



F2 Labs
16740 Peters Road
Middlefield, Ohio 44062
United States of America
www.f2labs.com

CERTIFICATION TEST REPORT

Manufacturer: TeraCode Inc.
801 Brickell Avenue, 8th Floor
Miami, Florida 33131 USA

Applicant: Same as Above

Product Description: Bluetooth radio used in telemetry device built for the purpose of relaying bathroom fixture sensor data

Operating Voltage/Freq. of EUT During Testing: 3.3VAC from AC Adapter

Equipment Under Test: **Communication Card**
Trade Name: TeraCode Inc.
Model: **TCCC024**

FCC ID: **2BCX2TCCC024**

Testing Commenced: 2023-09-29

Testing Ended: 2023-12-22

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**



Order Number: F2P30494A

Applicant: TeraCode Inc.
Model: TCCC024

Evaluation Conducted by:

Julius Chiller, Senior Wireless Project Engineer

Report Reviewed by:

Ken Littell, Vice President of Operations

F2 Labs
26501 Ridge Road
Damascus, MD 20872
Ph 301.253.4500

F2 Labs
16740 Peters Road
Middlefield, OH 44062
Ph 440.632.5541

F2 Labs
8583 Zionsville Road
Indianapolis, IN 46268
Ph 317.610.0611

This test report may be reproduced in full; partial reproduction only may be made with the written consent of F2 Labs. The results in this report apply only to the equipment tested.



TABLE OF CONTENTS

1	<u>ADMINISTRATIVE INFORMATION</u>
2	<u>SUMMARY OF TEST RESULTS/MODIFICATIONS</u>
3	<u>TABLE OF MEASURED RESULTS</u>
4	<u>ENGINEERING STATEMENT</u>
5	<u>EUT INFORMATION AND DATA</u>
6	<u>LIST OF MEASUREMENT INSTRUMENTATION</u>
7	<u>OCCUPIED BANDWIDTH</u>
8	<u>FIELD STRENGTH OF EMISSIONS / SPURIOUS EMISSIONS</u>
9	<u>VARIATION OF THE INPUT POWER</u>
10	<u>CONDUCTED EMISSIONS</u>
11	<u>PHOTOGRAPH(S) - TEST SETUPS</u>



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.



Order Number: F2P30494A

Applicant: TeraCode Inc.
Model: TCCC024

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P30494A-01E	First Issue	2023-12-28	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

Modifications Made to the Equipment
None

Power Setting
8dBm



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	88.1 dB μ V/m, 25.4 mV/m	88.6 dB μ V/m, 26.9 mV/m	87.7 dB μ V/m, 24.3 mV/m
Average Field Strength of Fundamental	Modulation: 2Mbps	80.4 dB μ V/m, 10.5 mV/m	80.4 dB μ V/m, 10.5 mV/m	80.4 dB μ V/m, 10.5 mV/m
Average Limit for Fundamental		50 millivolts/meter (93.97 dB μ V/m)	50 millivolts/meter (93.97 dB μ V/m)	50 millivolts/meter (93.97 dB μ V/m)
-20dB Occupied Bandwidth	1Mbps	1.152 MHz	1.131 MHz	1.129 MHz
	2Mbps	2.146 MHz	2.120 MHz	2.120 MHz
99% Occupied Bandwidth	1Mbps	1.05 MHz	1.051 MHz	1.062 MHz
	2Mbps	2.045 MHz	2.060 MHz	2.070 MHz
Variation of the Input Power	-15%	85.2dBuV/m, 18.2mV/m	---	85.8dBuV/m, 19.5mV/m
	+15%	85.6dBuV/m, 19.1mV/m	---	86.2dBuV/m, 18.2mV/m



4 ENGINEERING STATEMENT

This report has been prepared on behalf of TeraCode 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: Communication Card – Bluetooth Radio

Model: TCCC024

Serial No.: TCCC024-63294153DA022CF8

Firmware: v14.0.10

Hardware: v2.4

FCC ID: 2BCX2TCCC024

5.2 Trade Name:

TeraCode Inc.

5.3 Power Supply:

3.3VAC from AC Adapter

5.4 Applicable Rules:

CFR 47, Part 15.249, subpart C

5.5 Antenna:

Integral

5.6 Accessories:

Device	Manufacturer	Model Number	Serial Number
Serial Converter	Moyina	FT232	None Specified
Power Supply	CUI	SW16-3.3N	None Specified

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. Radio was controlled using Nordic NRF Connect software v4.2.1.

**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/C L318	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: 2023-09-29 to 2023-10-02		
Software:	EMC 32, Version 8.53.0		Software Verified: 2023-09-29 to 2023-10-02		
Spectrum Analyzer	0204	Hewlett Packard	HP8591A	3149A02546	2024-04-11
Software:	EMC Analyzer 8712D Rev. A.00.01			Date Verified	2023-09-29
Transient Limiter	0202	Hewlett Packard	11947A	3107A00729	2024-04-11
Software:	Tile Version 3.4.B.3.		Software Verified: 2023-09-29		
LISN	CL181	Com-Power	LI-125A	191226	2026-11-20
LISN	CL182	Com-Power	LI-125A	191225	2026-11-21
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.

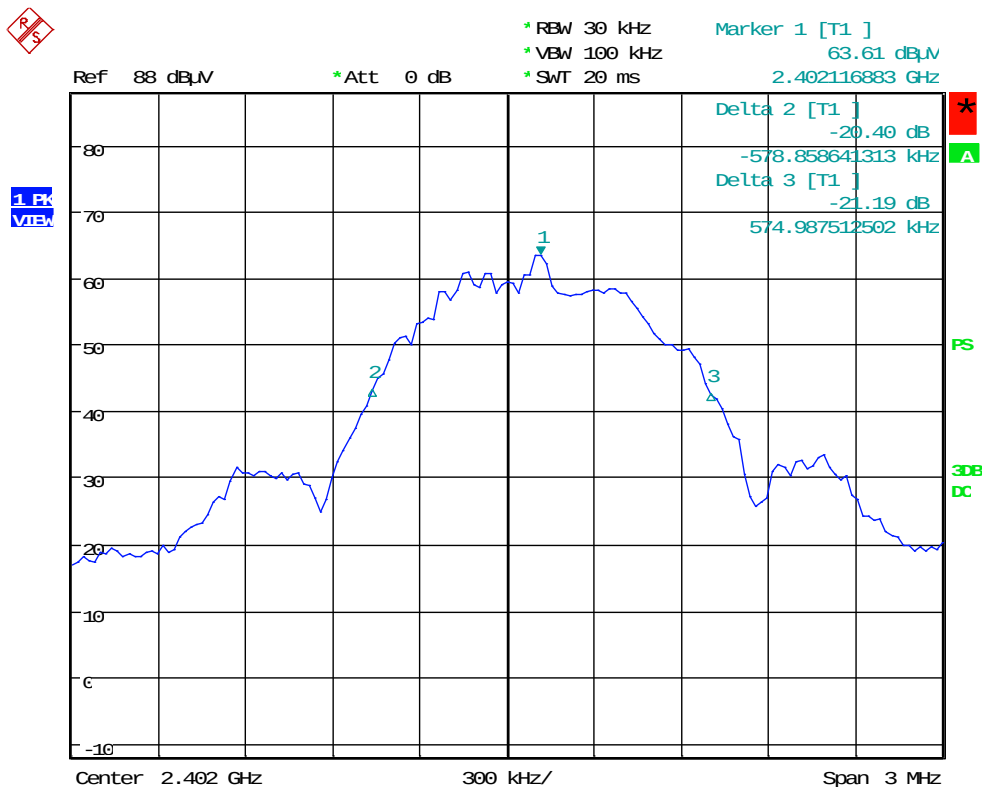
Bandwidth measurements were made at the low (2.402 GHz), mid (2.440 GHz) and upper (2.480 GHz) frequencies. The bandwidth was measured using the analyzer's marker function.



7.2 Occupied Bandwidth Test Data

Test Date(s):	2023-09-29	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	20.5°C
		Relative Humidity:	58%

