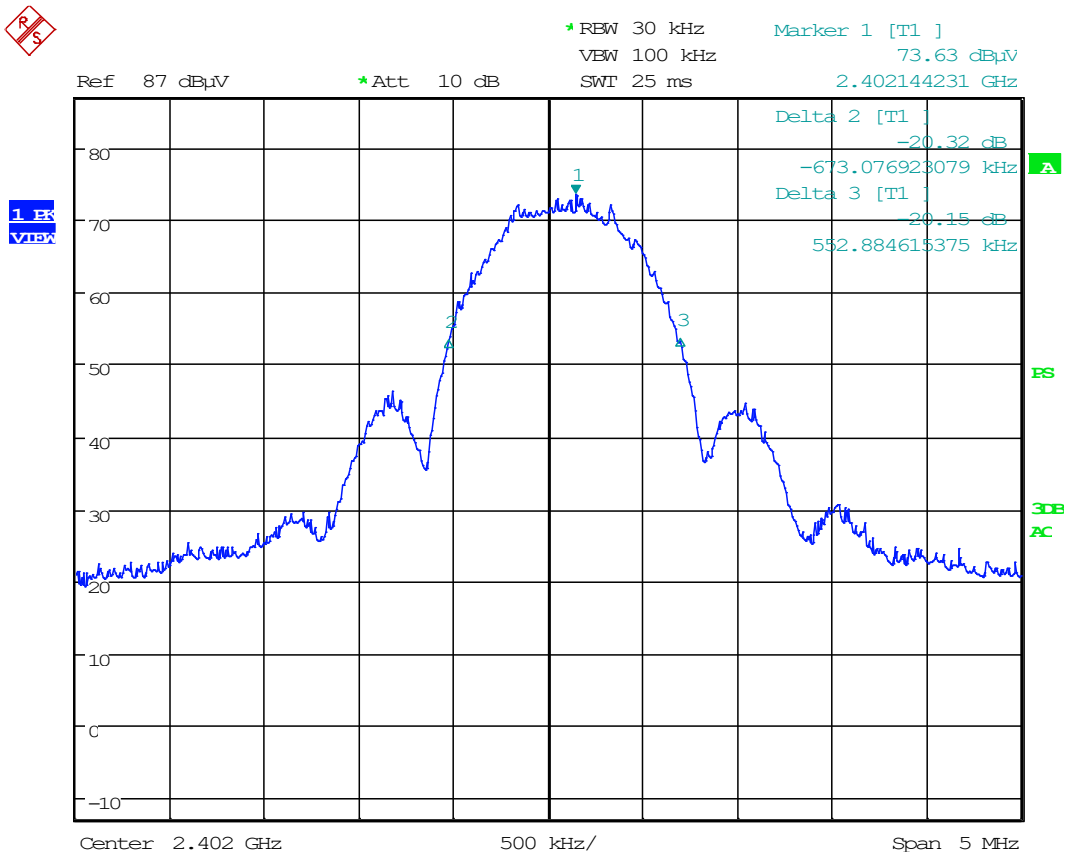
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Bandwidth measurements were made at the low (2.402 GHz), mid (2.440 GHz) and upper (2.480 GHz) frequencies. The bandwidth was measured using the analyzer's marker function.

7.2 Occupied Bandwidth Test Data

Test Date(s):	2023-02-08	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	21.9ºC
		Relative Humidity:	28%

-20dB, Low Channel



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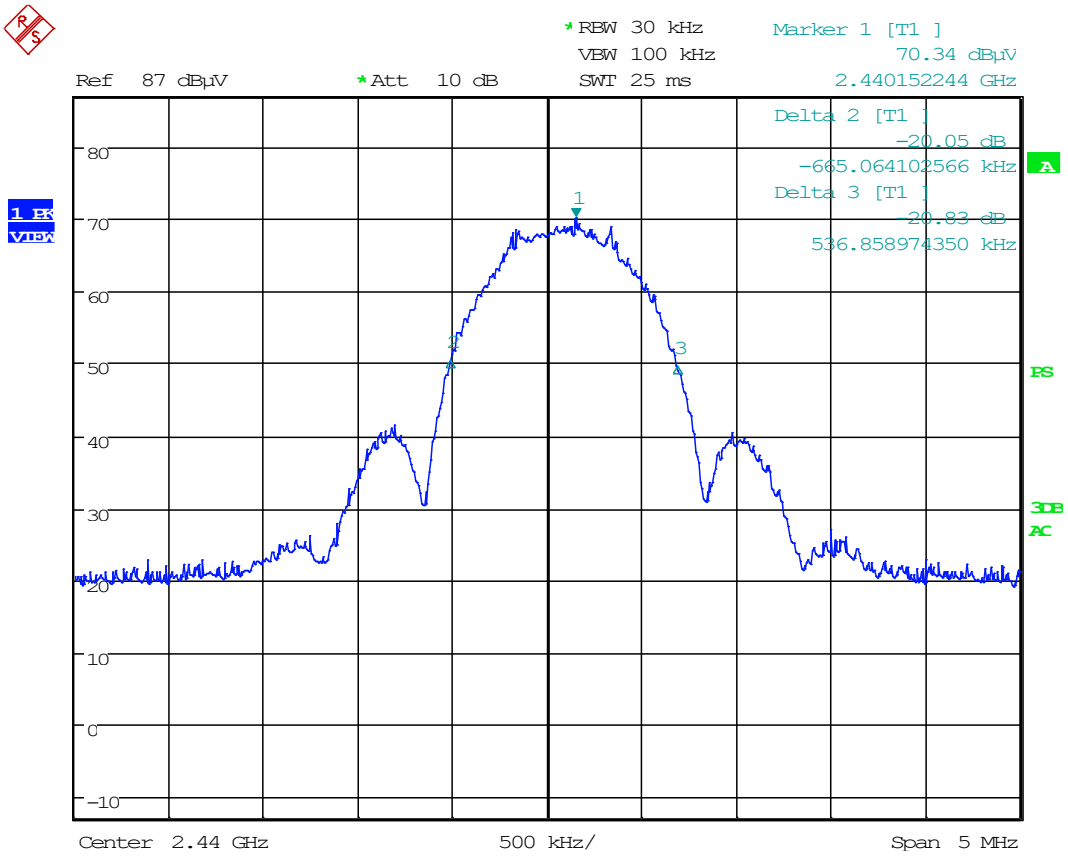
-20dB, Mid Channel



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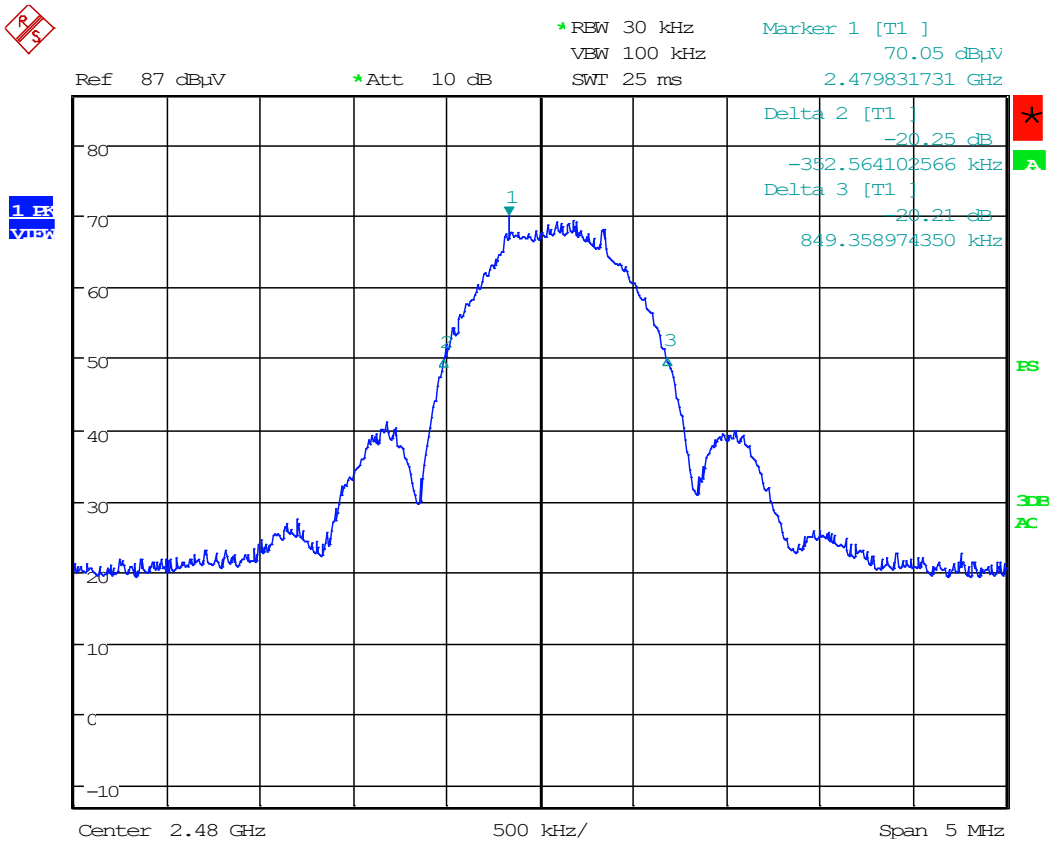
-20dB, High Channel



