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Middlefield, Ohio 44062
United States of America
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CERTIFICATION TEST REPORT

Manufacturer:	**Runwise, Inc.** **104 West 27th Street, Floor 3** **New York, New York 10001 USA**
Applicant:	**Same as Above**
Product Name:	**Gen2 Temperature and Humidity Sensor**
Product Description:	RF transmitter with onboard sensors, 2.4 GHz Bluetooth Radio
Operating Voltage/Freq. of EUT During Testing:	Battery-Operated (3VDC)
Model:	**V6.3**
FCC ID:	**2AQX2-G2RWSENS**
Testing Commenced:	2024-01-25
Testing Ended:	2024-01-25
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**
- **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
F2P31406-02E	First Issue	2024-02-03	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)	Not Applicable

Note: Product was operated using two AA batteries.
Requirements of 15.31 were met by using new batteries.

Modifications Made to the Equipment
None

Power Setting
8

3 TABLE OF MEASURED RESULTS

Test		Low Channel 2402 MHz	Mid Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength of Fundamental	Modulation: 1Mbps	78.4 dBµV/m / 8.3 mV/m	77.2 dBµV/m / 7.2 mV/m	77.0 dBµV/m / 7.0 mV/m
Average Field Strength of Fundamental	Modulation: 2Mbps	76.5 dBµV/m / 6.6 mV/m	75.6 dBµV/m / 6.0 mV/m	77.0 dBµV/m / 7.0 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
-20dB Occupied Bandwidth	1Mbps	1.182 MHz	1.211 MHz	1.186 MHz
	2Mbps	2.275 MHz	2.238 MHz	2.307 MHz
99% Occupied Bandwidth	1Mbps	1.043 MHz	1.043 MHz	1.060 MHz
	2Mbps	2.051 MHz	2.070 MHz	2.094 MHz

4 ENGINEERING STATEMENT

This report has been prepared on behalf of Runwise, Inc. 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 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: Temp/Humidity Sensor - 2.4 GHz Bluetooth Radio
Model: V6.3
Serial No.: 9
Firmware: V1.0
Hardware: V6.3
FCC ID: 2AQX2-G2RWSENS

5.2 Trade Name:

Runwise, Inc.

5.3 Power Supply:

3VDC

5.4 Applicable Rules:

CFR 47, Part 15.249, subpart C

5.5 Antenna:

Whip Antenna

5.6 Accessories:

Device	Manufacturer	Model Number	Serial Number
Launch Pad	Texas Instruments	CC1350	None Specified
Laptop*	Dell	Latitude 7490	None Specified

**Indicates F2 Labs-supplied equipment.*

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was set to transmit a continuous modulated signal in the 2.4 GHz BLE band. Measurements were taken on low (2402 MHz), mid (2440 MHz) and high (2480 MHz) channels using 1Mbps and 2Mbps modulations.

Note: The enclosure was not available at the time of testing. It is totally plastic and has no effect on the results.

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	2024-11-15
Temp/Hum. Recorder	CL294	Thermpro	TP50	2	2026-04-27
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2024-04-10
Low Loss Cable Set	CL315/CL318	Fairview Microwave	FMC0202914-72/FMC0202914	None Spec.	2024-04-14
Horn Antenna	CL098	Emco	3115	9809-5580	2024-01-19
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2024-01-19
Preamplifier	CL284	A.H. Systems, Inc.	PAM-1001	131	2024-04-12
Active 18” Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2024-12-14
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2024-09-25
Software:	Tile Version 3.4.B.3			Software Verified: 2024-01-25	
Software:	EMC 32, Version 8.53.0			Software Verified: 2024-01-25	
Temp/Hum. Recorder	CL295	Thermpro	TP50	3	2024-04-27
Temp/Hum. Recorder	CL296	Thermpro	TP50	4	2024-04-27

7 FCC PART 15.215(e), OCCUPIED BANDWIDTH

7.1 Requirements:

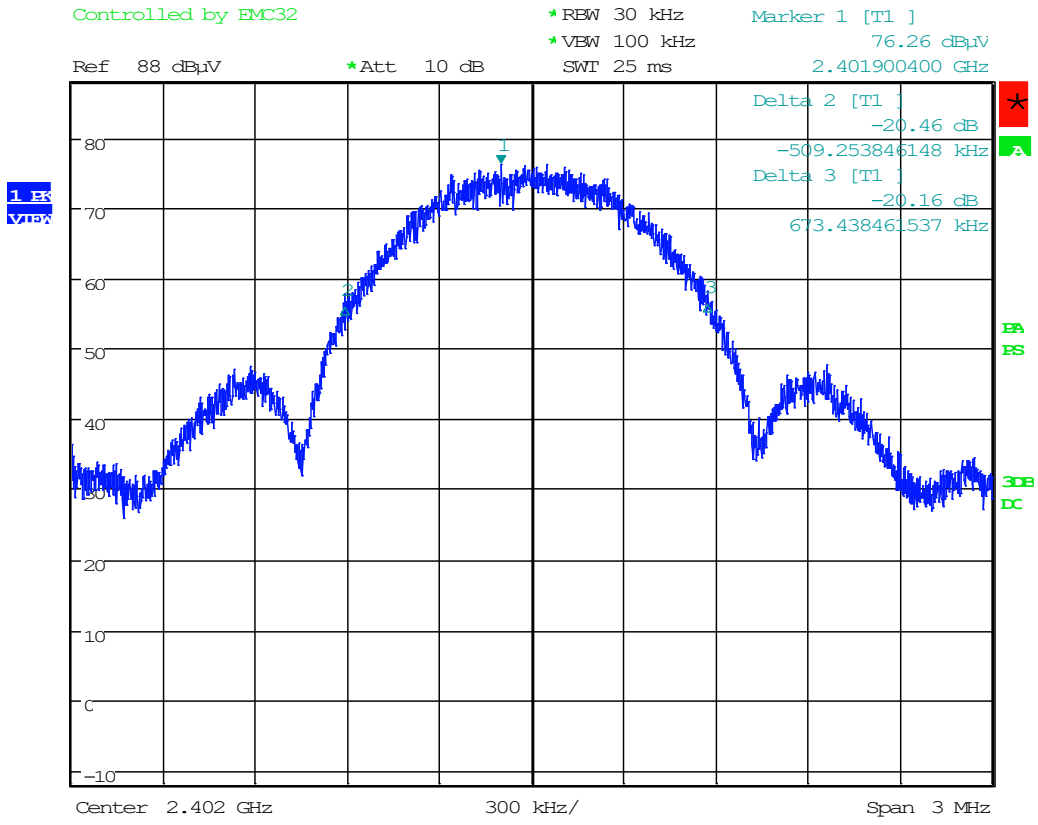
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific 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 20 dB bandwidth was measured using the marker delta method and the 99% bandwidth was measured using the analyzer's auto function.

7.2 Occupied Bandwidth Test Data

Test Date(s):	2024-01-25	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	22.4ºC
		Relative Humidity:	39%

1Mbps: -20dB, Low Channel



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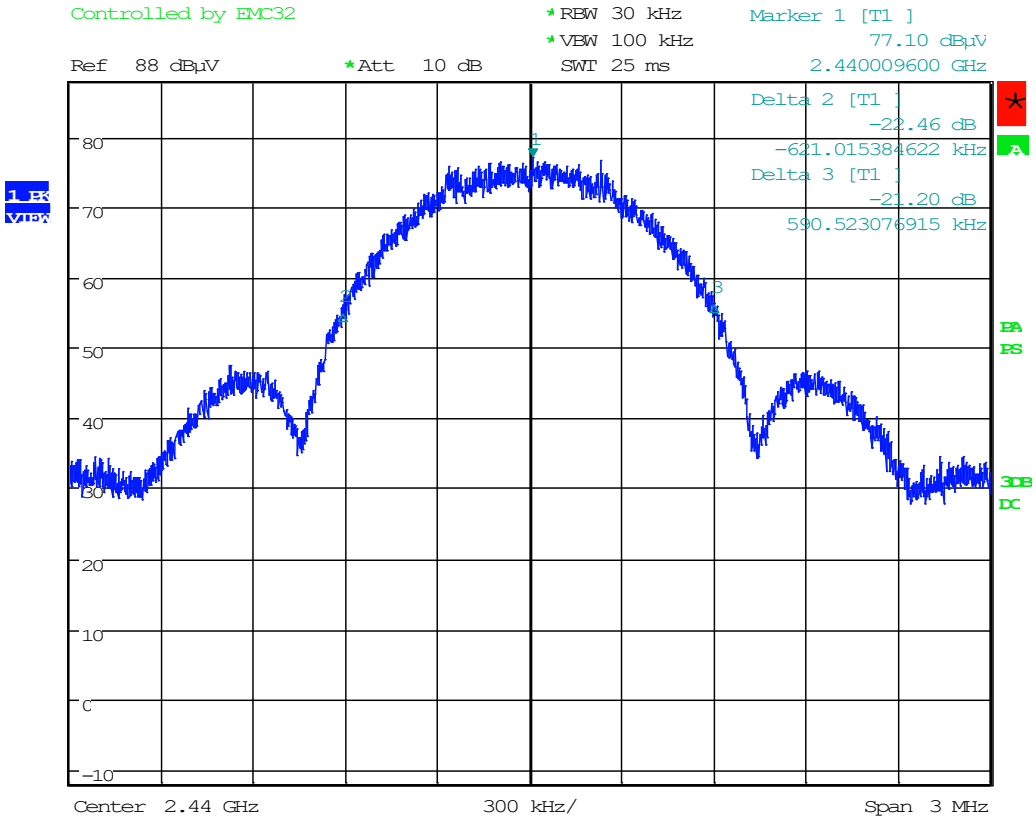
1Mbps: -20dB, Mid Channel



