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PCII TEST REPORT

Manufacturer:	**Avuity, LLC** **302 West Third** **Suite 810** **Cincinnati, Ohio 45208 USA**
Applicant:	**Same as Above**
Product Name:	**VuAi**
Product Description:	Battery-powered IoT device that uses Machine Learning and Artificial Intelligence to detect and classify objects in its field of view.
Operating Voltage/Frequency:	Battery-Powered (3.6VDC)
Model(s):	**V1**
FCC ID:	**2AUPP-VUAI01**
Testing Commenced:	2024-05-10
Testing Ended:	2024-05-13
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 the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of DXT operating 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	2.55dB	5.09dB
Radiated Emissions 1 GHz to 2.7 GHz	1.81dB	3.62dB
Radiated Emissions 2.7 GHz to 18 GHz	1.55dB	3.10dB
AC Power Line Conducted Emissions, 150kHz to 30 MHz	1.38dB	2.76dB
AC Power Line Conducted Emissions, 9kHz to 150kHz	1.66dB	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
F2P21720-R1-01E	First Issue	2024-05-31	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Field Strength of Emissions from Intentional Radiators	FCC PART 15.249(a)(d)	Complies
Radiated Spurious Emission	CFR 47 Part 15.249(d) / Part 15.209	Complies

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

3 TABLE OF MEASURED RESULTS

Test	Low Channel 2406 MHz	Mid Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength of Fundamental	80.2dBµV/m, 10.2mV/m	81.5dBµV/m, 11.8mV/m	81.7dBµV/m, 1.1mV/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

4 ENGINEERING STATEMENT

This report has been prepared on behalf of Avuity, 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.

4 EUT INFORMATION

4.1 Equipment Under Test:

Device	Manufacturer	Model Number	Serial Number	FCC ID
VuAi IoT Device	Avuity, LLC	V1	BABAC2072182	2AUPP-VUAI01

4.2 Trade Name:
Avuity, LLC

4.3 Power Supply:
Battery-powered

4.4 Applicable Rules:
CFR 47, Part 15.249, subpart C
CFR 47, Part 15.209

4.5 Equipment Category:
Radio Transmitter-DXT

4.6 Accessories:

Device	Manufacturer	Model Number	Serial Number
Battery	EXPOCELL	ER26500	None Specified
Gateway	Avuity	VuAI	2492

4.7 Test Item Condition:
The equipment to be tested was received in good condition.

4.8 Testing Algorithm:
EUT was tested for field strength and spurious emissions with power setting of 4dBm for increased power for PCII change.

5 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166-E	Albatross Projects	B83117-DF435-T261	US140023	2024-11-15
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2025-04-09
Low Loss Cable Set	CL315 / CL318	Fairview Microwave	FMC0202914-72/FMC0202914-240	None Spec.	2025-04-09 / 2025-04-10
Horn Antenna	CL098	Emco	3115	9809-5580	2025-01-02
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2026-01-09
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2024-11-14
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
Preamplifier	CL284	A.H. Systems, Inc.	PAM-1001	131	2025-04-10
Software:	Tile Version 3.4.B.3		Software Verified: 2024-05-10 to 2024-05-13		
Software:	EMC 32, Version 8.53.0		Software Verified: 2024-05-10 to 2024-05-13		
Temp/Hum. Recorder	CL293	Thermpro	TP50	1	2025-05-31

6 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.

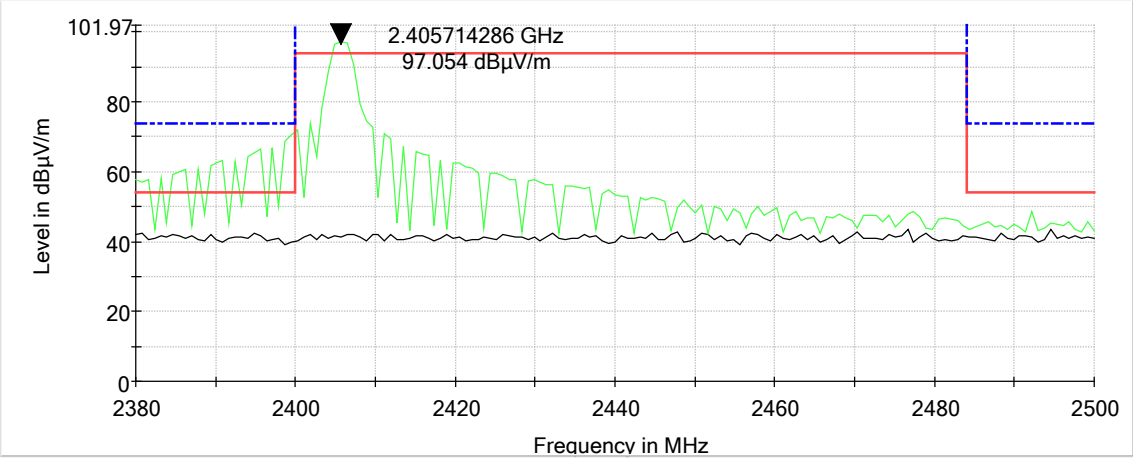
NOTE: During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions.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

In the pre-scan plots below, the green trace is MaxPeak, the red line is the average limit and the blue line is the peak limit.

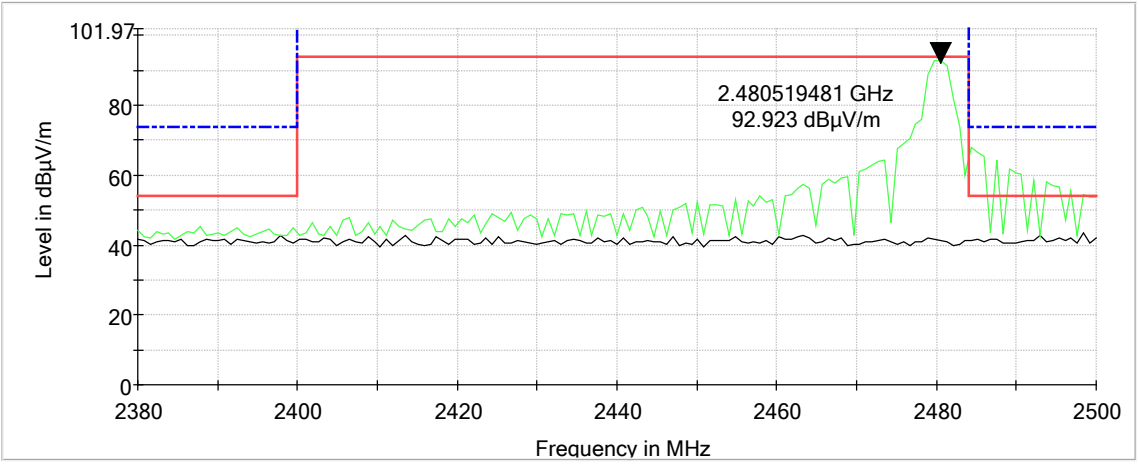
6.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date(s):	2024-05-10	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.249(a)	Air Temperature:	22.4ºC
		Relative Humidity:	47%