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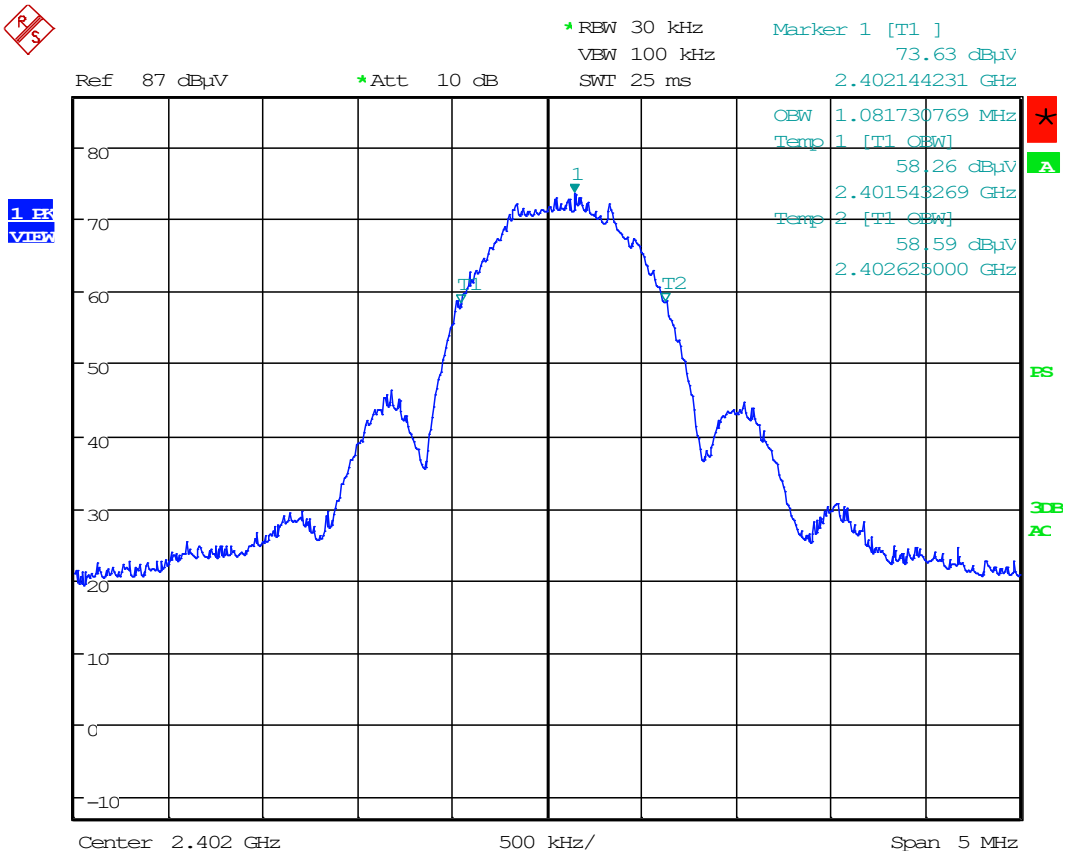
99%, Low Channel



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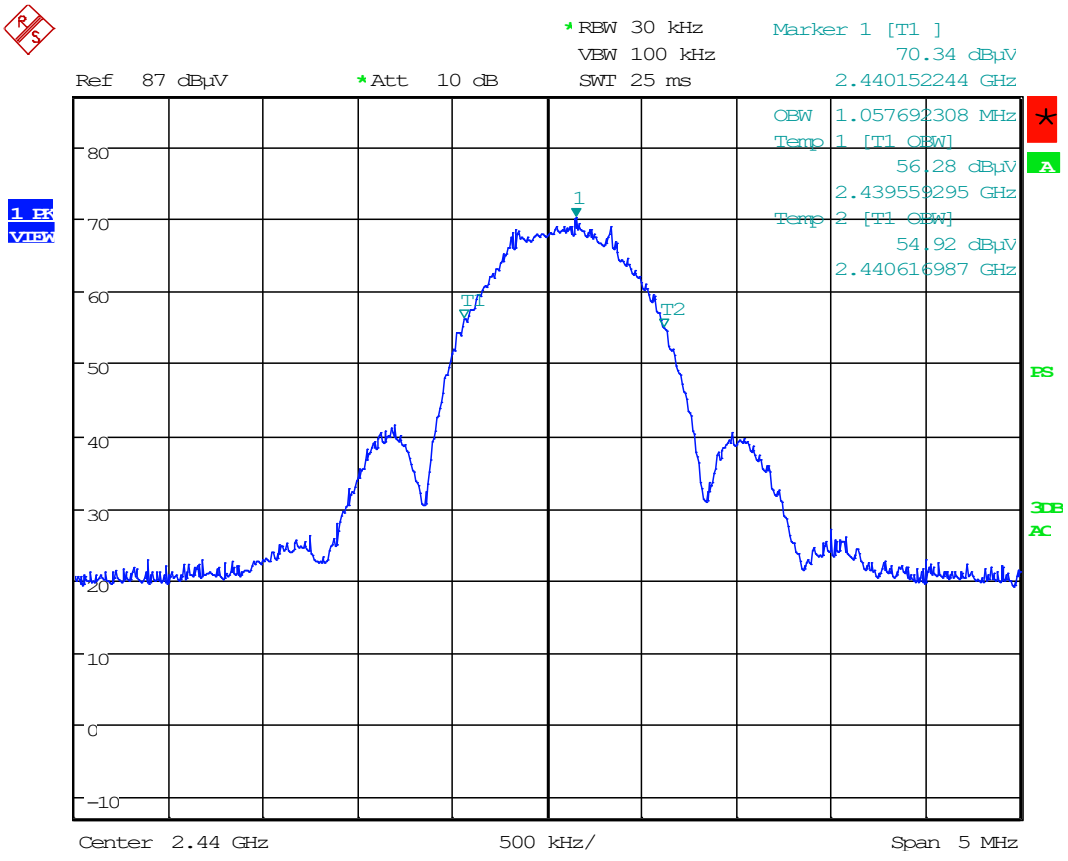
99%, Mid Channel



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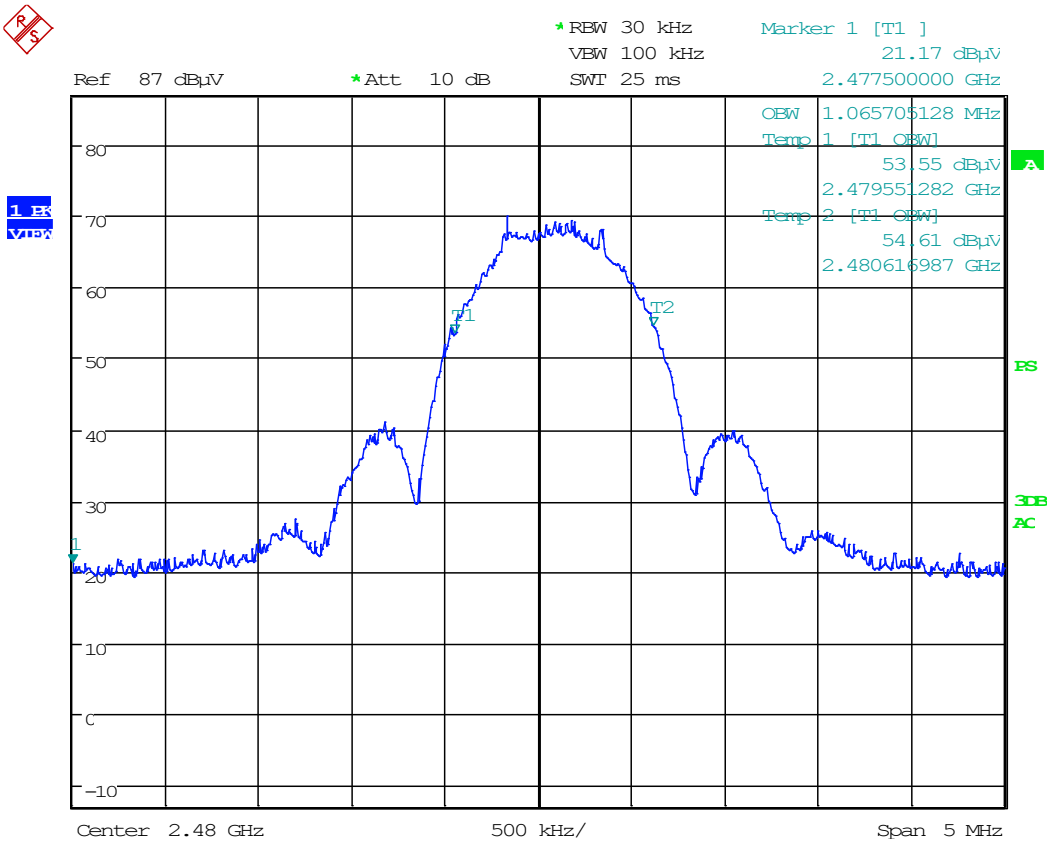
99%, High Channel