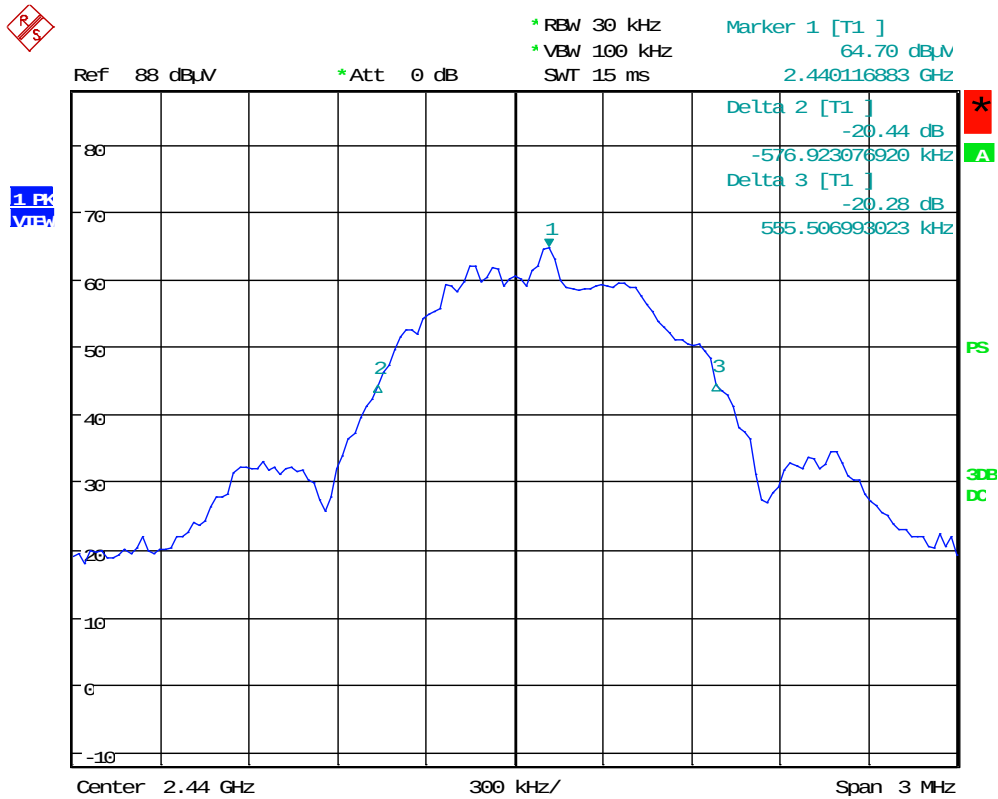
1Mbps: -20dB, Low Channel



Date: 29.SEP.2023 10:48:41



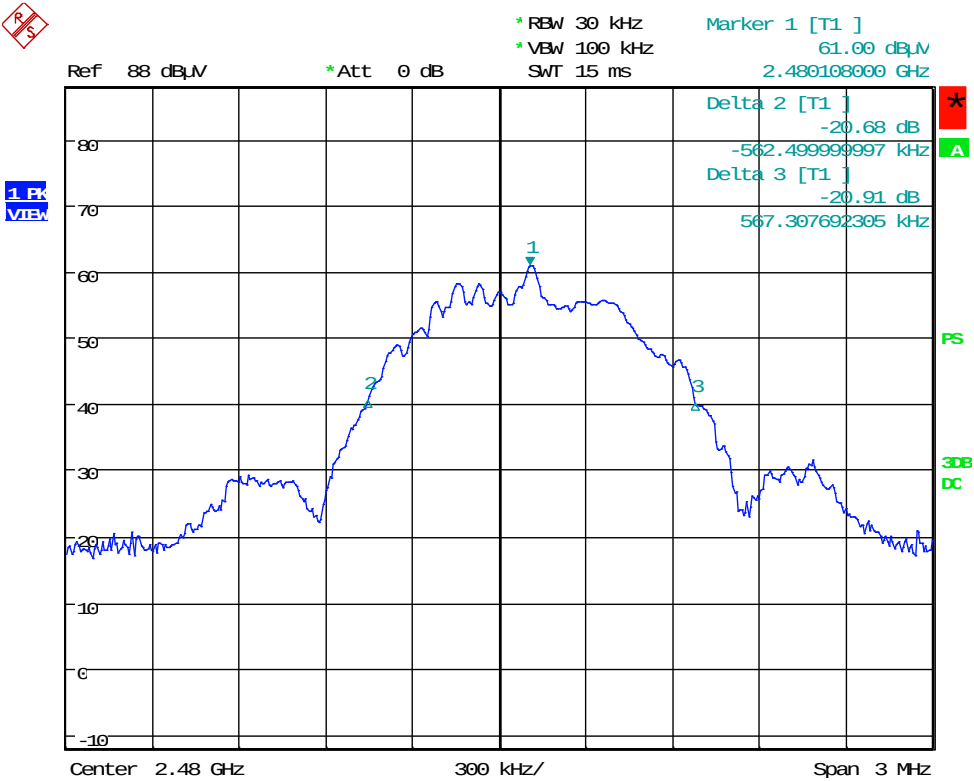
1Mbps: -20dB, Mid Channel



Date: 29.SEP.2023 10:56:27



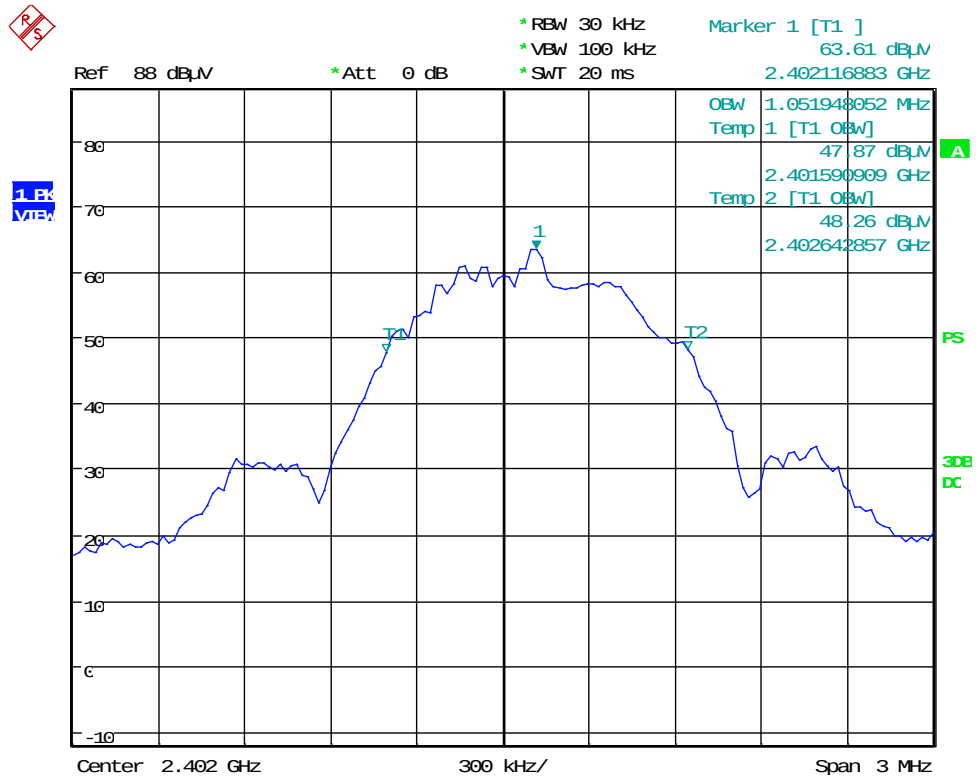
1Mbps: -20dB, High Channel



Date: 29.SEP.2023 11:04:45

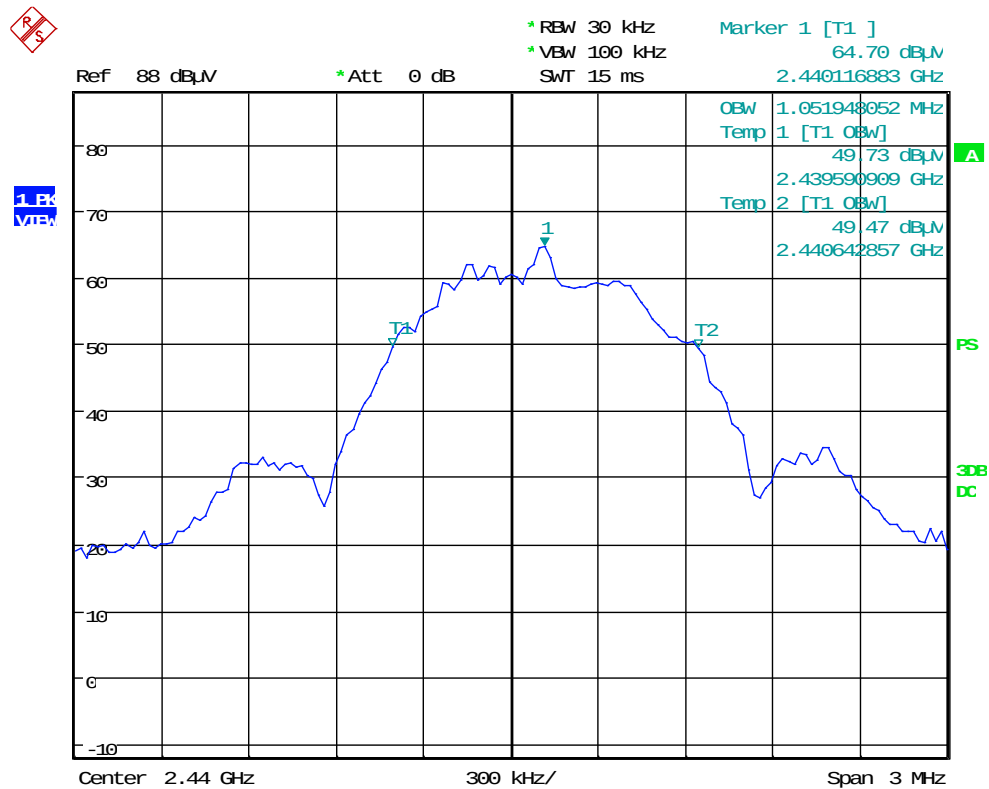


1Mbps: 99%, Low Channel



Date: 29.SEP.2023 10:47:54

1Mbps: 99%, Mid Channel



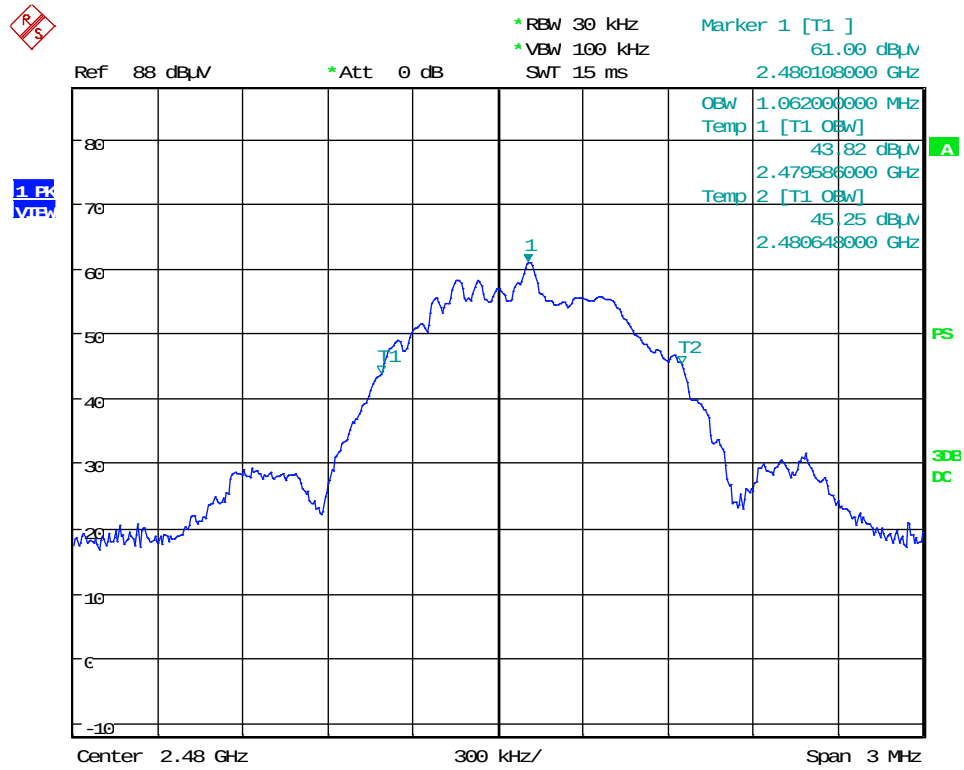
Date: 29.SEP.2023 10:55:47



Order Number: F2P30494A

Applicant: TeraCode Inc.
Model: TCCC024

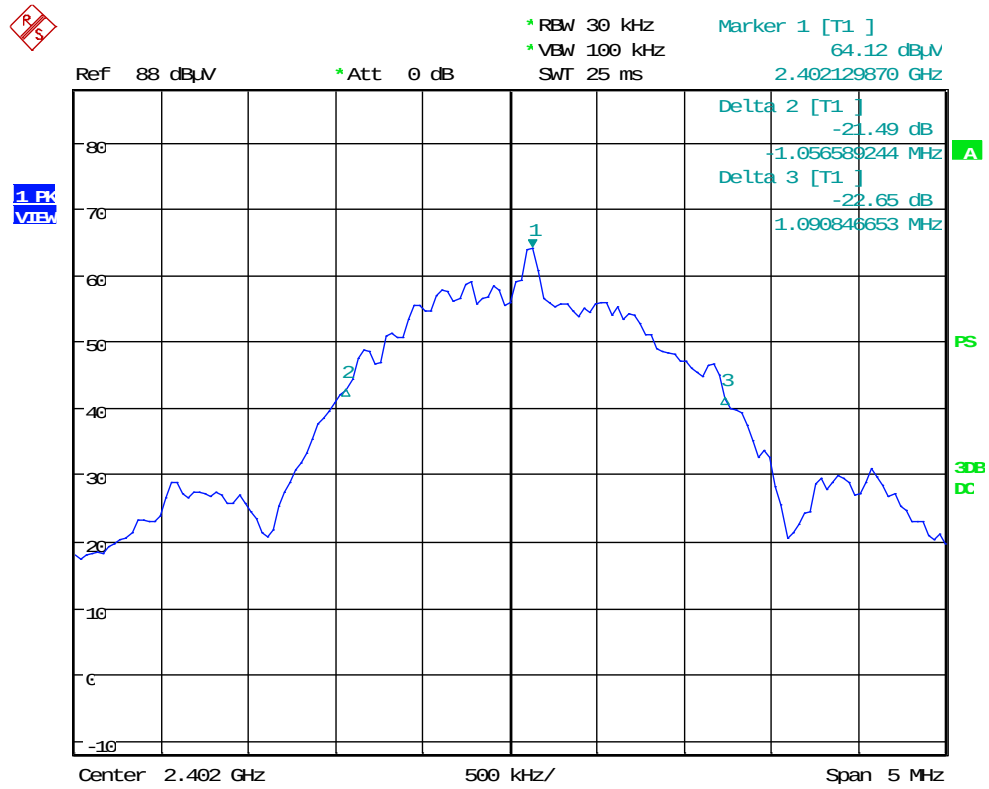
1Mbps: 99%, High Channel



Date: 29.SEP.2023 11:04:08



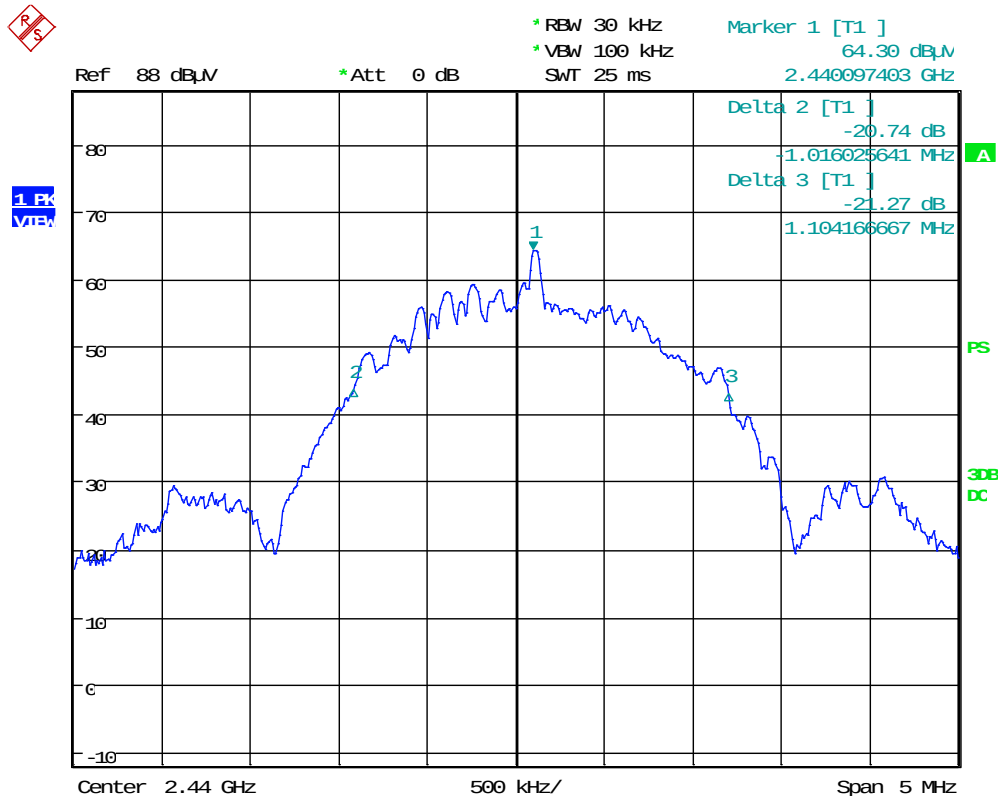
2Mbps: -20dB, Low Channel



Date: 29.SEP.2023 10:52:19



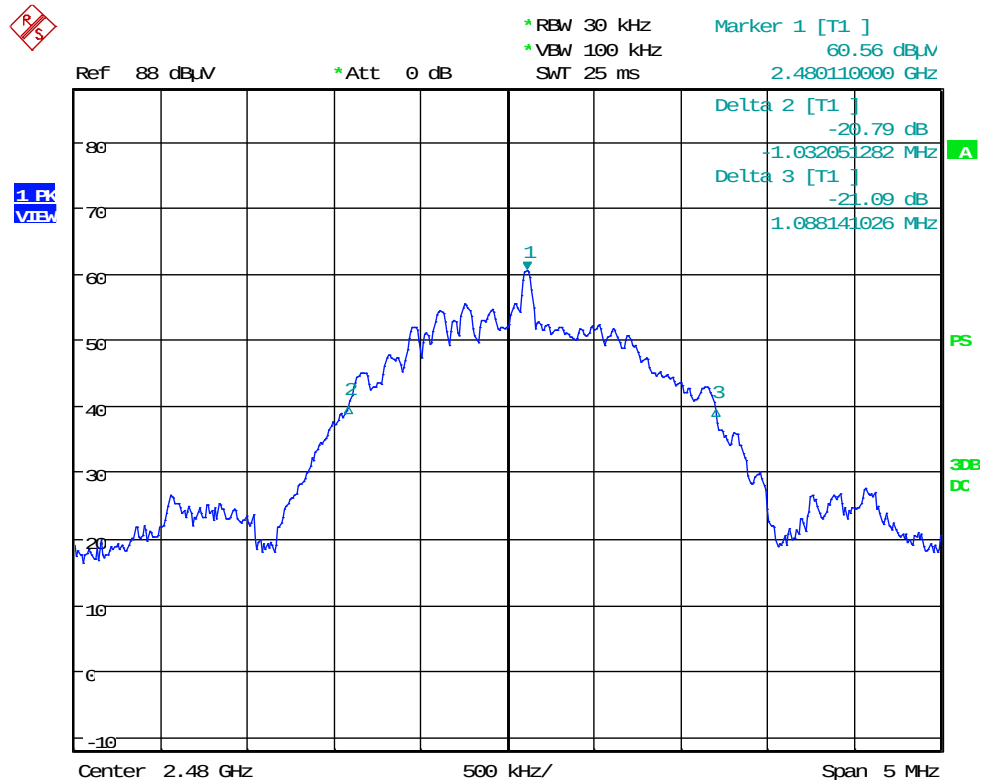
2Mbps: -20dB, Mid Channel



Date: 29.SEP.2023 11:00:12



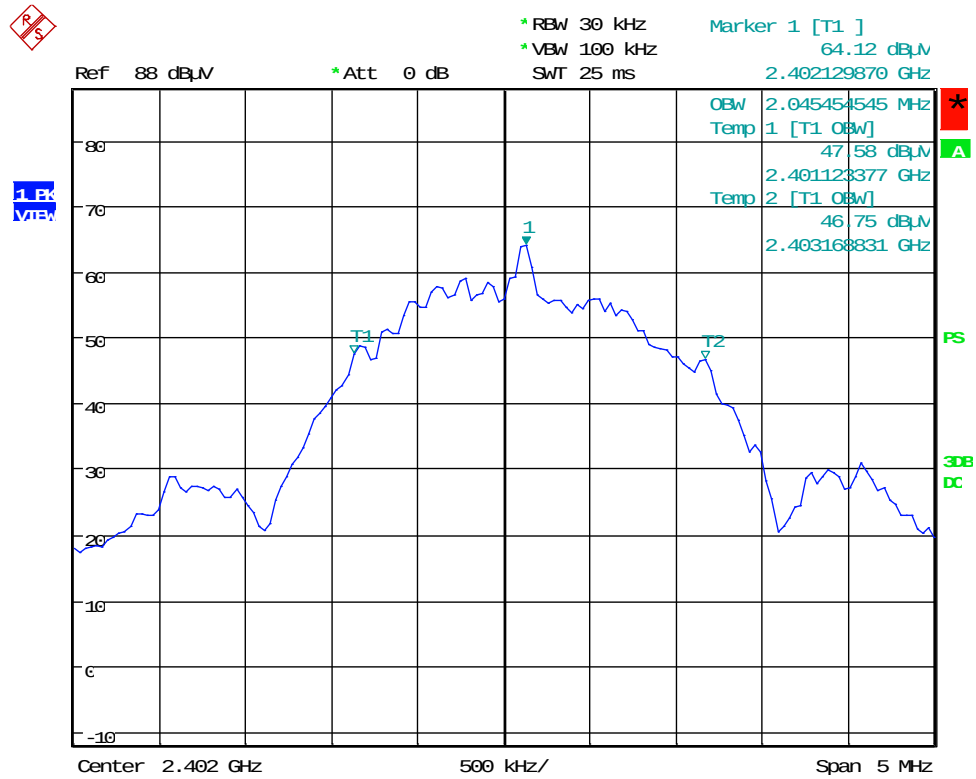
2Mbps: -20dB, High Channel



Date: 29.SEP.2023 11:07:21



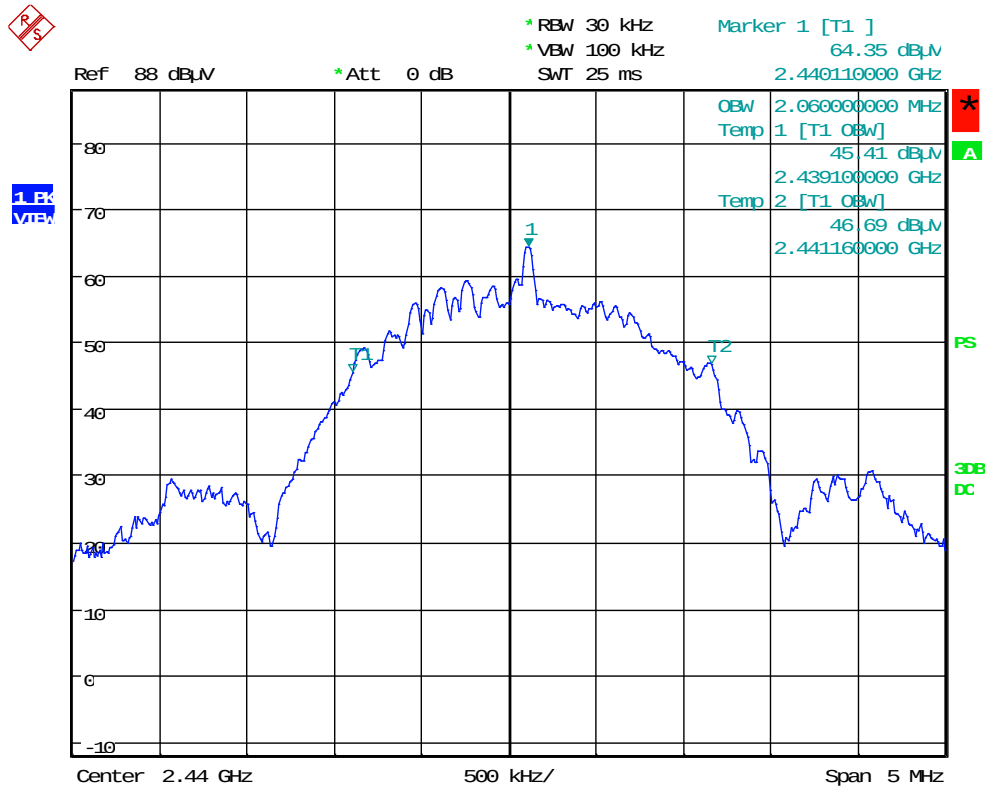
2Mbps: 99%, Low Channel



Date: 29.SEP.2023 10:53:42



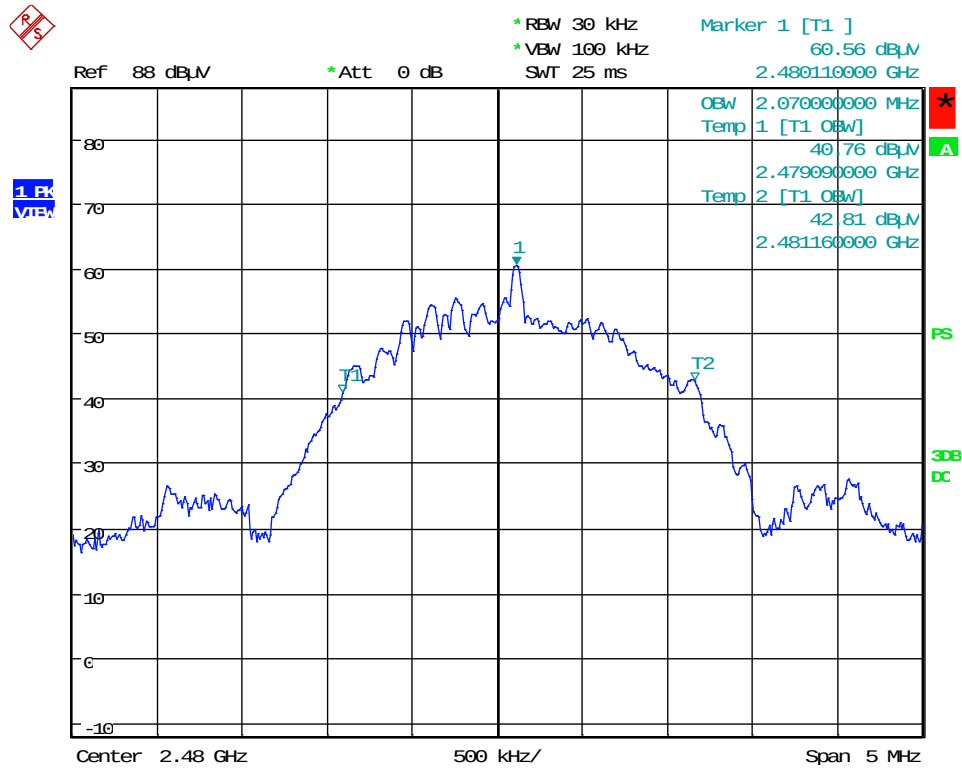
2Mbps: 99%, Mid Channel



Date: 29.SEP.2023 11:01:14



2Mbps: 99%, High Channel



Date: 29.SEP.2023 11:08:21



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.

