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United States of America
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CERTIFICATION TEST REPORT

Manufacturer:	**Structured Monitoring Products** **151 Innovation Way, Suite 210** **Elyria, Ohio 44035 USA** **United States of America**
Applicant:	**Same as Above**
Product Name:	**Heart Monitor**
Product Description:	**Heart rate and respiratory rate measurement device for animals.**
Operating Voltage/Freq. of EUT During Testing:	12VDC from AC supply
Model:	**SMPVG02* – Version 2.5** **Denotes actual model tested where models SMPVG02 and SMPVG03 are identical except for a different label for the unit name for branding purposes.*
FCC ID:	**2ARN8-SMPVG02**
Testing Commenced:	2022-04-26
Testing Ended:	2022-08-12
Summary of Test Results:	**In Compliance** The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Standards:

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

Evaluation Conducted by:

Julius Chiller, EMC/Wireless Engineer

Report Reviewed by:

Ken Littell, Vice President of EMC

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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 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.

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2P27463-01E	First Issue	2022-08-12	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Spurious Emissions	CFR 47 Part 15.209	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 15.231(e)	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test		5.87 GHz
Average Field Strength of Fundamental		84.9 dBµV/m / 17.58 mV/m
Average Limit for Fundamental		93.97 dBµV/m / 50 mV/m
Peak Field Strength of Fundamental		85.3 dBµV/m / 18.4 mV/m
Peak Limit for Fundamental		113.97 dBµV/m / 500,000 mV/m
-20dB Occupied Bandwidth		10kHz RBW: 35.255 kHz 200Hz RBW: 8.012kHz
Voltage Variations	-15%	84.54dBuV/m
	Nominal	84.66 dBuV/m
	+15%	84.72dBuV/m

The -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 Structured Monitoring Products 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: Heart Monitor
Model: SMPVG02* – Version 2.5
Serial No.: 1
Firmware: 2.5
Hardware: D
FCC ID: 2ARN8-SMPVG02

**Denotes actual model tested where models SMPVG02 and SMPVG03 are identical except for a different label for the unit name for branding purposes.*

5.2 Trade Name:

Structured Monitoring Products

5.3 Power Supply:

12VDC from AC Supply

5.4 Applicable Rules:

CFR 47, Part 15.249, subpart C

5.5 Antenna:

Integral Antenna, 0dBi Gain

5.6 Accessories:

CUI AC Adaptor ESTA120100UDC-P5P-SZ

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was placed in a continuous transmit mode on the new single frequency of 5870 MHz. EUT was scanned for band edge and spurious emissions compliance.

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	2022-09-06
Temp/Hum. Recorder	CL234	Extech	445814	03	2022-06-08
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2023-03-31
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	Verified
Horn Antenna 18-26.5 GHz	CL114	A.H. Systems, Inc.	SAS-572	237	2023-07-30
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2022-05-12
Active 18” Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2022-09-14
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2022-09-14
Horn Antenna	CL098	Emco	3115	9809-5580	2023-01-26
Horn Antenna 26.5-40 GHz	CL188	Com-Power	AH-640	091065	2023-07-29
Preamplifier	CL285	AH Systems	PAM-0207	322	2023-03-30
Spectrum Analyzer	0204	Hewlett Packard	HP8591A	3149A02546	2023-03-29
Software:	EMC Analyzer 85712D Rev. A.00.01			Date Verified:	2022-08-12
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	2023-03-29
Software:	Tile Version 3.4.B.3.		Software Verified: 2022-07-25, 2022-08-12		
LISN	CL181	Com-Power	LI-125A	191226	2023-12-01
LISN	CL182	Com-Power	LI-125A	191225	2023-12-01
Temp/Hum. Recorder	CL233	Extech	445814	02	2023-04-18
Shield Room	0175-3V	Ray Proof	N/A	11645	2023-01-05
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	2023-02-09
Preamplifier	CL250	Com-Power	PAM-118A	18040011	2023-04-01
Temp./Hum. Recorder	CL294	Thermpro	TP50	2	2023-04-15
Temp./Hum. Recorder	CL296	Thermpro	TP50	4	2023-04-15