Date: 8.FEB.2023 11:01:33

8 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

(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

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

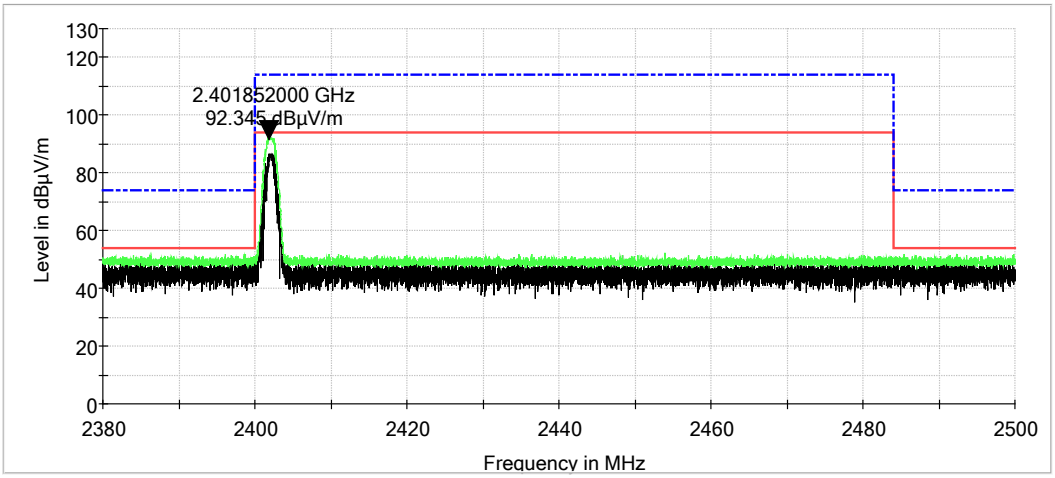
NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.

8.1 Test Data - Field Strength of Emissions from Intentional Radiators

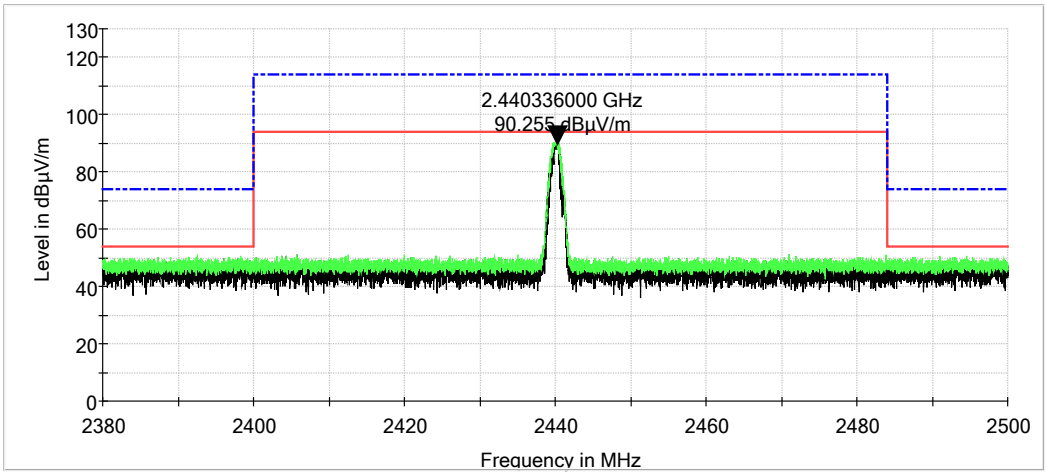
Test Date(s):	2023-02-08	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.249(a)	**Air Temperature:**	22.0ºC
		Relative Humidity:	28%