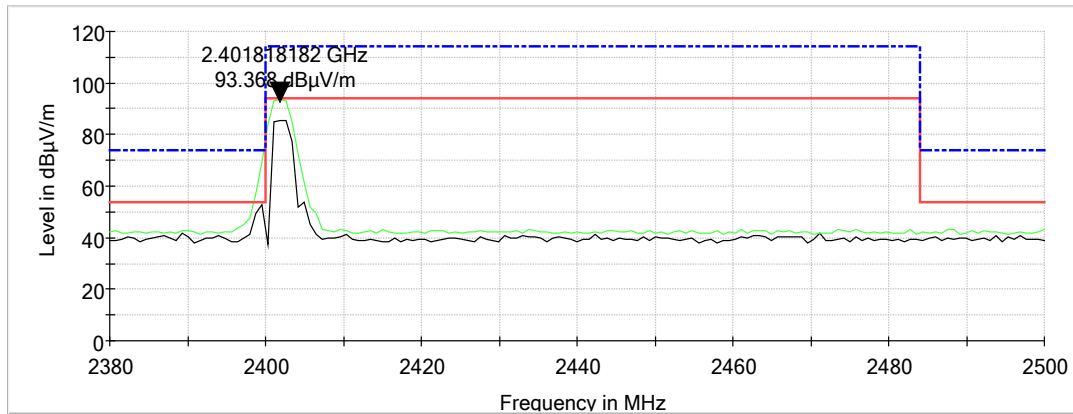
Power was set to 8dBm.



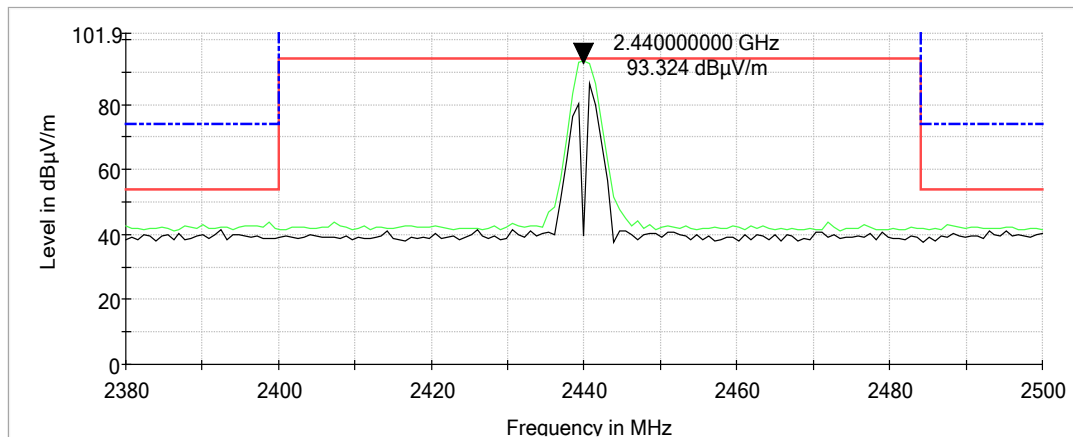
8.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date(s):	2023-09-29; 2023-12-22	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(a)	Air Temperature:	21.3°C; 21.7 °C
		Relative Humidity:	47%; 44%

1Mbps: Low Band Edge: Vertical

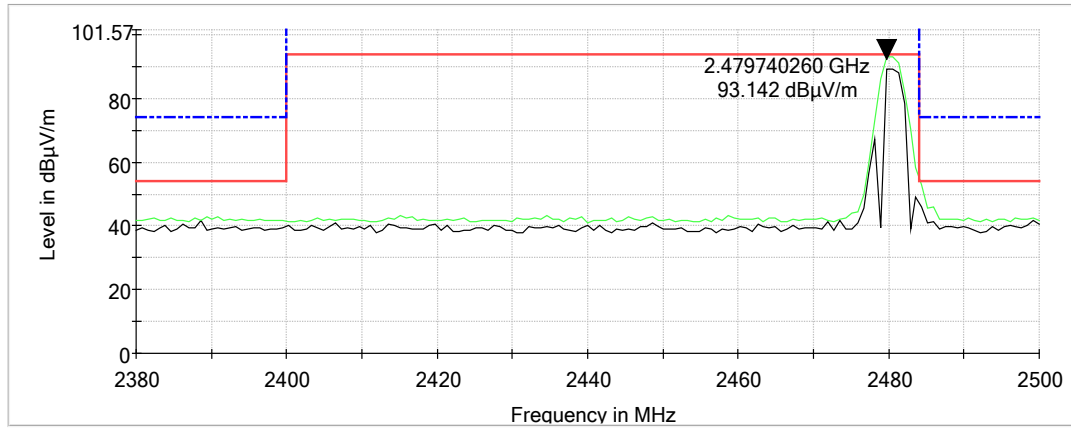


1Mbps: Mid Channel: Vertical

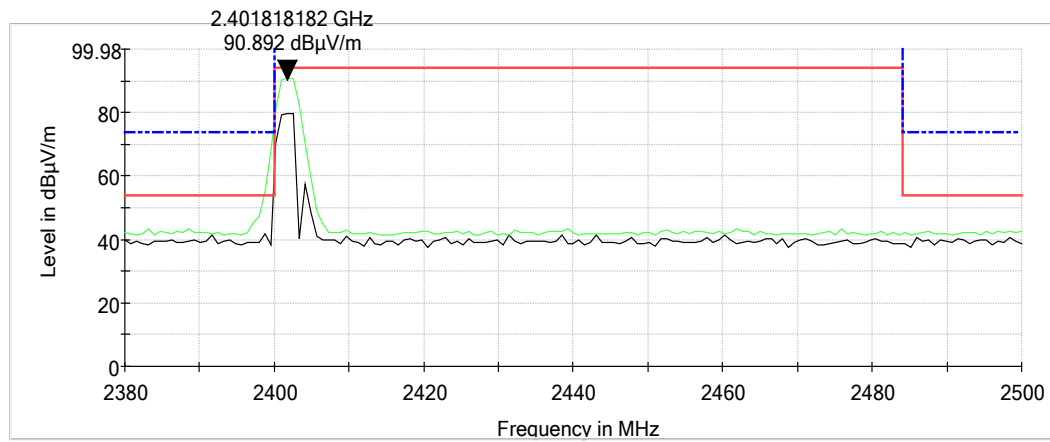




1Mbps: Upper Band Edge: Vertical

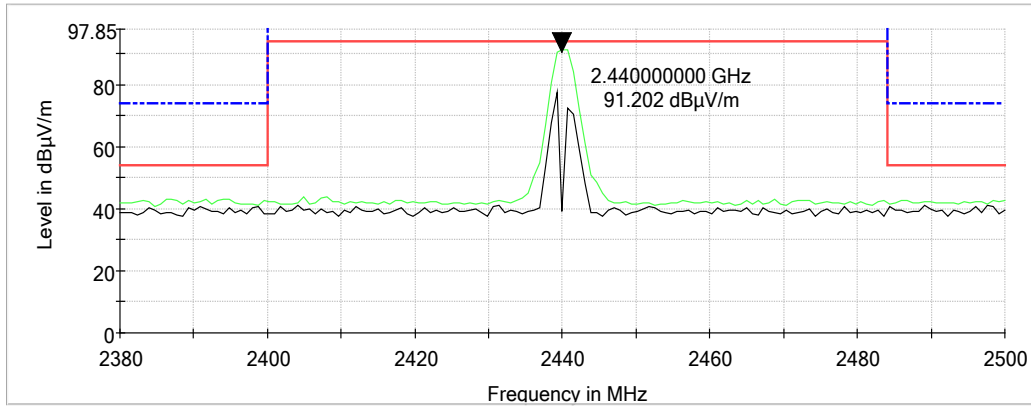


1Mbps: Low Band Edge: Horizontal

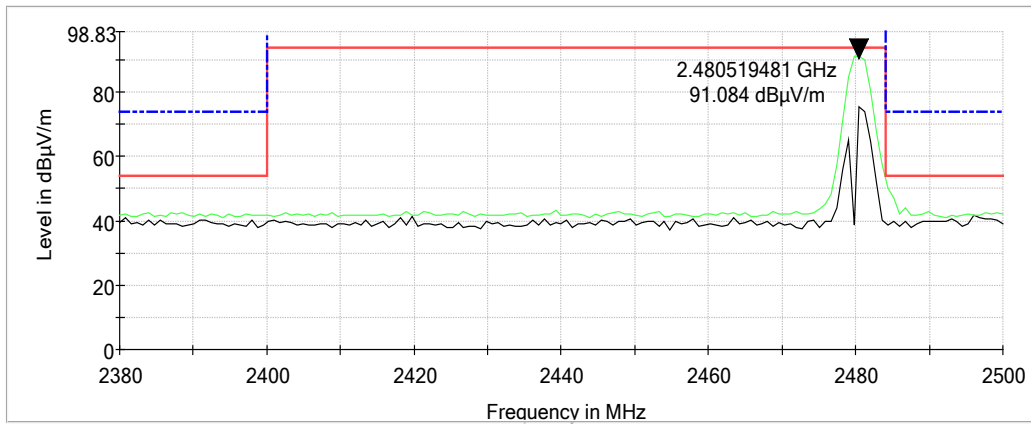




1Mbps: Mid Channel: Horizontal

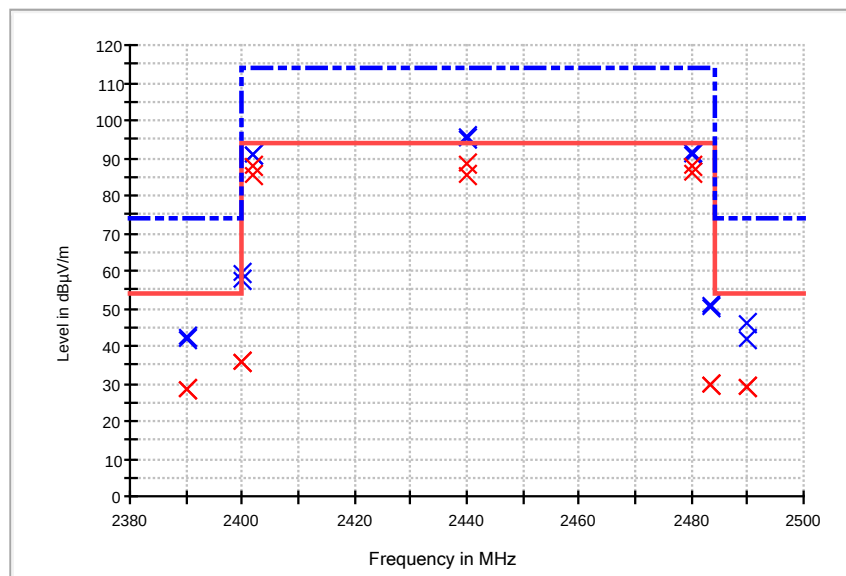


1Mbps: Upper Band Edge: Horizontal



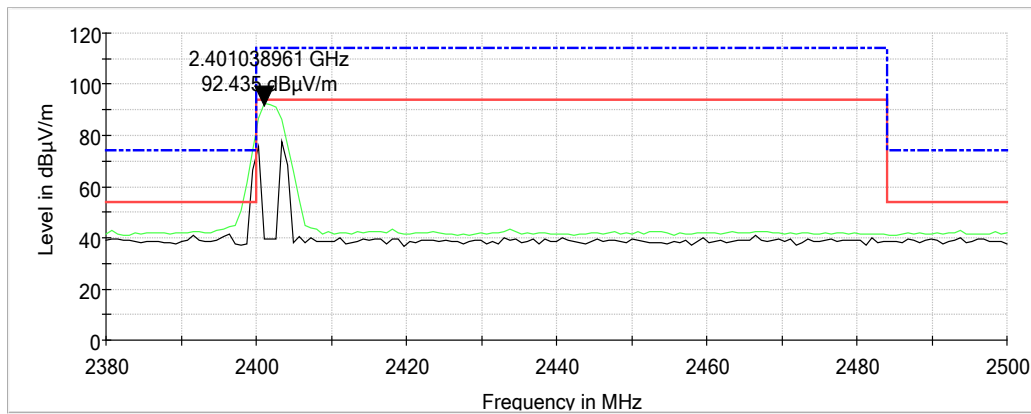
**1Mbps: Band Edge and Field Strength of the Fundamentals**

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBμV/m)
2390.000000	41.7	28.4	1000.0	1000.000	184.0	H	0.0	6.9	25.6	54.0
2390.000000	42.5	28.4	1000.0	1000.000	200.0	V	71.0	6.9	25.6	54.0
2400.000000	59.1	35.9	1000.0	1000.000	200.0	V	71.0	6.9	18.1	54.0
2400.000000	57.5	35.6	1000.0	1000.000	184.0	H	0.0	6.9	18.4	54.0
2402.000000	91.1	85.7	1000.0	1000.000	184.0	H	0.0	6.9	8.3	94.0
2402.000000	91.1	88.1	1000.0	1000.000	200.0	V	71.0	6.9	5.9	94.0
2440.000000	95.8	85.4	1000.0	1000.000	176.0	H	0.0	6.9	8.6	94.0
2440.000000	95.0	88.6	1000.0	1000.000	200.0	V	50.0	6.9	5.4	94.0
2480.000000	91.6	87.7	1000.0	1000.000	150.0	V	180.0	6.9	6.3	94.0
2480.000000	90.9	85.9	1000.0	1000.000	150.0	H	357.0	6.9	8.1	94.0
2483.500000	50.2	29.8	1000.0	1000.000	150.0	V	180.0	6.9	24.2	54.0
2483.500000	50.9	29.9	1000.0	1000.000	176.0	H	357.0	6.9	24.1	54.0
2490.000000	41.8	28.8	1000.0	1000.000	150.0	V	180.0	7.0	25.2	54.0
2490.000000	46.3	28.8	1000.0	1000.000	176.0	H	357.0	7.0	25.2	54.0