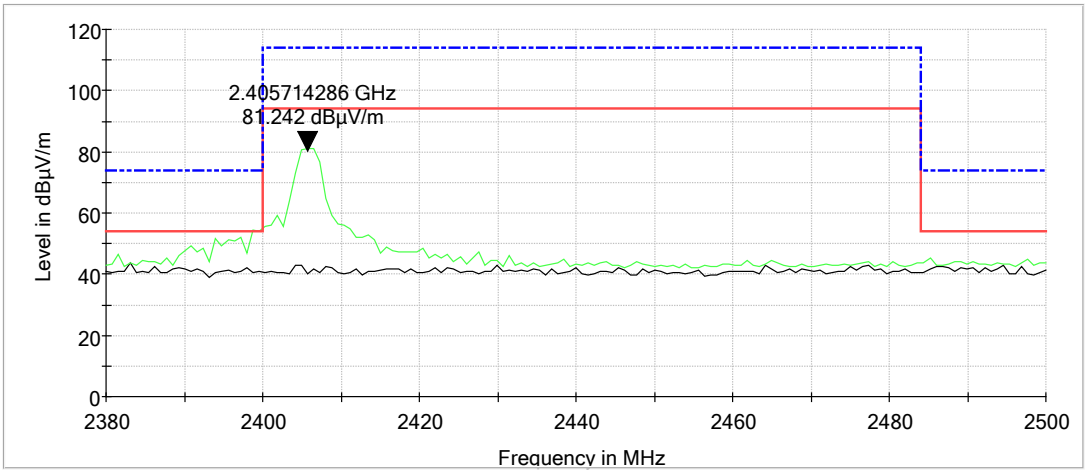
Low Band Edge: Vertical



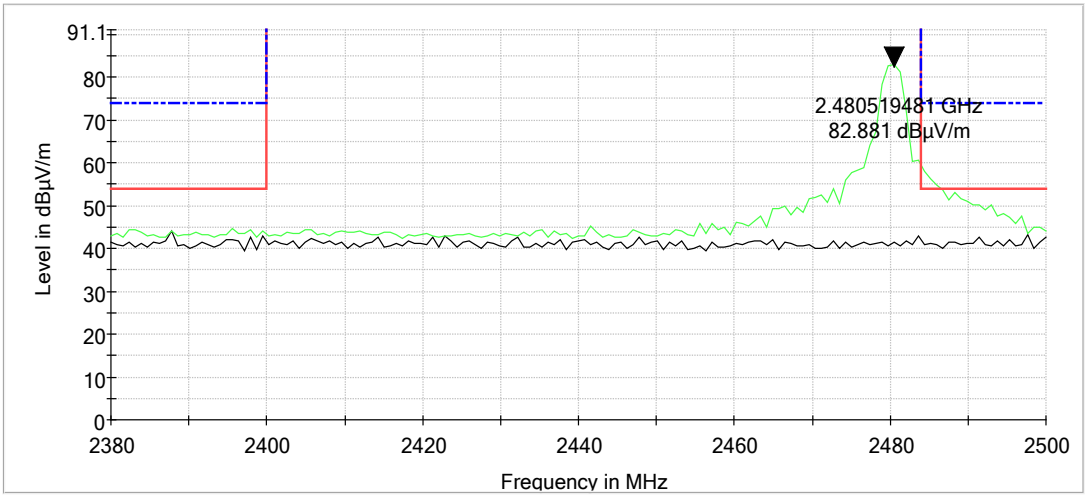
Upper Band Edge: Vertical



Low Band Edge: Horizontal

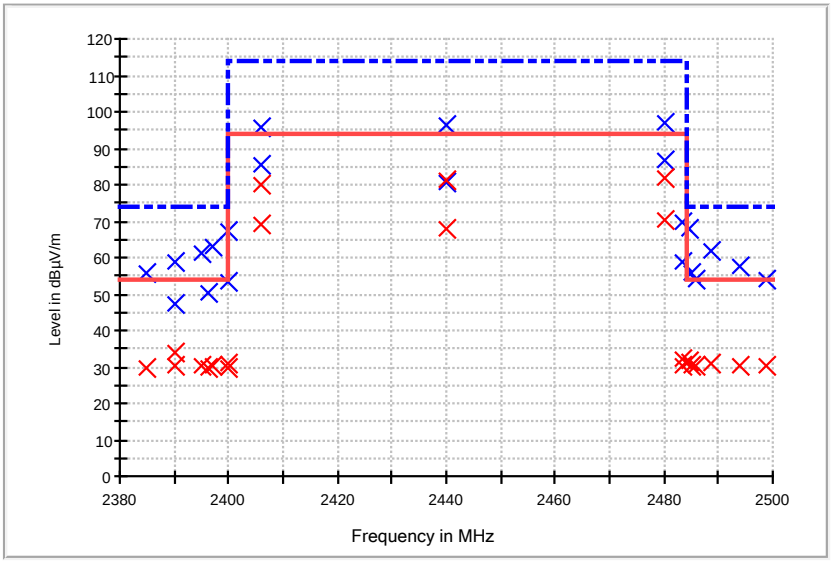


Upper Band Edge: Horizontal



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)
2385.000000	55.6	29.9	1000.0	1000.000	150.0	V	0.0	8.3	24.1	54.0
2390.000000	47.6	30.3	1000.0	1000.000	150.0	H	0.0	8.2	23.7	54.0
2390.000000	59.0	34.2	1000.0	1000.000	150.0	V	0.0	8.2	19.8	54.0
2394.805195	61.0	30.3	1000.0	1000.000	150.0	V	0.0	8.2	23.7	54.0
2396.363636	50.4	29.9	1000.0	1000.000	150.0	H	0.0	8.2	24.1	54.0
2397.142857	63.3	30.5	1000.0	1000.000	150.0	V	0.0	8.2	23.5	54.0
2400.000000	67.1	31.1	1000.0	1000.000	150.0	V	0.0	8.2	22.9	54.0
2400.000000	53.4	30.0	1000.0	1000.000	150.0	H	0.0	8.2	24.0	54.0
2406.000000	95.9	80.2	1000.0	1000.000	150.0	V	0.0	8.2	13.8	94.0
2406.000000	85.5	68.9	1000.0	1000.000	150.0	H	0.0	8.2	25.1	94.0
2440.000000	96.3	81.5	1000.0	1000.000	150.0	V	0.0	8.2	12.5	94.0
2440.000000	80.3	67.6	1000.0	1000.000	150.0	H	0.0	8.2	26.4	94.0
2480.000000	86.6	70.4	1000.0	1000.000	150.0	H	0.0	8.3	23.6	94.0
2480.000000	97.0	81.7	1000.0	1000.000	150.0	V	0.0	8.3	12.3	94.0
