



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

PCII TEST REPORT

Manufacturer: Sound Quest, LLC
806 Beaver Street
Bristol, Pennsylvania 19007 USA

Applicant: Hearing Lab Technology, LLC
14301 FAA Boulevard, Suite 105
Fort Worth, Texas 76155 USA

Product Name: Custom ITE-U / Custom ITE-A

Product Description: Custom Hearing Aid with Bluetooth Connectivity

**Operating Voltage/Freq.
of EUT During Testing:** Battery-Operated (1.5VDC)

Model(s): Custom ITE-A*
**Denotes actual model tested as representative of product family that includes models ITE-U (also known as made for iPhone) and ITE-A (also known as Android).*

FCC ID: 2AC2W-SQCUSITC

Testing Commenced: 2023-02-17

Testing Ended: 2023-02-17

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.

Note: Test report represents PCII to add additional antenna.

- ❖ 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

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

Section	Title	Page
1	ADMINISTRATIVE INFORMATION	4
2	SUMMARY OF TEST RESULTS/MODIFICATIONS	7
3	TABLE OF MEASURED RESULTS	8
4	ENGINEERING STATEMENT	9
5	EUT INFORMATION AND DATA	10
6	LIST OF MEASUREMENT INSTRUMENTATION	11
7	OCCUPIED BANDWIDTH	12
8	FIELD STRENGTH	19
9	TEST SETUP PHOTOGRAPHS	33



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	2.54	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.



Order Number: F2P27157A-R1

Applicant: Hearing Lab Technology, LLC
Model: Custom ITE-A

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P27157A-R1-01E	First Issue	2023-03-03	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
Conducted Emissions	CFR 47 Part 15.207(a)	Not Applicable
Voltage Variation	CFR 47 Part 15.31(e)	Complies*

**Requirements of 15.31 were met by using new 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	3.23 mV/m 70.2 dB μ V/m	2.72 mV/m 68.7 dB μ V/m	4.26 mV/m 72.6 dB μ V/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
Peak Field Strength of Fundamental	75.8 dB μ V/m	75.0 dB μ V/m	78.7dB μ V/m
Peak Limit for Fundamental	113.97 dB μ V/m	113.97 dB μ V/m	113.97 dB μ V/m
-20dB Occupied Bandwidth (MHz)	1.095	1.091	1.158
99% Occupied Bandwidth (MHz)	1.11	1.052	1.048

The 99% / -20dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.



4 ENGINEERING STATEMENT

This report has been prepared on behalf of Hearing Lab Technology, 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: **Custom ITE-U / Custom ITE-A**

Model: **Custom ITE-A**

**Denotes actual model tested as representative of product family that includes models ITE-U (also known as made for iPhone) and ITE-A (also known as Android).*

Serial No.: 22912346

FCC ID: **2AC2W-SQCUSITC**

5.2 Trade Name:

SoundQuest LLC

5.3 Power Supply:

Battery-operated (1.45VDC)

5.4 Applicable Rules:

CFR 47, Part 15.249

5.5 Antenna:

Integral, -12dB max/-16dB Avg Gain

5.6 Accessories:

None

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

Bluetooth radio in hearing aid was tested on the low (2402 MHz), mid (2440 MHz) and high (2480 MHz) channels.

**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
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
Pre-amplifier	CL285	Com-Power	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:	EMC 32, Version 8.53.0		Software Verified: 2023-02-17		
Software	Tile Version 3.4.B.3		Software Verified: 2023-02-17		
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2023-10-12



7 OCCUPIED BANDWIDTH

7.1 Requirements:

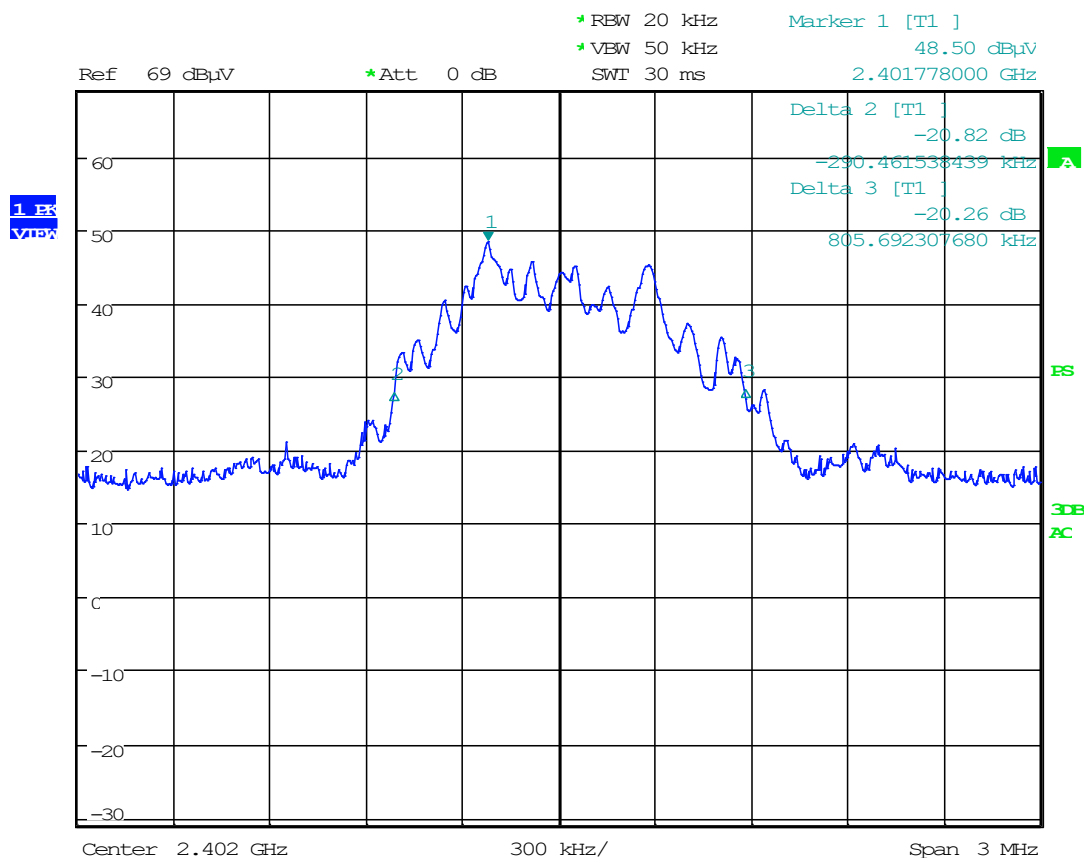
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific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