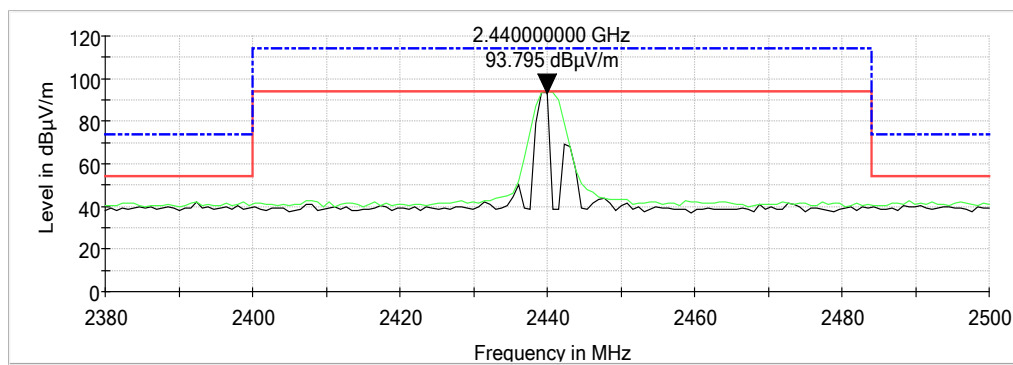




2Mbps: Low Band Edge: Vertical

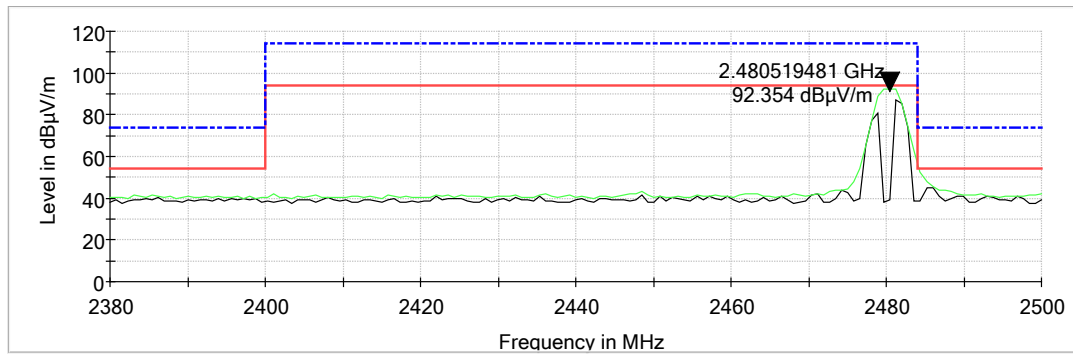


2Mbps: Mid Channel: Vertical

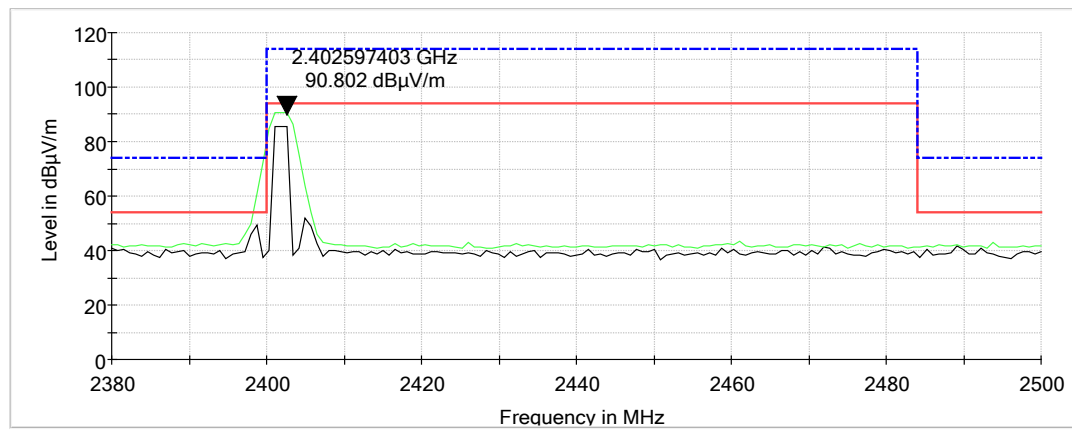




2Mbps: Upper Band Edge: Vertical

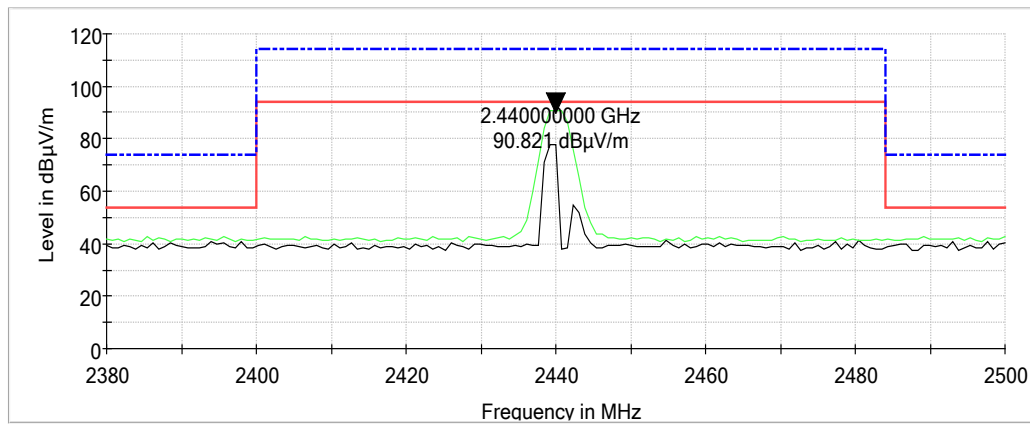


2Mbps: Low Band Edge: Horizontal

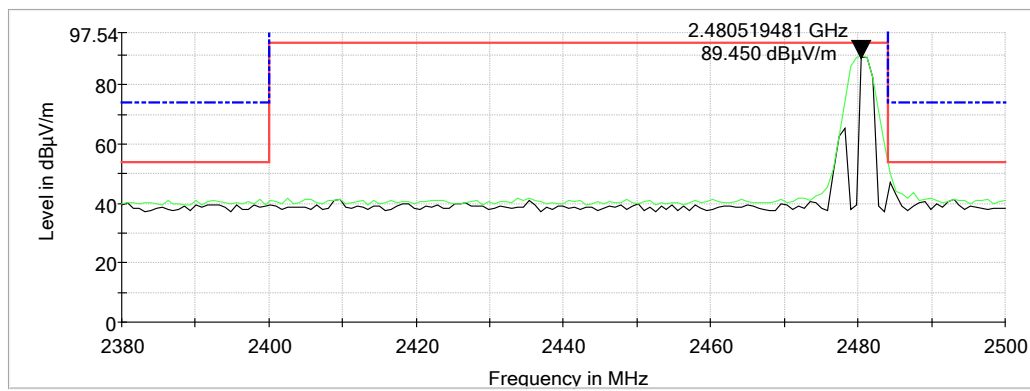




2Mbps: Mid Channel: Horizontal

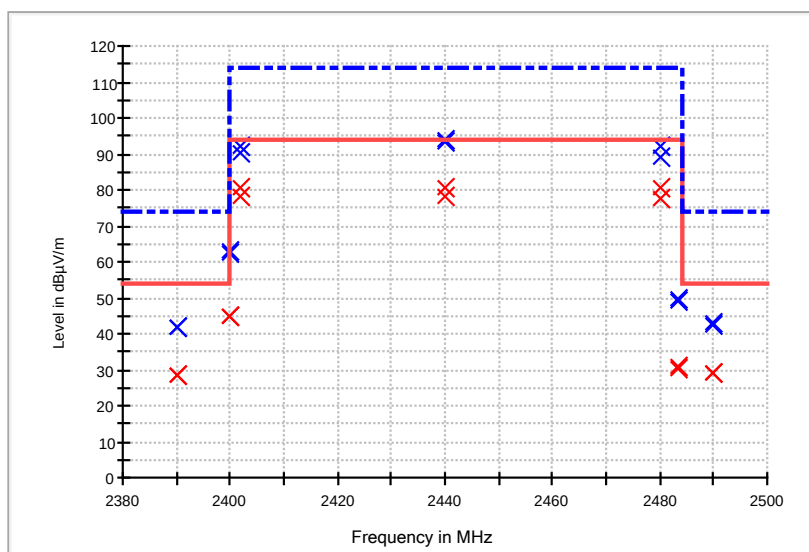


2Mbps: Upper Band Edge: Horizontal



**2Mbps: Band Edge and Field Strength of the Fundamentals**

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/m)
2390.000000	41.8	28.4	1000.0	1000.000	190.0	V	63.0	6.9	25.6	54.0
2390.000000	41.6	28.4	1000.0	1000.000	150.0	H	0.0	6.9	25.6	54.0
2400.000000	62.7	44.6	1000.0	1000.000	150.0	H	0.0	6.9	19.4	54.0
2400.000000	63.1	44.9	1000.0	1000.000	190.0	V	63.0	6.9	9.1	54.0
2402.000000	92.3	80.4	1000.0	1000.000	190.0	V	63.0	6.9	13.6	94.0
2402.000000	90.1	78.3	1000.0	1000.000	150.0	H	352.0	6.9	15.7	94.0
2440.000000	93.6	80.4	1000.0	1000.000	190.0	V	43.0	6.9	13.6	94.0
2440.000000	94.1	78.2	1000.0	1000.000	210.0	H	0.0	6.9	15.8	94.0
2480.000000	89.2	77.3	1000.0	1000.000	150.0	H	0.0	6.9	16.7	94.0
2480.000000	92.2	80.4	1000.0	1000.000	190.0	V	262.0	6.9	13.6	94.0
2483.500000	50.0	30.3	1000.0	1000.000	150.0	H	0.0	6.9	23.7	54.0
2483.500000	49.0	30.8	1000.0	1000.000	190.0	V	261.0	7.0	23.2	54.0
2490.000000	42.5	29.0	1000.0	1000.000	150.0	H	0.0	7.0	25.0	54.0
2490.000000	43.3	29.2	1000.0	1000.000	190.0	V	261.0	7.0	24.8	54.0





8.2 Test Data – Spurious Emissions

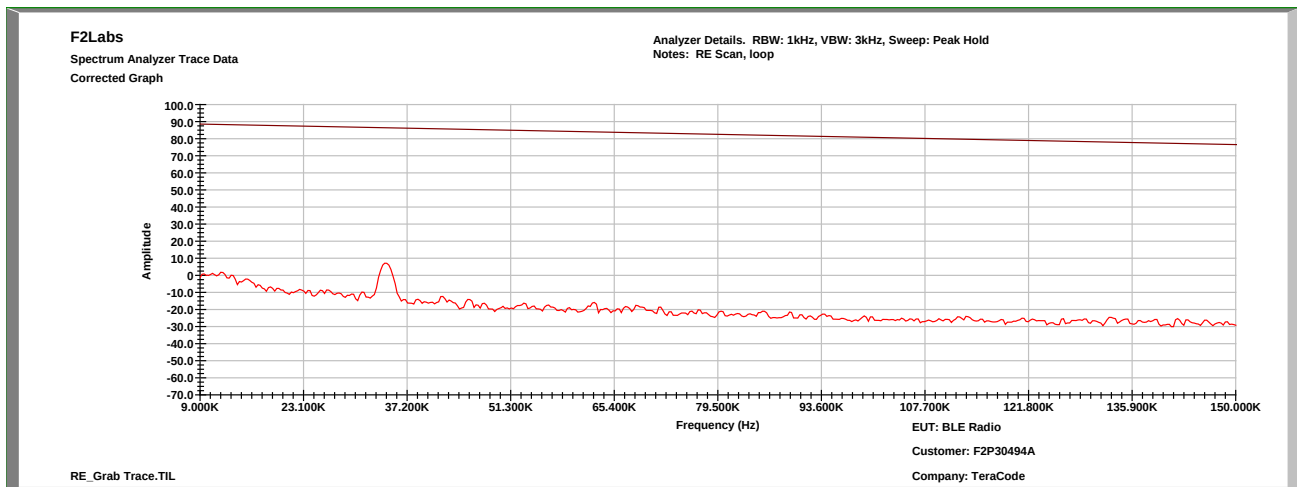
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some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

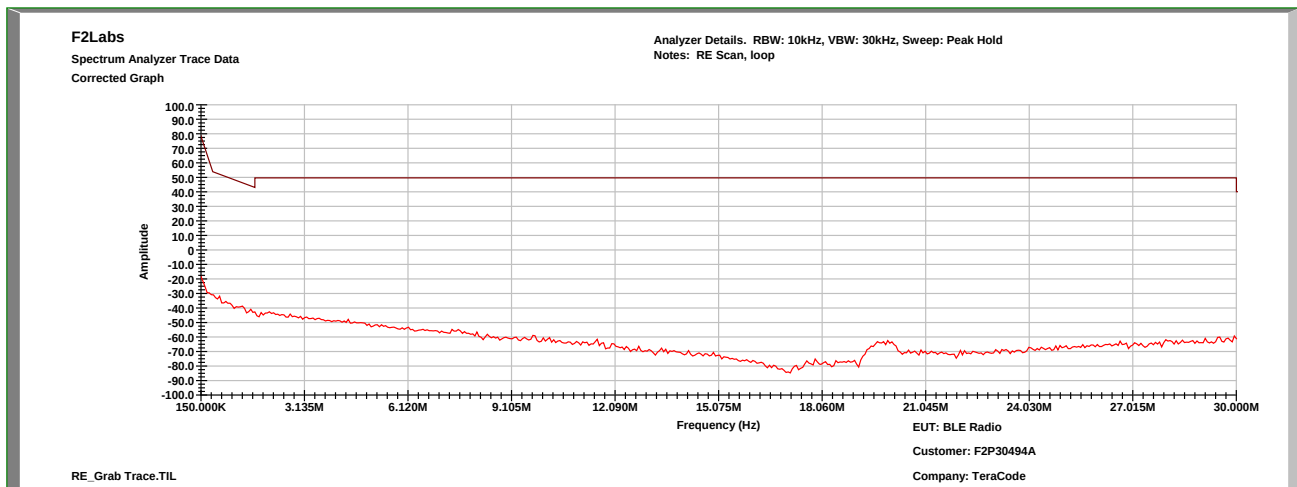


Test Date(s):	2023-09-29; 2023-12-22	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	20.4°C; 21.7 °C
		Relative Humidity:	59%; 44%

Characterization Scan, 9 kHz to 150 kHz



Characterization Scan, 150 kHz to 30 MHz

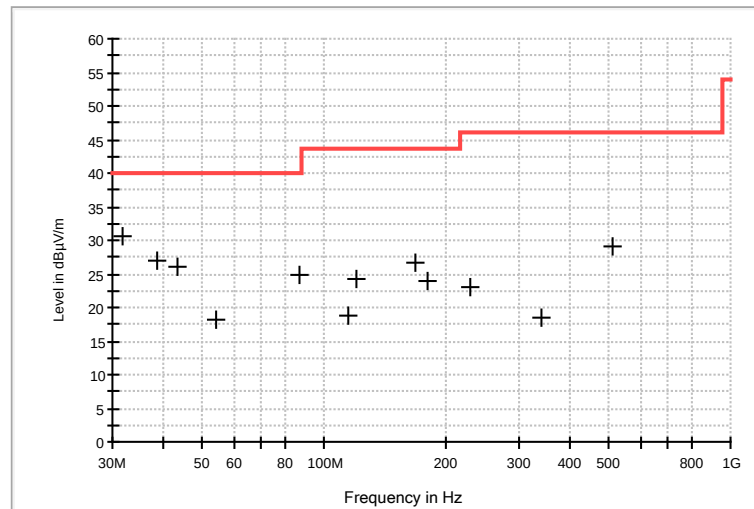




1Mbps: 30 MHz to 1000 MHz

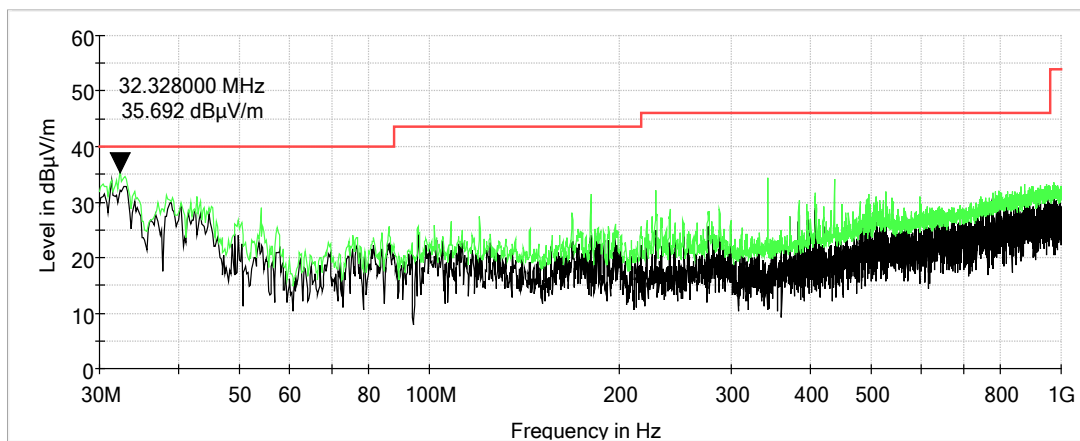
Note: Chart below includes data from all three channels.
No difference between 2Mbps and 1Mbps setting.