2483.500000	69.7	32.0	1000.0	1000.000	150.0	V	0.0	8.3	22.0	54.0
2483.500000	58.8	30.4	1000.0	1000.000	150.0	H	0.0	8.3	23.6	54.0
2484.636364	67.8	31.3	1000.0	1000.000	150.0	V	0.0	8.3	22.7	54.0
2485.194805	55.9	30.2	1000.0	1000.000	150.0	H	0.0	8.3	23.8	54.0
2485.974026	54.2	30.2	1000.0	1000.000	150.0	H	0.0	8.3	23.8	54.0
2488.532468	62.1	30.6	1000.0	1000.000	150.0	V	0.0	8.4	23.4	54.0
2493.987013	57.8	30.5	1000.0	1000.000	150.0	V	0.0	8.4	23.5	54.0
2498.662338	53.7	30.2	1000.0	1000.000	150.0	V	0.0	8.5	23.8	54.0



7 RADIATED SPURIOUS EMISSION

The EUT was configured so that both the Bluetooth and Wi-Fi were transmitting on the closest channels possible to each other. Radiated emissions were measured in a Semi-Anechoic Chamber. All emissions generated from the EUT were examined.

7.1 Requirements:

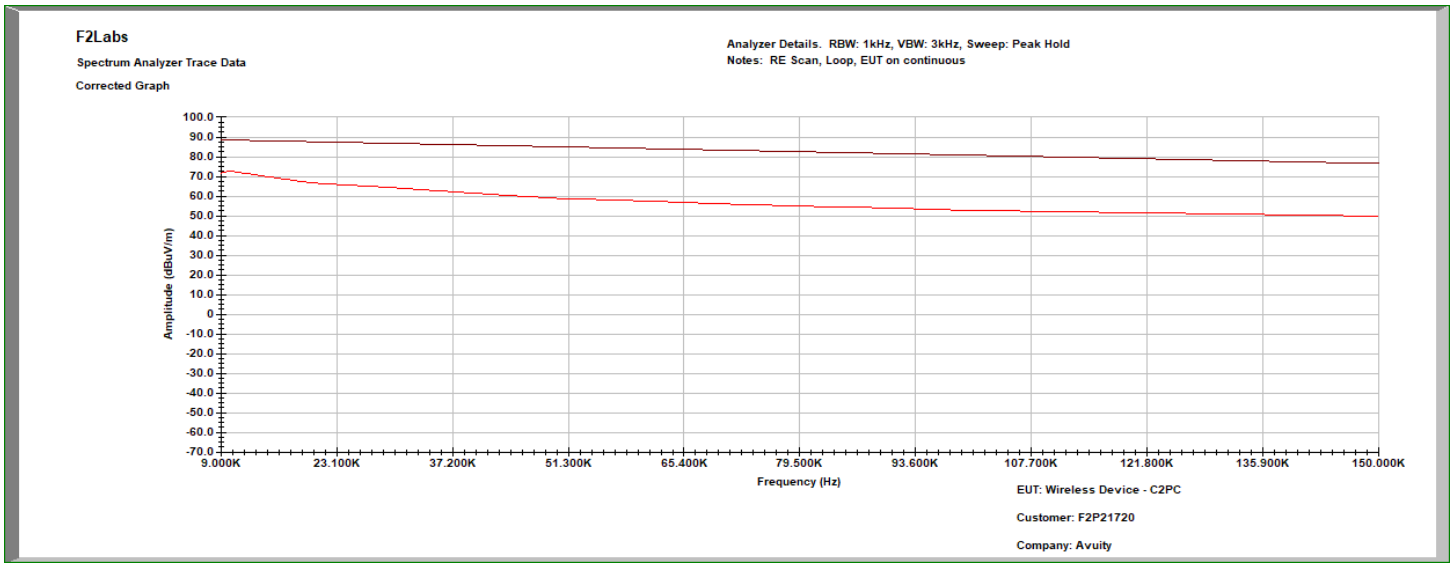
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

7.2 Radiated Spurious Emission Test Data

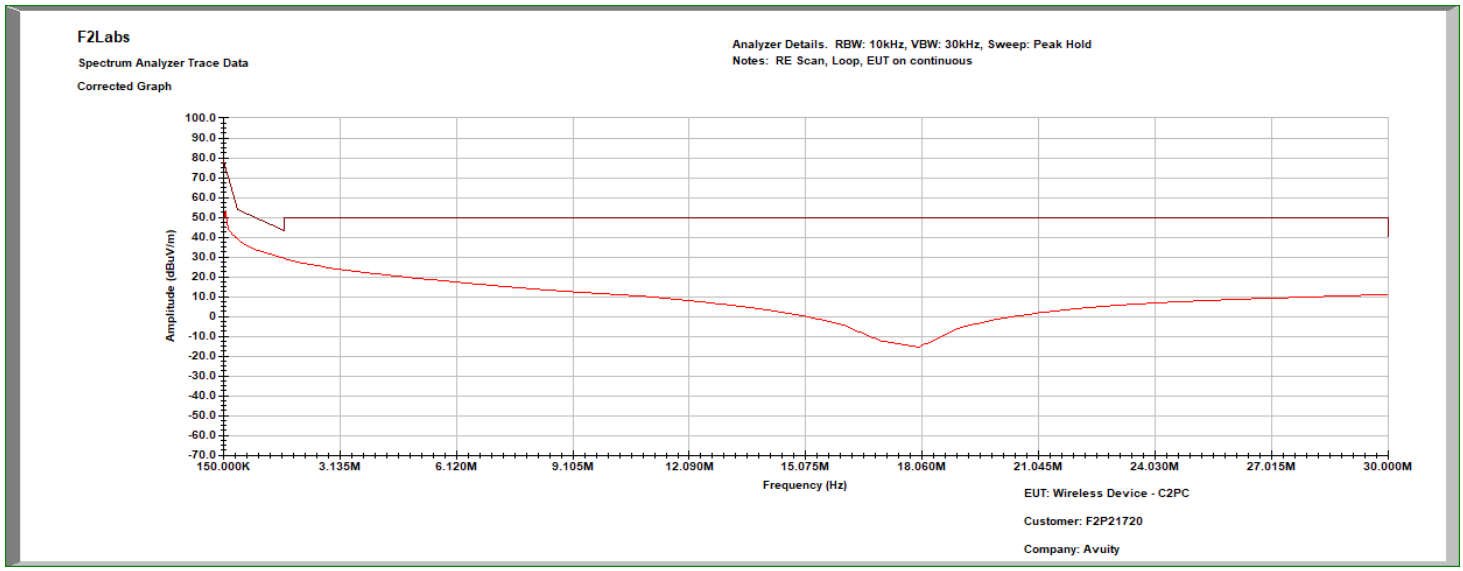
Test Dates:	2024-05-13	**Test Engineers:**	J. Chiller
Standards:	CFR 47 Part 15.249(d); Part 15.209 / KDB558074	**Air Temperature:**	22.9°C
		Relative Humidity:	42%