7 FCC PART 15.215(e), OCCUPIED BANDWIDTH

7.1 Requirements:

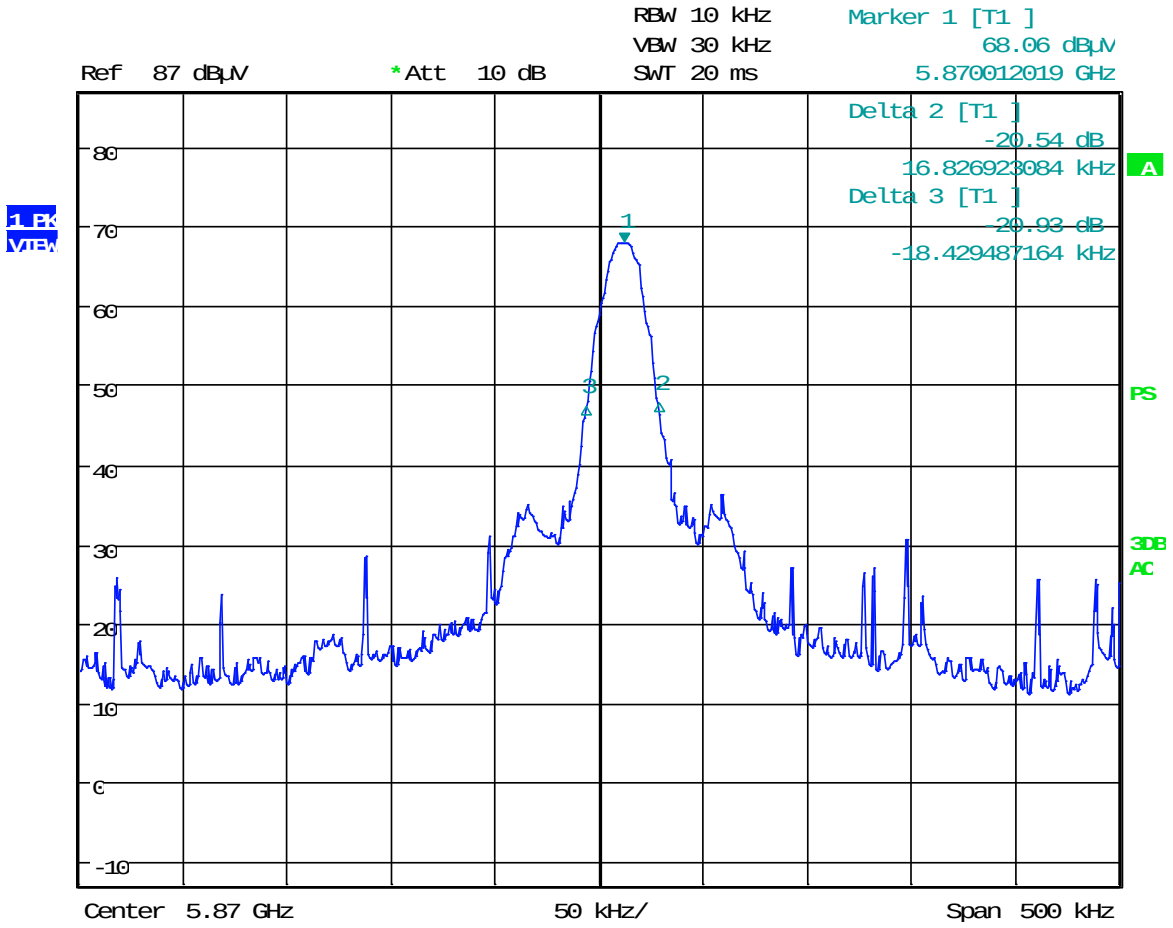
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the -20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific 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 5.87 GHz frequency. The bandwidth was measured using the analyzer's marker function. Two resolution bandwidths were used.

7.2 Occupied Bandwidth Test Data

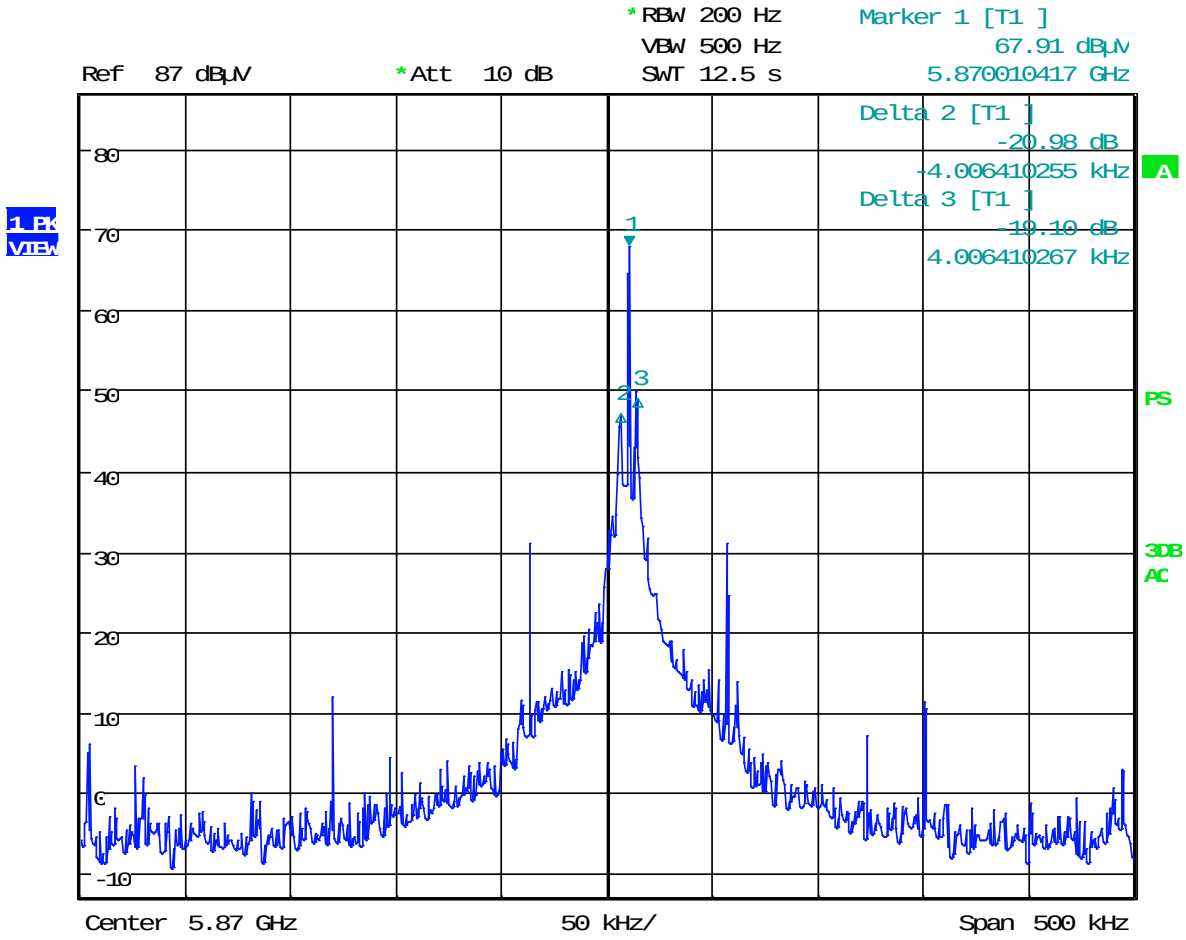
Test Date(s):	2022-04-26	Test Engineer(s):	J. Chiller
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	21.4ºC
		Relative Humidity:	40%