7.2 Occupied Bandwidth Test Data

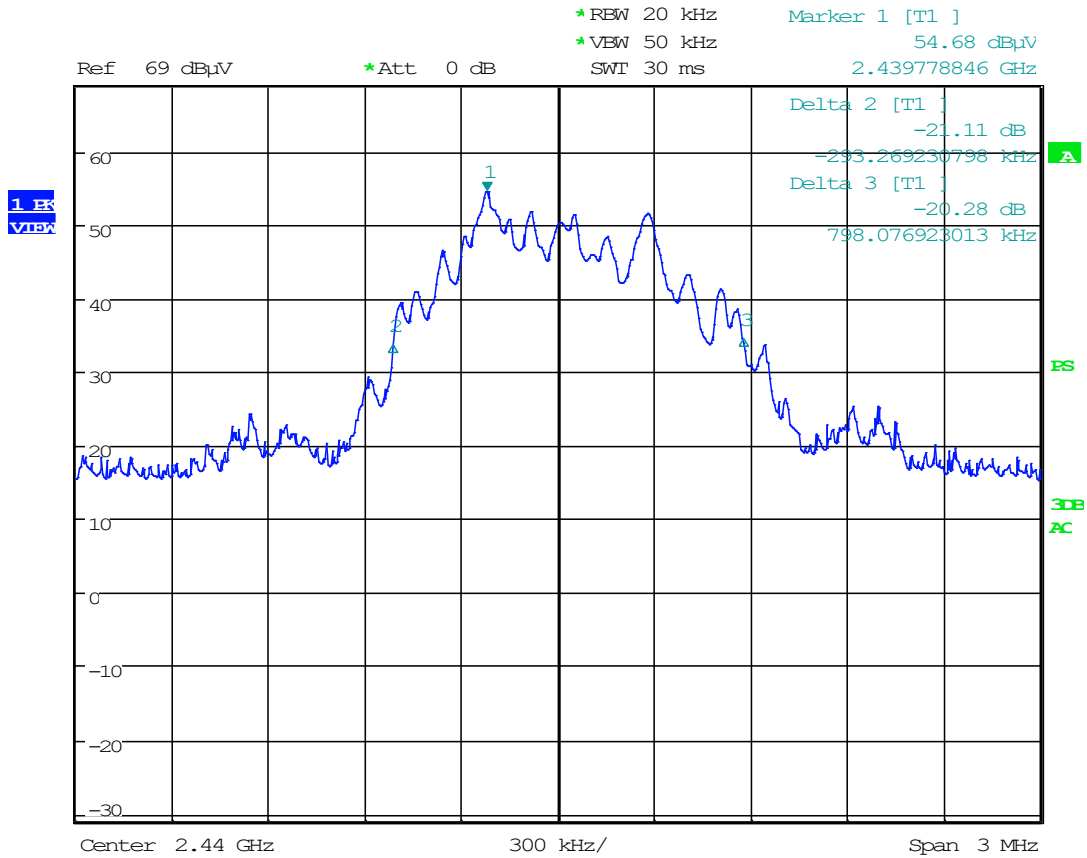
Test Date(s):	2023-02-17	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	21.0°C
		Relative Humidity:	32%