Modulation: 1M GFSK

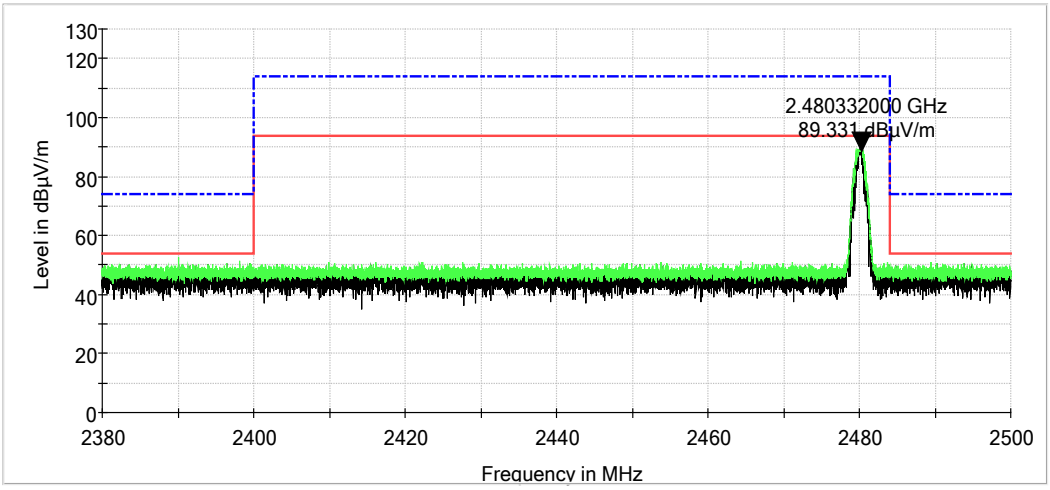
Low Band Edge: Vertical



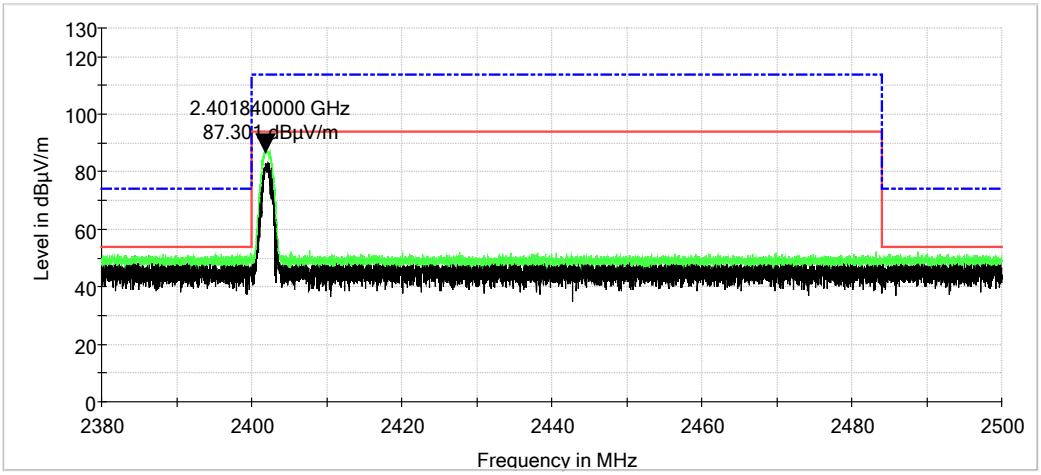
Mid Band Edge: Vertical



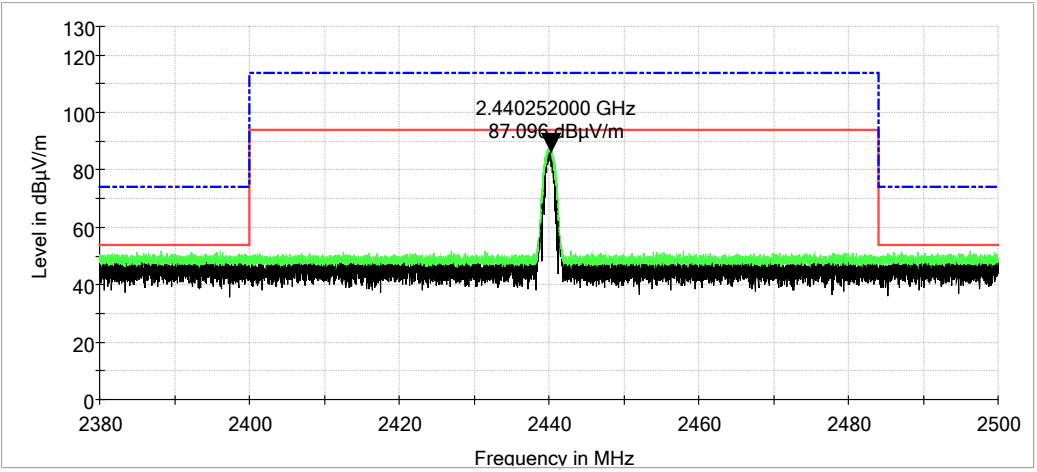
Upper Band Edge: Vertical



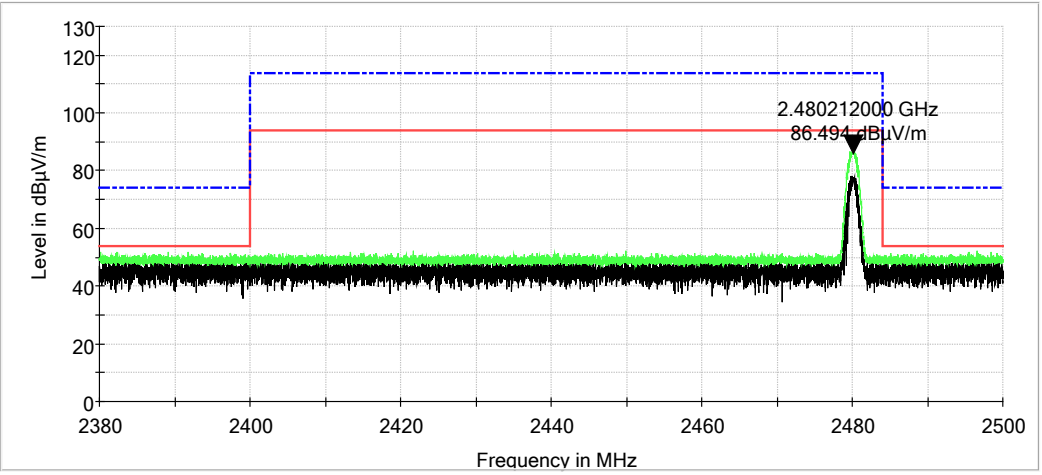
Low Band Edge: Horizontal



Mid Band Edge: Horizontal

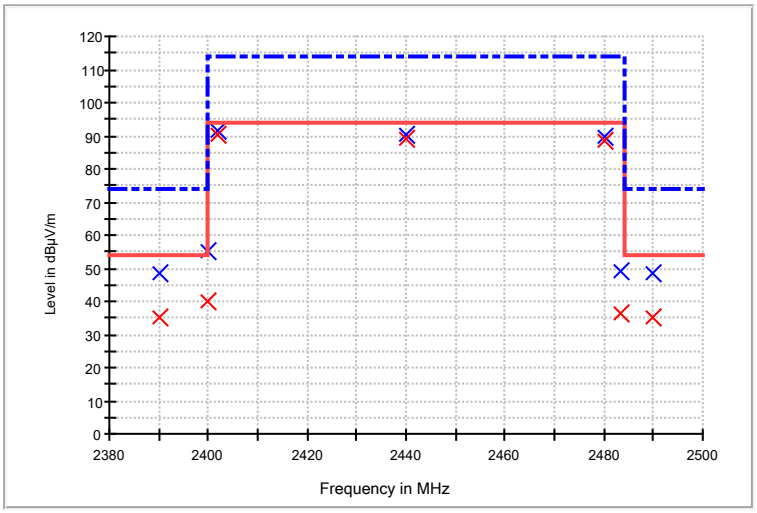


Upper Band Edge: Horizontal



Band Edge and Field Strength of the Fundamentals

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/	Limit - PK (dBµV/m)	Margin PK (dBµV/m)
2390.0000	48.2	35.2	1000.000	150.0	V	264.0	10.6	18.8	54.0	74.0	25.8
2400.0000	54.9	40.2	1000.000	150.0	V	264.0	10.5	13.8	54.0	74.0	19.1
2402.0000	91.3	90.3	1000.000	150.0	V	264.0	10.5	3.7	94.0	114.0	22.7
2440.0000	90.4	89.4	1000.000	150.0	V	261.0	10.5	4.6	94.0	114.0	23.6
2480.0000	89.4	88.4	1000.000	150.0	V	271.0	10.5	5.6	94.0	114.0	24.6
2483.5000	49.3	36.6	1000.000	150.0	V	271.0	10.5	17.4	54.0	74.0	24.7
2490.0000	48.3	35.3	1000.000	150.0	V	271.0	10.6	18.7	54.0	74.0	25.7



8.2 Test Data – Spurious Emissions

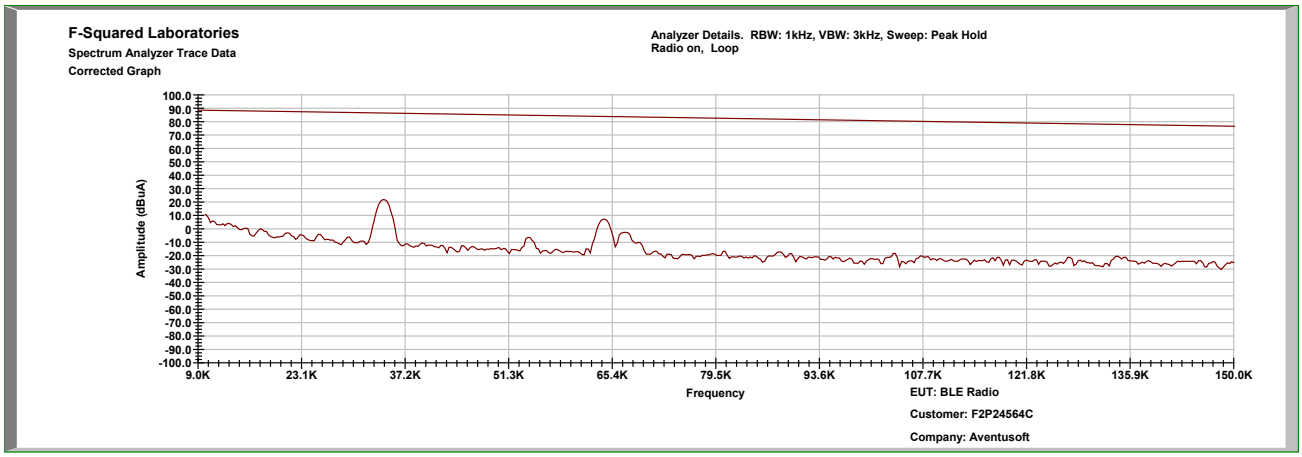
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some 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 1 GHz 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 26 GHz and the highest emissions are listed below.

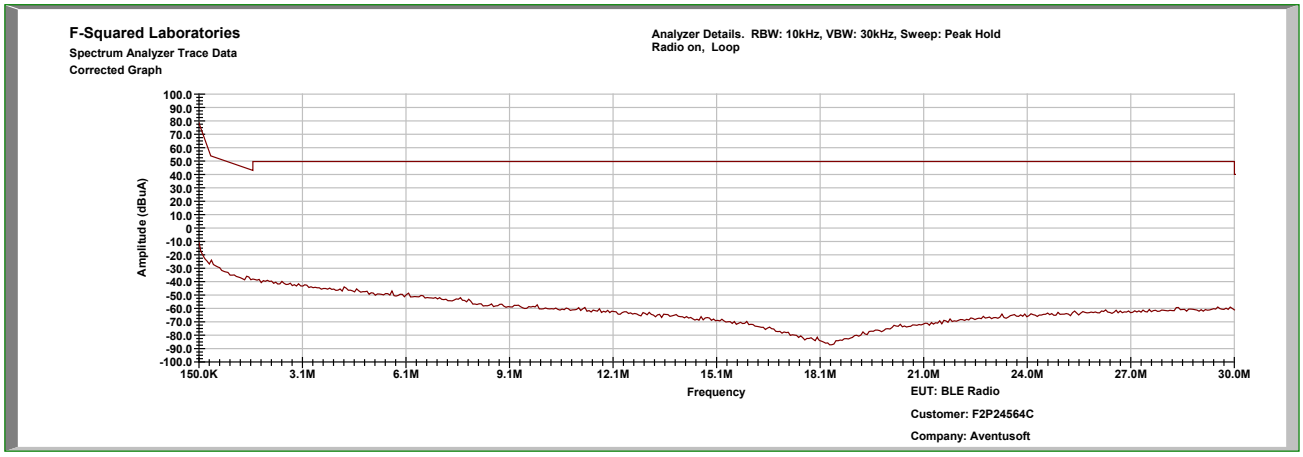
In the following plots, the black line indicates ambient noise and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.

Test Date(s):	2023-02-08	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	22.4ºC
		Relative Humidity:	27%

Characterization Scan, 9 kHz to 150 kHz



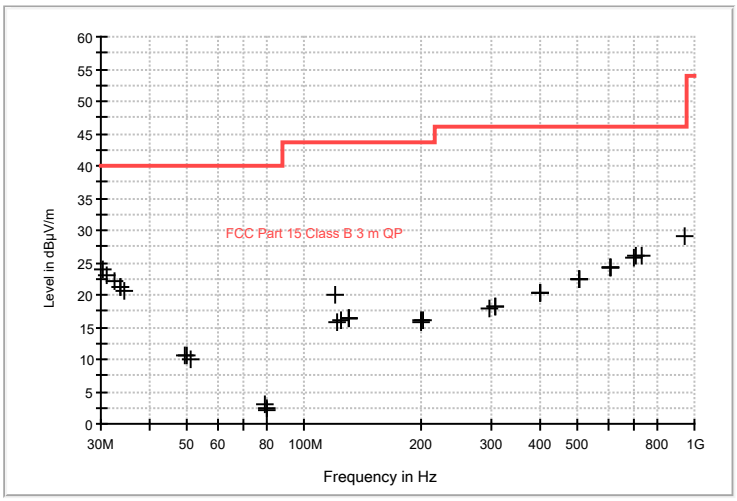
Characterization Scan, 150 kHz to 30 MHz