-20dB, 10kHz RBW



Date: 26 APR 2022 13:05:54

-20dB, 200Hz RBW



8 FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

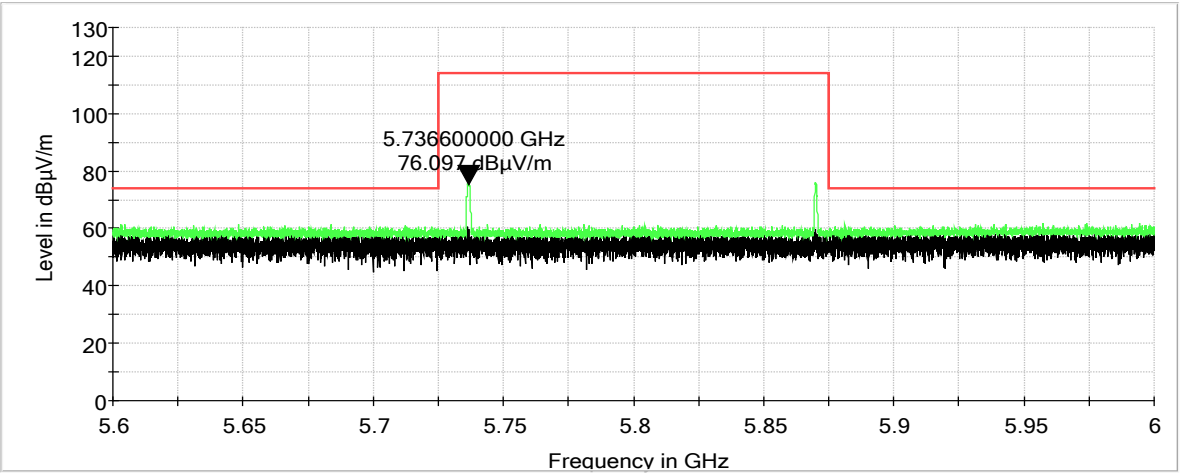
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

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

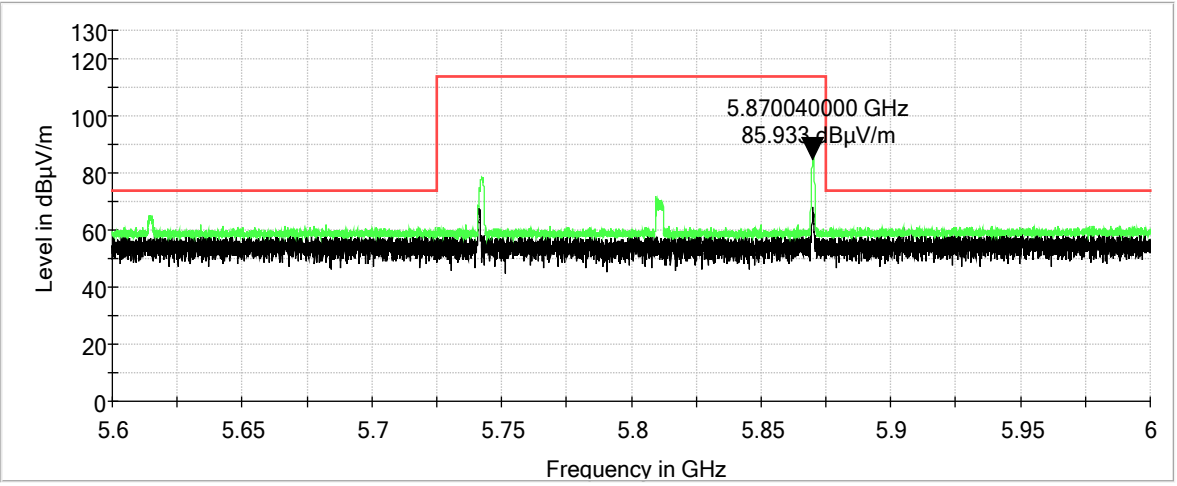
8.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date(s):	2022-04-26	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.249(a)	**Air Temperature:**	21.4ºC
		Relative Humidity:	40%