Frequency (MHz)	Ant. Pol.	Antenna Height (cm)	Azimuth (degrees)	Reading (dBμV)	Corr. Factors (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
31.960000	V	V	100.00	51.3	-20.7	30.60	40.0	-9.4
38.720000	V	V	100.00	52.8	-25.8	27.00	40.0	-13.0
43.400000	V	V	100.00	55.1	-29.1	26.00	40.0	-14.0
54.040000	V	V	100.00	51.2	-32.9	18.30	40.0	-21.7
86.280000	V	V	100.00	57.6	-32.8	24.80	40.0	-15.2
113.800000	H	H	100.00	45.5	-26.8	18.70	43.5	-24.8
120.000000	V	V	100.00	50.2	-26.1	24.10	43.5	-19.4
167.920000	H	H	100.00	54.4	-27.6	26.80	43.5	-16.7
179.960000	V	V	100.00	52.1	-28.2	23.90	43.5	-19.6
228.280000	V	V	100.00	50.8	-27.9	22.90	46.0	-23.1
343.320000	V	V	100.00	43.0	-24.4	18.60	46.0	-27.4
511.120000	H	H	100.00	50.2	-21.0	29.20	46.0	-16.8

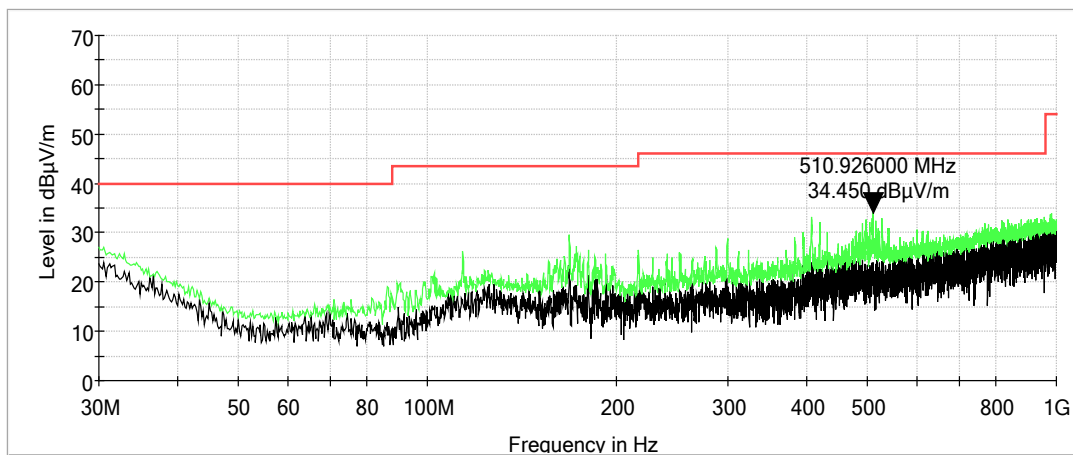




30 MHz to 1000 MHz, Vertical

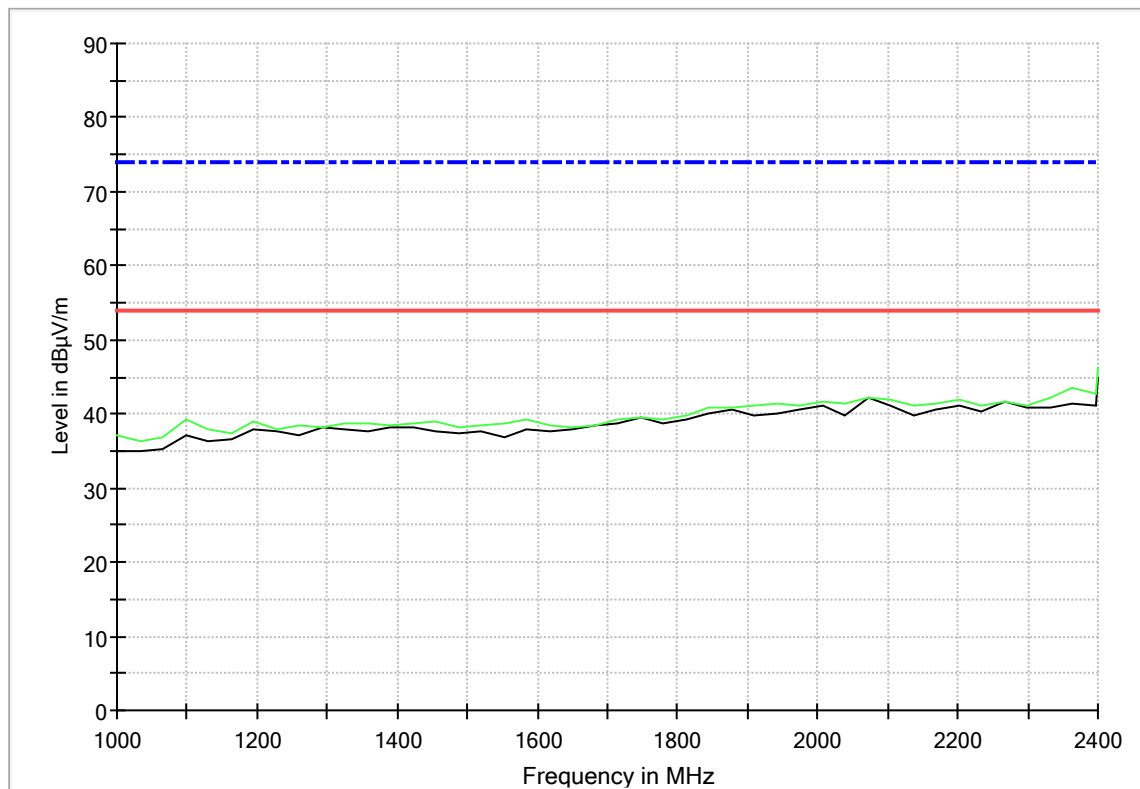


30 MHz to 1000 MHz, Horizontal



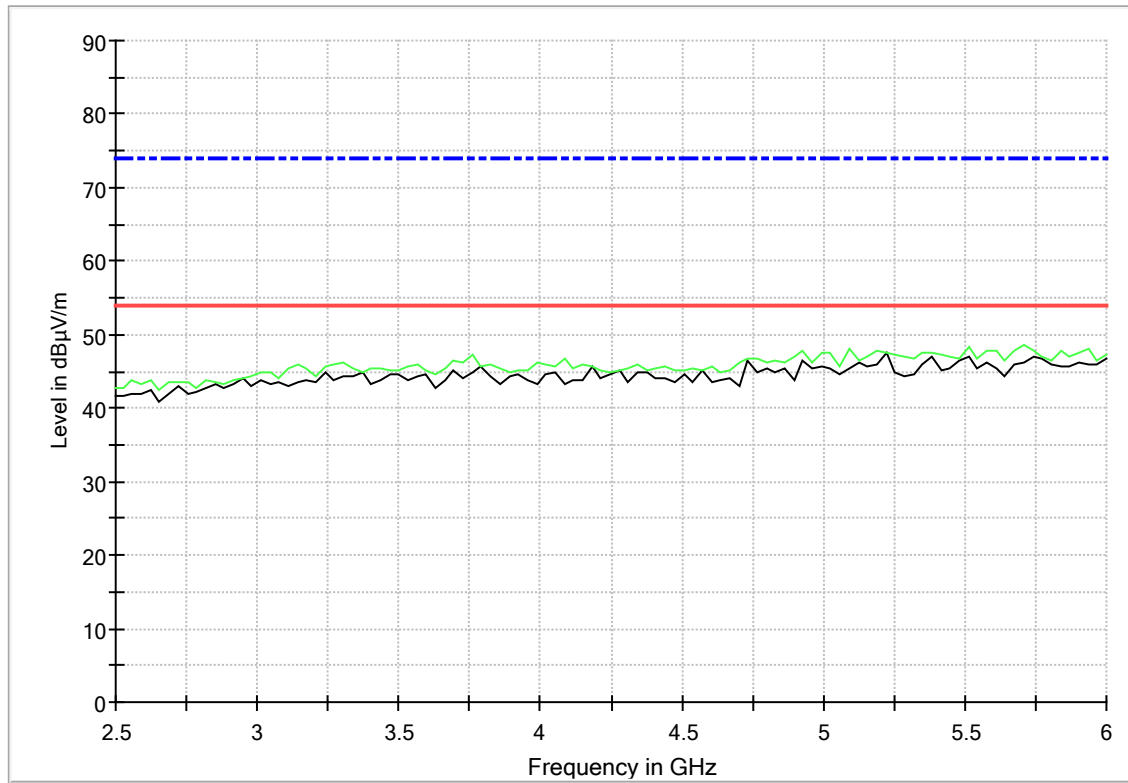


1Mbps: 1 GHz to 2.4 GHz, Vertical



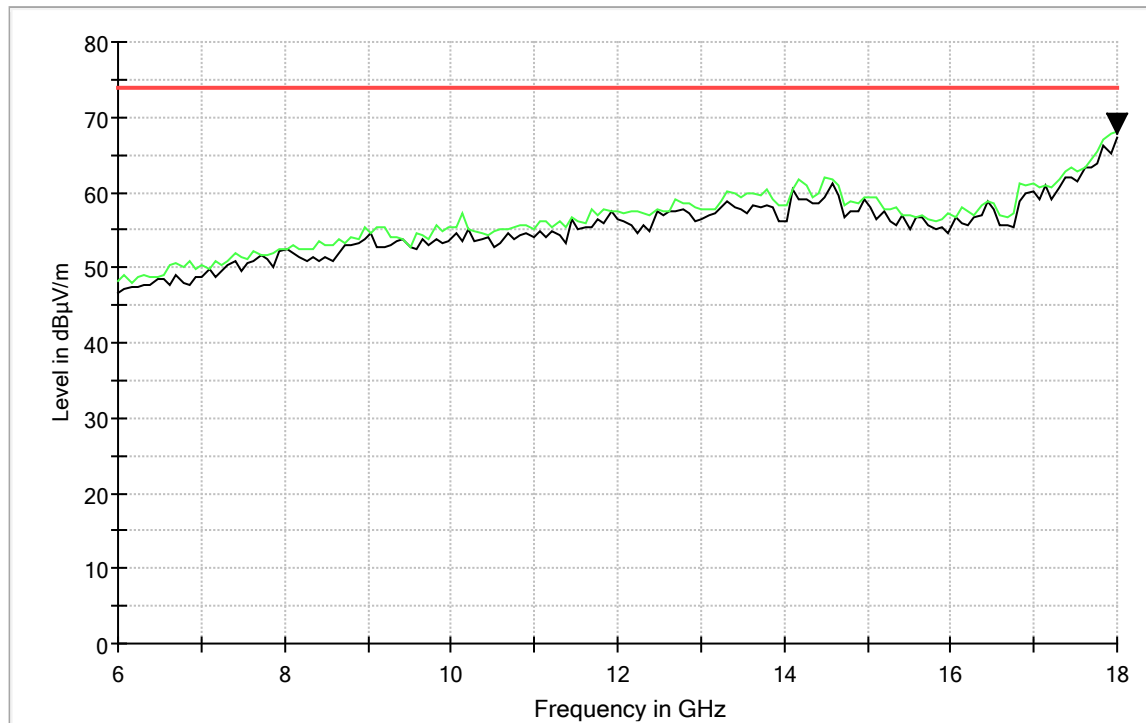


1Mbps: 2.5 GHz to 6 GHz, Vertical





1Mbps: 6 GHz to 18 GHz, Vertical

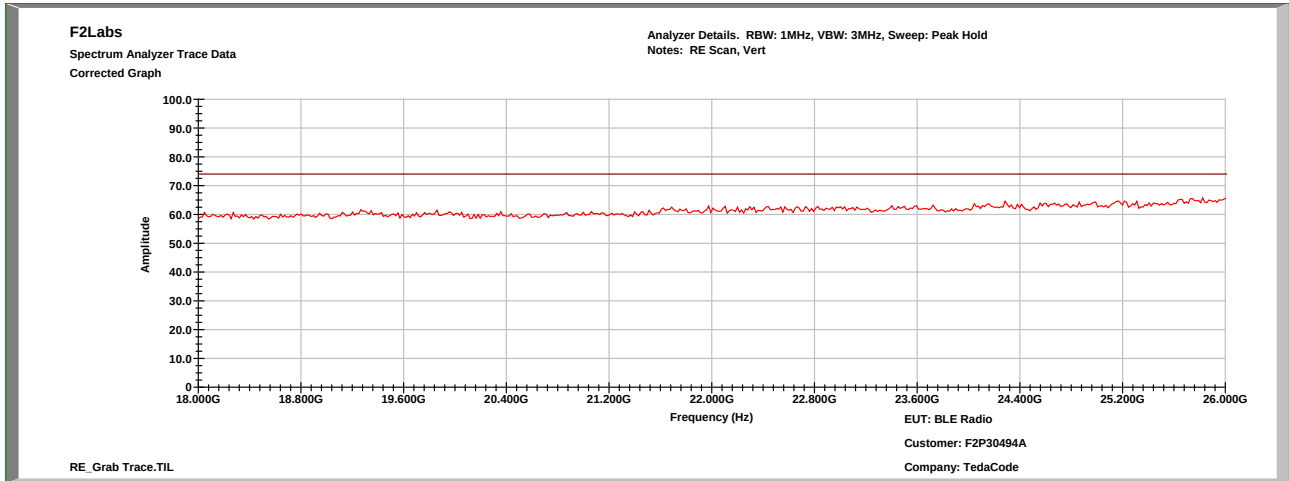




Order Number: F2P30494A

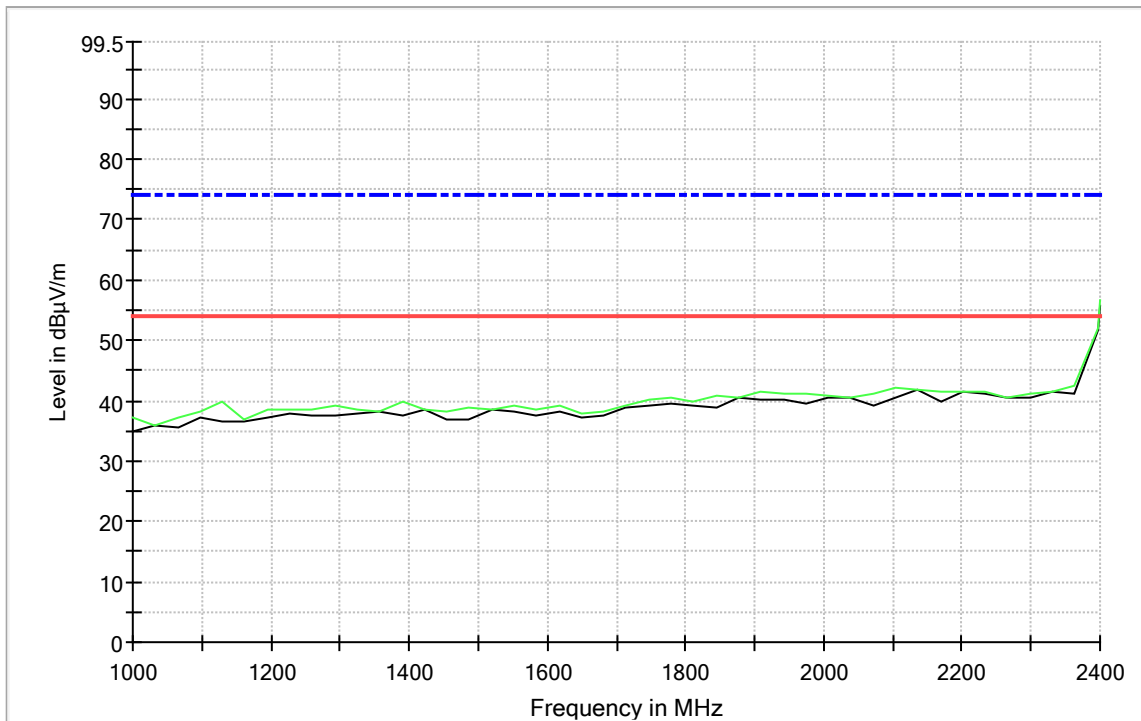
Applicant: TeraCode Inc.
Model: TCCC024

1Mbps: 18 GHz to 26 GHz, Vertical



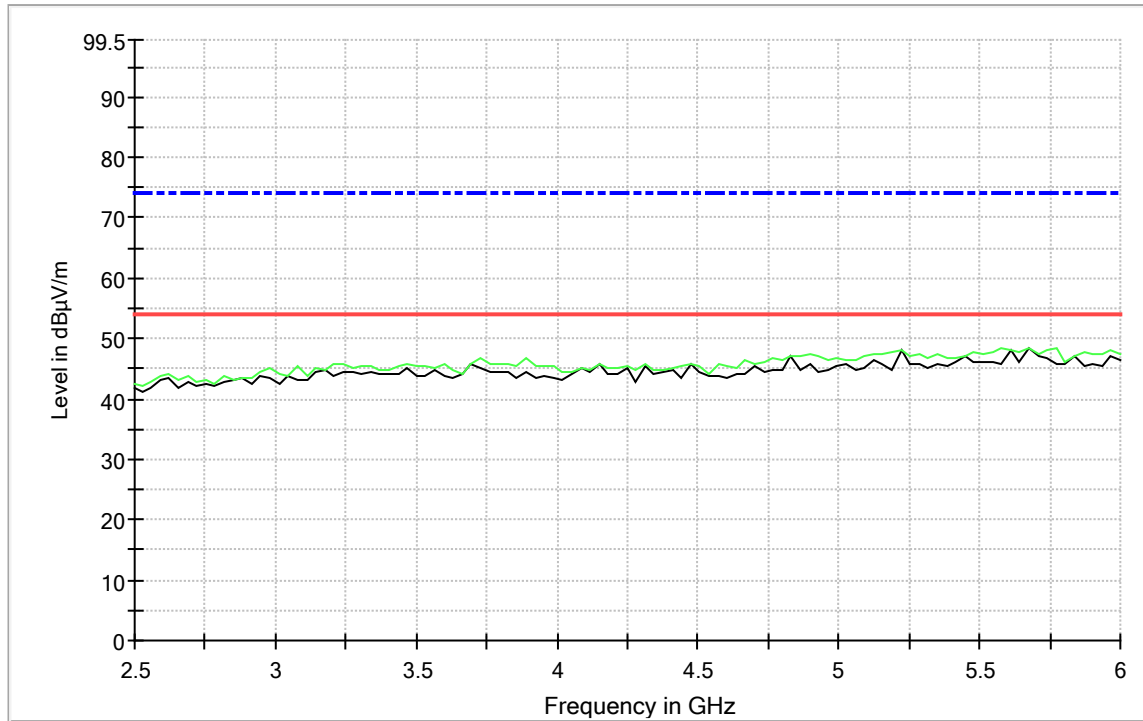


1Mbps: 1 GHz to 2.4 GHz, Horizontal