Notes: Plots are peak, max hold data. During the 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. Measurements were taken with the 2 transmitters set to continuous transmit at closest frequencies and High, Mid, and Low channels were tested and graphs of results are shown below. From 9kHz to 30 MHz, the worse-case channel was used for the graphs. The measurement table includes data from all three channels.

Loop Antenna, 0.009 MHz to 0.15 MHz

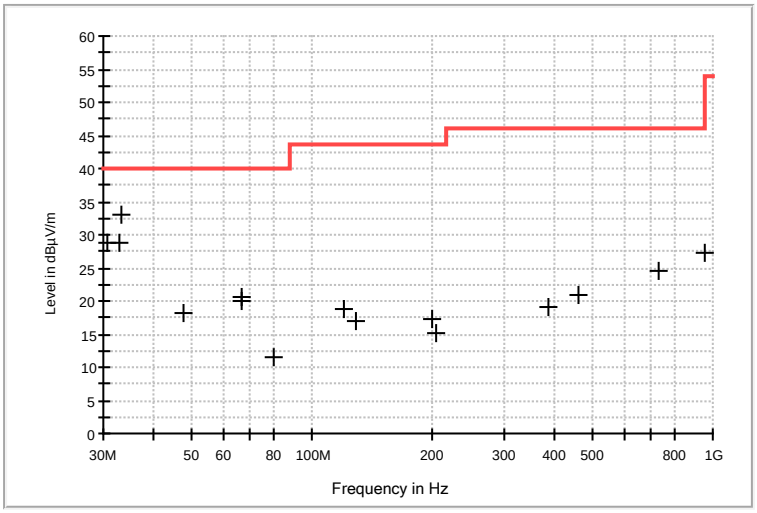


Loop Antenna, 0.15 MHz to 30 MHz



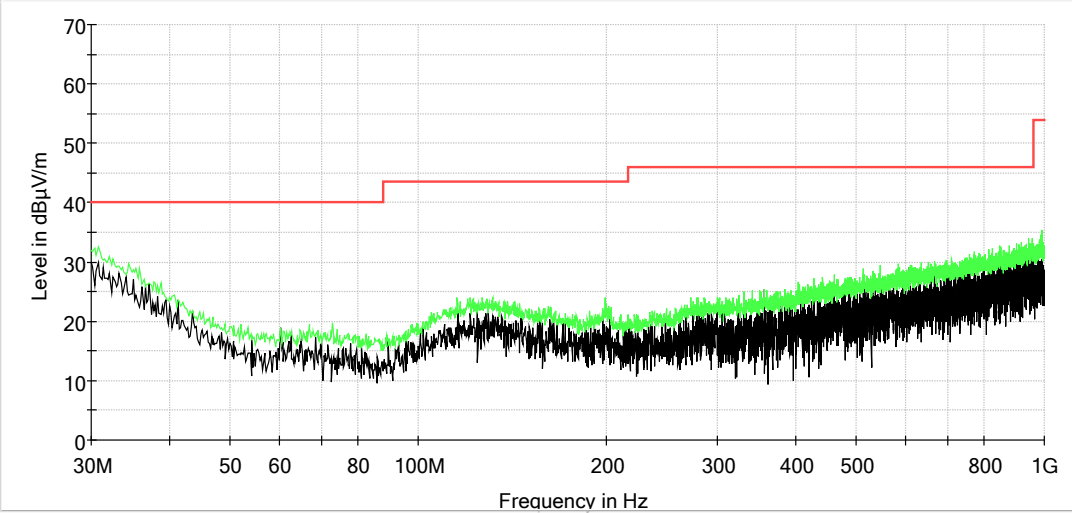
Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	Ant. Pol.	Ant. Height (em)	Azimuth (deg)	Reading (dBµV)	Corr. Factors (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.76	V	100.00	0.00	22.50	6.4	28.90	40.0	-11.1
32.92	H	100.00	0.00	24.00	4.7	28.70	40.0	-11.3
33.28	V	100.00	0.00	28.50	4.4	32.90	40.0	-7.1
47.48	H	100.00	0.00	23.80	-5.5	18.30	40.0	-21.7
66.48	V	100.00	0.00	27.80	-7.2	20.60	40.0	-19.4
66.68	H	100.00	0.00	27.10	-7.2	19.90	40.0	-20.1
79.84	H	100.00	0.00	19.20	-7.6	11.60	40.0	-28.4
120	V	100.00	0.00	20.70	-1.8	18.90	43.5	-24.6
128.76	H	100.00	0.00	18.70	-1.7	17.00	43.5	-26.5
199.96	V	100.00	0.00	19.80	-2.5	17.30	43.5	-26.2
204.6	H	100.00	0.00	18.90	-3.9	15.00	43.5	-28.5
390.08	H	100.00	0.00	18.80	0.2	19.00	46.0	-27.0
462.24	V	100.00	0.00	18.90	2.1	21.00	46.0	-25.0
733.44	H	100.00	0.00	19.00	5.5	24.50	46.0	-21.5
952.68	V	100.00	0.00	19.50	7.8	27.30	46.0	-18.7

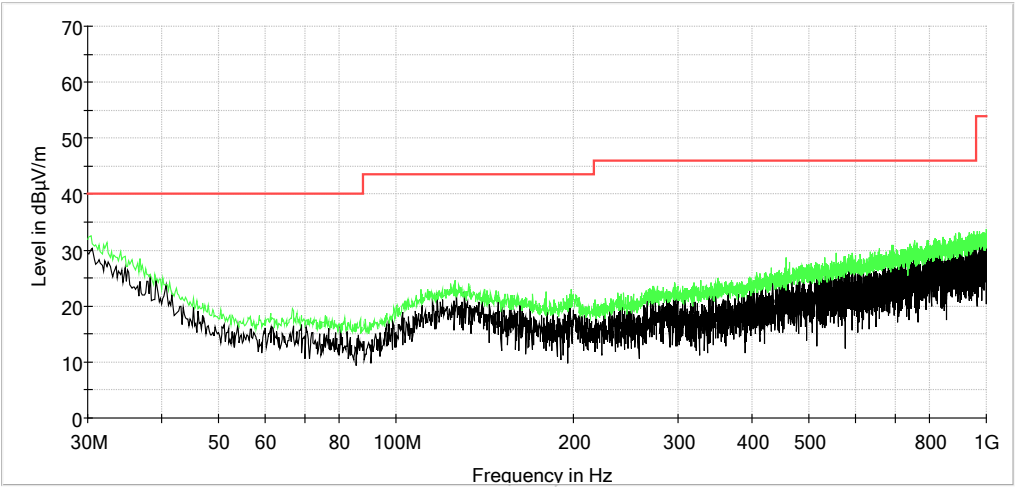


Note: In plots that follow, black waveform represents the active scan, green waveform represents MaxPk emissions readings with EUT on, red line is the limit line.