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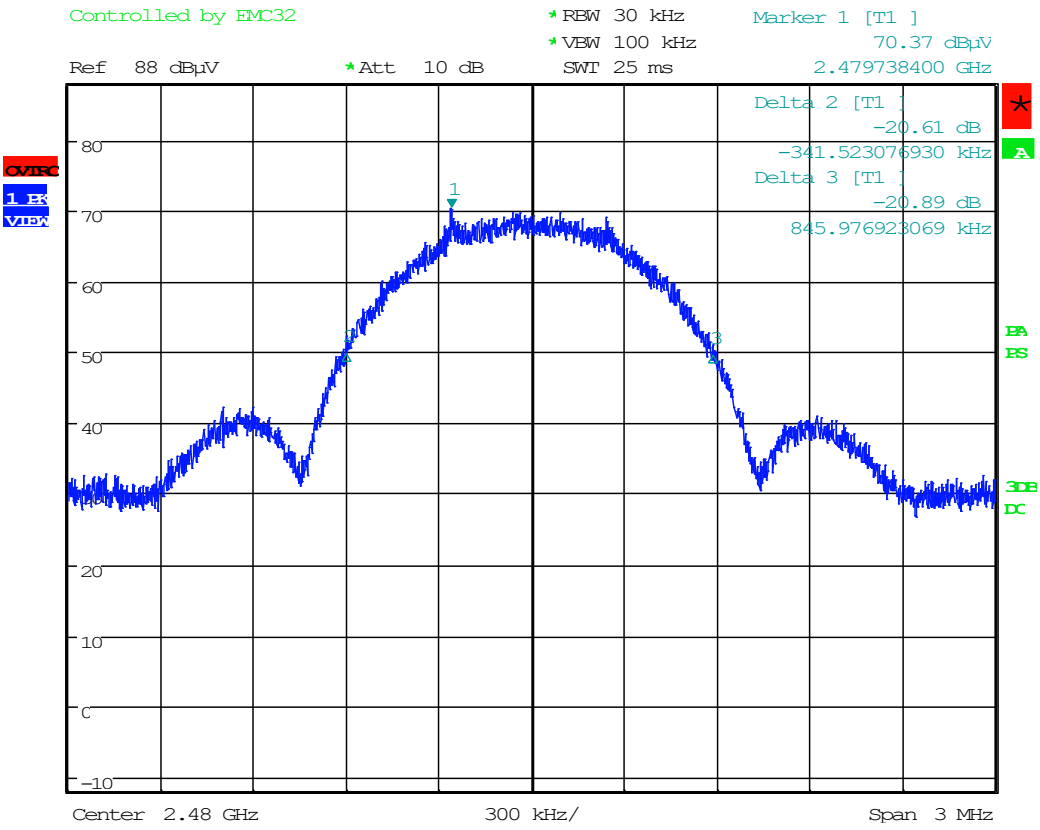
1Mbps: -20dB, High Channel



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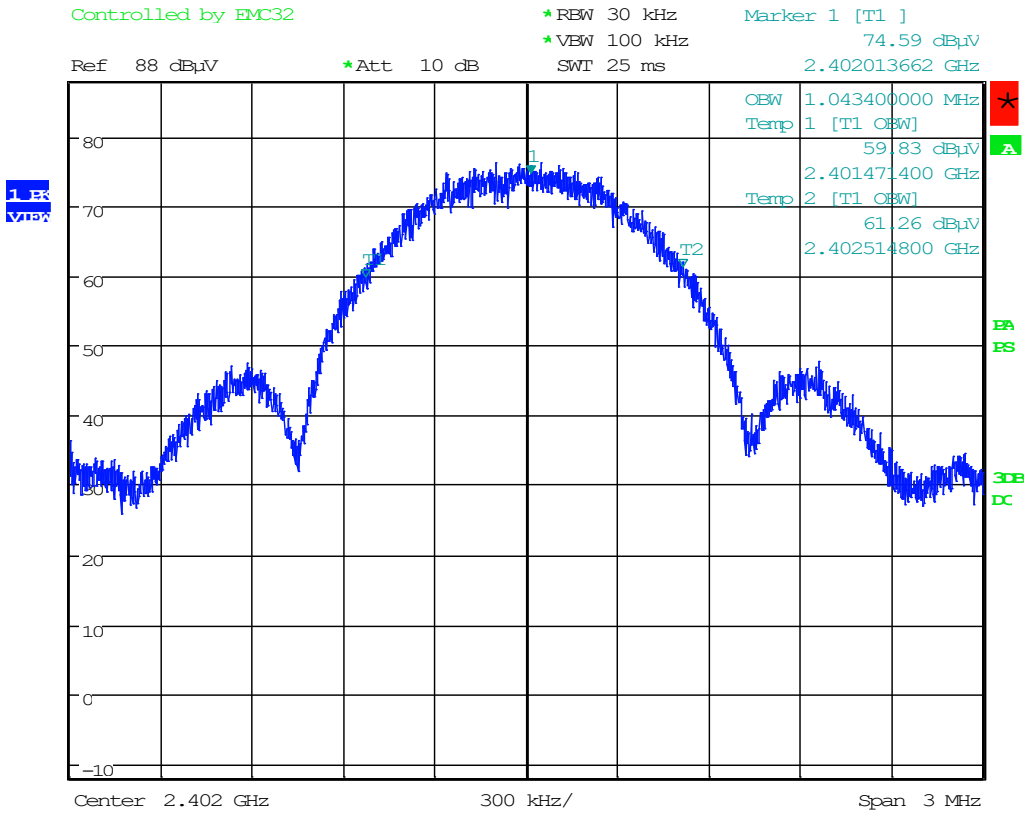
1Mbps: 99%, Low Channel



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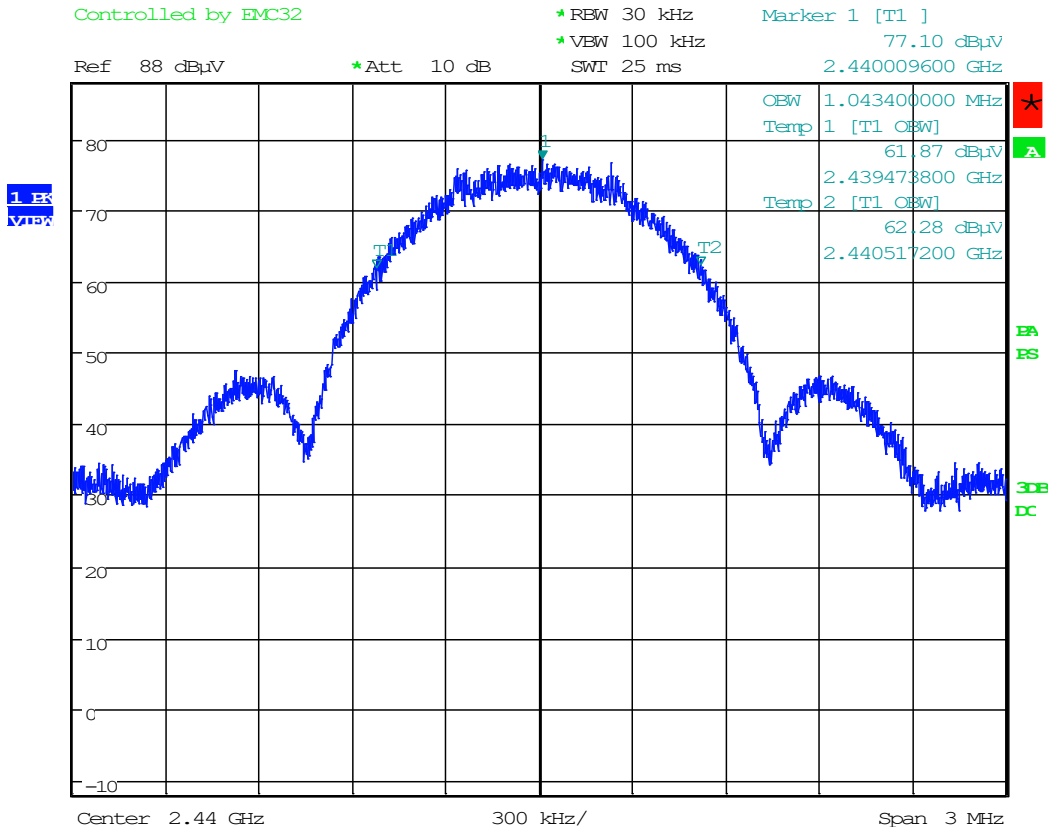
1Mbps: 99%, Mid Channel



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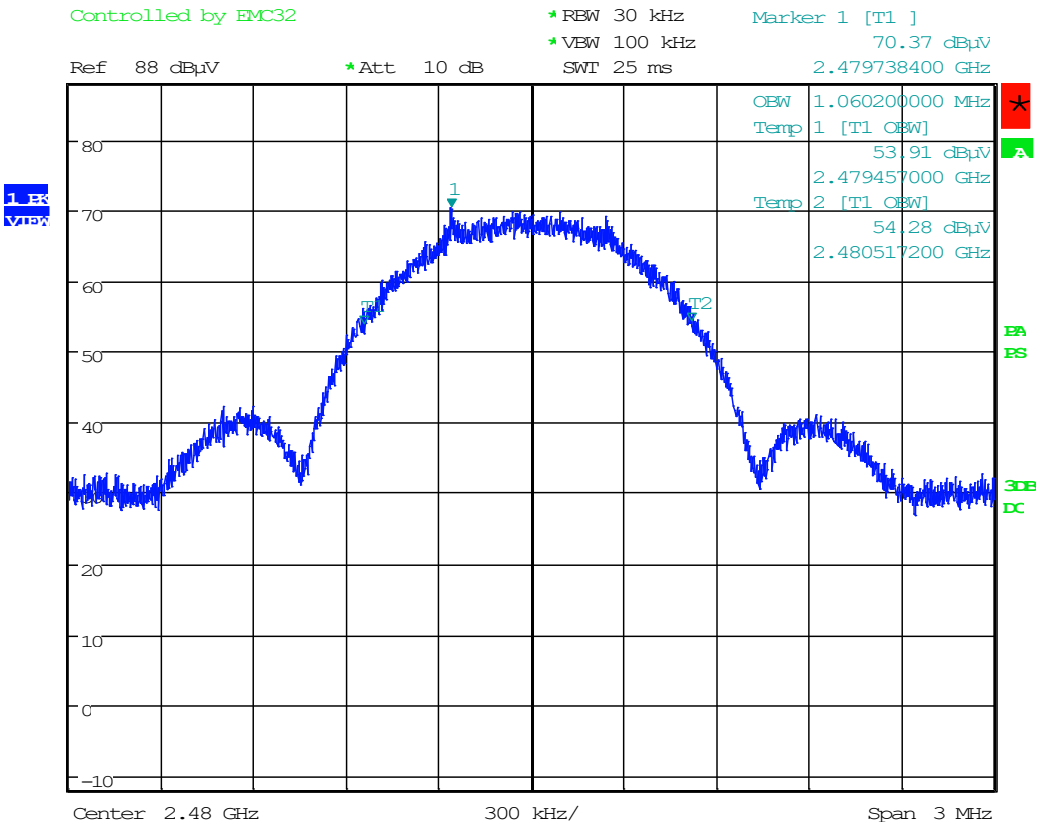
1Mbps: 99%, High Channel