-20dB, Low Channel

Date: 17.FEB.2023 14:10:00

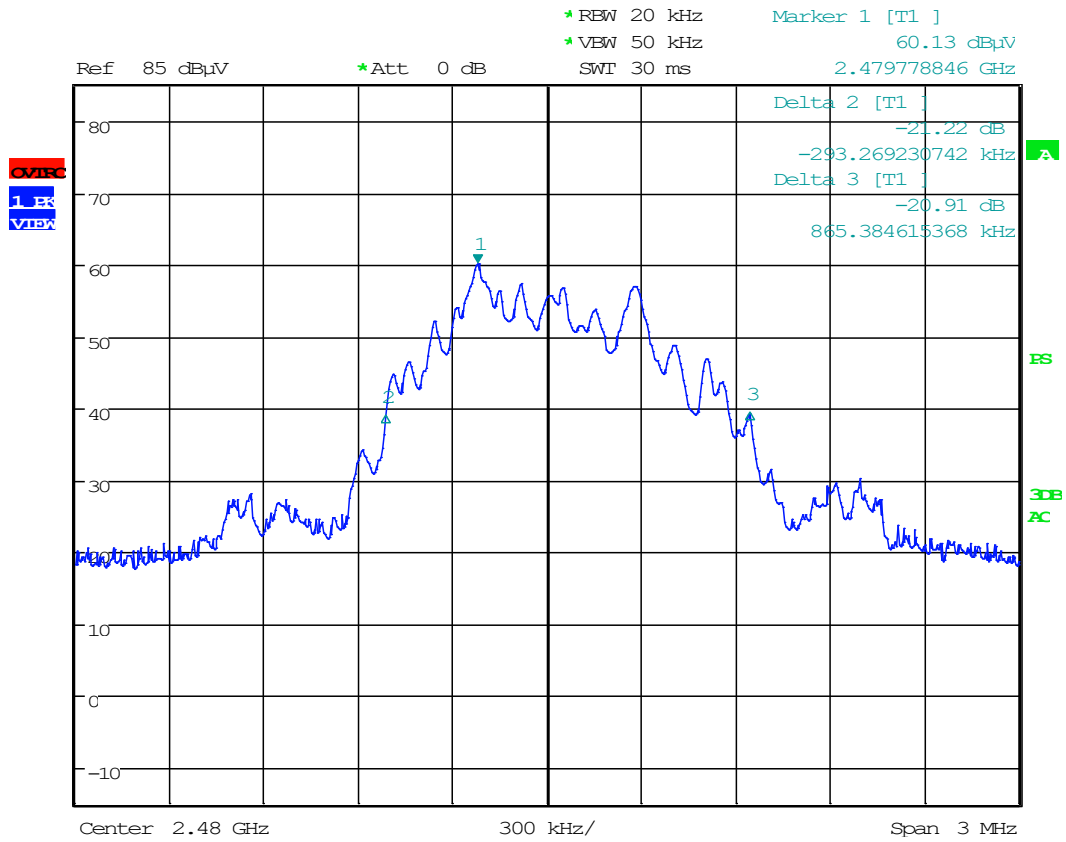


-20dB, Mid Channel



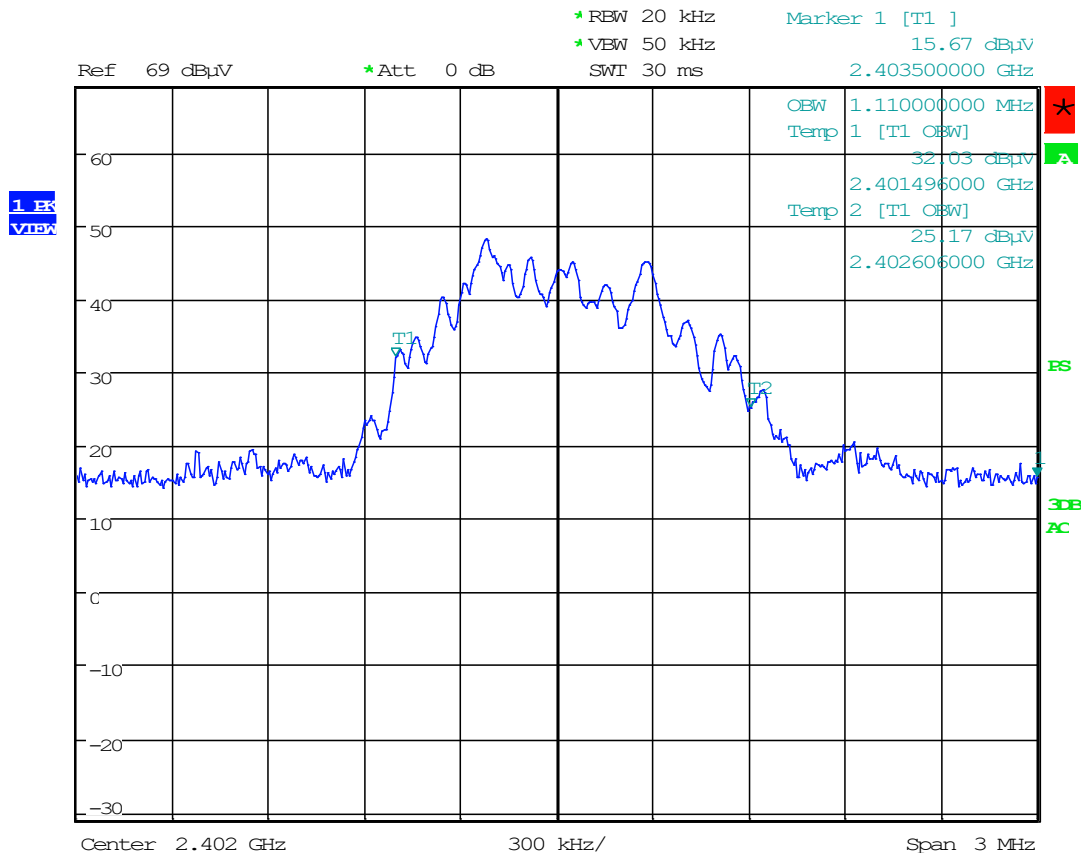


-20dB, High Channel





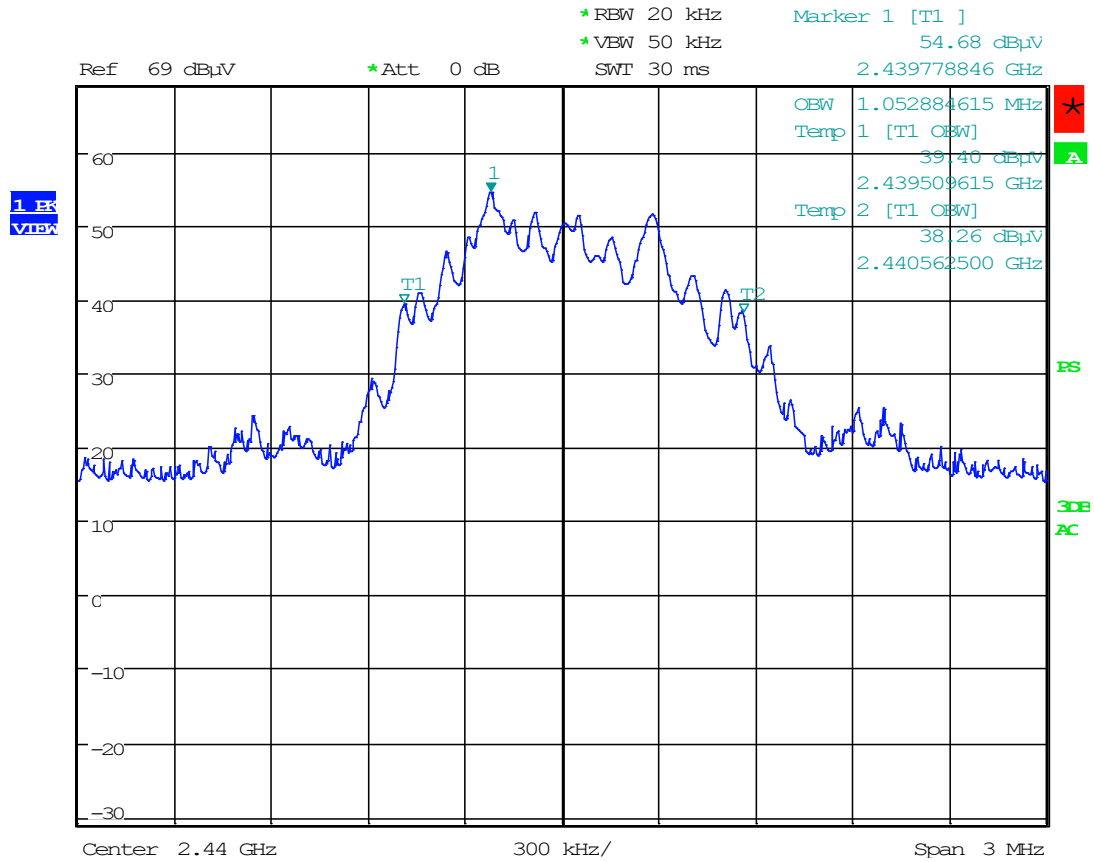
99%, Low Channel



Date: 17.FEB.2023 14:07:38

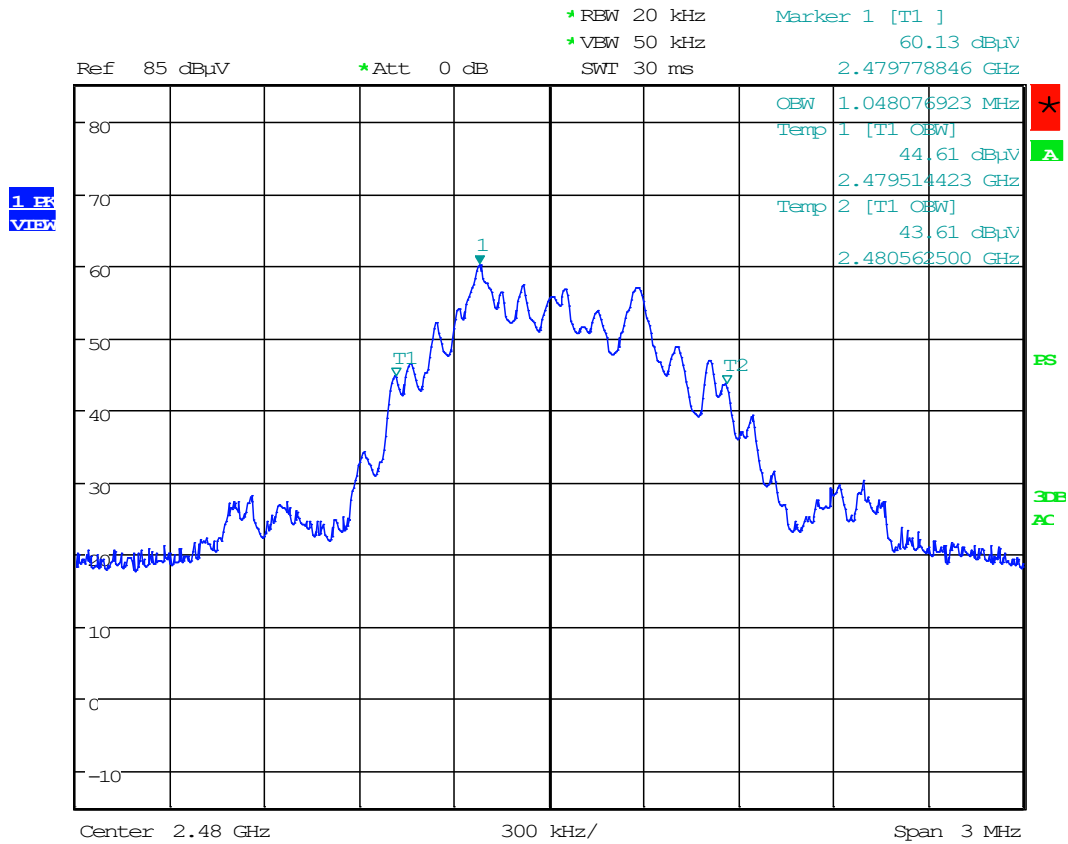


99%, Mid Channel





99%, High Channel





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 50 dB 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.

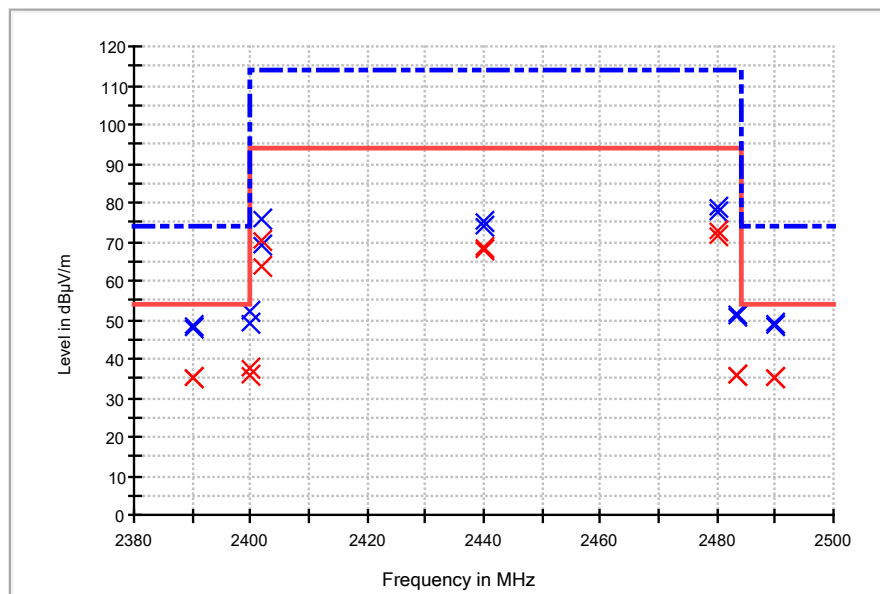


8.1 Test Data - Field Strength – Band Edges

Test Date(s):	2023-02-17	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(a)	Air Temperature:	21.2°C
		Relative Humidity:	32%