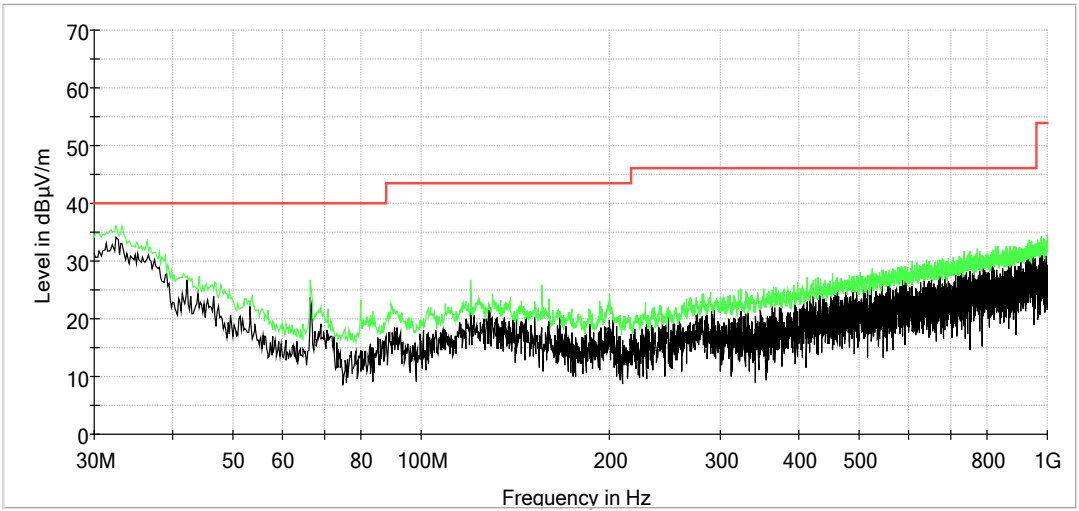
Low Channel: Characterization Scan, 30 MHz to 1000 MHz, Vertical



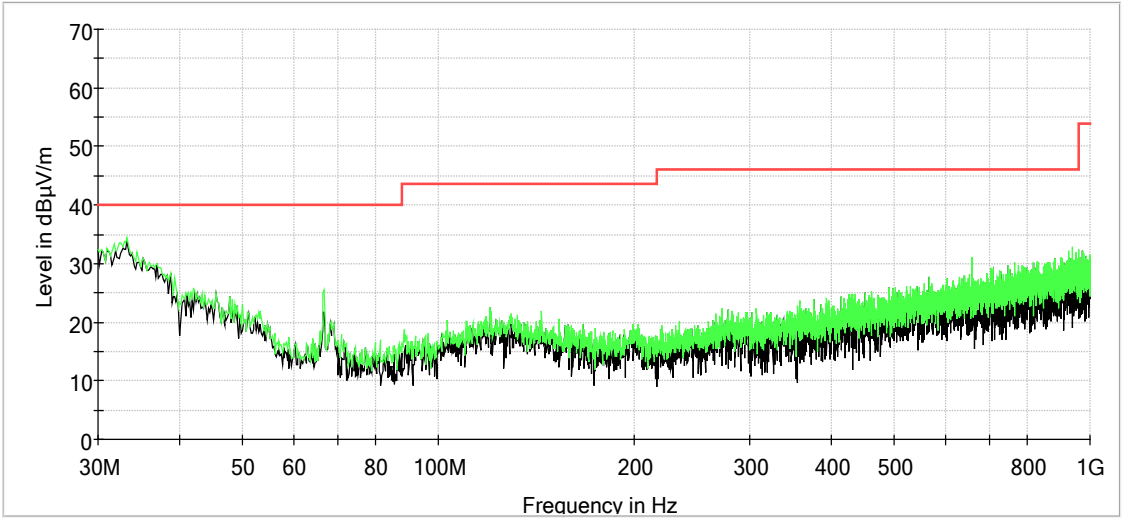
Low Channel: Characterization Scan, 30 MHz to 1000 MHz, Horizontal



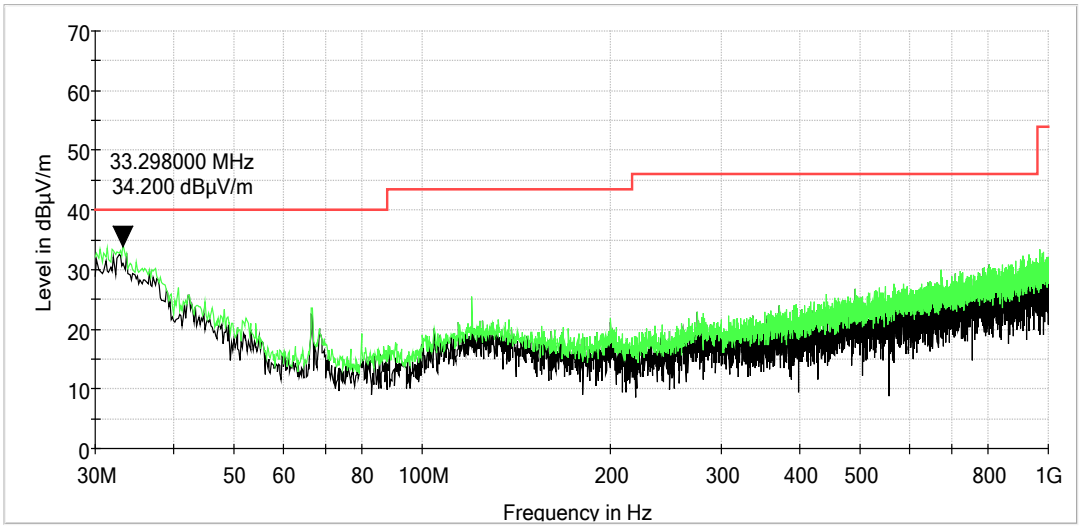
Mid Channel: Characterization Scan, 30 MHz to 1000 MHz, Vertical