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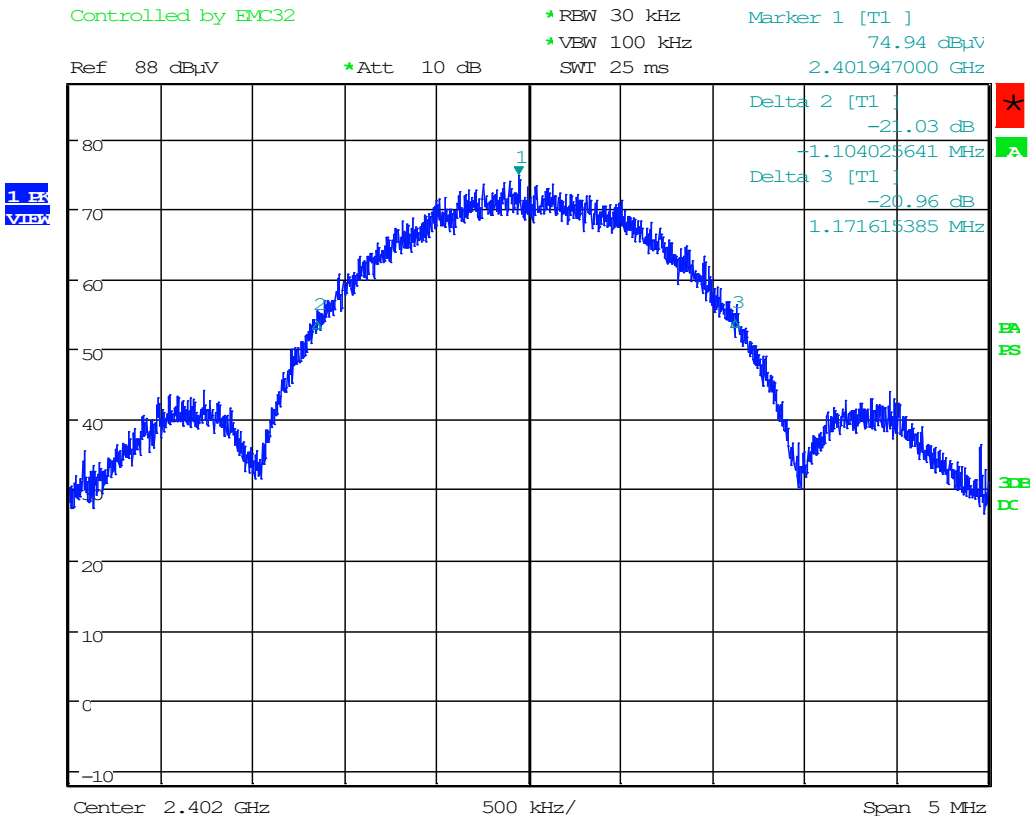
2Mbps: -20dB, Low Channel



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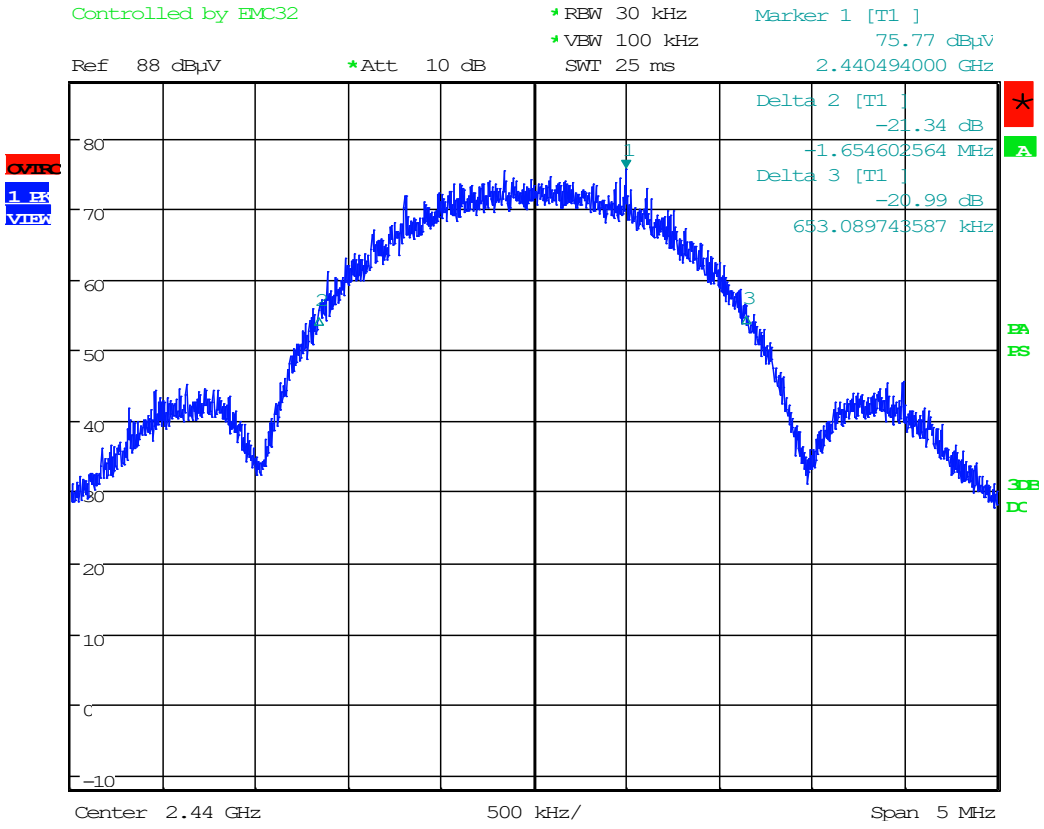
2Mbps: -20dB, Mid Channel



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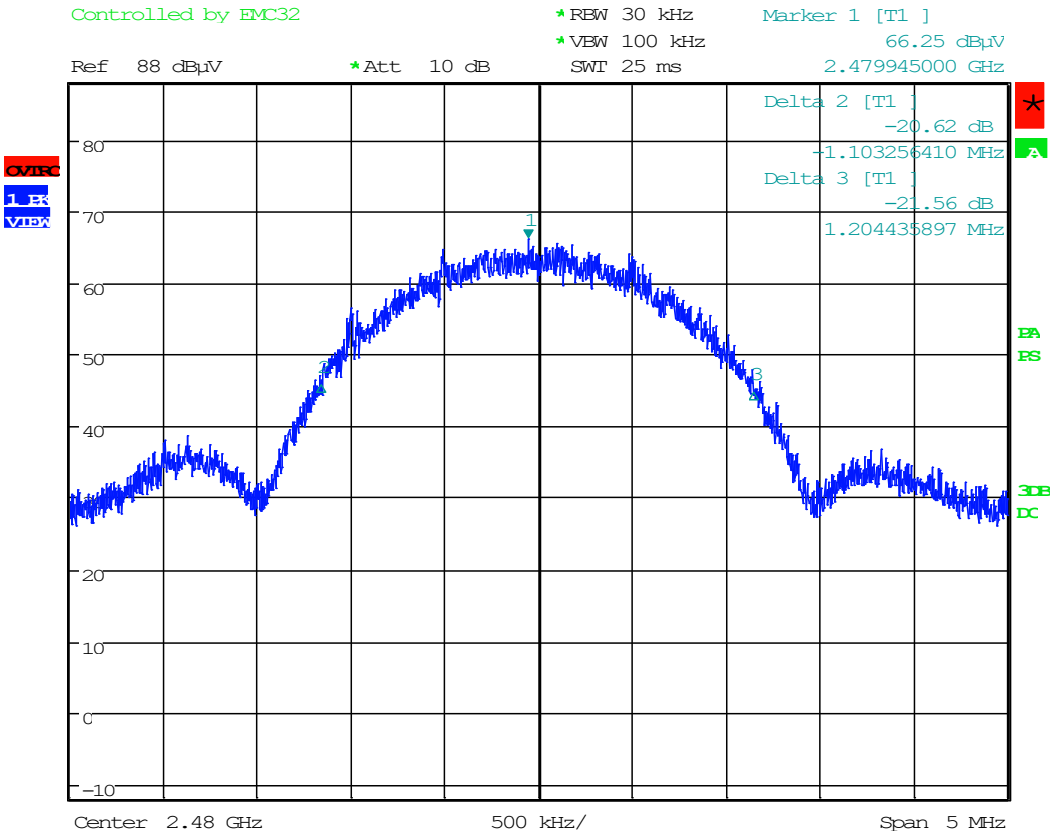
2Mbps: -20dB, High Channel



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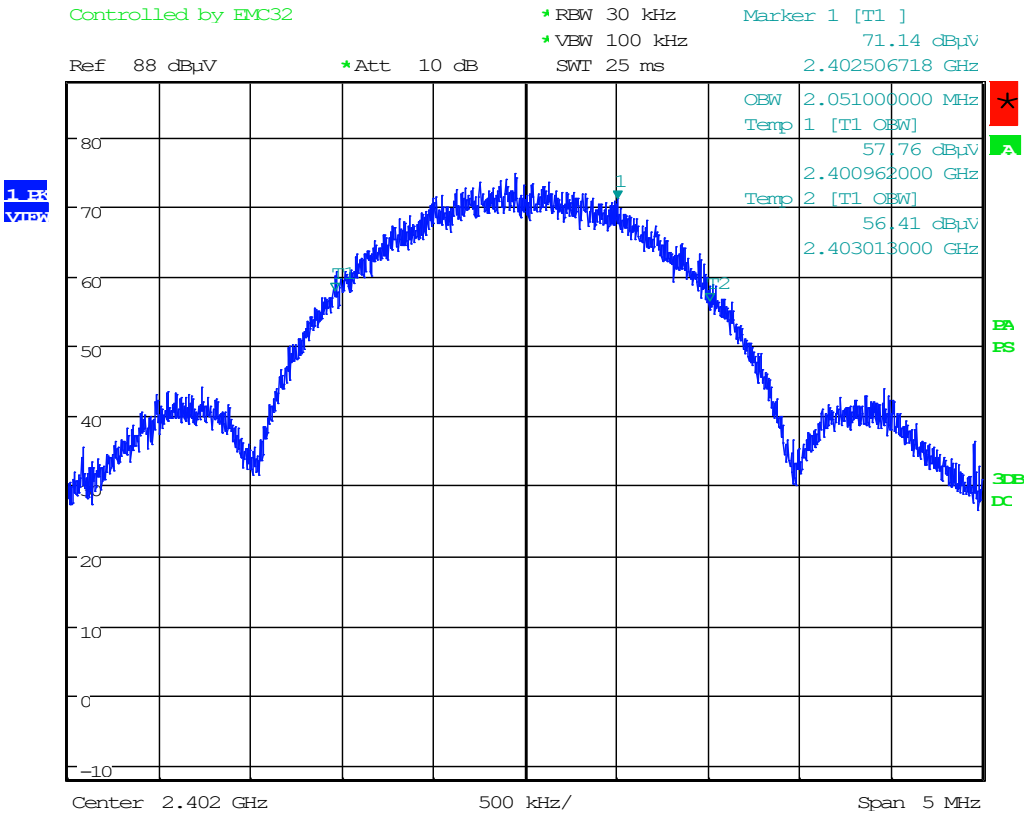
2Mbps: 99%, Low Channel