Band Edges: Vertical



Band Edges: Horizontal



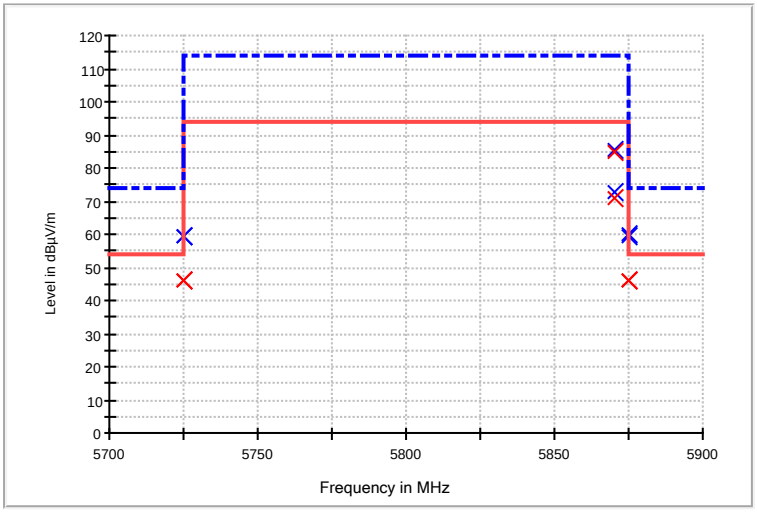
Band Edge and Field Strength of the Fundamentals

MaxPeak

Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Antenna Height (cm)	Azimuth (deg)	Reading (dBµV/m)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5725.00	V	1000.00	150.00	351.00	39.7	19.9	59.60	74.0	-14.4
5725.00	H	1000.00	150.00	0.00	39.4	19.9	59.30	74.0	-14.7
5870.00	V	1000.00	150.00	351.00	53.0	20.0	73.00	114.0	-41.0
5870.00	H	1000.00	150.00	0.00	65.3	20.0	85.30	114.0	-28.7
5875.00	V	1000.00	150.00	351.00	39.5	20.1	59.60	74.0	-14.4
5875.00	H	1000.00	150.00	0.00	39.8	20.1	59.90	74.0	-14.1

AVG

Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Antenna Height (cm)	Azimuth (deg)	Reading (dBµV/m)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5725.00	V	1000.00	150.00	351.00	26.1	19.9	46.00	54.0	-8.0
5725.00	H	1000.00	150.00	0.00	26.1	19.9	46.00	54.0	-8.0
5870.00	V	1000.00	150.00	351.00	51.1	20.0	71.10	94.0	-22.9
5870.00	H	1000.00	150.00	0.00	64.9	20.0	84.90	94.0	-9.1
5875.00	V	1000.00	150.00	351.00	26.1	20.1	46.20	54.0	-7.8
5875.00	H	1000.00	150.00	0.00	26.1	20.1	46.20	54.0	-7.8



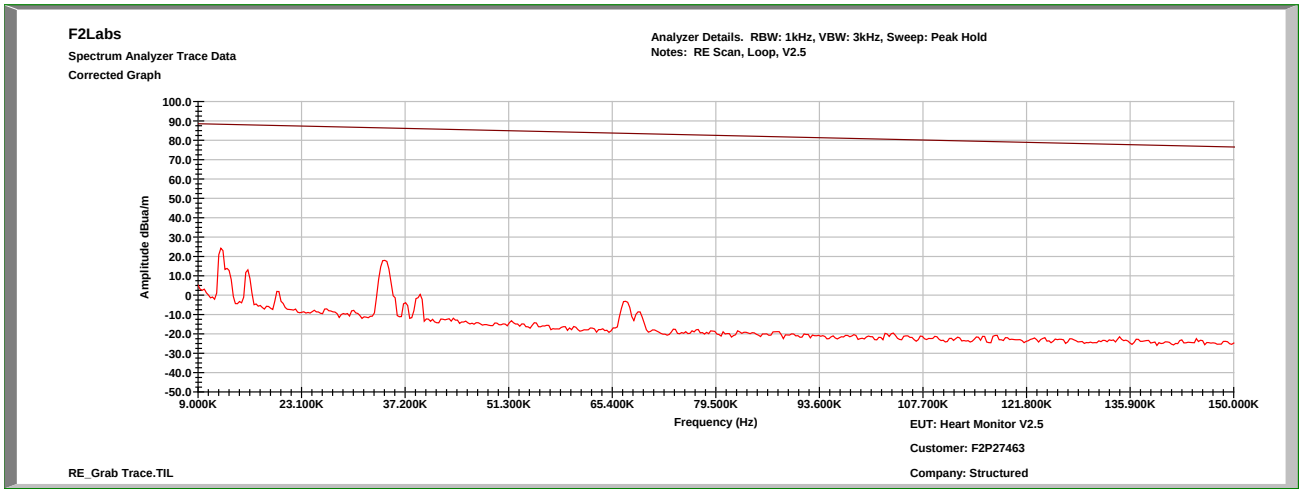
8.2 Test Data – Spurious Emissions

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.