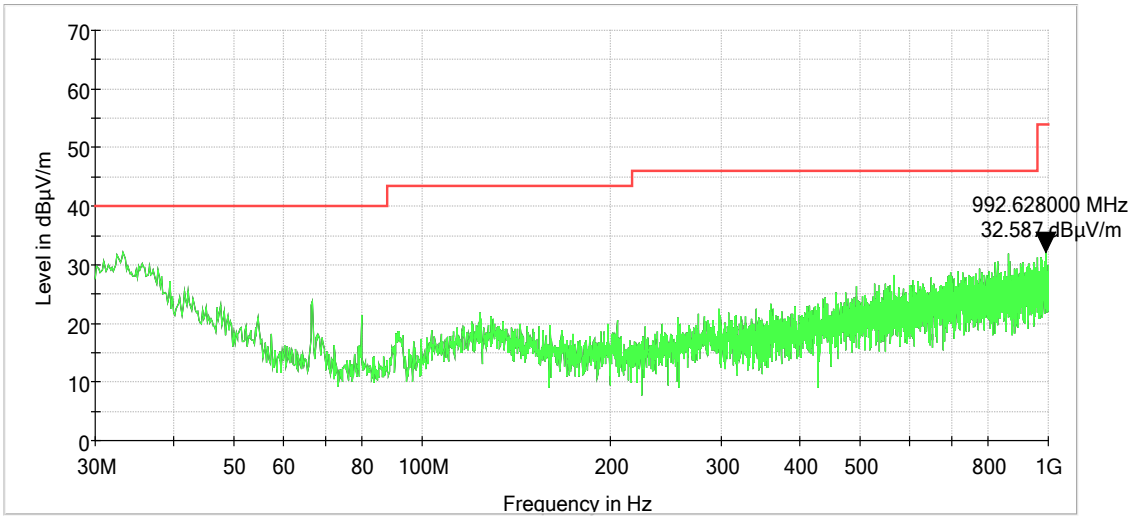
Mid Channel: Characterization Scan, 30 MHz to 1000 MHz, Horizontal



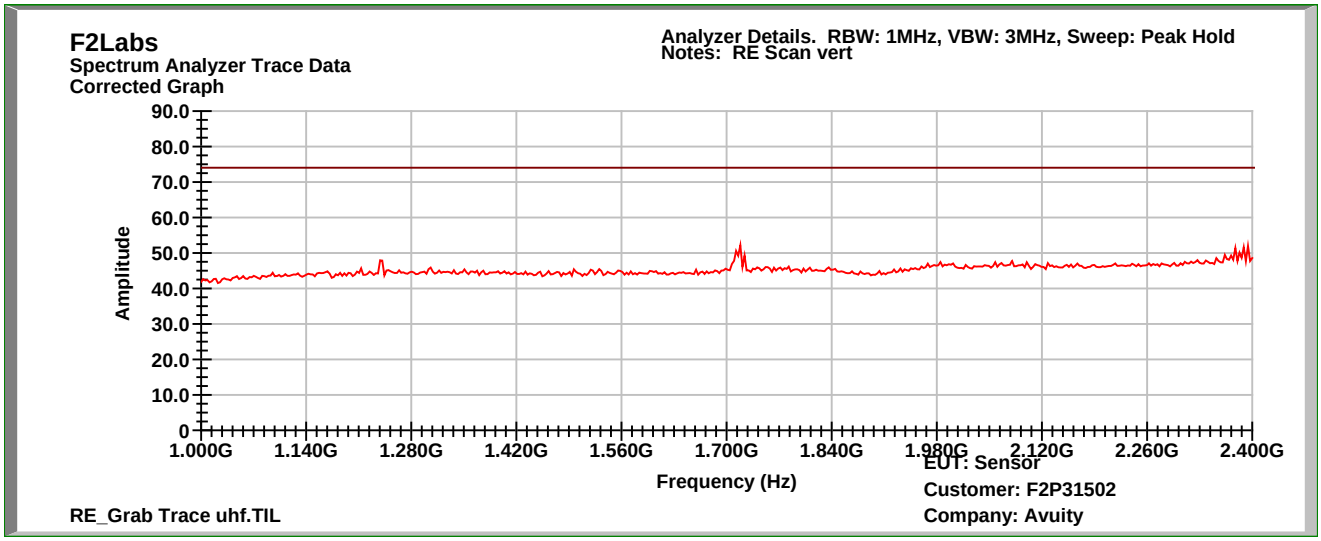
High Channel: Characterization Scan, 30 MHz to 1000 MHz, Vertical



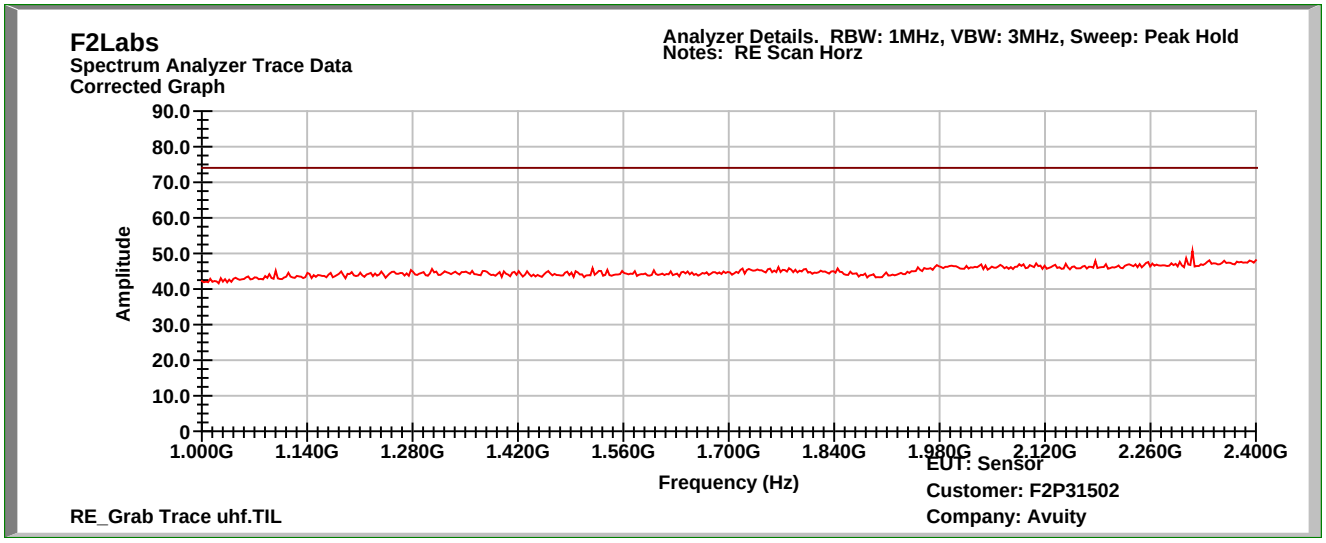
High Channel: Characterization Scan, 30 MHz to 1000 MHz, Horizontal