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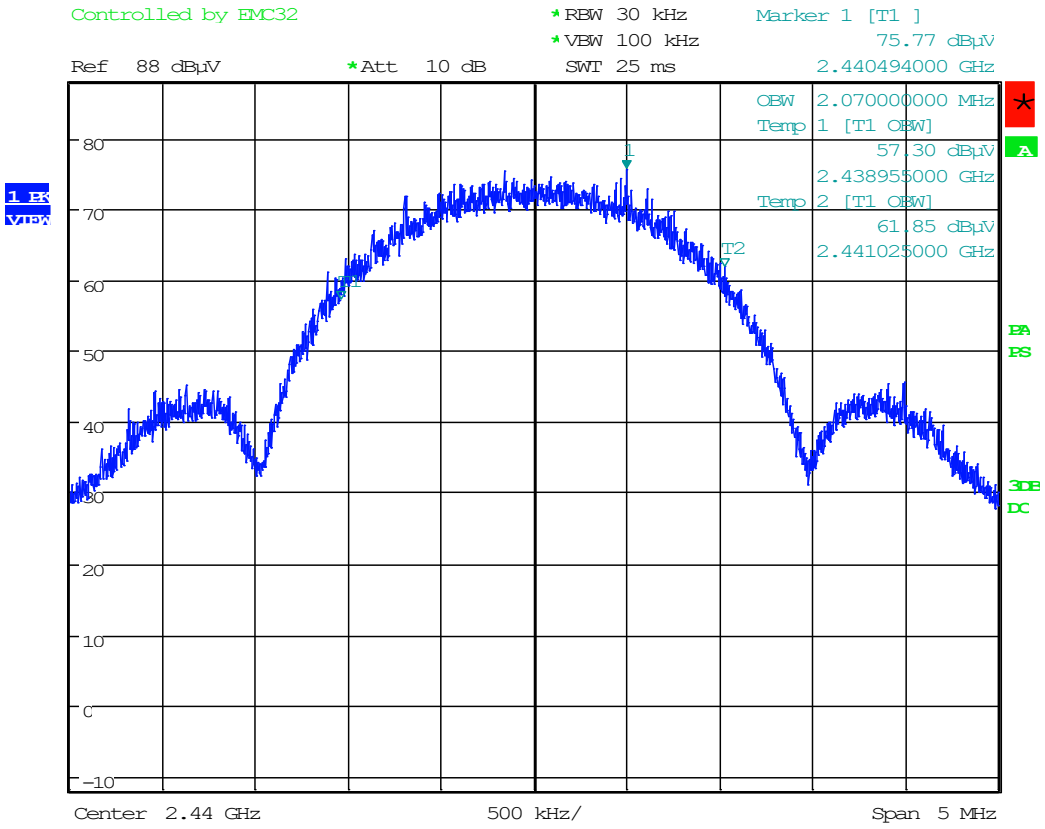
2Mbps: 99%, Mid Channel



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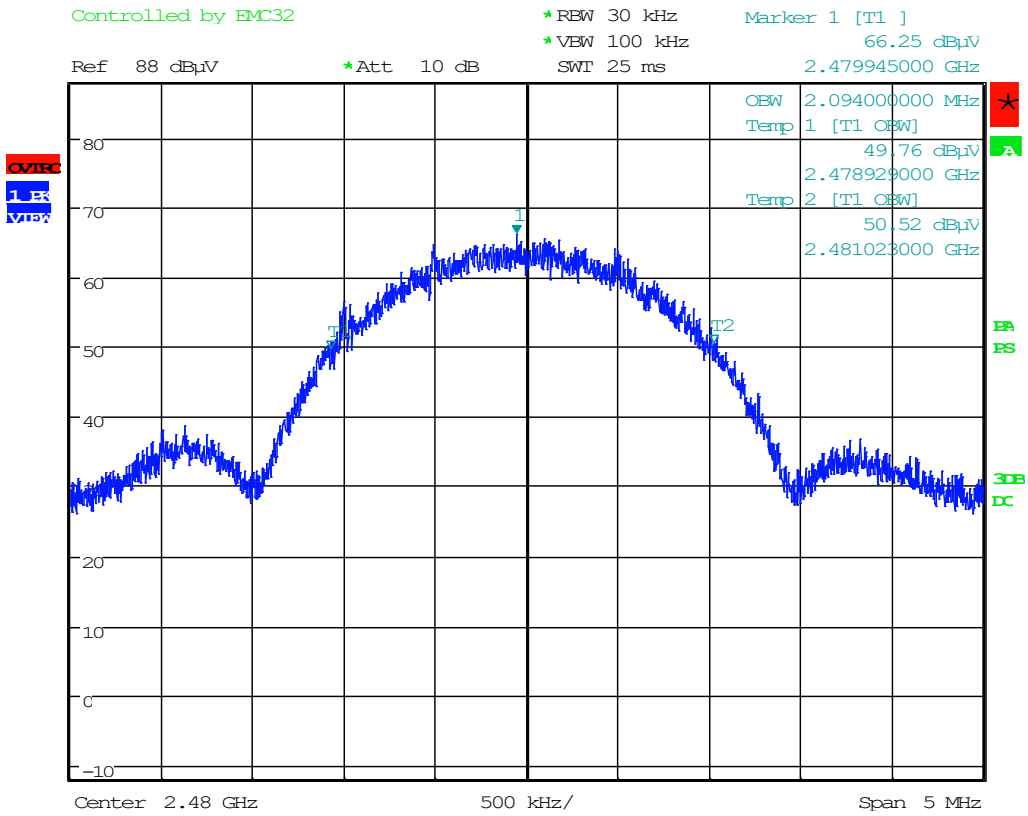
2Mbps: 99%, High Channel



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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.

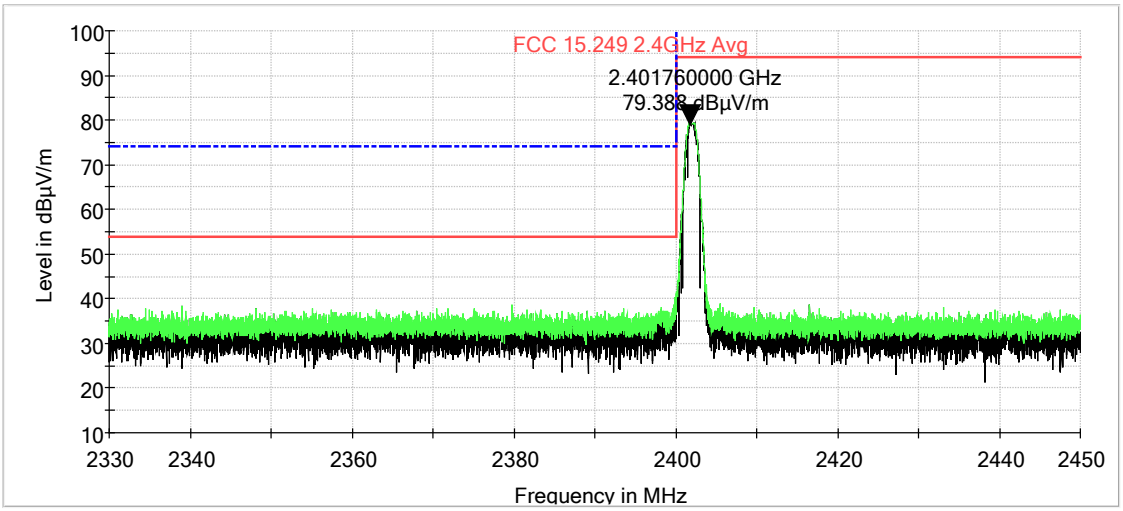
NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.

Software power setting was 8.

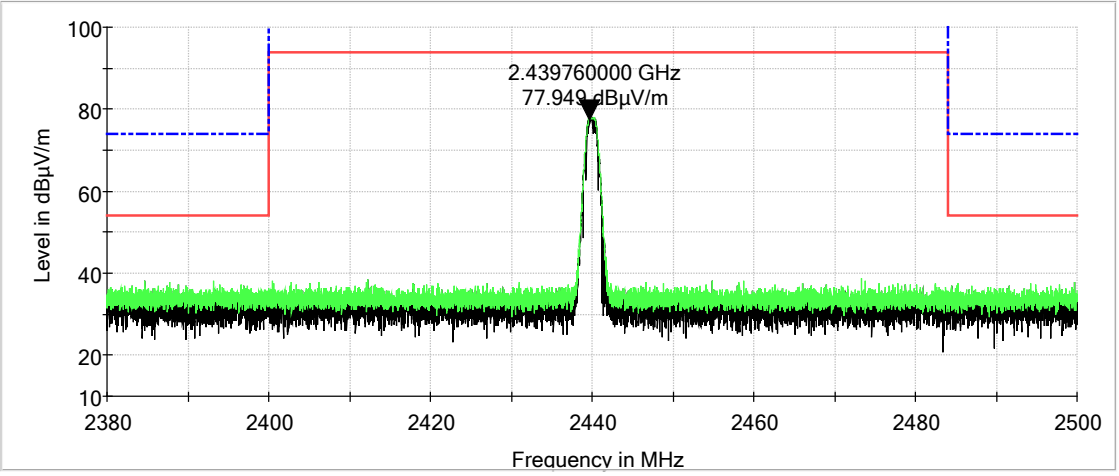
8.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date(s):	2024-01-25	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.249(a)	**Air Temperature:**	23.0ºC
		Relative Humidity:	37%