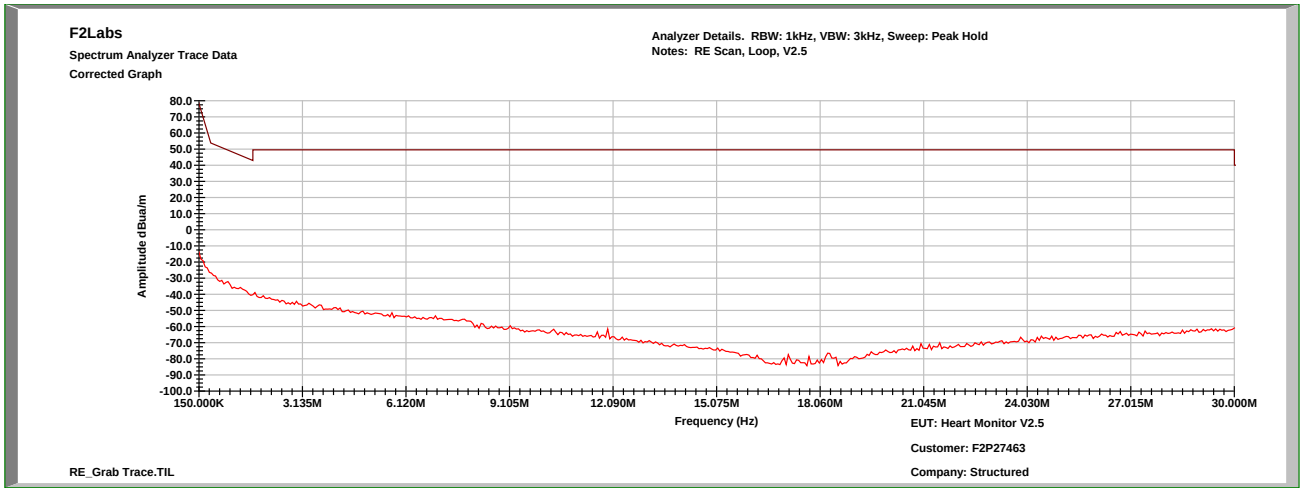
At least 6 of the highest frequencies were measured per ANSI 63.4 in a 3-meter anechoic chamber. Frequencies below 1 GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies 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 40 GHz and the highest emissions are listed below.

Test Date(s):	2022-04-26	**Test Engineer(s):**	J. Chiller
Standards:	CFR 47 Part 15.249(d) / Part 15.209	**Air Temperature:**	21.4ºC
		Relative Humidity:	40%