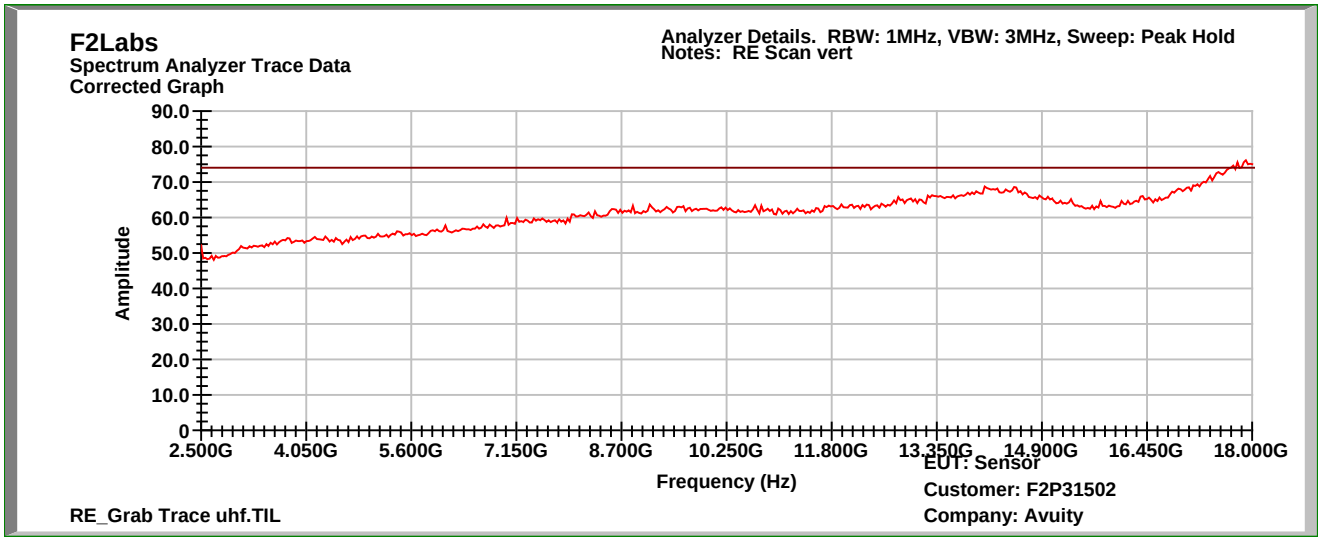
1 GHz to 2.4 GHz, Vertical



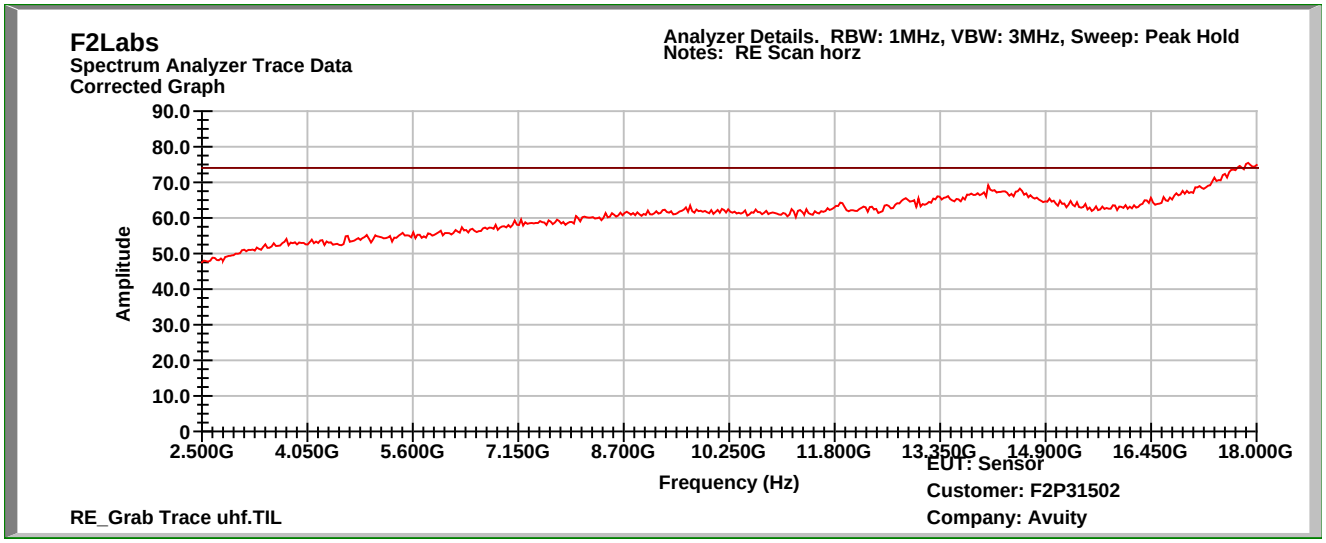
1 GHz to 2.4 GHz, Horizontal



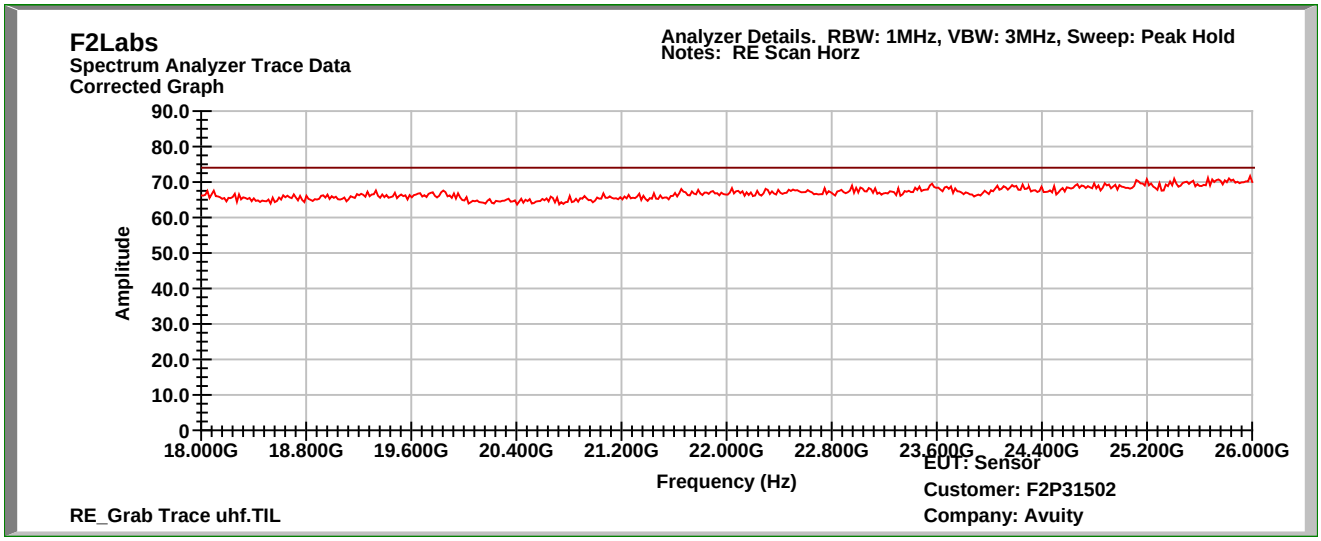
2.5 GHz to 18 GHz, Vertical



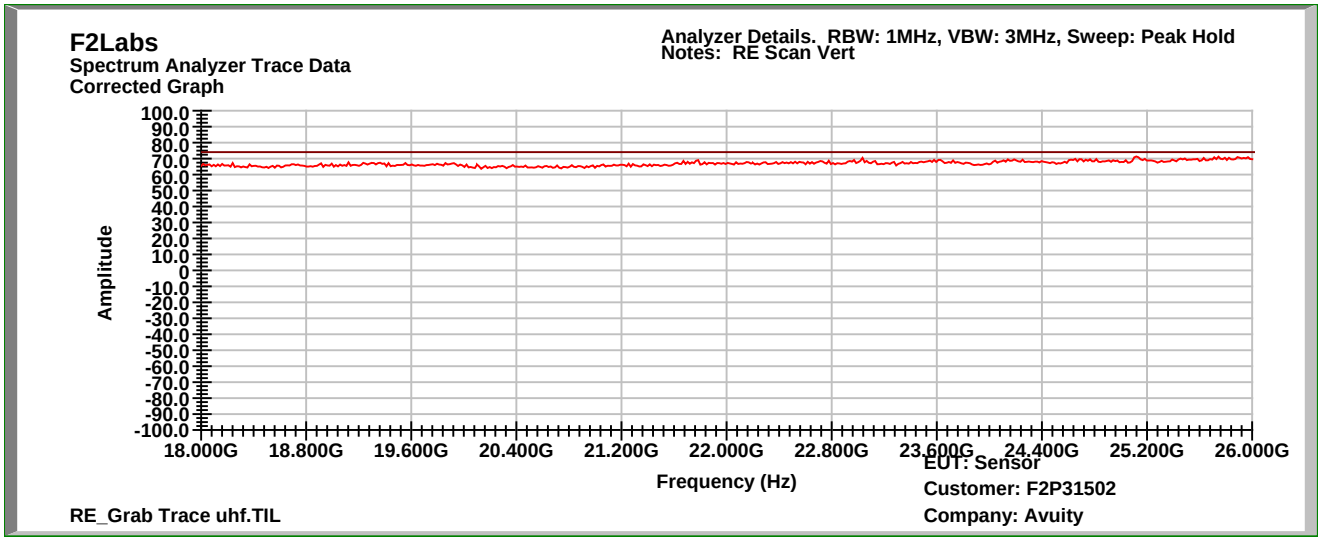
2.5 GHz to 18 GHz, Horizontal



18 GHz to 26 GHz, Vertical



18 GHz to 26 GHz, Horizontal



8 MPE CALCULATION

The MPE calculation below uses the output power of this module with max power of a Wi-Fi module and 6dBi gain of antenna as worst case.

MPE RF EXPOSURE FOR DEVICE

Distance Used: **20cm**

Limit: 1mW/cm^2

Formula Used for Result: $\frac{\text{E.I.R.P.}}{4\ \pi\ R^2}$

Results: E.I.R.P = 4000.044mW with worst case Wi-Fi

E.I.R.P of 0.044mW was determined by using the worst case E.I.R.P. on the High Channel 2480 MHz, 81.7 dBuV/m @ 3m, which equals;