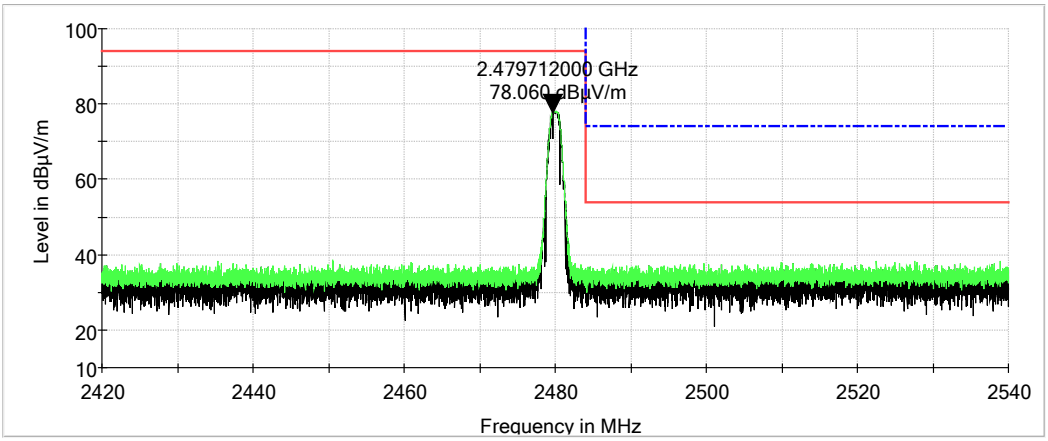
1Mbps: Low Band Edge - Vertical



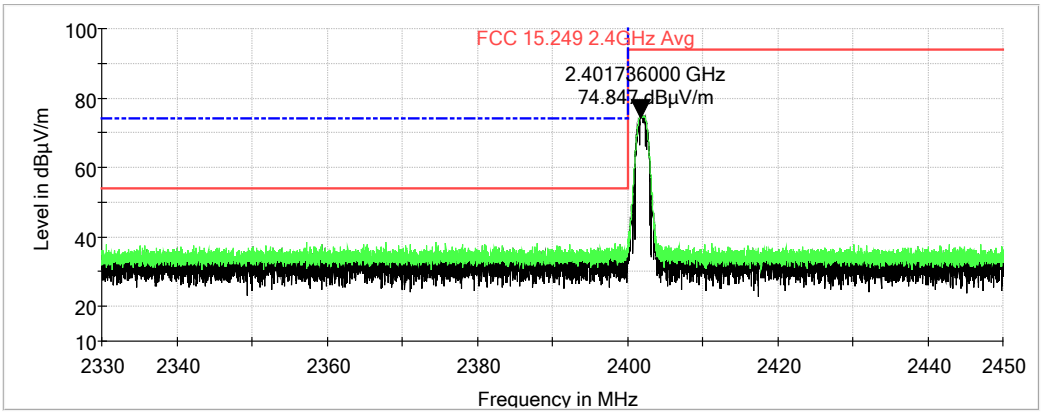
1Mbps: Mid Channel - Vertical



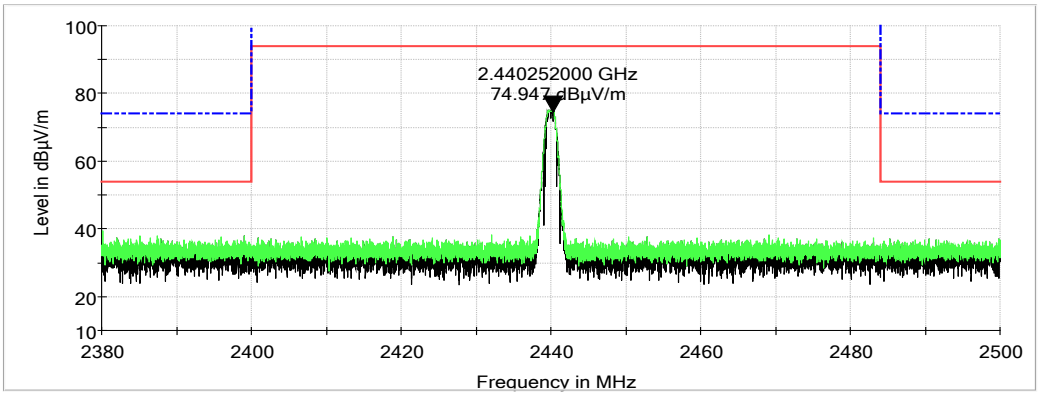
1Mbps: Upper Band Edge - Vertical



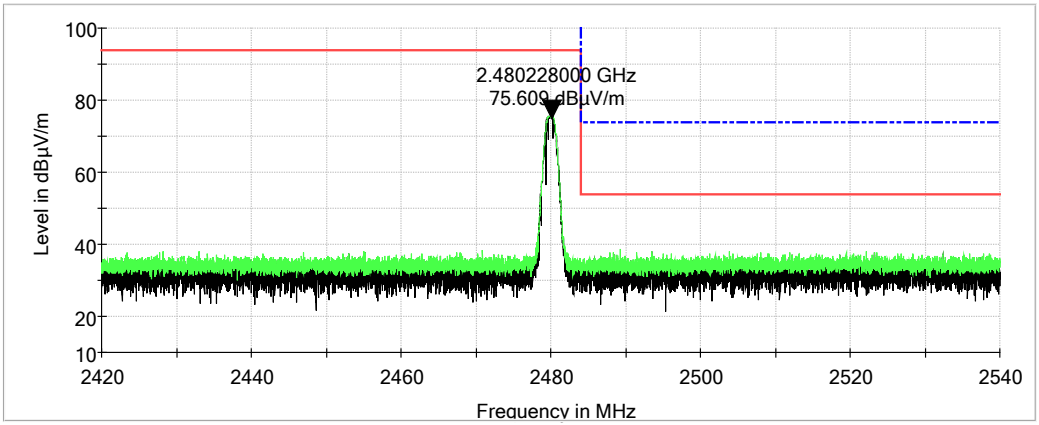
1Mbps: Low Band Edge - Horizontal



1Mbps: Mid Channel - Horizontal

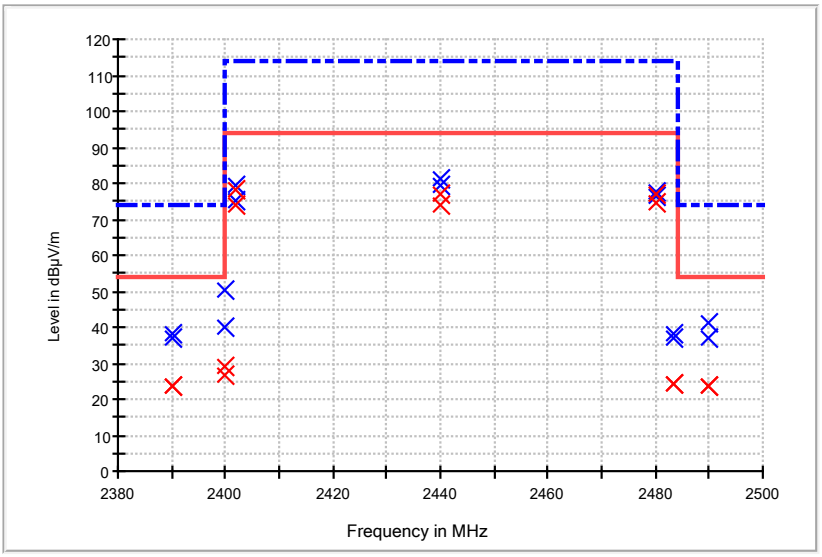


1Mbps: Upper Band Edge - Horizontal

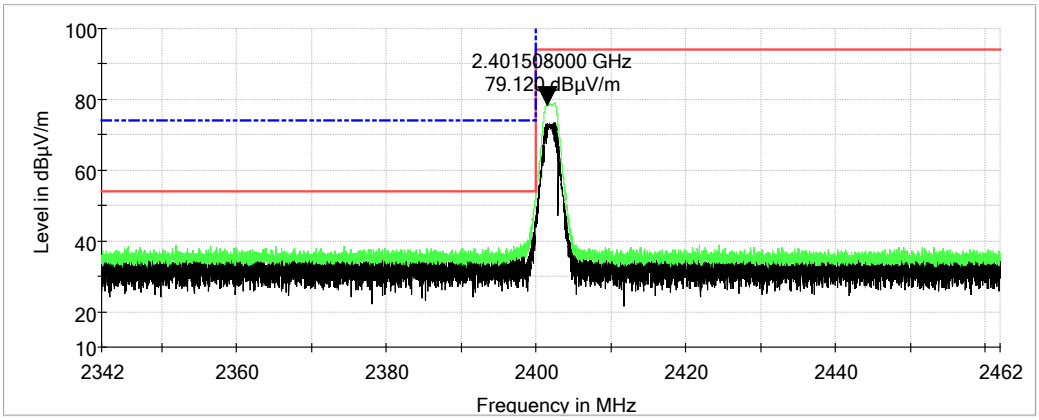


1Mbps: Band Edge and Field Strength of the Fundamentals

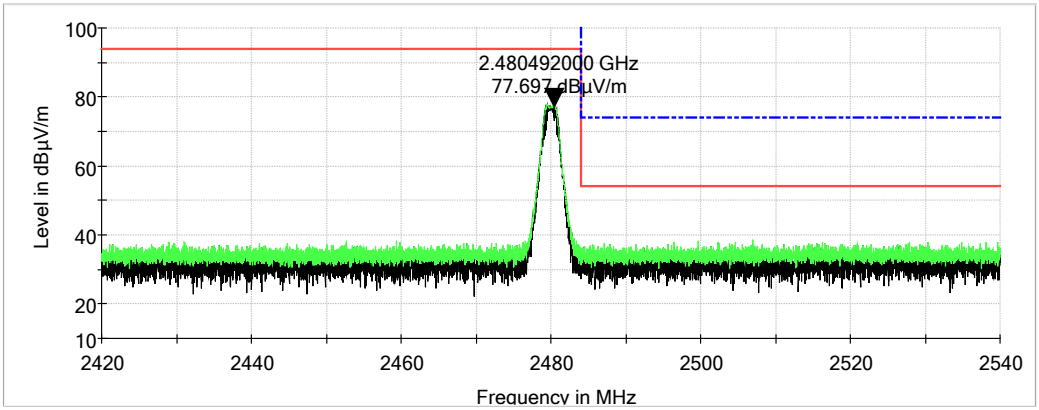
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2390.000000	37.0	23.5	1000.000	150.0	V	311.0	-10.8	30.5	54.0	
2390.000000	38.0	23.4	1000.000	150.0	H	12.0	-10.8	30.6	54.0	
2400.000000	40.1	26.4	1000.000	150.0	H	12.0	-10.8	27.6	54.0	
2400.000000	50.5	29.1	1000.000	150.0	V	311.0	-10.8	24.9	54.0	
2402.000000	79.2	78.4	1000.000	150.0	V	311.0	-10.8	15.6	94.0	
2402.000000	75.2	74.0	1000.000	150.0	H	12.0	-10.8	20.0	94.0	
2440.000000	79.1	77.2	1000.000	150.0	V	309.0	-10.9	16.8	94.0	
2440.000000	81.5	74.1	1000.000	150.0	H	331.0	-10.9	19.9	94.0	
2480.000000	76.3	74.6	1000.000	150.0	H	319.0	-11.0	19.4	94.0	
2480.000000	77.8	77.0	1000.000	150.0	V	303.0	-11.0	17.0	94.0	
2483.500000	37.0	23.9	1000.000	150.0	H	319.0	-11.0	30.1	54.0	
2483.500000	37.9	24.4	1000.000	150.0	V	303.0	-11.0	29.6	54.0	
2490.000000	41.2	23.4	1000.000	150.0	H	319.0	-10.9	30.6	54.0	
2490.000000	36.8	23.3	1000.000	150.0	V	303.0	-10.9	30.7	54.0	