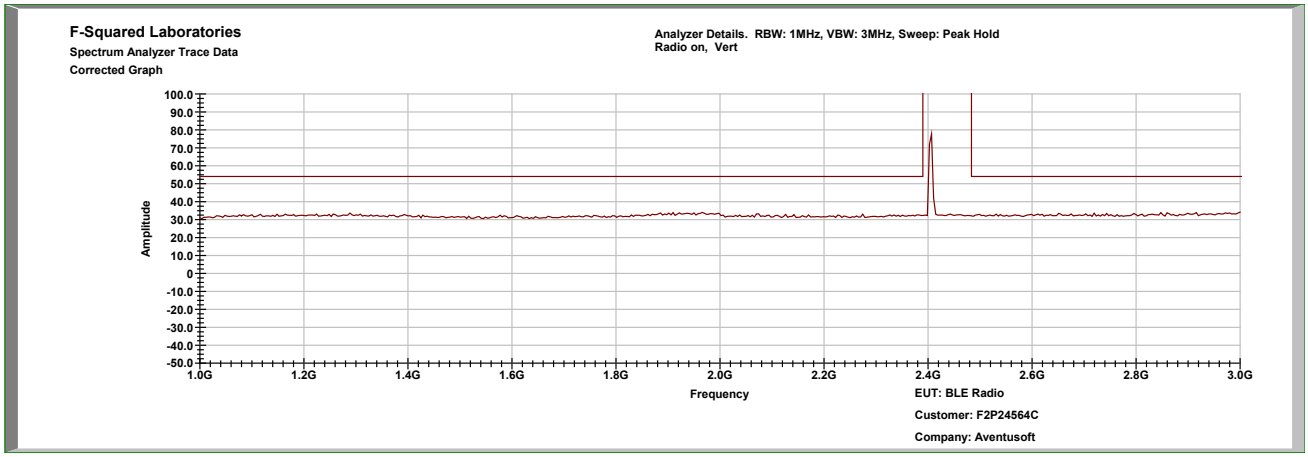
30 MHz to 1000 MHz

Note: Chart below includes data from all three channels.

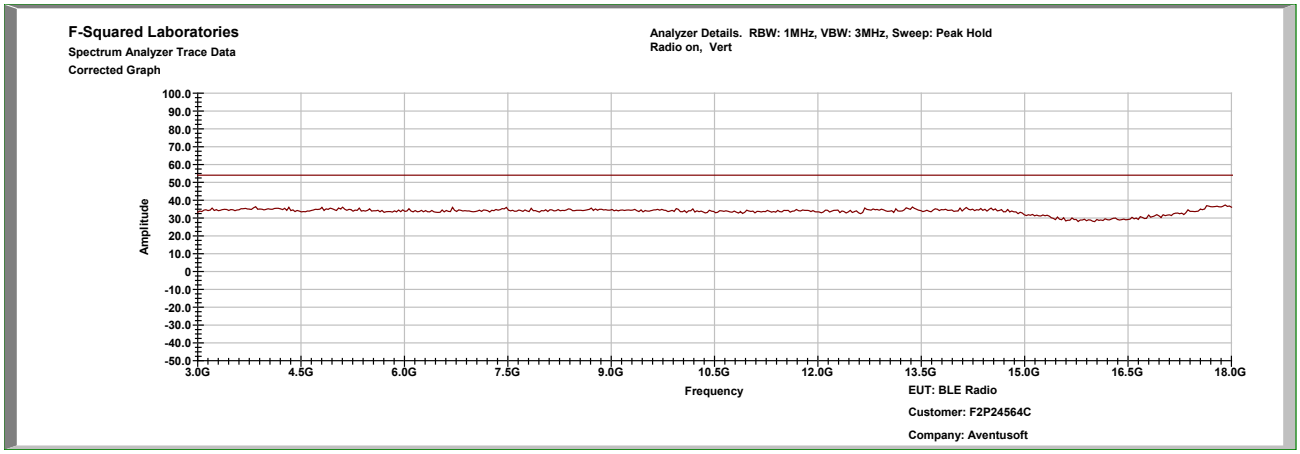
Frequency (MHz)	Ant. Pol.	Antenna Height (cm)	Azimuth (degrees)	Reading (dBµV)	Corr. Factors (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.200000	V	100.00	0.00	25.1	-1.3	23.80	40.0	-16.2
30.960000	V	100.00	0.00	25.1	-2.0	23.10	40.0	-16.9
32.520000	V	100.00	0.00	25.1	-3.1	22.00	40.0	-18.0
33.480000	H	100.00	0.00	25.1	-3.8	21.30	40.0	-18.7
33.480000	H	100.00	0.00	25.1	-3.8	21.30	40.0	-18.7
34.280000	H	100.00	0.00	25.0	-4.4	20.60	40.0	-19.4
49.000000	V	100.00	0.00	24.6	-13.9	10.70	40.0	-29.3
50.000000	V	100.00	0.00	24.7	-14.2	10.50	40.0	-29.5
50.960000	V	100.00	0.00	24.6	-14.5	10.10	40.0	-29.9
78.694000	H	100.00	0.00	17.6	-14.5	3.10	40.0	-36.9
79.840000	H	100.00	0.00	16.9	-14.6	2.30	40.0	-37.7
79.858000	H	100.00	0.00	16.9	-14.6	2.30	40.0	-37.7
120.000000	V	100.00	0.00	28.5	-8.4	20.10	43.5	-23.4
121.000000	V	100.00	0.00	24.0	-8.3	15.70	43.5	-27.8
124.280000	V	100.00	0.00	24.3	-8.1	16.20	43.5	-27.3
130.064000	H	100.00	0.00	24.7	-8.2	16.50	43.5	-27.0
130.104000	H	100.00	0.00	24.6	-8.2	16.40	43.5	-27.1
130.144000	H	100.00	0.00	24.7	-8.2	16.50	43.5	-27.0
198.000000	V	100.00	0.00	24.7	-8.7	16.00	43.5	-27.5
198.000000	V	100.00	0.00	24.6	-8.7	15.90	43.5	-27.6
201.120000	V	100.00	0.00	24.7	-8.7	16.00	43.5	-27.5
298.496000	H	100.00	0.00	25.1	-7.3	17.80	46.0	-28.2
309.708000	H	100.00	0.00	25.2	-6.9	18.30	46.0	-27.7
309.748000	H	100.00	0.00	25.2	-6.9	18.30	46.0	-27.7
400.920000	V	100.00	0.00	24.7	-4.5	20.20	46.0	-25.8
402.880000	V	100.00	0.00	24.7	-4.3	20.40	46.0	-25.6
402.880000	V	100.00	0.00	24.6	-4.3	20.30	46.0	-25.7
503.862000	H	100.00	0.00	24.4	-1.9	22.50	46.0	-23.5
503.942000	H	100.00	0.00	24.4	-1.9	22.50	46.0	-23.5
503.982000	H	100.00	0.00	24.4	-1.9	22.50	46.0	-23.5
610.602000	H	100.00	0.00	24.1	0.1	24.20	46.0	-21.8
610.642000	H	100.00	0.00	24.0	0.1	24.10	46.0	-21.9
610.682000	H	100.00	0.00	24.0	0.1	24.10	46.0	-21.9
700.640000	V	100.00	0.00	23.9	1.8	25.70	46.0	-20.3
706.480000	V	100.00	0.00	24.0	1.9	25.90	46.0	-20.1
731.880000	V	100.00	0.00	23.7	2.3	26.00	46.0	-20.0
948.202000	H	100.00	0.00	23.8	5.3	29.10	46.0	-16.9


60
55
50
45
40
35
30
25
20
15
10
5
0
Level in dBµV/m
FCC Part 15 Class B 3 m QP
30M
50
60
80
100M
200
300
400
500
800
1G
Frequency in Hz