$P(dBm)=E(dBuVm)+20LOG(d)-G$ −104.77

81.7 + 9.542425 + 0 - 104.77 = - 13.53dBm

$P(dBm)$= − 13.53dBm $which\ is$ 0.044mW

Wi-Fi: Max E.I.R.P. = 4000mW

Combined E.I.R.P. (Wi-Fi + Module) = 4000mW+ 0.044mW= 4000.044mW

Combined MPE (Maximum allowed Wi-Fi + Module) =
4000.044mW / (4 (3.1416)(20 x 20)) =
4000.044/5026 =0.7958 mW/cm2.

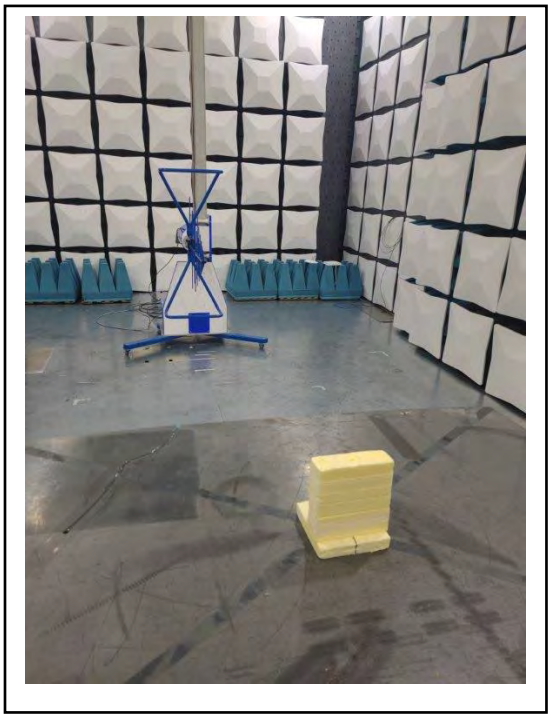
Combined Ratio = $\frac{0.7958\ \text{mW/cm2}}{1\text{mW/cm2}}$ = Ratio of 0.7958

The calculated combined MPE is below the MPE limit when the Limited Modular Approved module is co-located with a Wi-Fi device operating in Maximum allowed E.I.R.P.

9 PHOTOGRAPHS – TEST SETUP

Loop Antenna

30 MHz to 1000 MHz



Greater Than 1 GHz