Characterization Scan, 9 kHz to 150 kHz

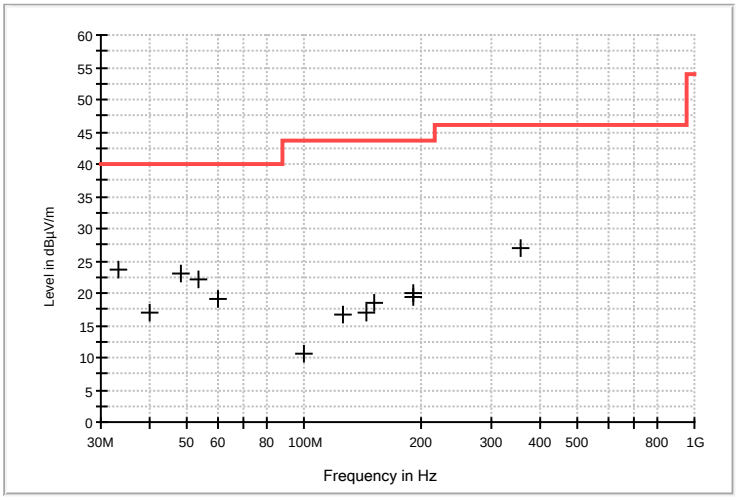


Characterization Scan, 150 kHz to 30 MHz

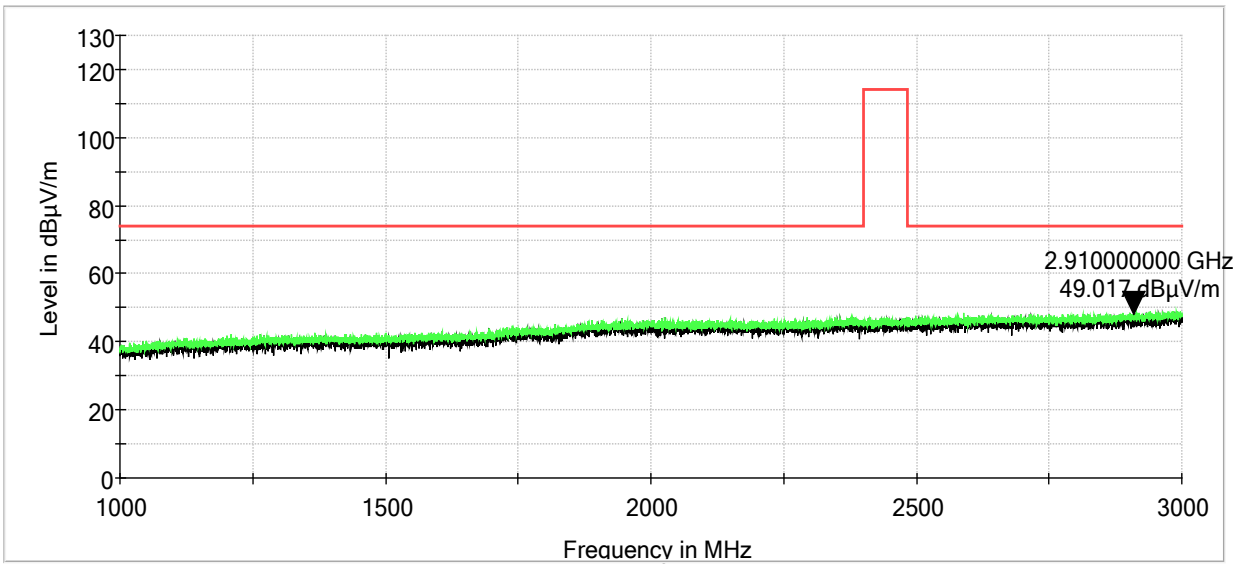


30 MHz to 1000 MHz

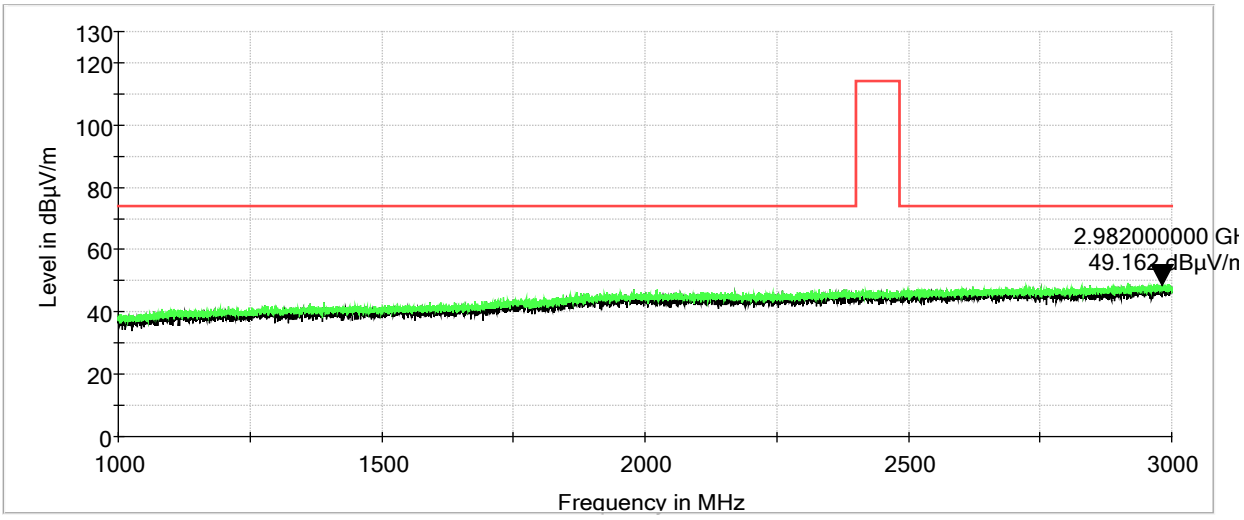
Frequency (MHz)	Ant. Pol.	Ant. Height (cm)	Azimuth (degrees)	Reading (dBµV)	Correction Factors (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
33.300000	V	100.00	0.00	27.2	-3.6	23.60	40.0	-16.4
40.000000	H	100.00	47.00	25.7	-8.7	17.00	40.0	-23.0
48.040000	V	100.00	0.00	36.7	-13.6	23.10	40.0	-16.9
53.280000	V	100.00	0.00	36.8	-14.7	22.10	40.0	-17.9
59.880000	V	100.00	0.00	34.0	-15.0	19.00	40.0	-21.0
100.000000	H	100.00	47.00	22.7	-12.0	10.70	43.5	-32.8
125.000000	H	100.00	47.00	24.9	-8.3	16.60	43.5	-26.9
144.070000	V	100.00	0.00	26.0	-9.1	16.90	43.5	-26.6
151.640000	H	100.00	47.00	27.8	-9.4	18.40	43.5	-25.1
189.860000	V	100.00	0.00	30.1	-10.1	20.00	43.5	-23.5
191.020000	H	100.00	47.00	29.6	-10.1	19.50	43.5	-24.0
359.990000	H	100.00	47.00	32.5	-5.5	27.00	46.0	-19.0