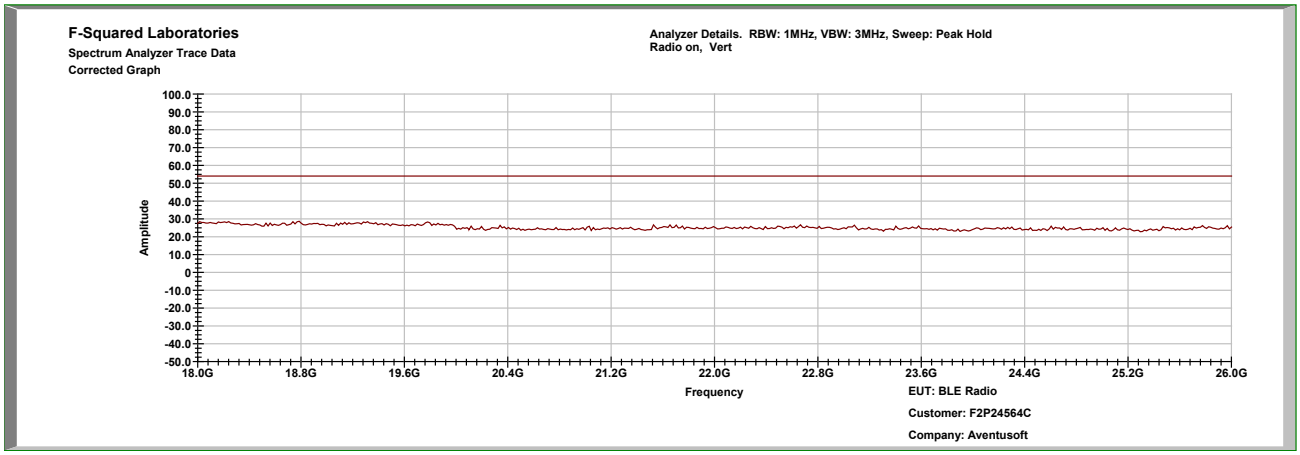
1 GHz to 3 GHz, Vertical



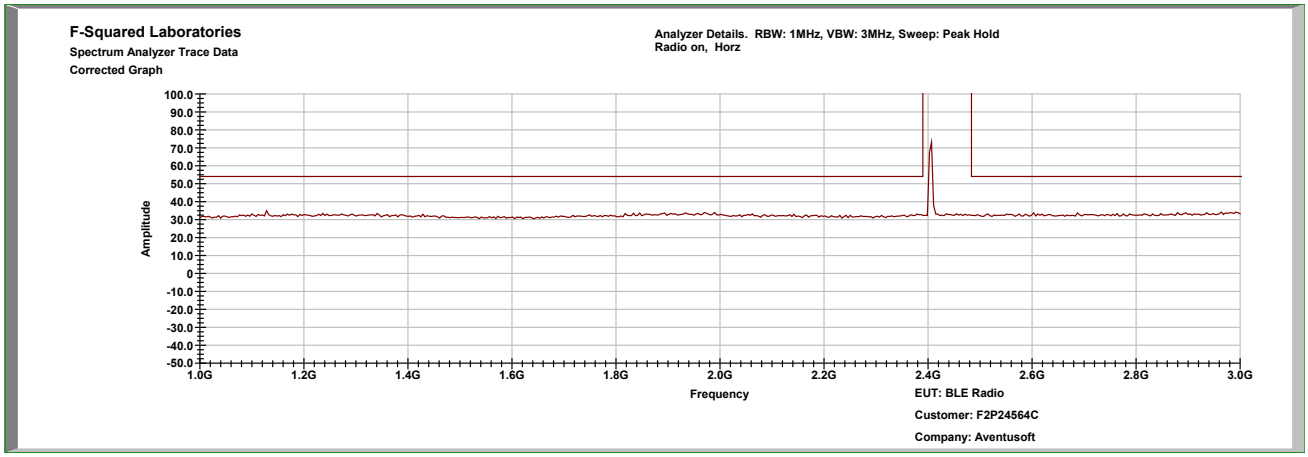
3 GHz to 18 GHz, Vertical



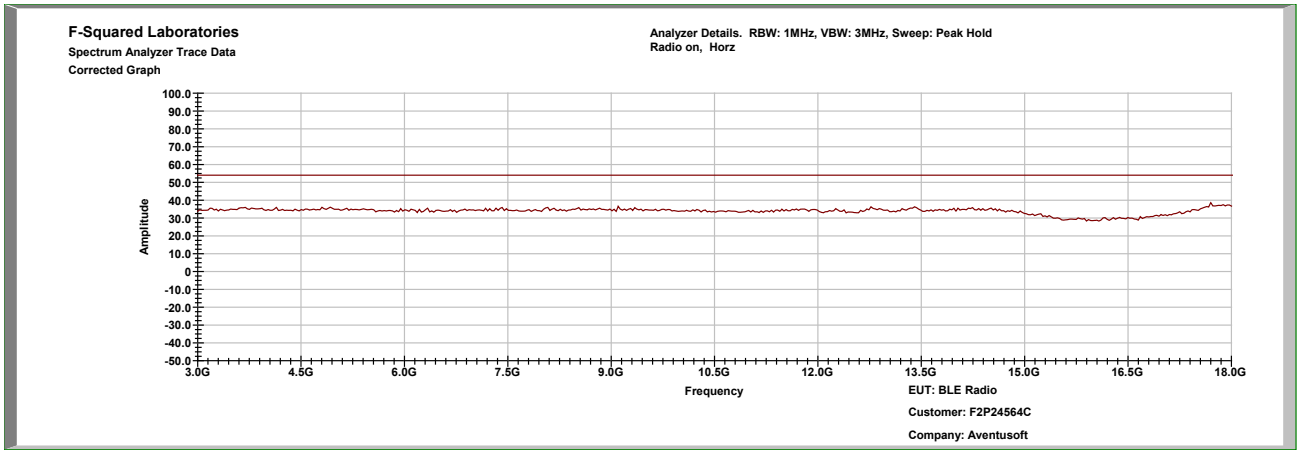
18 GHz to 26 GHz, Vertical



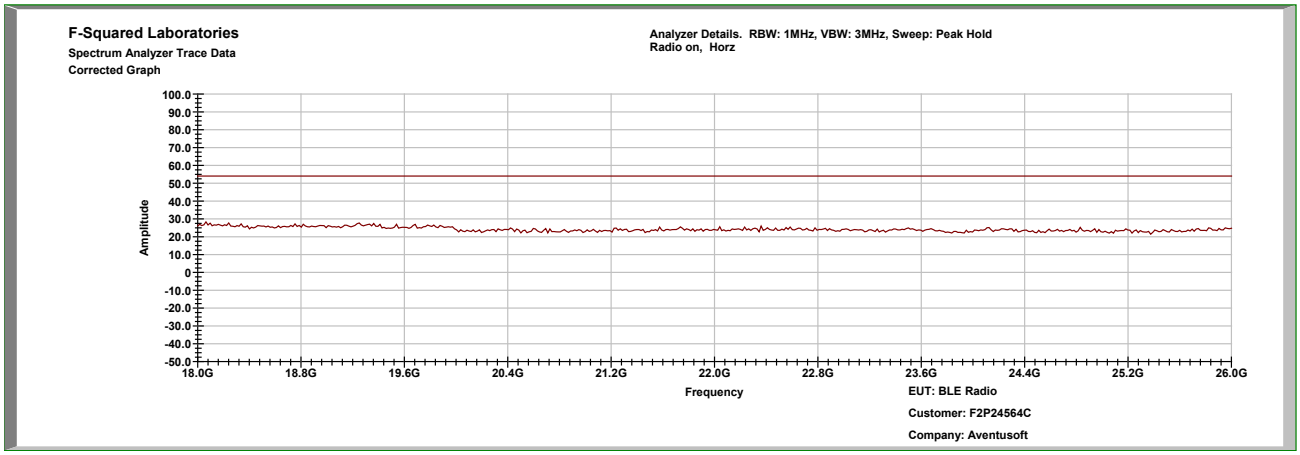
1 GHz to 3 GHz, Horizontal



3 GHz to 18 GHz, Horizontal



18 GHz to 26 GHz, Horizontal



9 CONDUCTED EMISSIONS

9.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), “Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

*Decreases with the logarithm of the frequency.

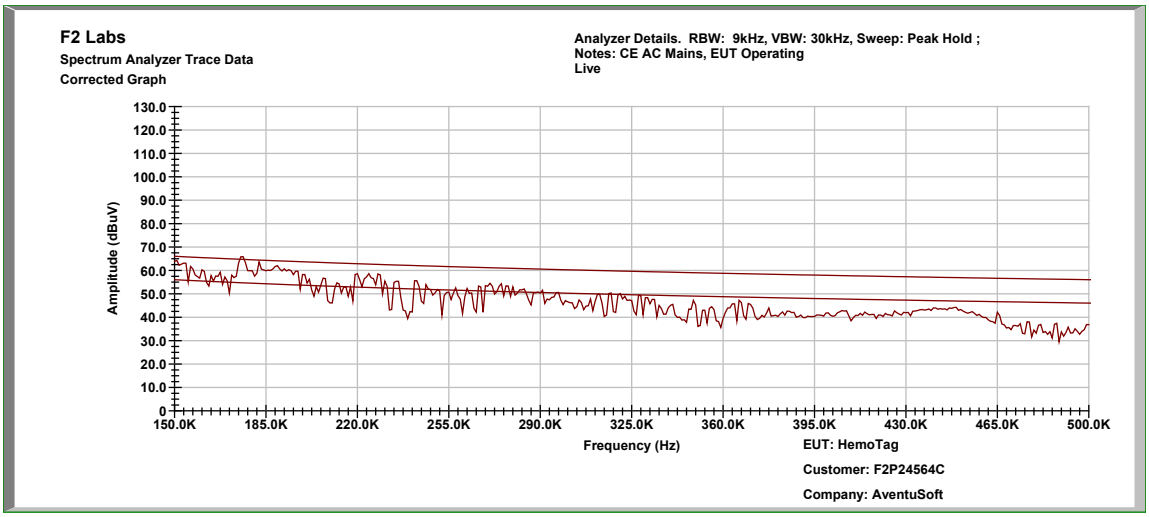
9.2 Procedure

The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.