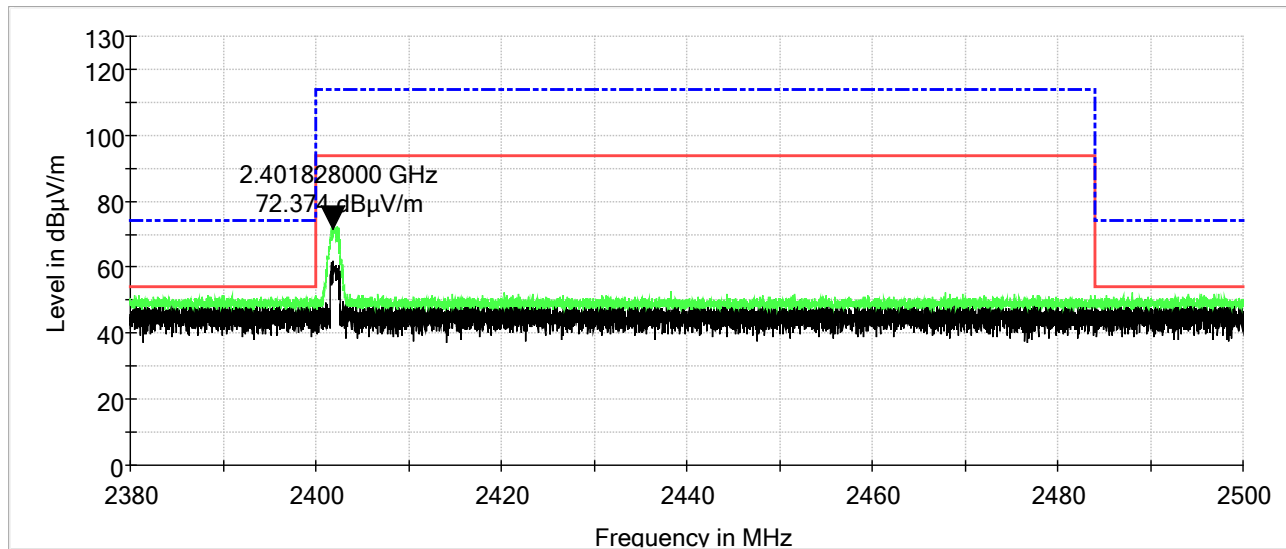
Band Edges

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBμV/m)	Limit - PK (dBμV/m)
2390.000000	47.7	35.0	1000.000	150.0	H	7.0	10.6	19.0	54.0	74.0
2390.000000	48.5	35.0	1000.000	150.0	V	44.0	10.6	19.0	54.0	74.0
2400.000000	49.4	35.7	1000.000	150.0	V	44.0	10.5	18.3	54.0	74.0
2400.000000	52.1	37.3	1000.000	150.0	H	7.0	10.5	16.7	54.0	74.0
2402.000000	75.8	70.2	1000.000	150.0	H	7.0	10.5	23.8	94.0	114.0
2402.000000	69.3	63.5	1000.000	150.0	V	44.0	10.5	30.5	94.0	114.0
2440.000000	75.0	68.7	1000.000	150.0	H	16.0	10.5	25.3	94.0	114.0
2440.000000	74.1	67.7	1000.000	150.0	V	70.0	10.5	26.3	94.0	114.0
2480.000000	77.4	71.8	1000.000	150.0	V	85.0	10.5	22.2	94.0	114.0
2480.000000	78.7	72.6	1000.000	150.0	H	206.0	10.5	21.4	94.0	114.0
2483.500000	51.8	35.7	1000.000	150.0	V	85.0	10.5	18.3	54.0	74.0
2483.500000	50.9	35.7	1000.000	150.0	H	206.0	10.5	18.3	54.0	74.0
2490.000000	49.1	35.2	1000.000	150.0	V	85.0	10.6	18.8	54.0	74.0
2490.000000	48.3	35.2	1000.000	150.0	H	206.0	10.6	18.8	54.0	74.0