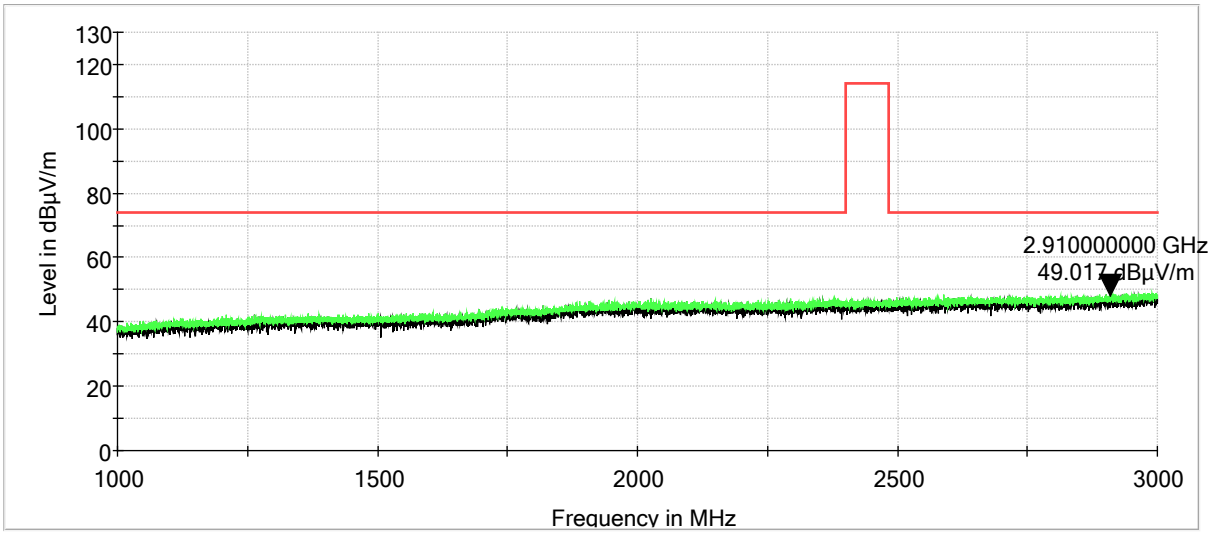
Radar, 1 GHz to 3 GHz, Vertical



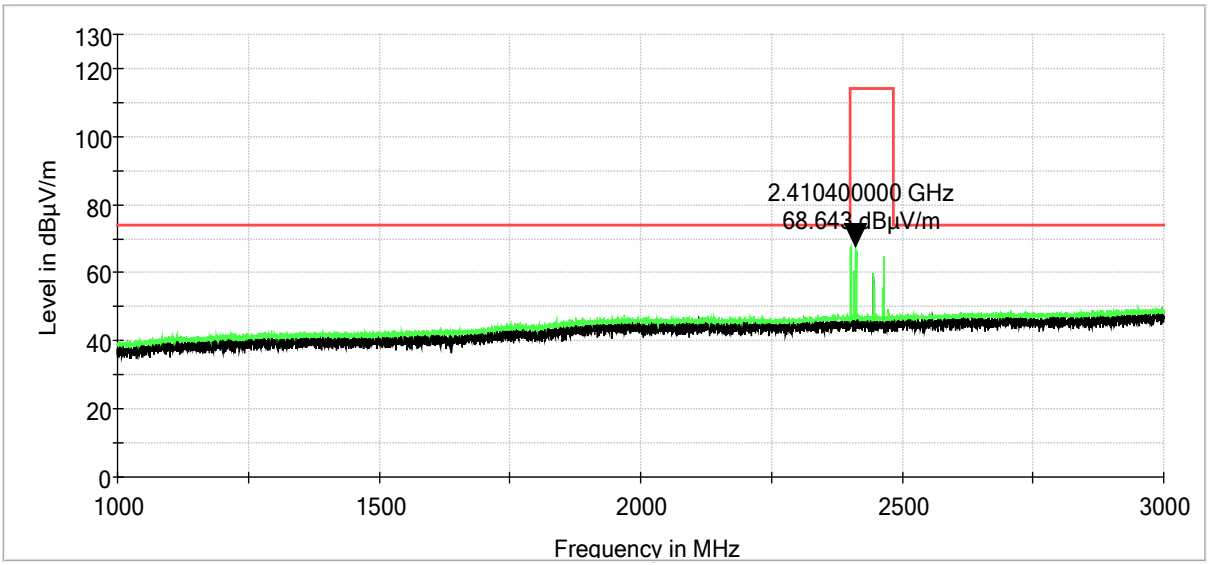
Radar, 1 GHz to 3 GHz, Horizontal



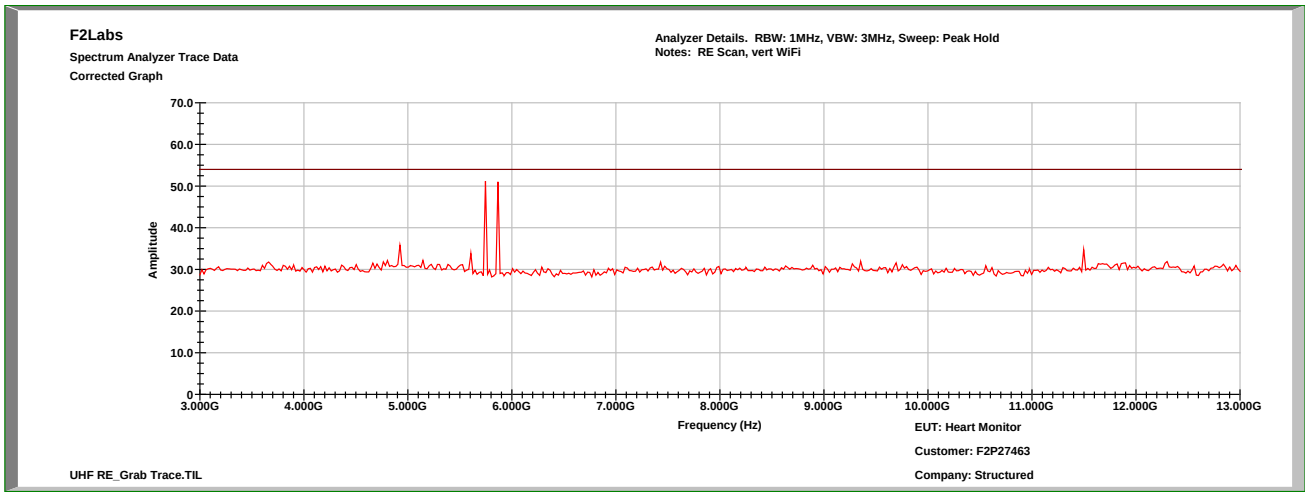
BLE, 1 GHz to 3 GHz, Vertical