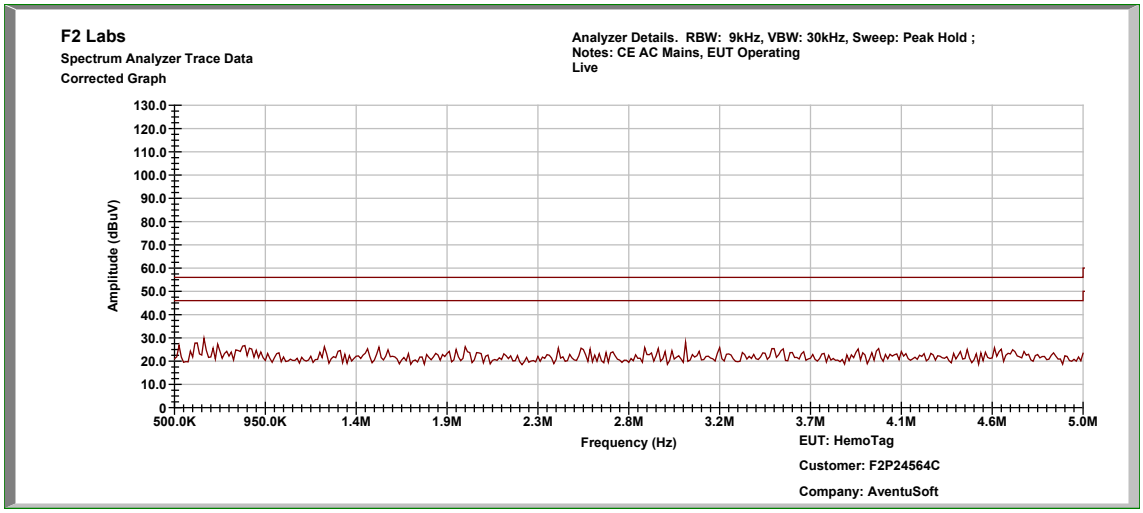
9.3 Conducted Emissions Test Data

Test Date(s):	2023-02-08	Test Engineer:	J. Chiller
Rule:	15.207	Air Temperature:	20.3º C
Test Results:	Complies	Relative Humidity:	37%

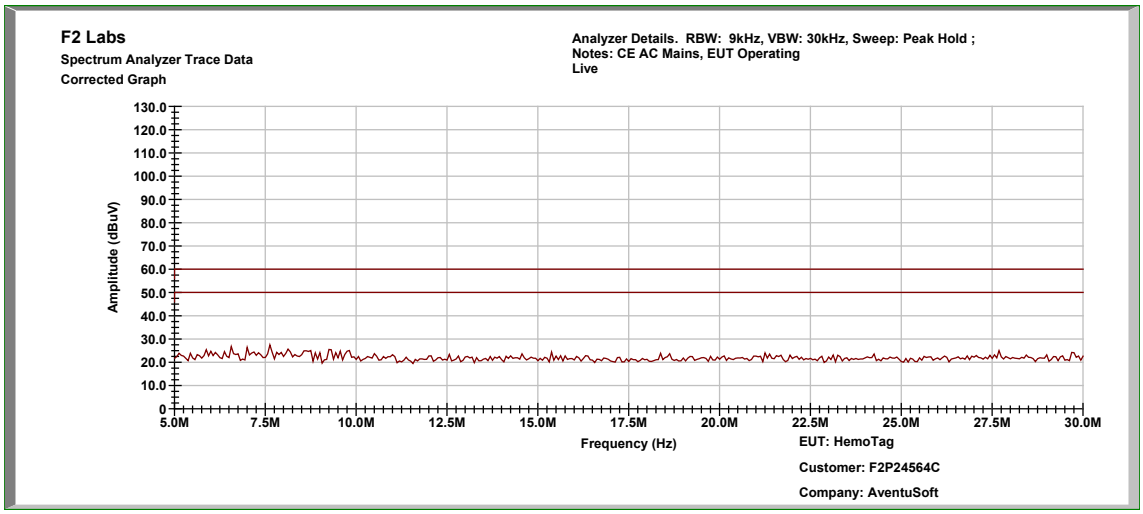
Conducted Test – Line 1: 0.15 MHz to 0.5 MHz



Conducted Test – Line 1: 0.5 MHz to 5.0 MHz

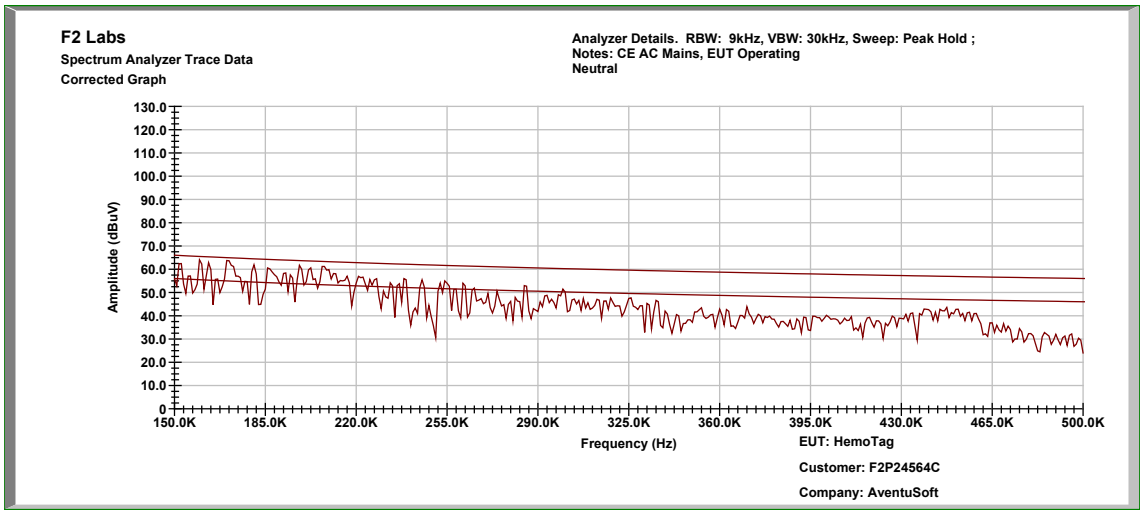


Conducted Test – Line 1: 5.0 MHz to 30.0 MHz

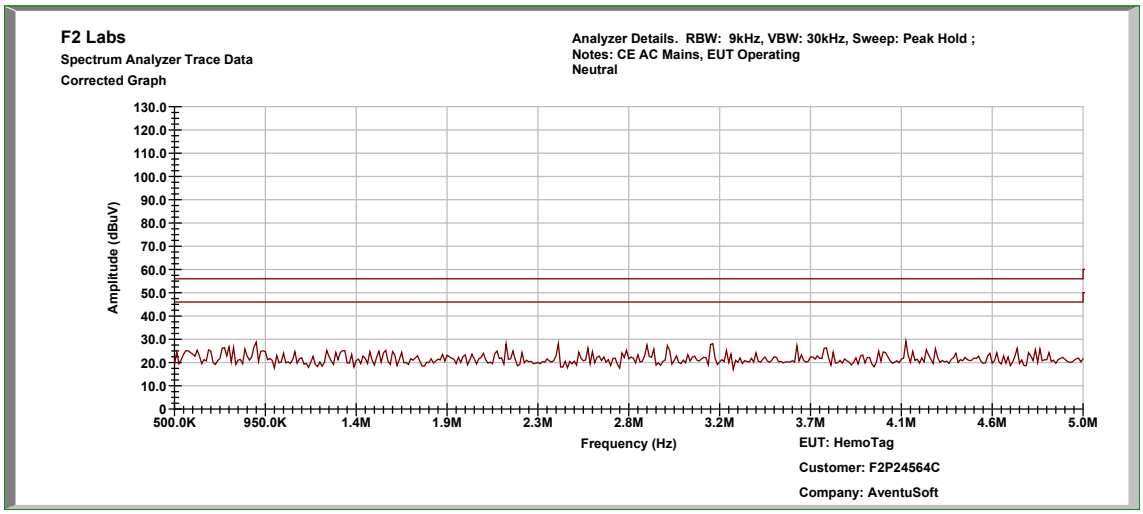


Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Live	0.17625	Quasi-Peak	44.89	11.0	55.89	64.661	-8.8
			Average	16.41	11.0	27.41	54.661	-27.3
2	Live	0.150875	Quasi-Peak	49.35	11.0	60.35	65.952	-5.6
			Average	22.36	11.0	33.36	55.952	-22.6
3	Live	0.156125	Quasi-Peak	44.75	11.0	55.75	65.669	-9.9
			Average	19.74	11.0	30.74	55.669	-24.9
4	Live	0.18325	Quasi-Peak	46.50	11.0	57.50	64.338	-6.8
			Average	16.57	11.0	27.57	54.338	-26.8
5	Live	0.189375	Quasi-Peak	41.50	11.0	52.50	64.065	-11.6
			Average	15.97	11.0	26.97	54.065	-27.1
6	Live	0.22875	Quasi-Peak	38.81	11.0	49.81	62.495	-12.7
			Average	9.83	11.0	20.83	52.495	-31.7
7	Live	0.24275	Quasi-Peak	37.52	11.0	48.52	62.002	-13.5
			Average	9.46	11.0	20.46	52.002	-31.5