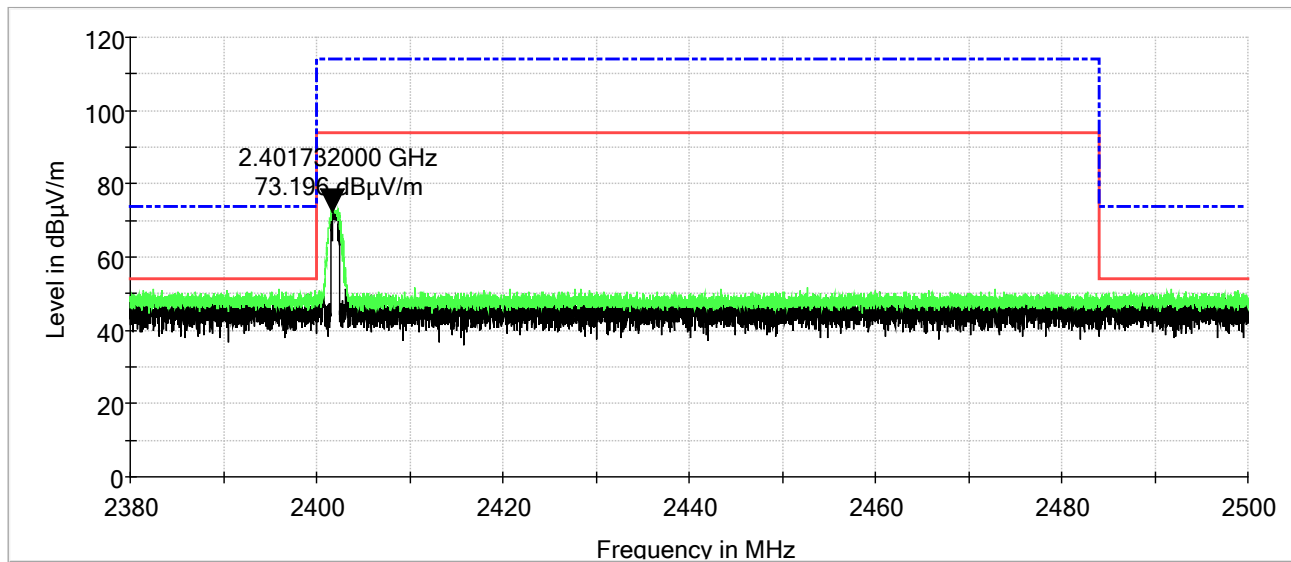




Low Band Edge, Vertical

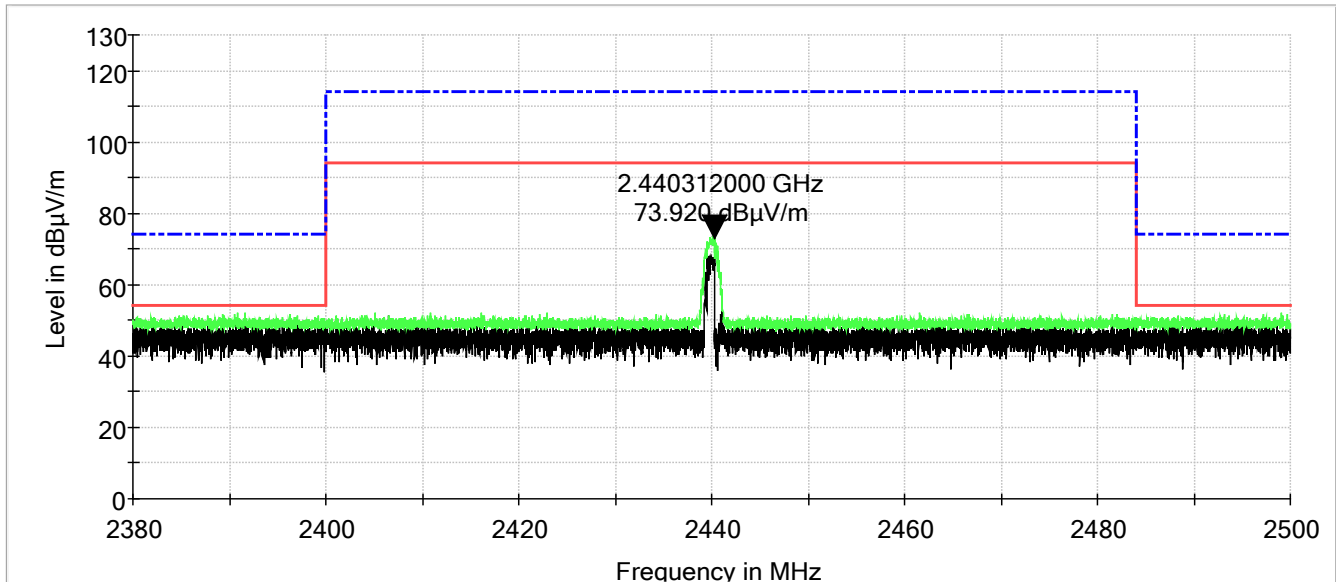


Low Band Edge, Horizontal

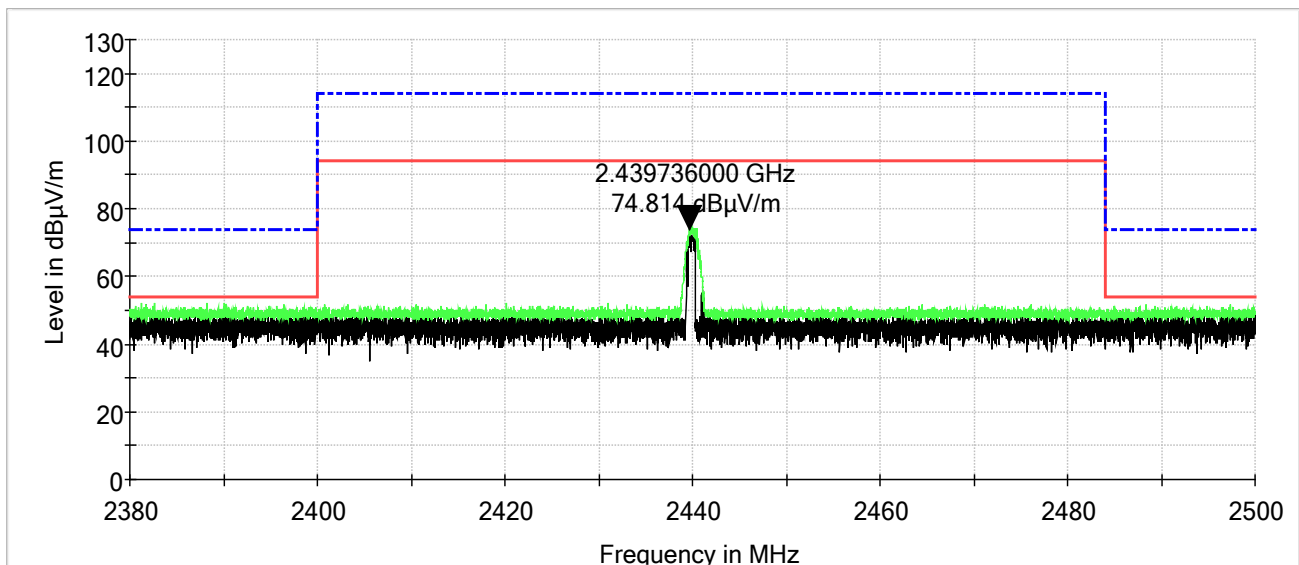




Mid Band Edge, Vertical

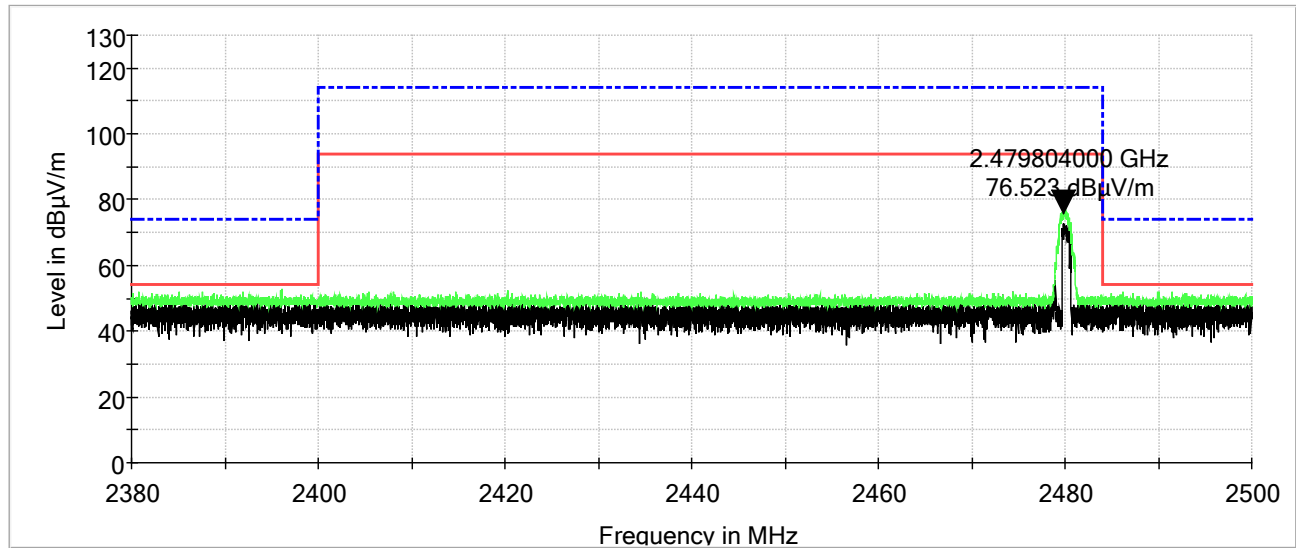


Mid Band Edge, Horizontal

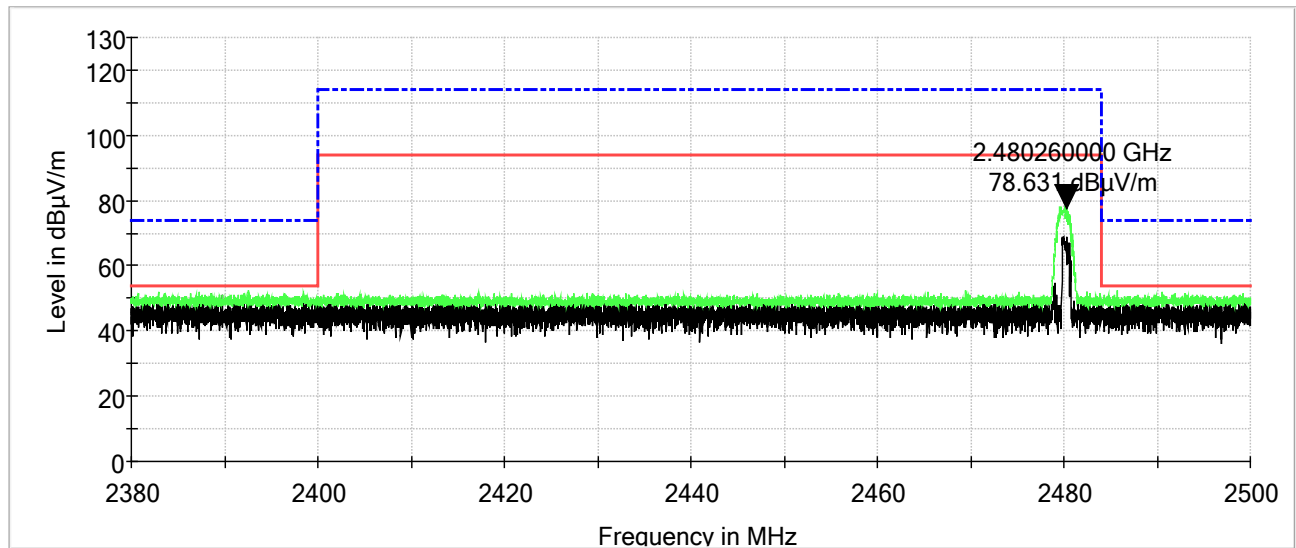




High Band Edge, Vertical



High Band Edge, Horizontal





8.2 Test Data – Spurious Emissions