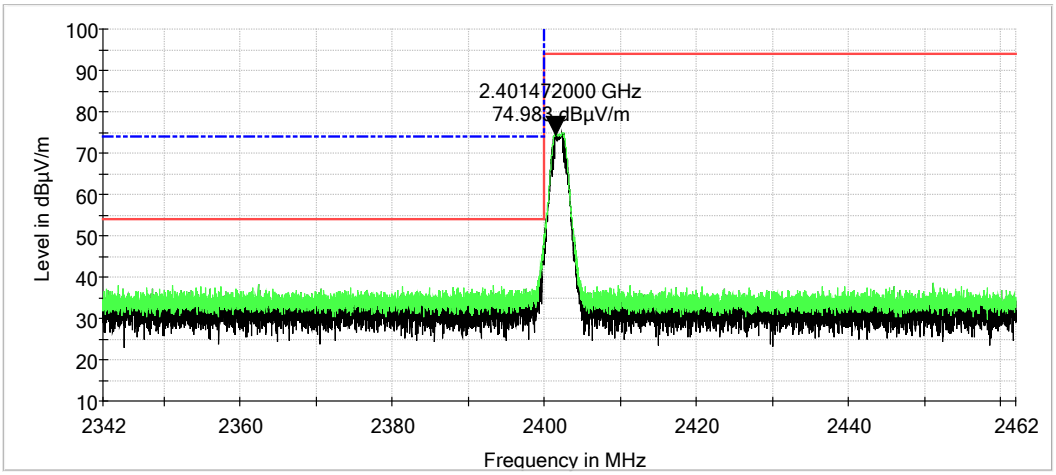
2Mbps: Low Band Edge - Vertical



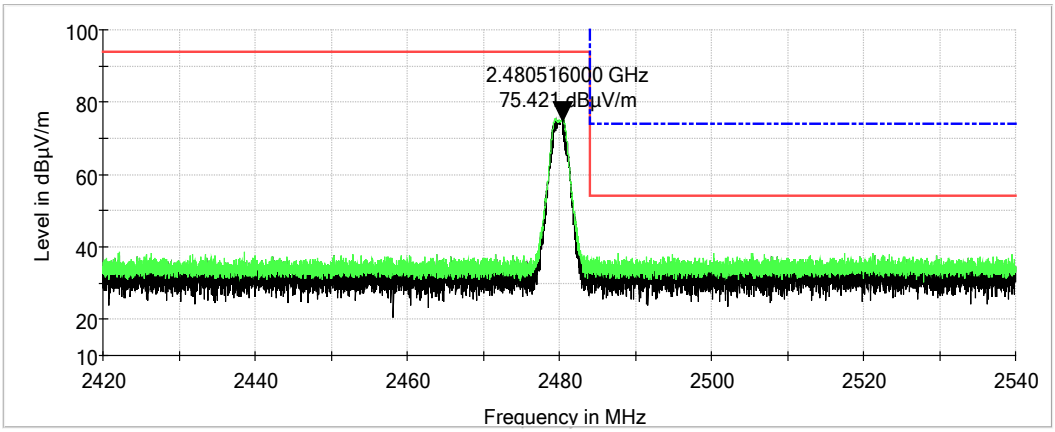
2Mbps: Upper Band Edge - Vertical



2Mbps: Low Band Edge - Horizontal

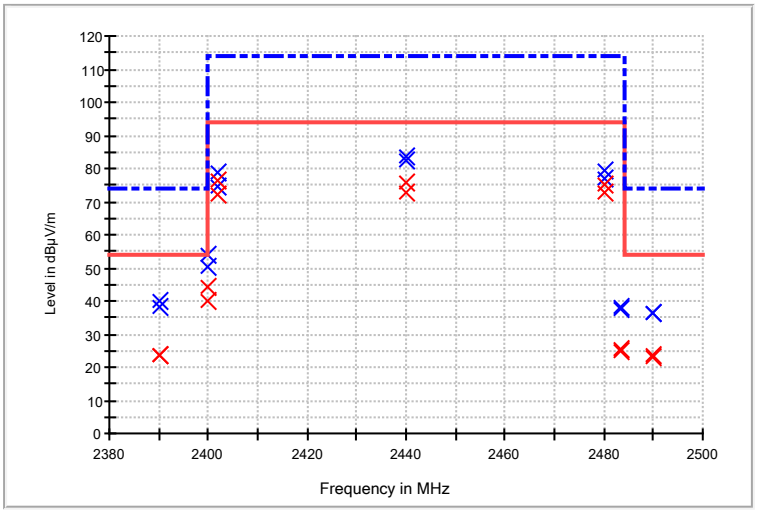


2Mbps: Upper Band Edge - Horizontal



2Mbps: 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/m)	Comment
2390.000000	38.2	23.7	1000.000	150.0	V	299.0	-10.8	30.3	54.0	
2390.000000	39.9	23.5	1000.000	150.0	H	12.0	-10.8	30.5	54.0	
2400.000000	50.1	40.2	1000.000	150.0	H	12.0	-10.8	13.8	54.0	
2400.000000	53.9	44.3	1000.000	150.0	V	299.0	-10.8	9.7	54.0	
2402.000000	78.7	76.5	1000.000	150.0	V	299.0	-10.8	17.5	94.0	
2402.000000	74.6	72.4	1000.000	150.0	H	12.0	-10.8	21.6	94.0	
2440.000000	83.8	75.6	1000.000	150.0	V	310.0	-10.9	18.4	94.0	
2440.000000	82.5	72.4	1000.000	150.0	H	331.0	-10.9	21.6	94.0	
2480.000000	76.9	72.9	1000.000	150.0	H	320.0	-11.0	21.1	94.0	
2480.000000	79.5	75.2	1000.000	150.0	V	307.0	-11.0	18.8	94.0	
2483.500000	37.8	24.7	1000.000	150.0	H	320.0	-11.0	29.3	54.0	
2483.500000	38.3	25.3	1000.000	150.0	V	307.0	-11.0	28.7	54.0	
2490.000000	36.3	23.3	1000.000	150.0	H	320.0	-10.9	30.7	54.0	
2490.000000	36.2	23.4	1000.000	150.0	V	307.0	-10.9	30.6	54.0	



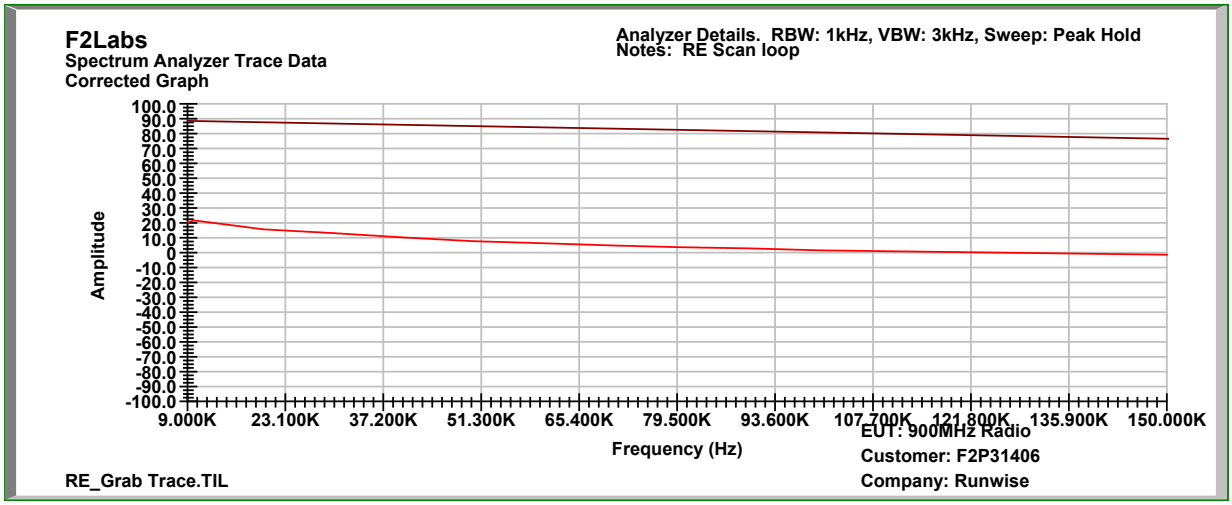
8.2 Test Data – Spurious Emissions

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.

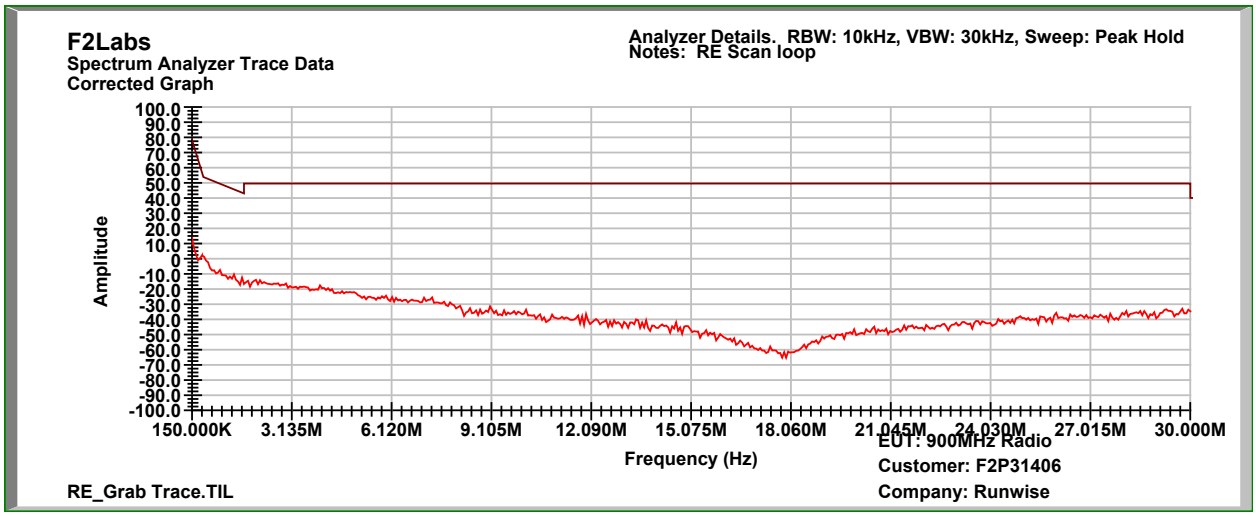
At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1 GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies 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.