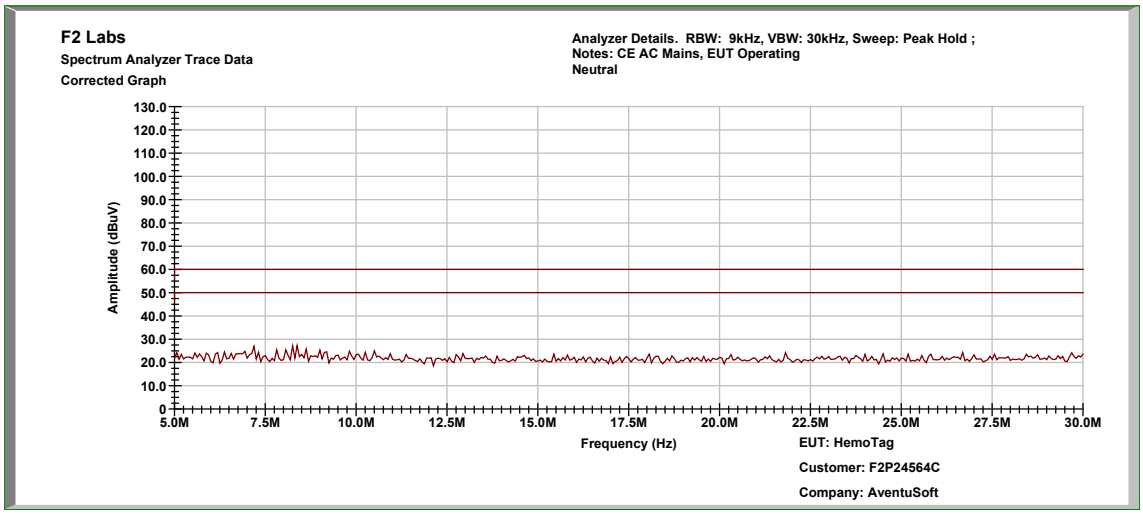
Conducted Test – Line 2: 0.15 MHz to 0.5 MHz



Conducted Test – Line 2: 0.5 MHz to 5.0 MHz



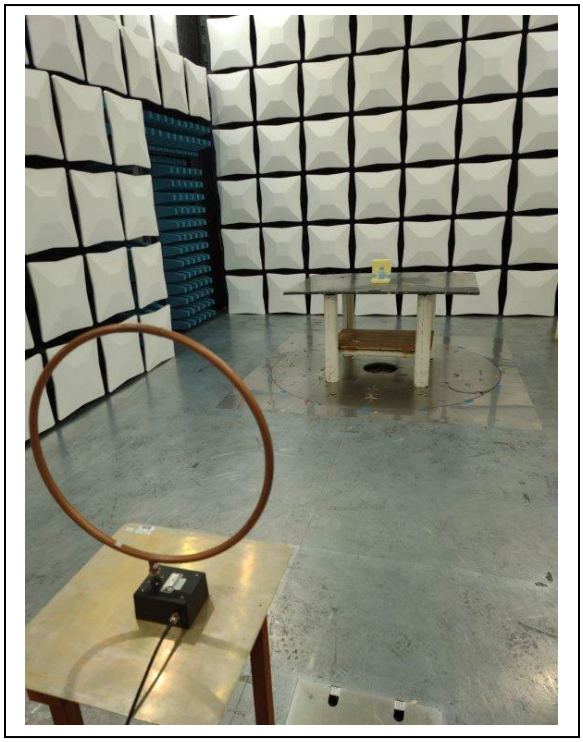
Conducted Test – Line 2: 5.0 MHz to 30.0 MHz



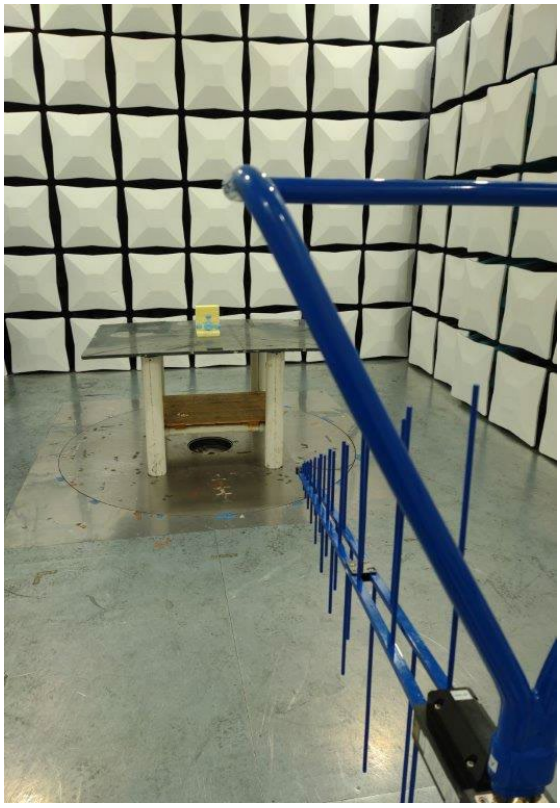
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Neutral	0.152625	Quasi-Peak	50.18	11.0	61.18	65.857	-4.7
			Average	20.24	11.0	31.24	55.857	-24.6
2	Neutral	0.1605	Quasi-Peak	47.67	11.0	58.67	65.438	-6.8
			Average	16.10	11.0	27.10	55.438	-28.3
3	Neutral	0.1710	Quasi-Peak	44.39	11.0	55.39	64.913	-9.5
			Average	18.68	11.0	29.68	54.913	-25.2
4	Neutral	0.198125	Quasi-Peak	42.09	11.0	53.09	63.690	-10.6
			Average	13.11	11.0	24.11	53.690	-29.6
5	Neutral	0.208875	Quasi-Peak	41.31	11.0	52.31	63.260	-11.0
			Average	10.61	11.0	21.61	53.260	-31.7
6	Neutral	0.2025	Quasi-Peak	42.96	11.0	53.96	63.508	-9.5
			Average	14.02	11.0	25.02	53.508	-28.5

10 PHOTOGRAPHS - TEST SETUPS

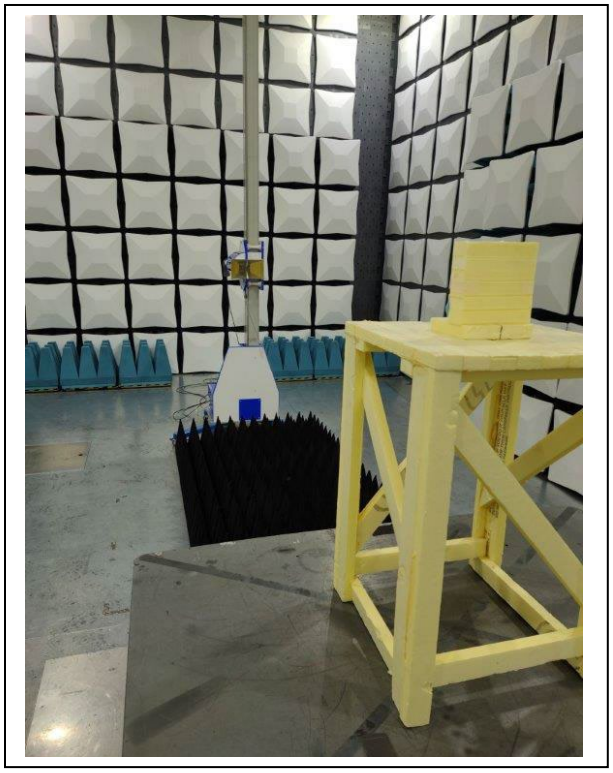
Loop Antenna



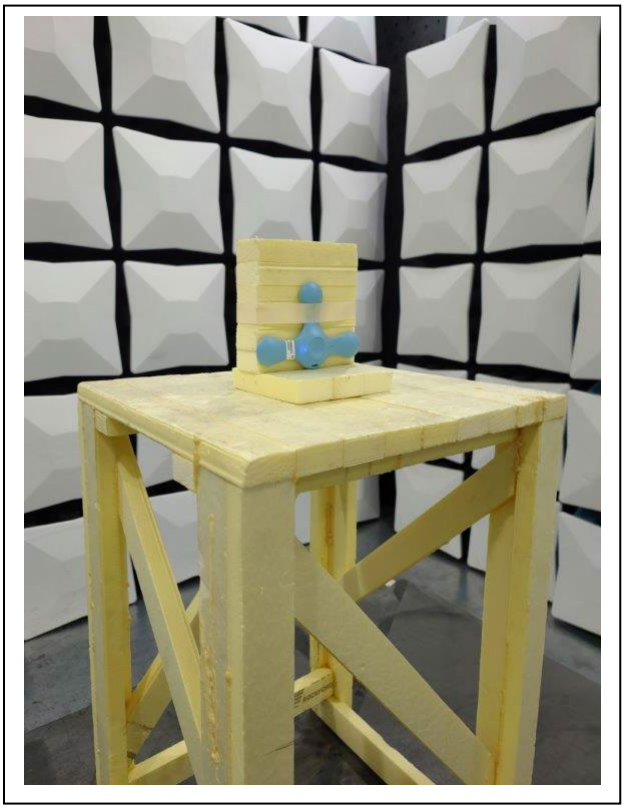
Spurious Emissions, 30 MH to 1000 MHz



Occupied Bandwidth, Field Strength of Emissions, Band Edge, Spurious Emissions Greater Than 1 GHz



EUT Highest Emissions Position



Conducted Emissions