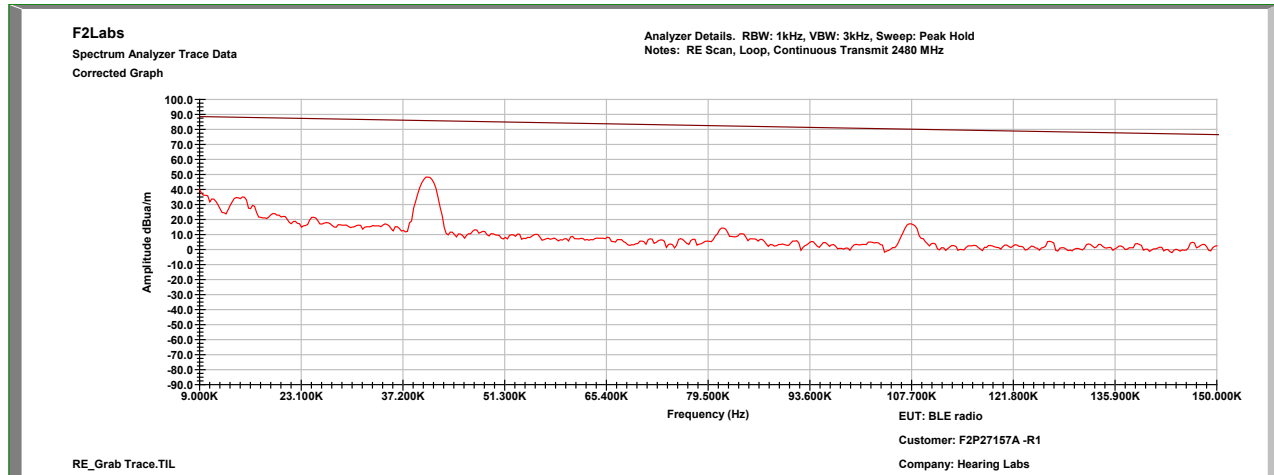
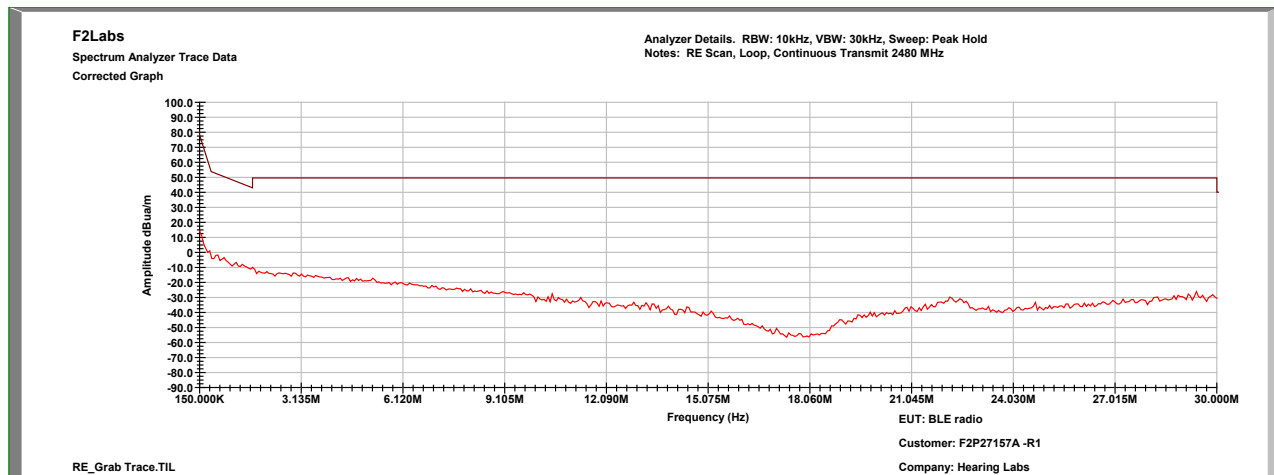
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some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

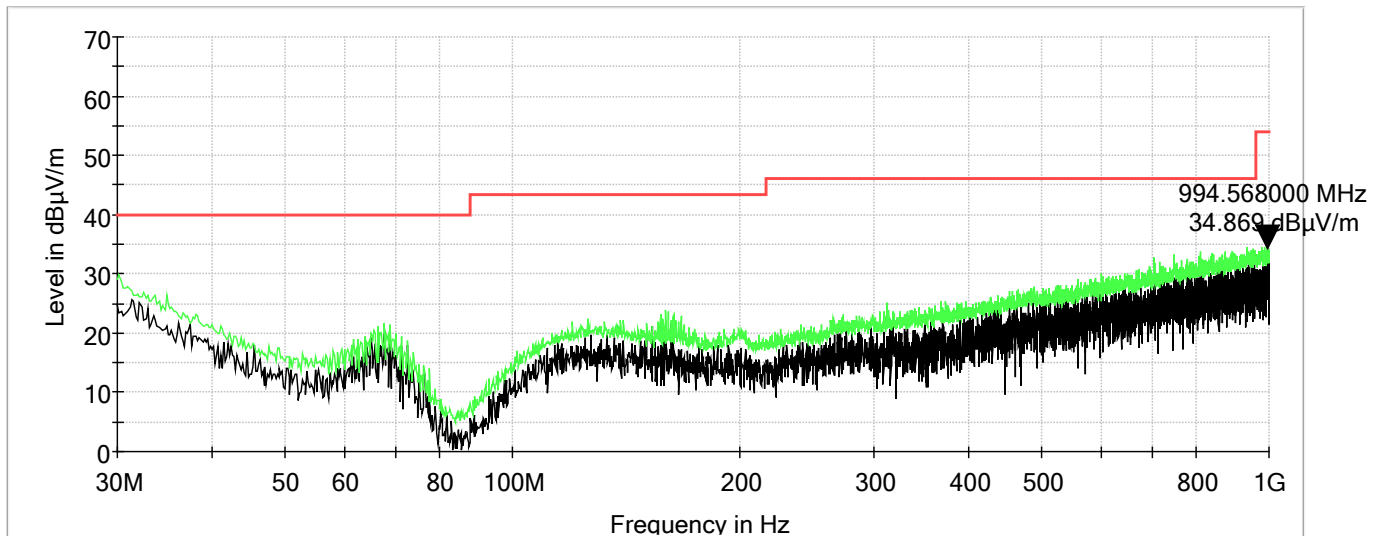


Test Date(s):	2023-02-17	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(d)	Air Temperature:	21.5°C
		Relative Humidity:	33

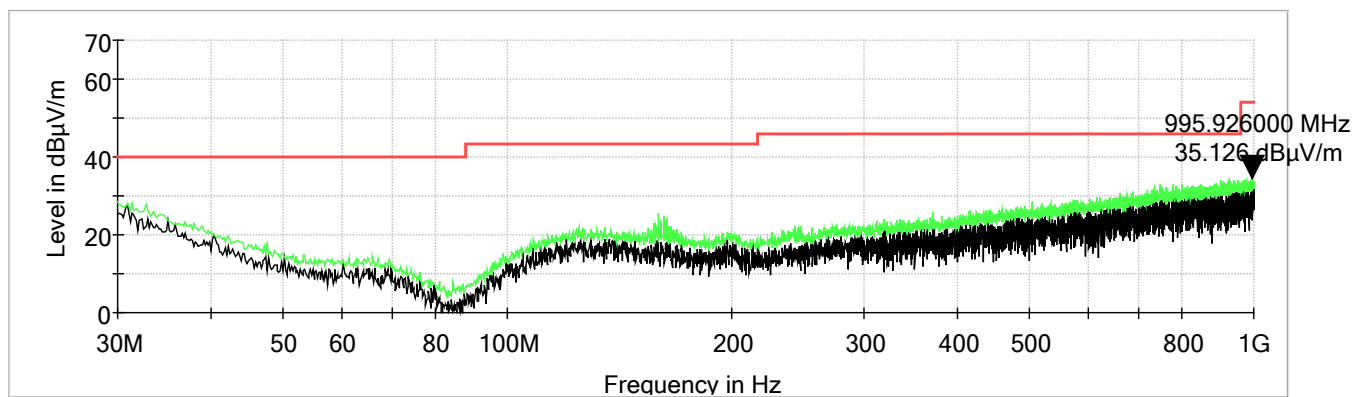
0.009 MHz to 0.15 MHz**0.15 MHz to 30 MHz**