Test Date(s):	2024-01-25	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	23.4ºC
		Relative Humidity:	37%

Characterization Scan, 9 kHz to 150 kHz



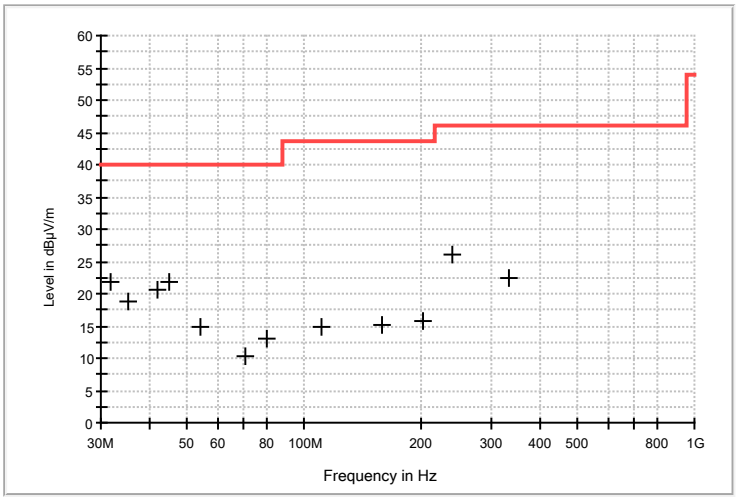
Characterization Scan, 150 kHz to 30 MHz



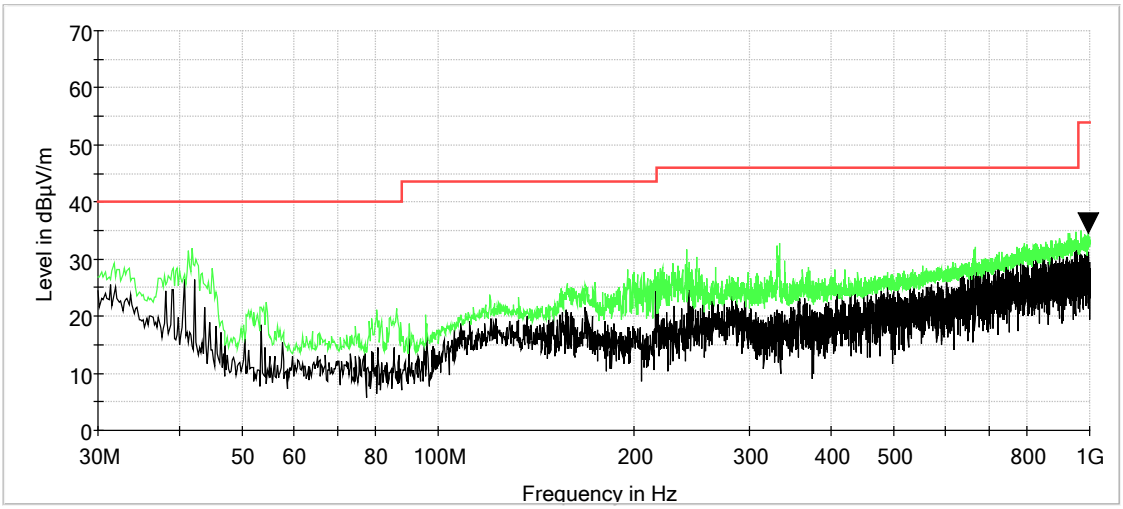
1Mbps: 30 MHz to 1000 MHz

**Note: Chart below includes data from all three channels.
No difference between 2Mbps and 1Mbps setting.**

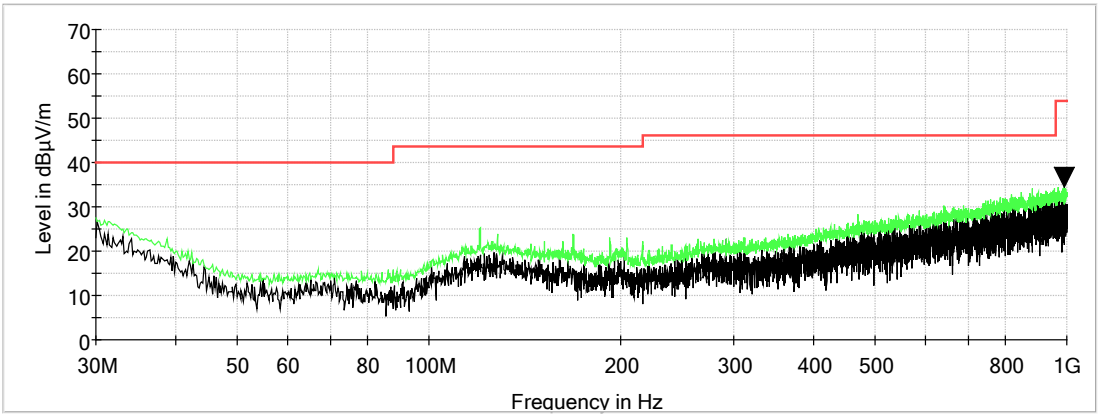
Frequency (MHz)	Ant. Pol.	Antenna Height (cm)	Azimuth (degrees)	Reading (dBµV)	Corr. Factors (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
31.750000	V	100.00	100.00	42.4	-20.4	22.00	40.0	-18.0
35.430000	H	100.00	100.00	41.8	-23.1	18.70	40.0	-21.3
41.830000	V	100.00	100.00	48.5	-27.8	20.70	40.0	-19.3
44.940000	V	100.00	100.00	51.5	-29.7	21.80	40.0	-18.2
53.860000	V	100.00	100.00	47.4	-32.6	14.80	40.0	-25.2
70.740000	H	100.00	100.00	41.8	-31.5	10.30	40.0	-29.7
80.250000	V	100.00	100.00	44.9	-32.0	12.90	40.0	-27.1
110.120000	H	100.00	100.00	41.8	-27.0	14.80	43.5	-28.7
158.230000	H	100.00	100.00	42.0	-26.8	15.20	43.5	-28.3
200.330000	H	100.00	100.00	42.0	-26.1	15.90	43.5	-27.6
240.300000	V	100.00	100.00	53.0	-26.8	26.20	46.0	-19.8
334.580000	V	100.00	100.00	46.7	-24.3	22.40	46.0	-23.6