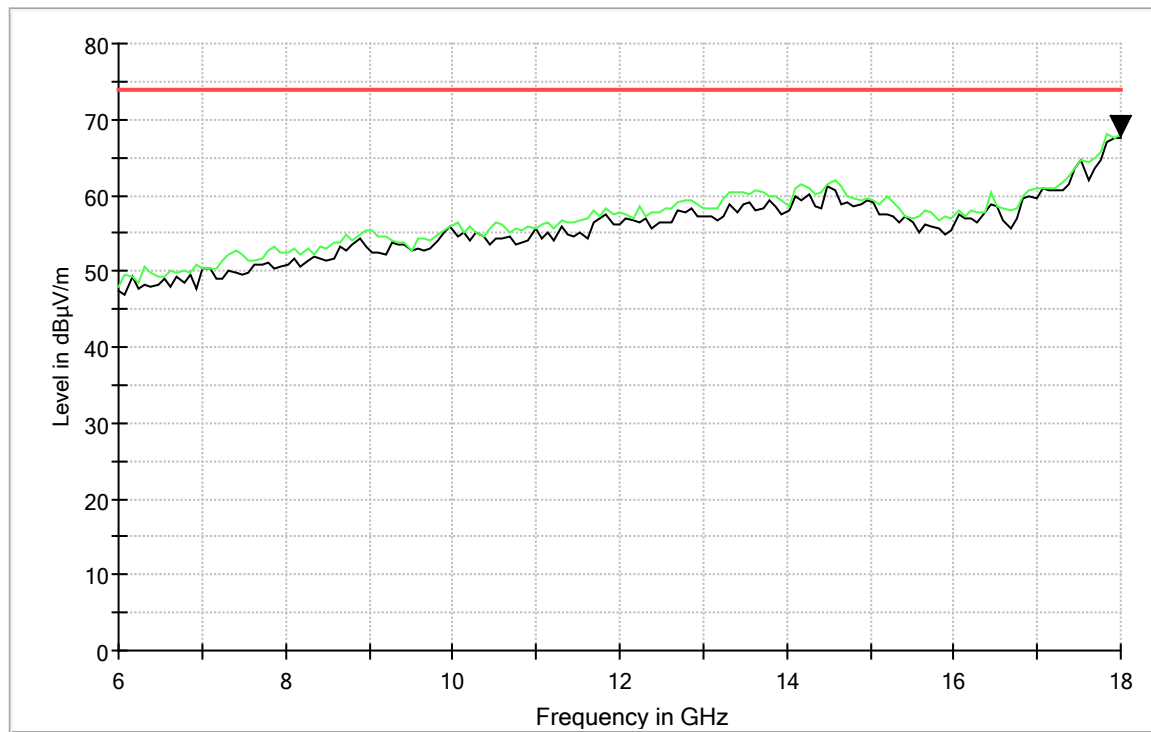


1Mbps: 2.5 GHz to 6 GHz, Horizontal



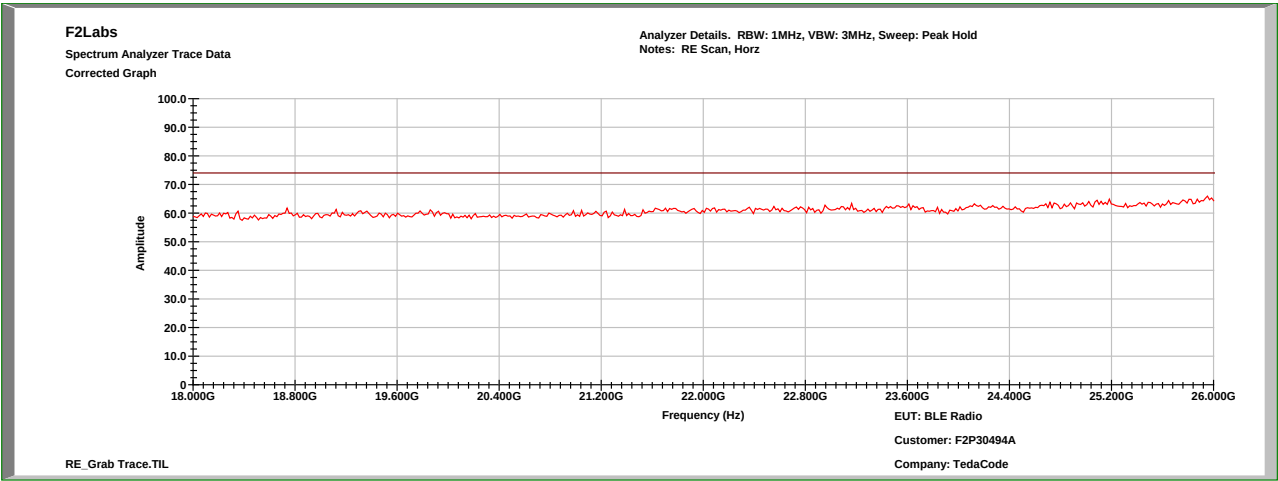


1Mbps: 6 GHz to 18 GHz, Horizontal



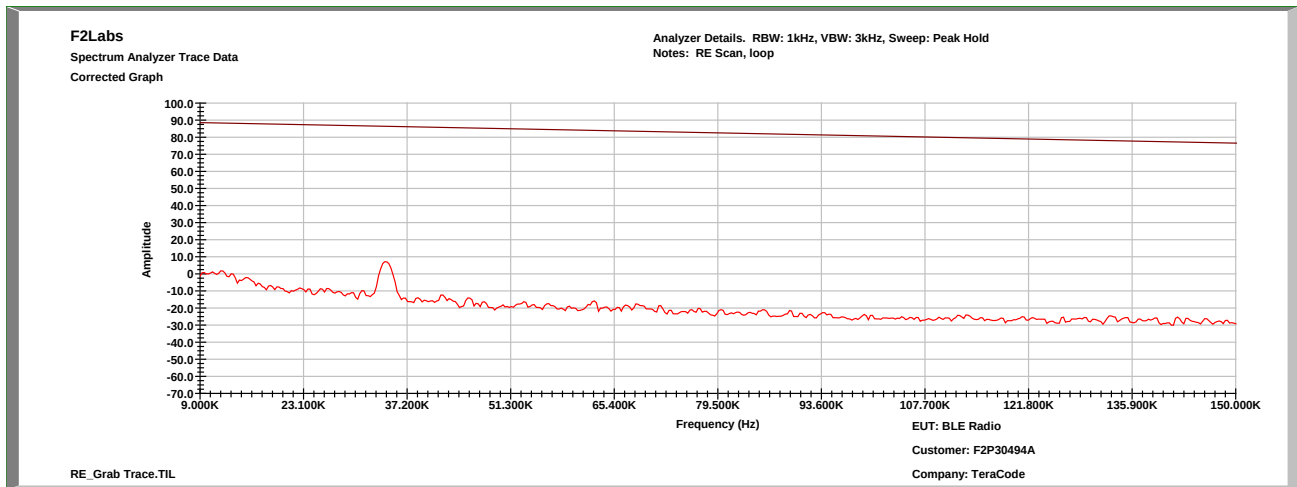


1Mbps: 18 GHz to 26 GHz, Horizontal

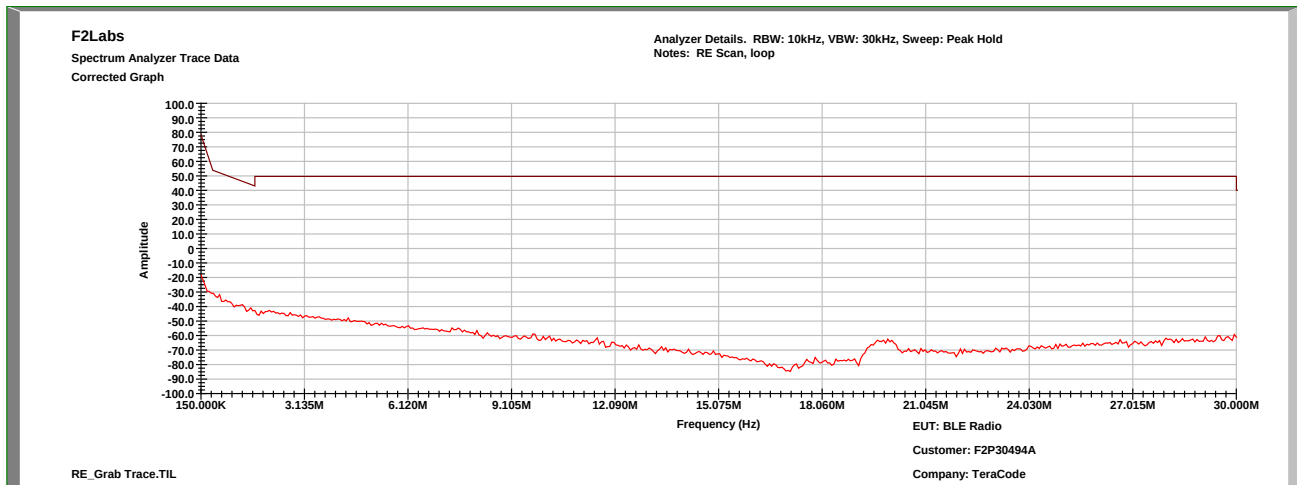




2Mbps: Characterization Scan, 9 kHz to 150 kHz



2Mbps: Characterization Scan, 150 kHz to 30 MHz

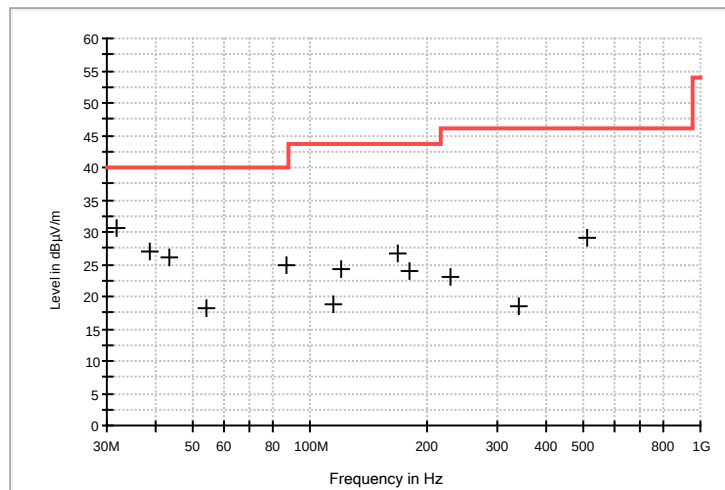




2Mbps: 30 MHz to 1000 MHz

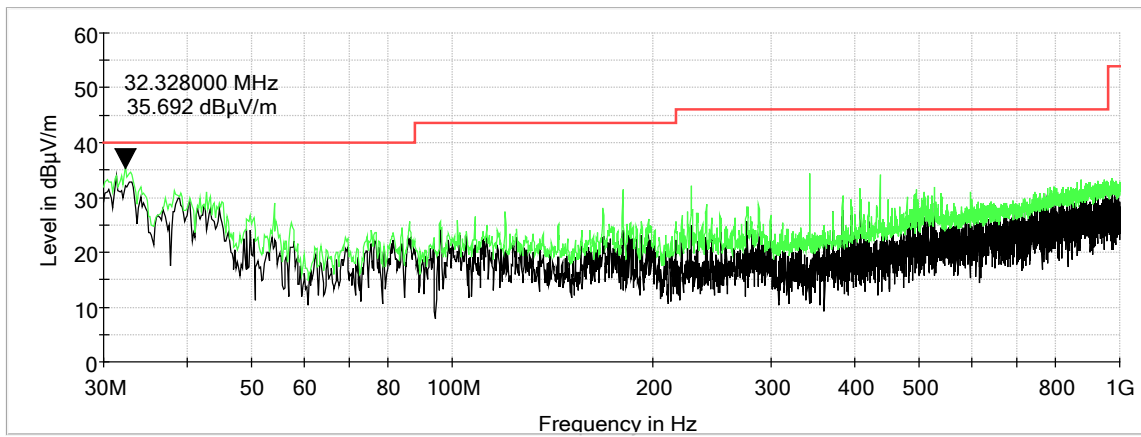
Note: Chart below includes data from all three channels.
No difference between 2Mbps and 1Mbps setting.

Frequency (MHz)	Ant. Pol.	Antenna Height (cm)	Azimuth (degrees)	Reading (dBμV)	Corr. Factors (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
31.960000	V	V	100.00	51.3	-20.7	30.60	40.0	-9.4
38.720000	V	V	100.00	52.8	-25.8	27.00	40.0	-13.0
43.400000	V	V	100.00	55.1	-29.1	26.00	40.0	-14.0
54.040000	V	V	100.00	51.2	-32.9	18.30	40.0	-21.7
86.280000	V	V	100.00	57.6	-32.8	24.80	40.0	-15.2
113.800000	H	H	100.00	45.5	-26.8	18.70	43.5	-24.8
120.000000	V	V	100.00	50.2	-26.1	24.10	43.5	-19.4
167.920000	H	H	100.00	54.4	-27.6	26.80	43.5	-16.7
179.960000	V	V	100.00	52.1	-28.2	23.90	43.5	-19.6
228.280000	V	V	100.00	50.8	-27.9	22.90	46.0	-23.1
343.320000	V	V	100.00	43.0	-24.4	18.60	46.0	-27.4
511.120000	H	H	100.00	50.2	-21.0	29.20	46.0	-16.8