30 MHz to 1000 MHz, Vertical



30 MHz to 1000 MHz, Horizontal

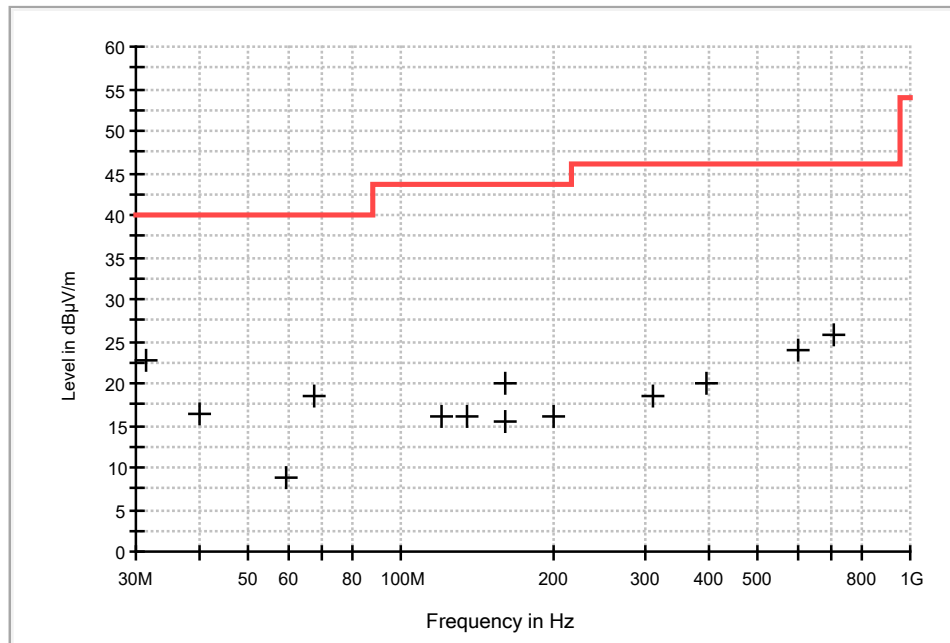


**Measurements, 30 MHz to 1000 MHz (Includes data from all channels)**

Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (degrees)	Reading (dBμV)	Correction Factors (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
31.360000	V	100.00	0.00	25.1	-2.3	22.80	40.0	-17.2
40.080000	H	100.00	0.00	25.1	-8.8	16.30	40.0	-23.7
59.480000	H	100.00	0.00	23.8	-15.1	8.70	40.0	-31.3
67.640000	V	100.00	0.00	32.7	-14.4	18.30	40.0	-21.7
120.000000	V	100.00	0.00	24.4	-8.4	16.00	43.5	-27.5
134.960000	H	100.00	0.00	24.3	-8.4	15.90	43.5	-27.6
159.400000	H	100.00	142.00	29.4	-9.3	20.10	43.5	-23.4
160.560000	V	100.00	0.00	24.7	-9.3	15.40	43.5	-28.1
198.800000	H	100.00	358.00	24.6	-8.6	16.00	43.5	-27.5
313.040000	V	100.00	0.00	25.2	-6.7	18.50	46.0	-27.5
396.480000	H	100.00	0.00	24.8	-4.7	20.10	46.0	-25.9
604.040000	H	100.00	0.00	24.0	0.0	24.00	46.0	-22.0
705.720000	V	100.00	0.00	23.7	1.9	25.60	46.0	-20.4