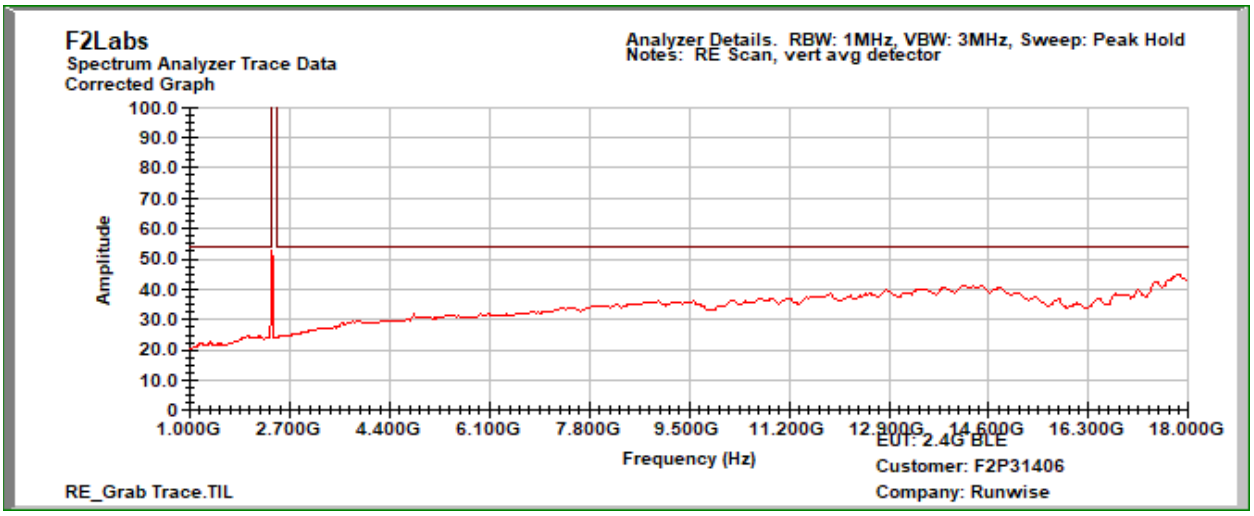
30 MHz to 1000 MHz, Vertical



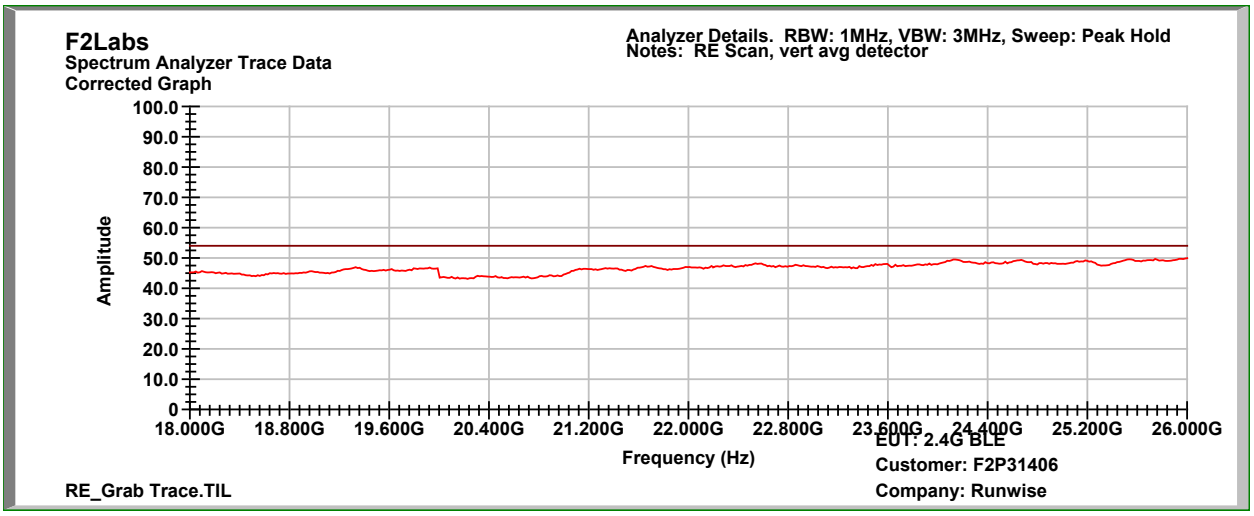
30 MHz to 1000 MHz, Horizontal



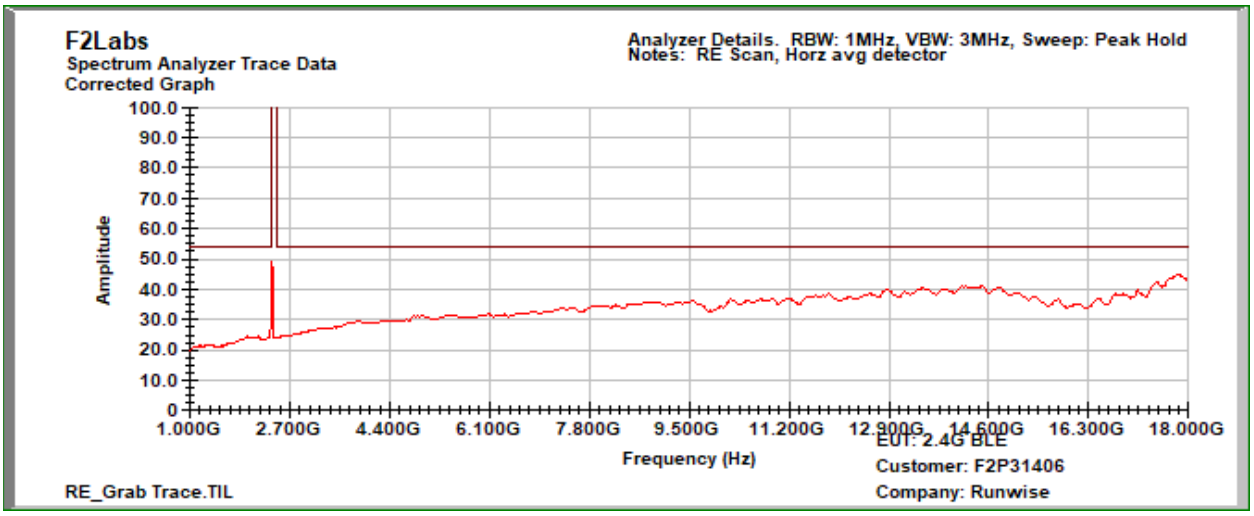
1Mbps: 1 GHz to 18 GHz, Vertical



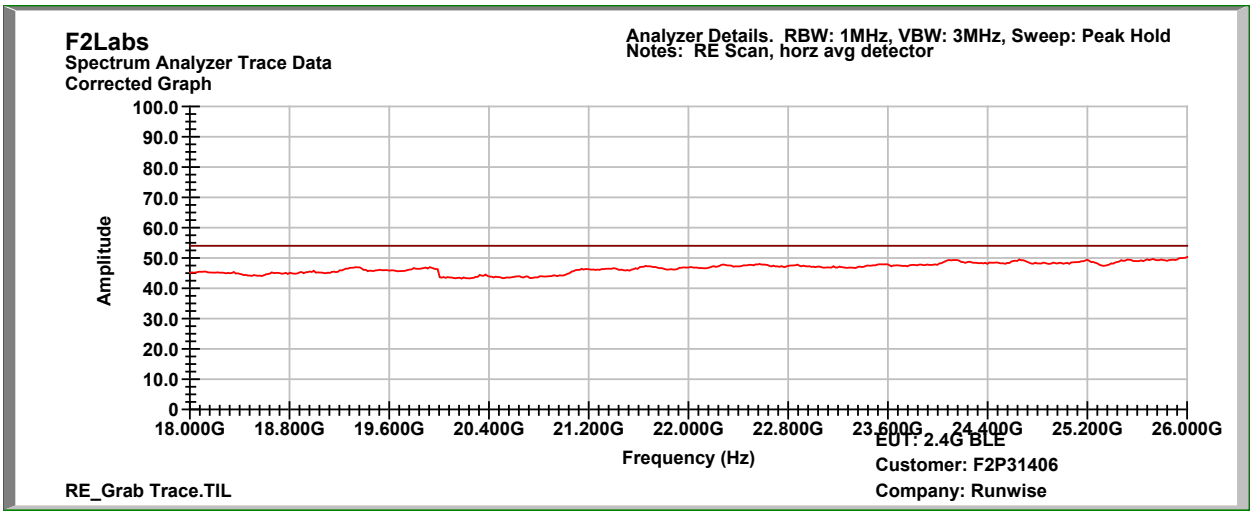
1Mbps: 18 GHz to 26 GHz, Vertical



1Mbps: 1 GHz to 18 GHz, Horizontal



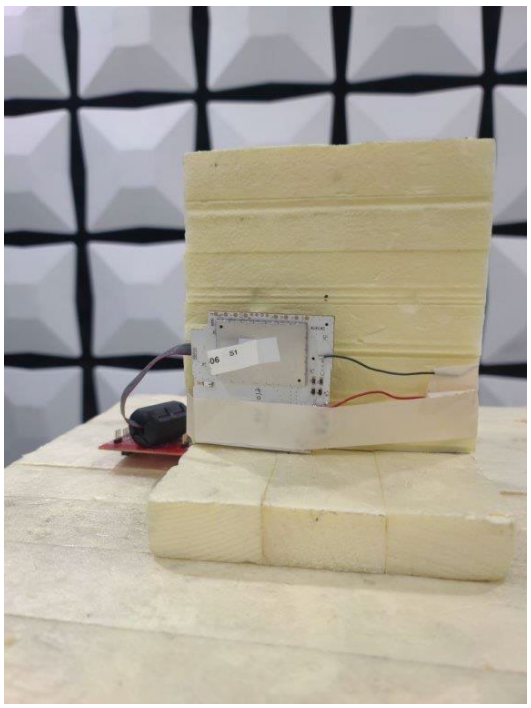
1Mbps: 18 GHz to 26 GHz, Horizontal



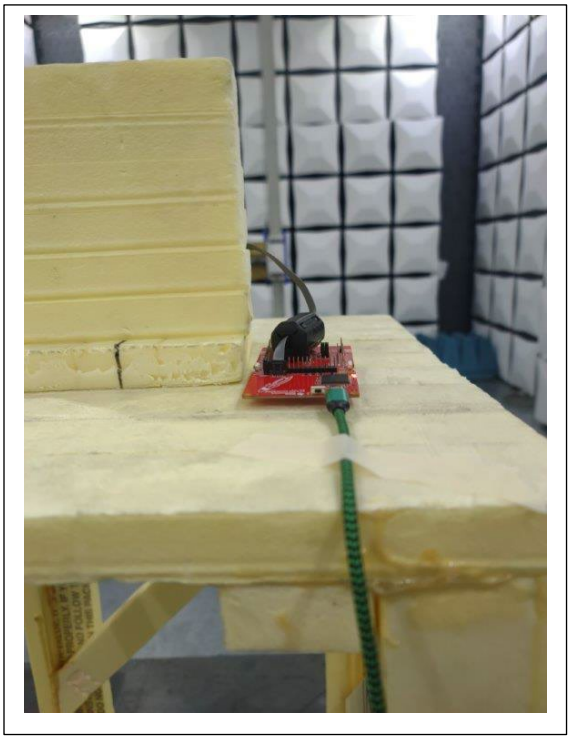
9 PHOTOGRAPH(S) - TEST SETUPS

Radio Setup: Less Than 1 GHz

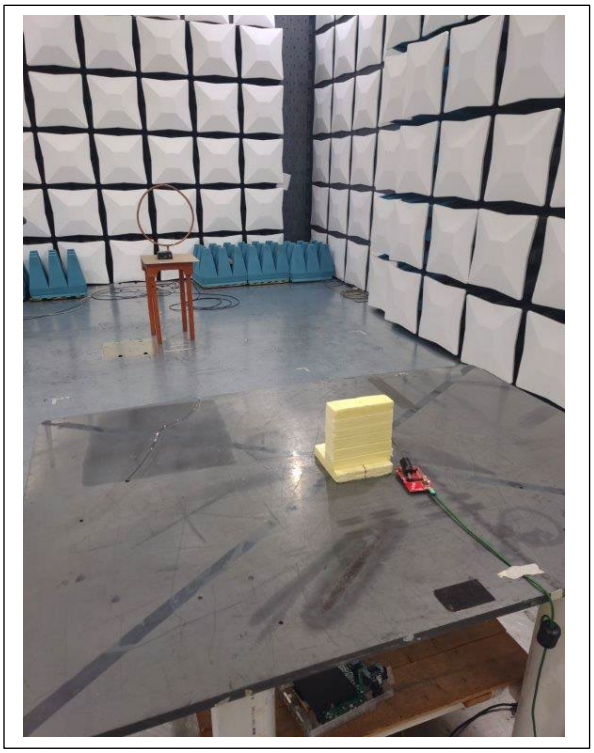
Radio Setup: Greater Than 1 GHz



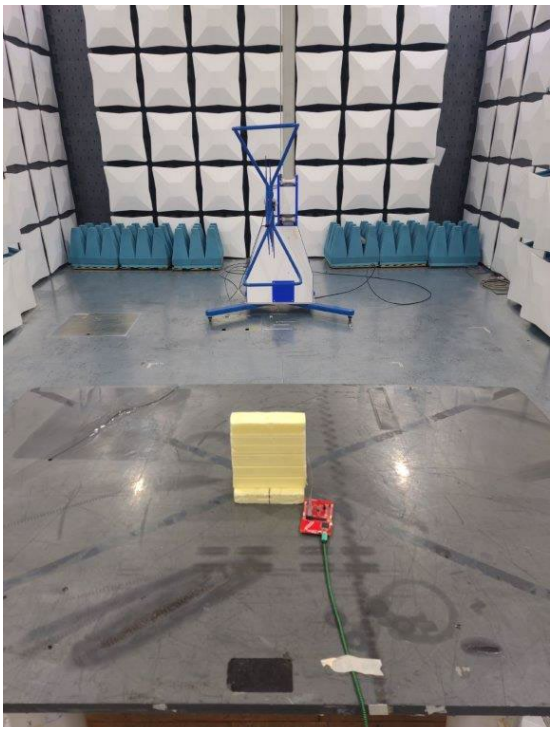
Interface



Radiated Spurious Emissions: 0.009 MHz to 30 MHz



Radiated Spurious Emissions: 30 MHz to 1000 MHz



Radiated Spurious Emissions: Greater Than 1 GHz