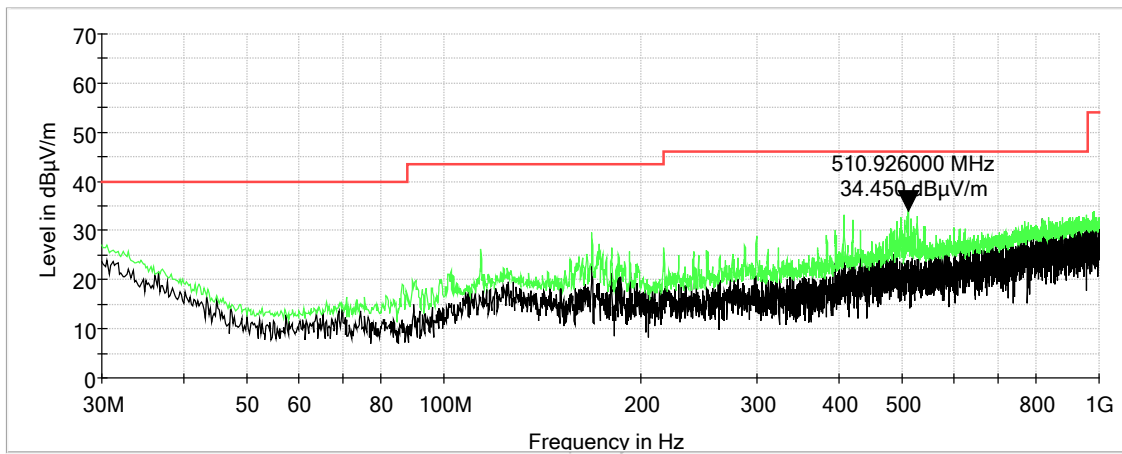




2Mbps: 30 MHz to 1000 MHz, Vertical

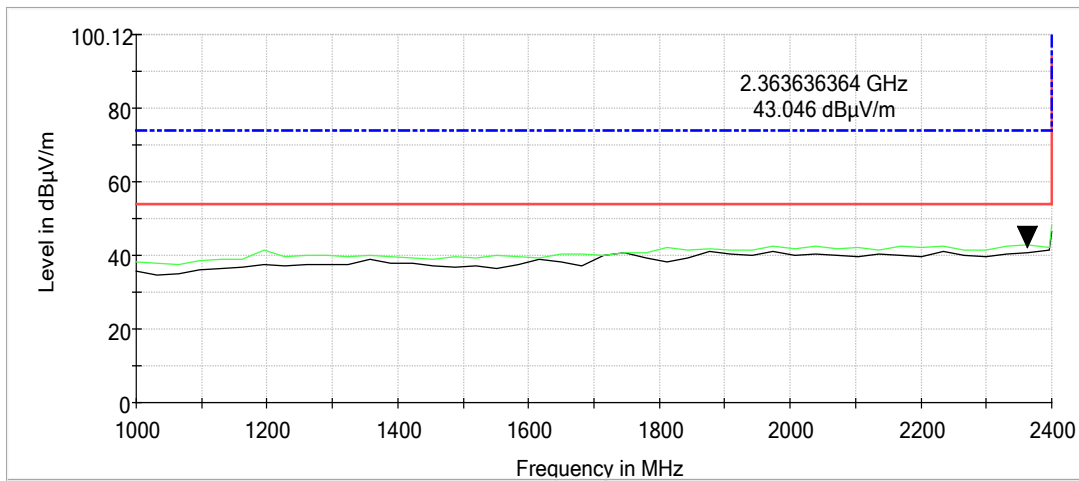


2Mbps: 30 MHz to 1000 MHz, Horizontal

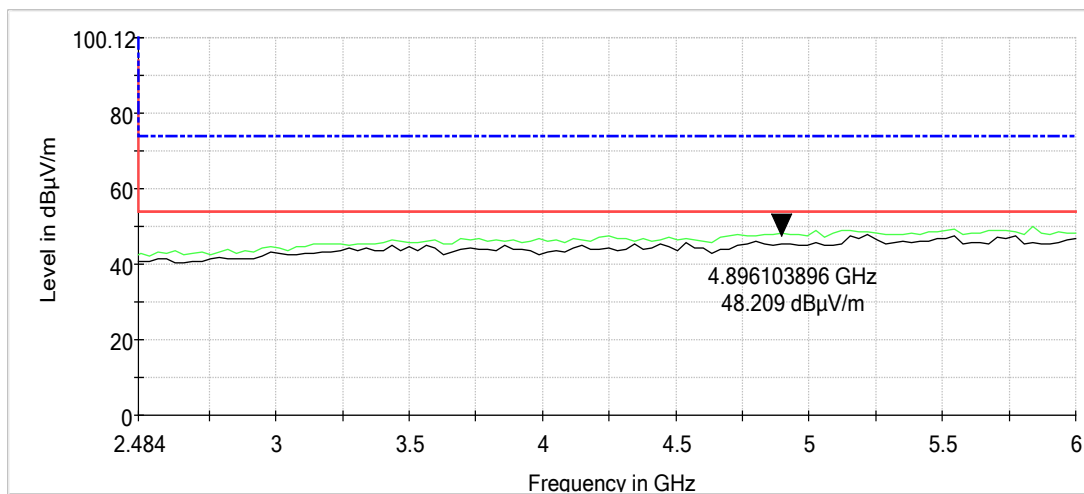




2Mbps: 1 GHz to 2.4 GHz, Vertical

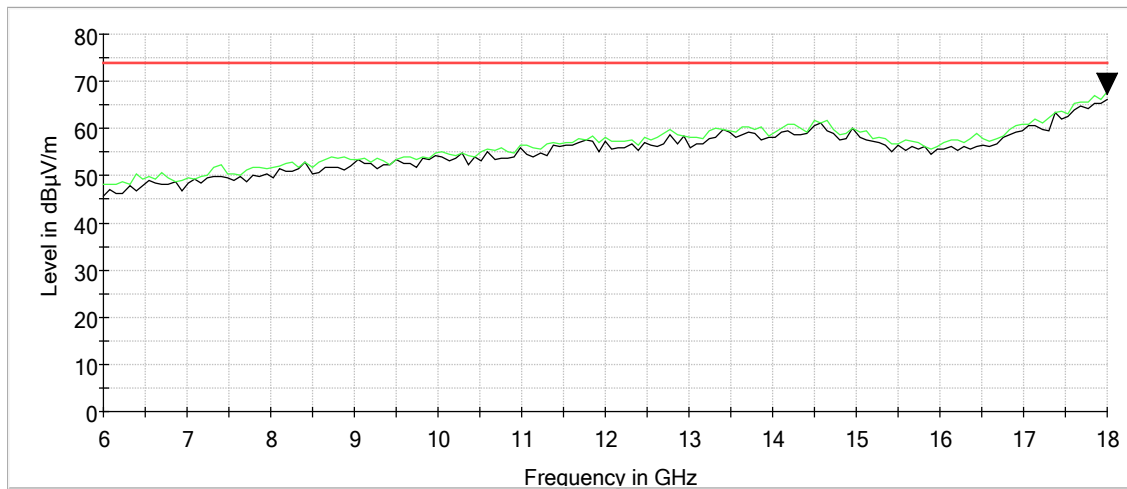


2Mbps: 2.5 GHz to 6 GHz, Vertical

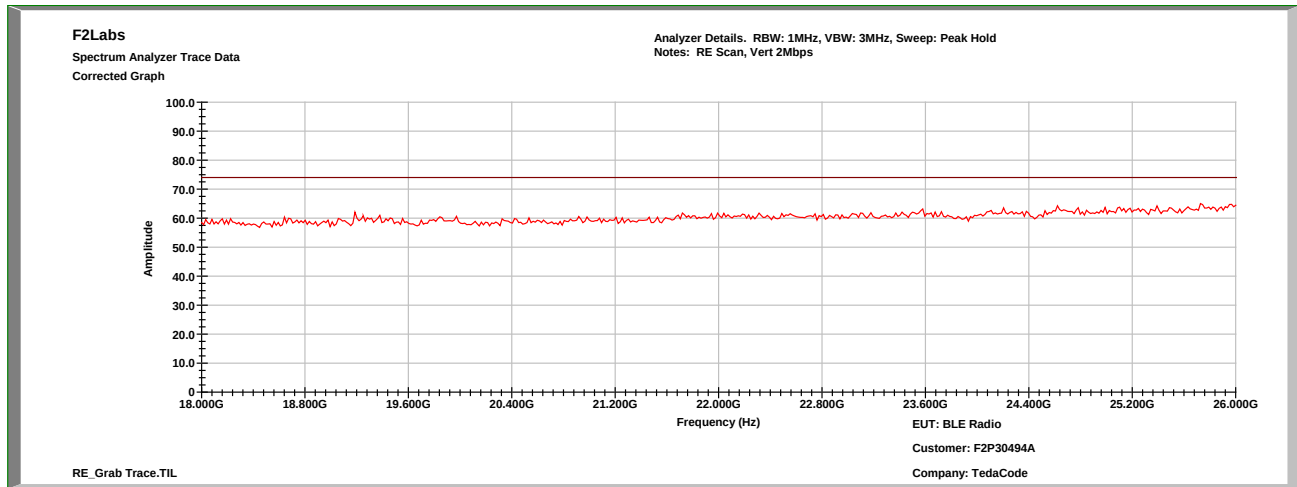




2Mbps: 6 GHz to 18 GHz, Vertical

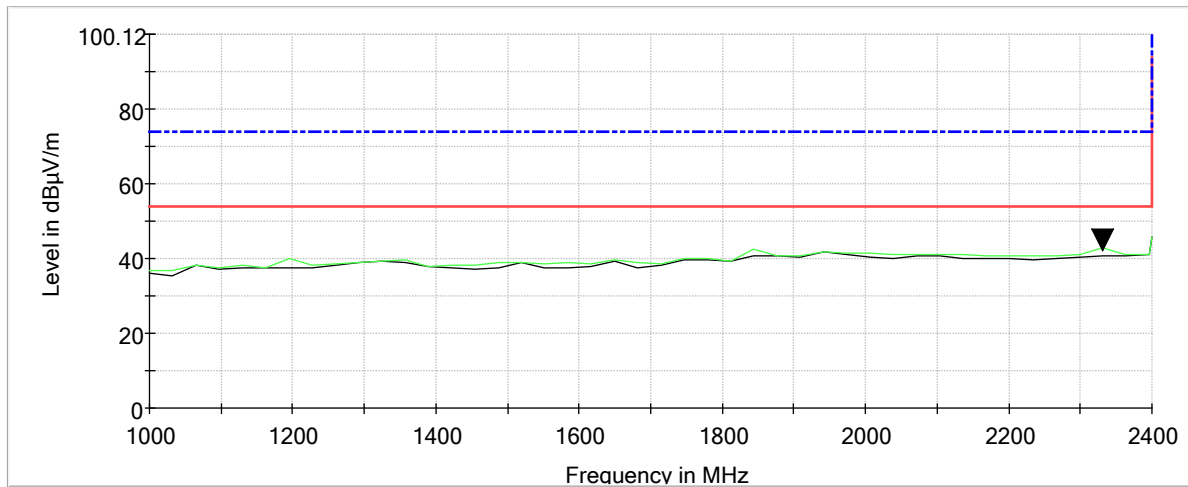


2Mbps: 18 GHz to 26 GHz, Vertical

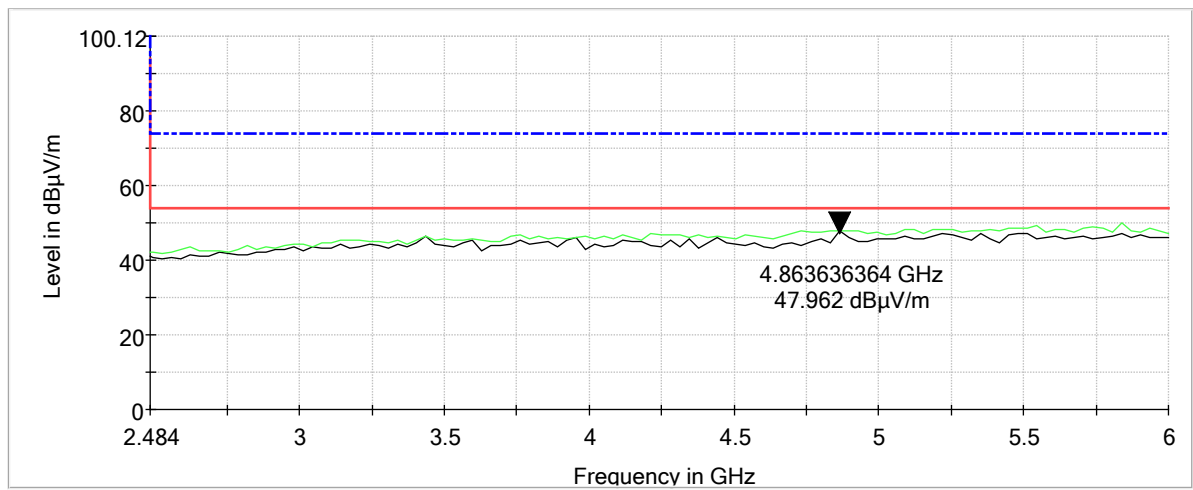




2Mbps: 1 GHz to 2.4 GHz, Horizontal

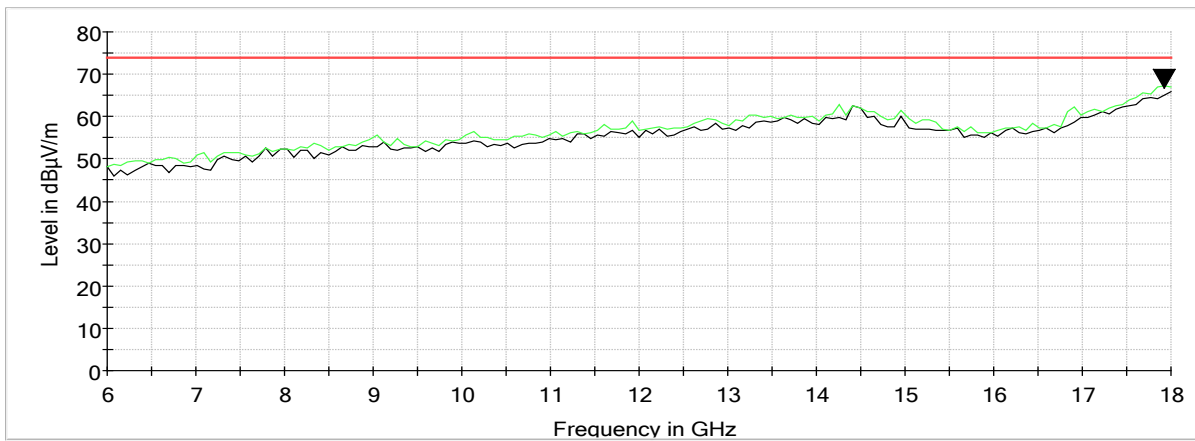


2Mbps: 2.5 GHz to 6 GHz, Horizontal

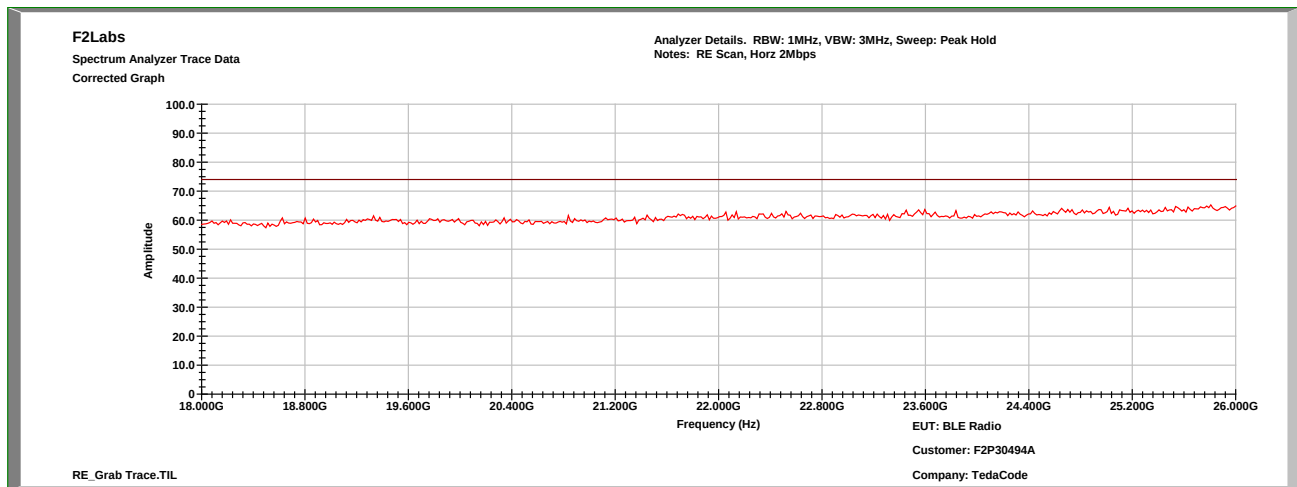




2Mbps: 6 GHz to 18 GHz, Horizontal



2Mbps: 18 GHz to 26 GHz, Horizontal





9 VARIATION OF INPUT POWER

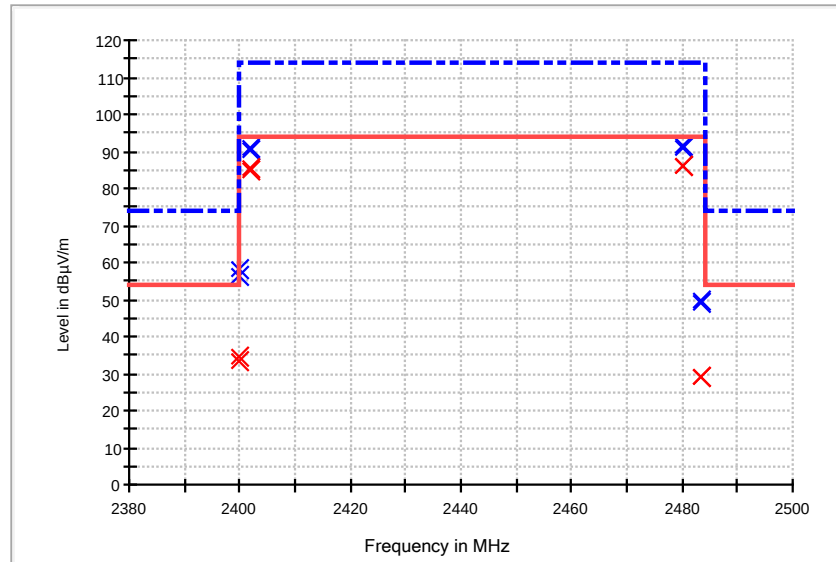
For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery. A nominal voltage of 110VAC was used and then 93.5VAC and 126.5VAC were used as the 85% and 115% variations.

RESULTS: The results showed that the fundamental frequency did not move outside the frequency band and the field strength did not increase above the limit during the variations.



Test Date:	2023-09-29	Test Engineer:	J. Chiller
Rule:	FCC 15.31(e)	Air Temperature:	22.2° C
Test Results:	Pass	Relative Humidity:	57%

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
2400.000000	56.2	33.5	1000.000	160.0	V	268.0	6.6	20.5	54.0	85%
2400.000000	58.2	34.3	1000.000	160.0	V	268.0	6.6	19.7	54.0	115%
2402.000000	90.6	85.6	1000.000	160.0	V	268.0	6.6	8.4	94.0	115%
2402.000000	90.2	85.2	1000.000	160.0	V	268.0	6.6	8.8	94.0	85%
2480.000000	90.9	85.8	1000.000	160.0	V	268.0	6.5	8.2	94.0	85%
2480.000000	91.2	86.2	1000.000	160.0	V	268.0	6.5	7.8	94.0	115%
2483.500000	49.1	28.8	1000.000	160.0	V	268.0	6.5	25.2	54.0	85%
2483.500000	49.4	29.0	1000.000	160.0	V	268.0	6.5	25.0	54.0	115%





10 CONDUCTED EMISSIONS

10.1 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 μ H/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 (dB μ V)	
	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.