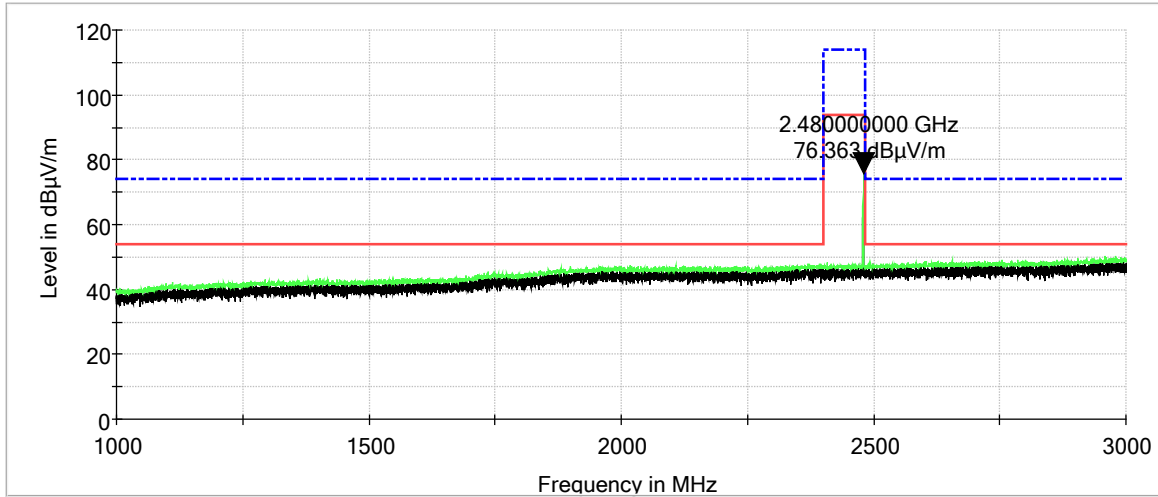


Measurements - 30 MHz to 1000 MHz

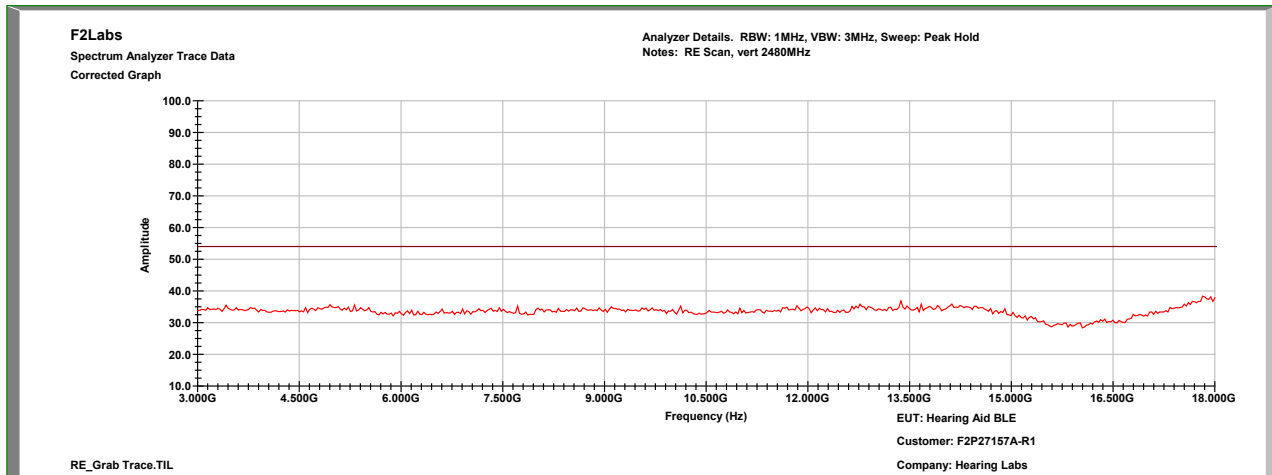




1 GHz to 3 GHz, Vertical

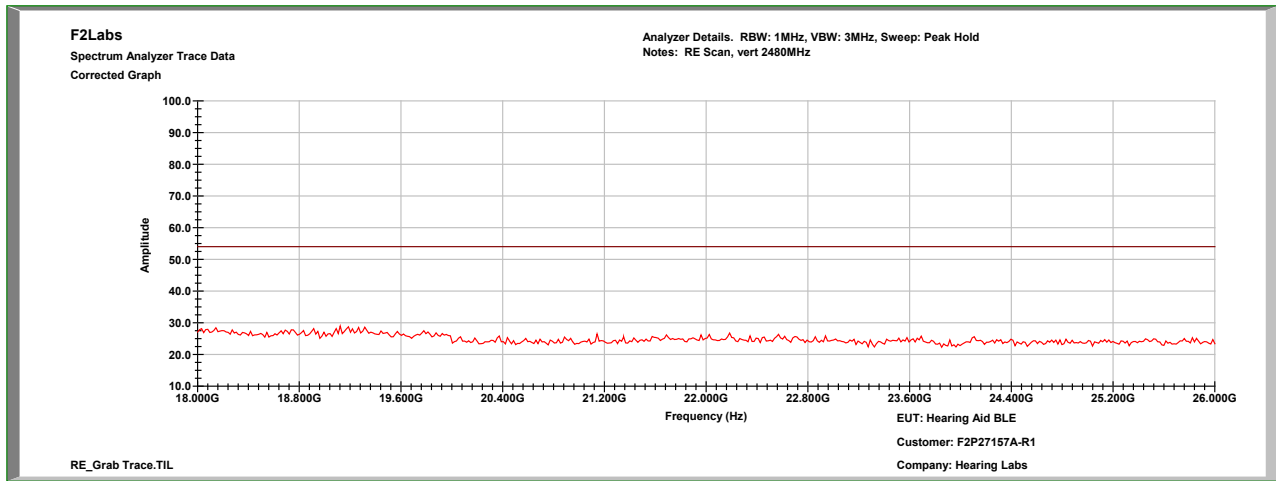


3 GHz to 18 GHz, Vertical



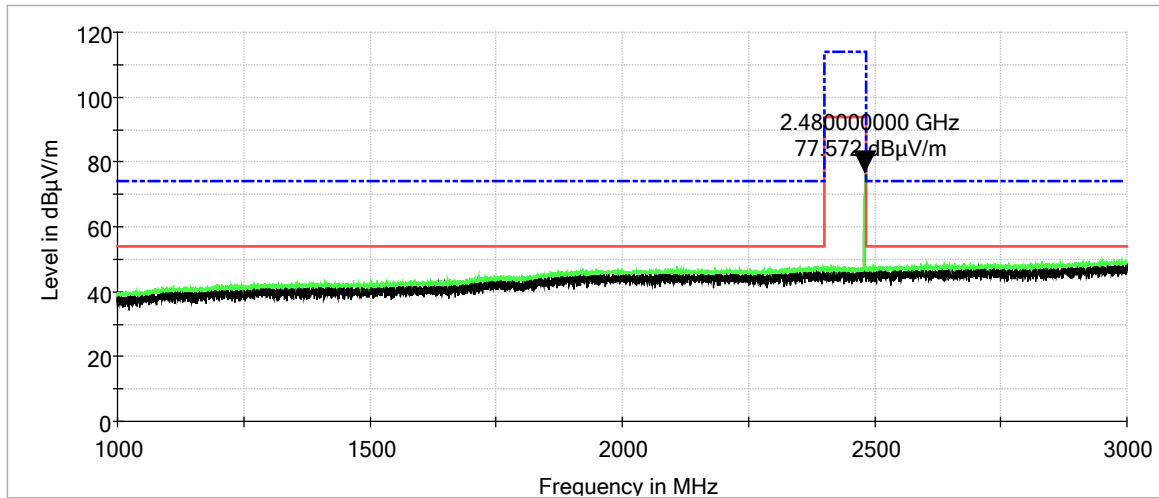


18 GHz to 26 GHz, Vertical

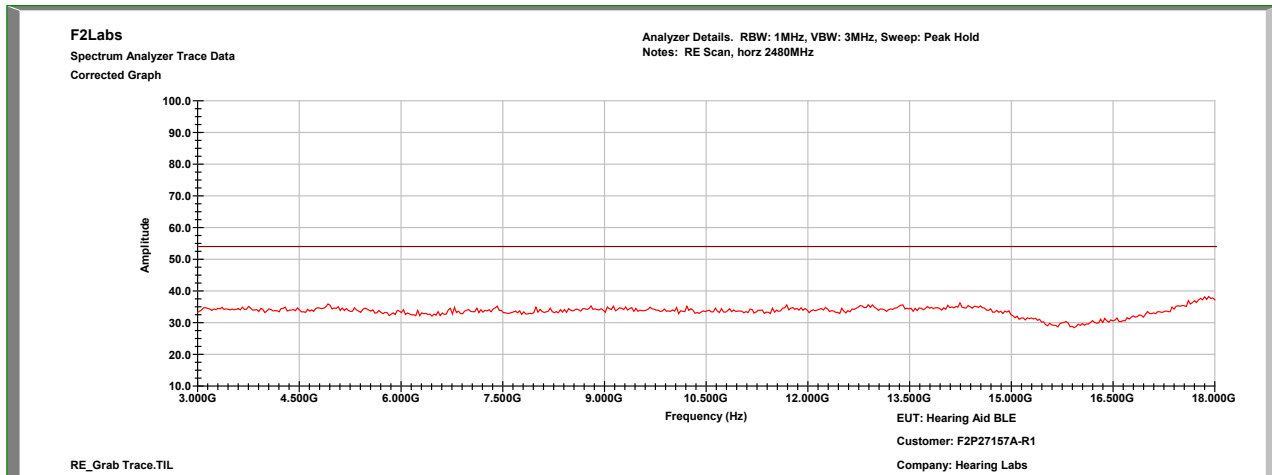




1 GHz to 3 GHz, Horizontal



3 GHz to 18 GHz, Horizontal

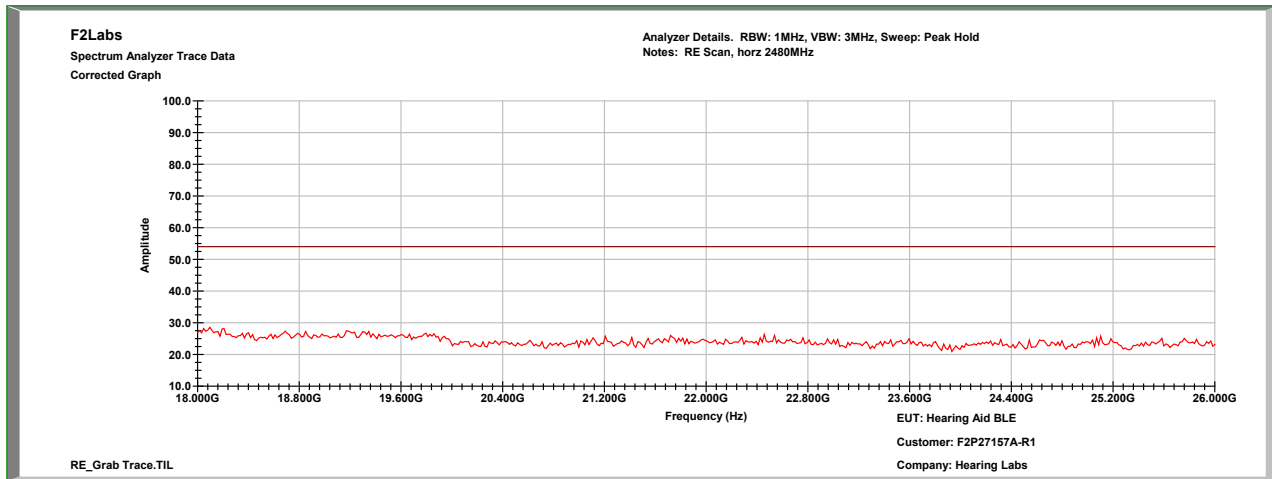




Order Number: F2P27157A-R1

Applicant: Hearing Lab Technology, LLC
Model: Custom ITE-A

18 GHz to 26 GHz, Horizontal





9 TEST SETUP PHOTOGRAPHS

Radiated Emissions: 0.009 MHz to 0.15 MHz



Radiated Emissions: 30 MHz to 1000 MHz





**Radiated Emissions: 1 GHz to 26 GHz,
Band Edge, Field Strength of Emissions, Occupied Bandwidth**