10.2 Procedure

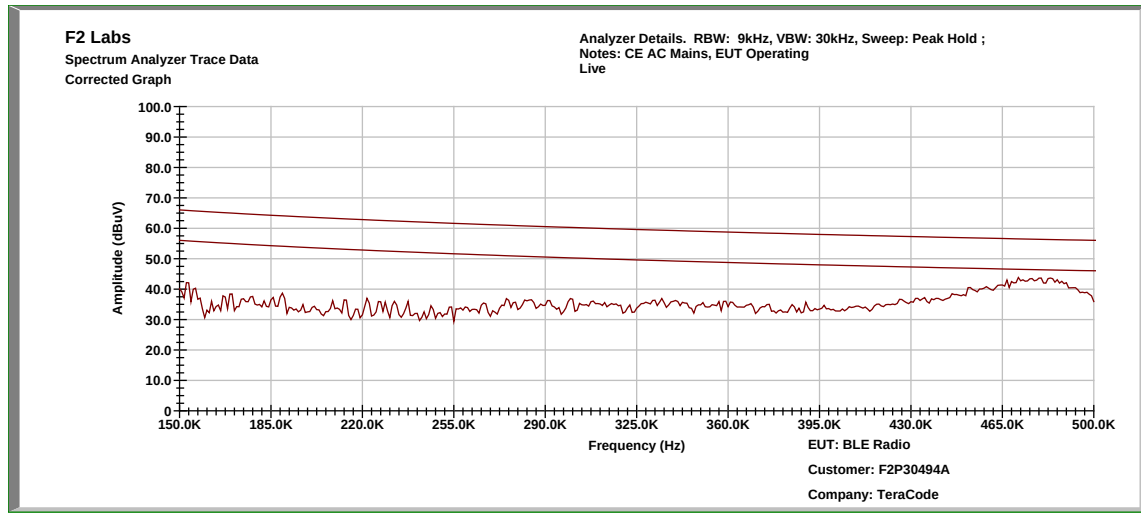
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power 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.



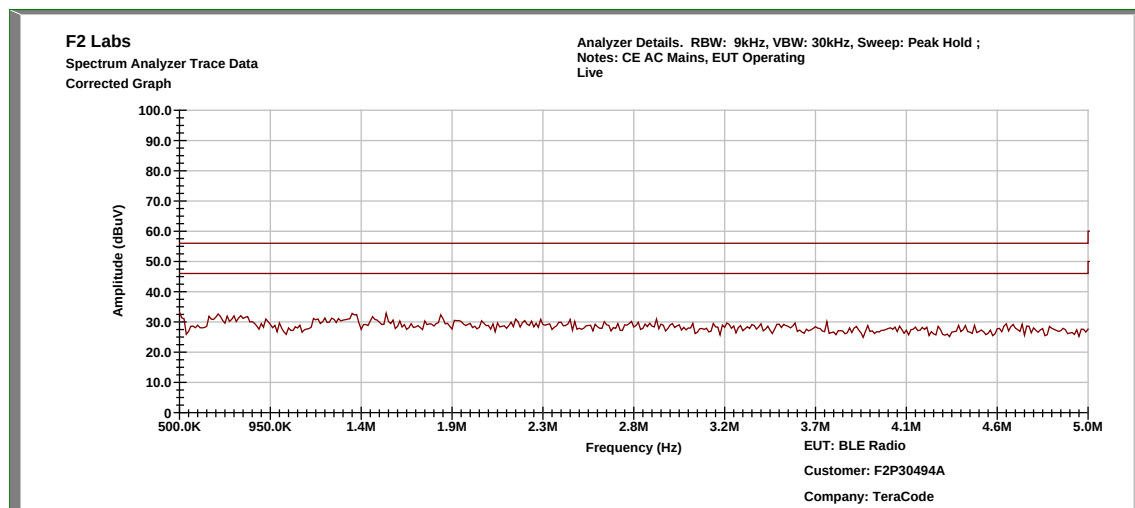
10.3 Conducted Emissions Test Data

Test Date(s):	2023-09-29	Test Engineer:	J. Chiller
Rule:	15.207	Air Temperature:	22.1° C
Test Results:	Complies	Relative Humidity:	51%

Conducted Test – Live: 0.15 MHz to 0.5 MHz

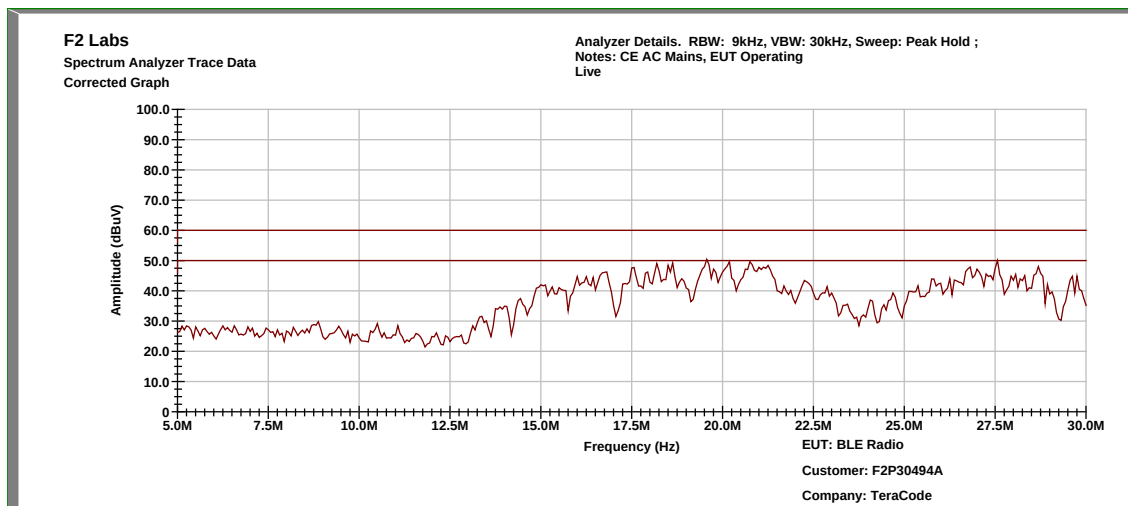


Conducted Test – Live: 0.5 MHz to 5.0 MHz





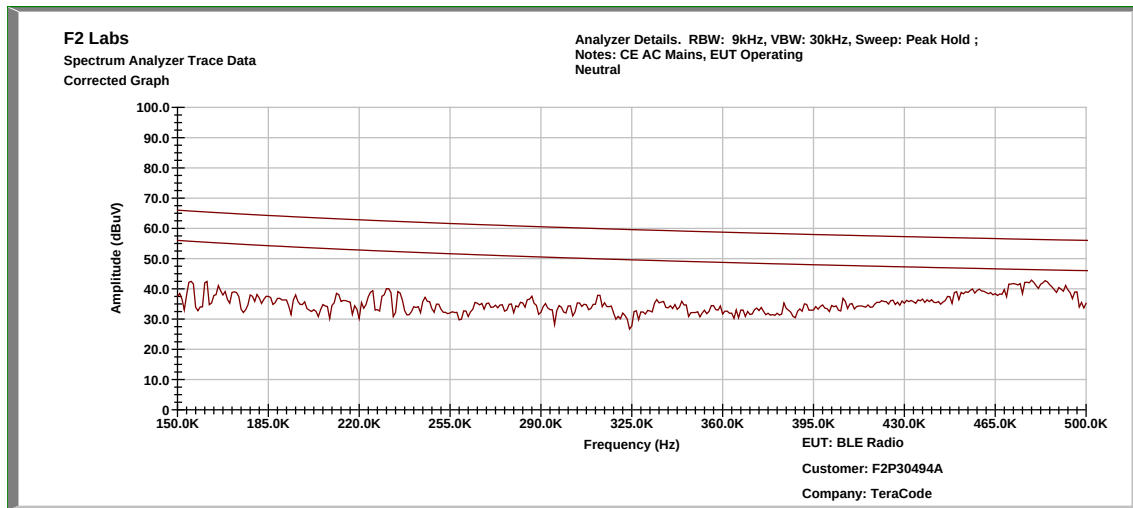
Conducted Test – Live: 5.0 MHz to 30.0 MHz



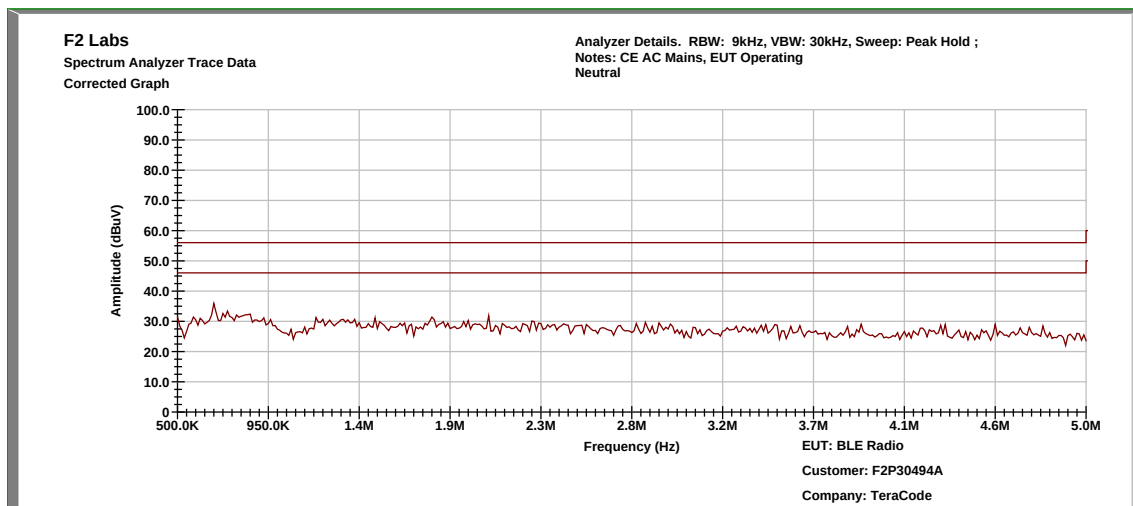
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Live	18.187	Quasi-Peak	27.28	10.74	38.02	60.0	-22.0
			Average	23.90	10.74	34.64	50.0	-15.4
2	Live	19.562	Quasi-Peak	28.81	10.804	39.61	60.0	-20.4
			Average	25.25	10.804	36.05	50.0	-13.9
3	Live	20.187	Quasi-Peak	30.67	10.856	41.53	60.0	-18.5
			Average	18.43	10.856	29.29	50.0	-20.7
4	Live	20.75	Quasi-Peak	31.94	10.904	42.84	60.0	-17.2
			Average	28.48	10.904	39.38	50.0	-10.6
5	Live	27.562	Quasi-Peak	33.81	11.392	45.20	60.0	-14.8
			Average	21.91	11.392	33.30	50.0	-16.7



Conducted Test – Neutral: 0.15 MHz to 0.5 MHz

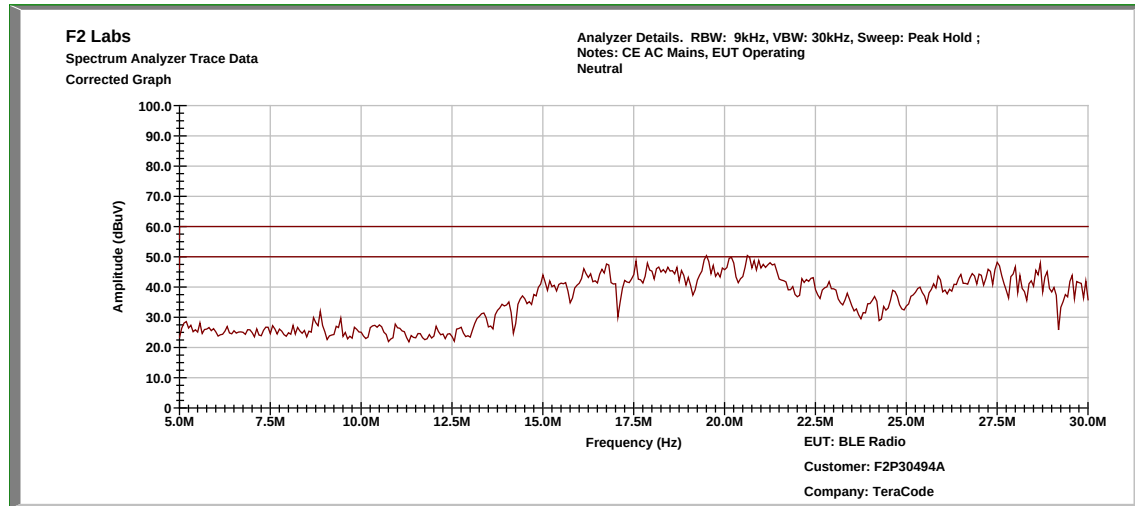


Conducted Test – Neutral: 0.5 MHz to 5.0 MHz





Conducted Test – Neutral: 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	17.56	Quasi-Peak	34.04	10.999	45.04	60.0	-15.0
			Average	22.57	10.999	33.57	50.0	-16.4
2	Neutral	19.5	Quasi-Peak	34.79	11.078	45.87	60.0	-14.1
			Average	23.58	11.078	34.66	50.0	-15.3
3	Neutral	20.187	Quasi-Peak	34.45	11.132	45.58	60.0	-14.4
			Average	30.29	11.132	41.42	50.0	-8.6
4	Neutral	20.687	Quasi-Peak	31.58	11.172	42.75	60.0	-17.2
			Average	24.79	11.172	35.96	50.0	-14.0
5	Neutral	21.375	Quasi-Peak	32.04	11.229	43.27	60.0	-16.7
			Average	27.79	11.229	39.02	50.0	-11.0



11 PHOTOGRAPH(S) - TEST SETUPS

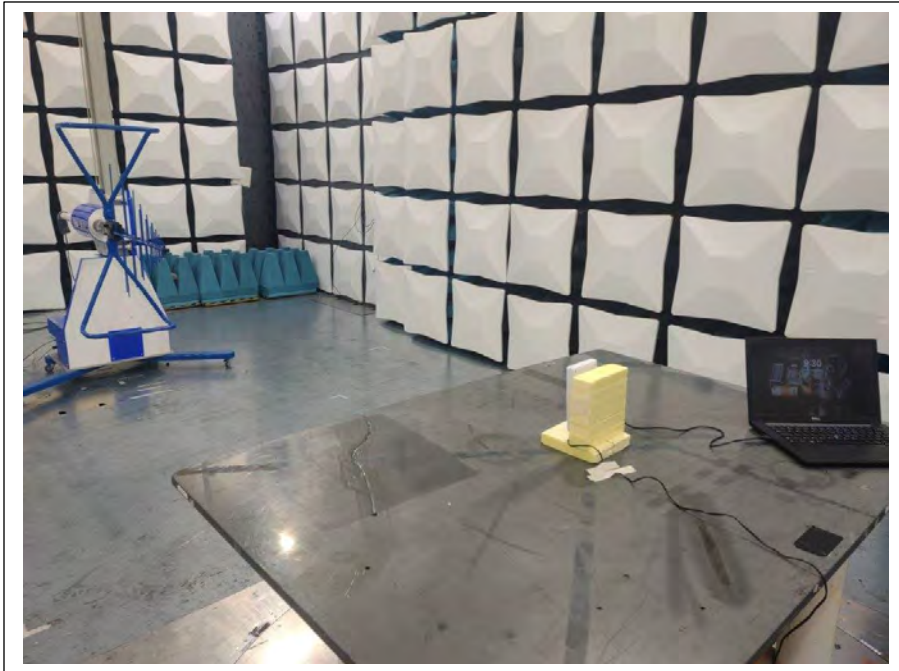
Radio Setup: Less Than 1 GHz



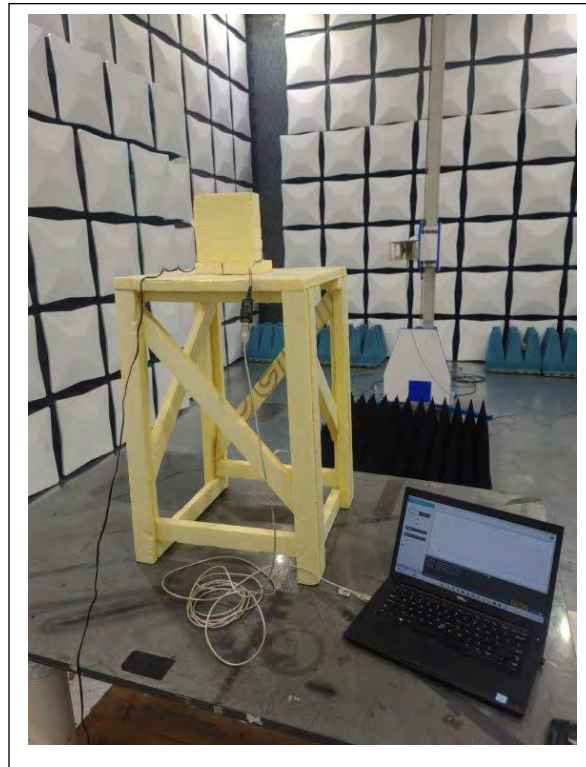
Radio Setup: Greater Than 1 GHz



Radiated Spurious Emissions: Less Than 1 GHz



Radiated Spurious Emissions: Greater Than 1 GHz





Conducted Emissions