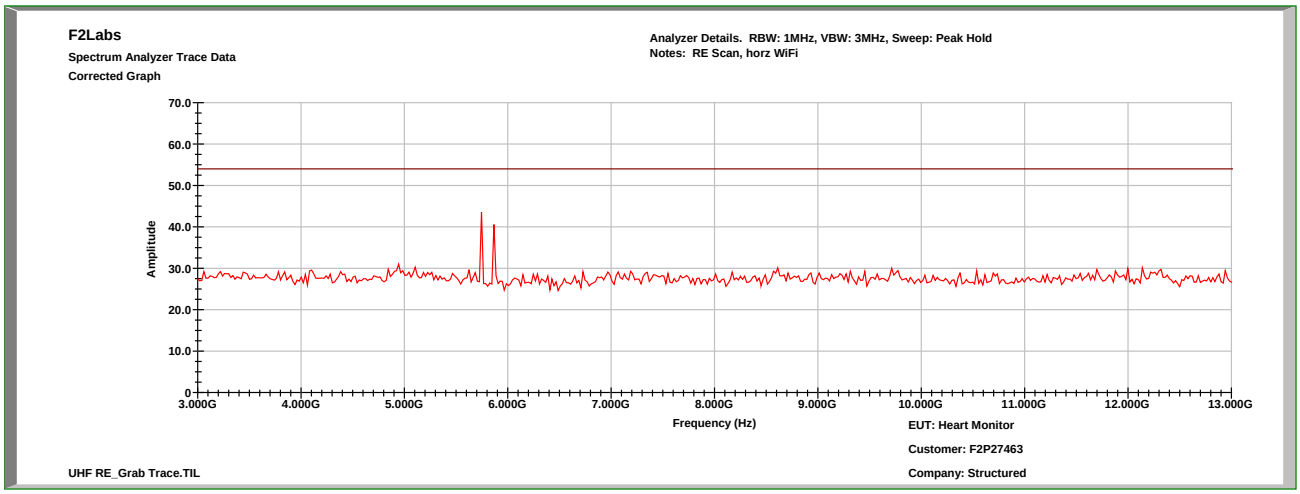
BLE, 1 GHz to 3 GHz, Horizontal



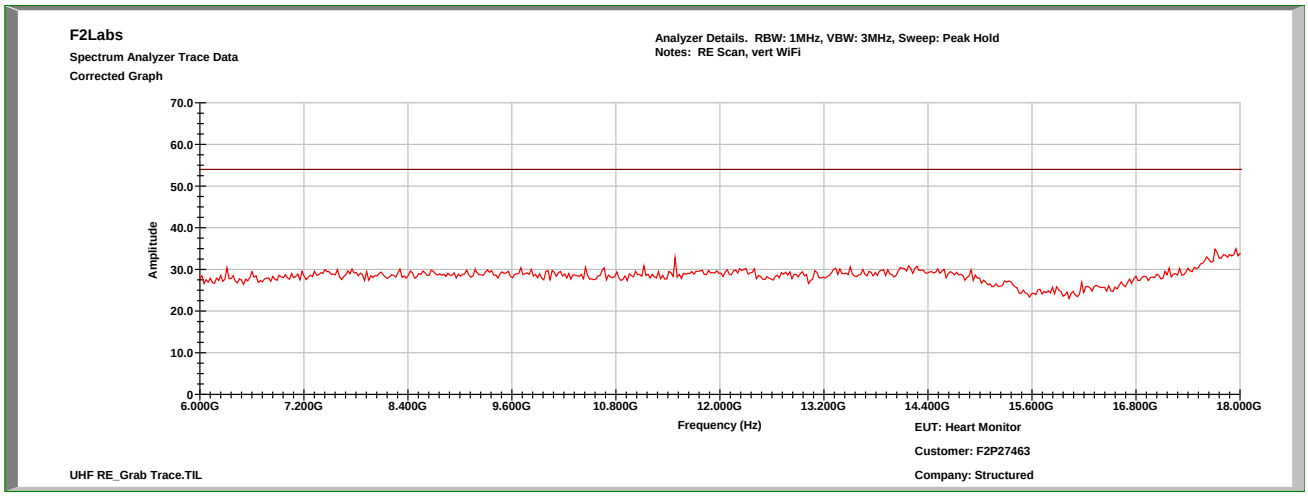
3 GHz to 13 GHz, Vertical



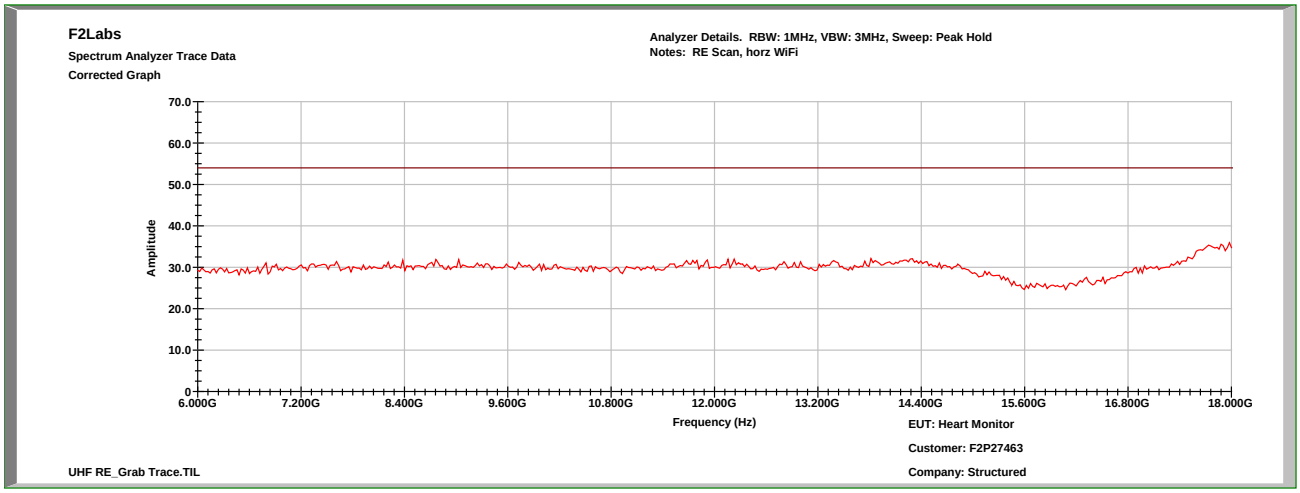
3 GHz to 13 GHz, Horizontal



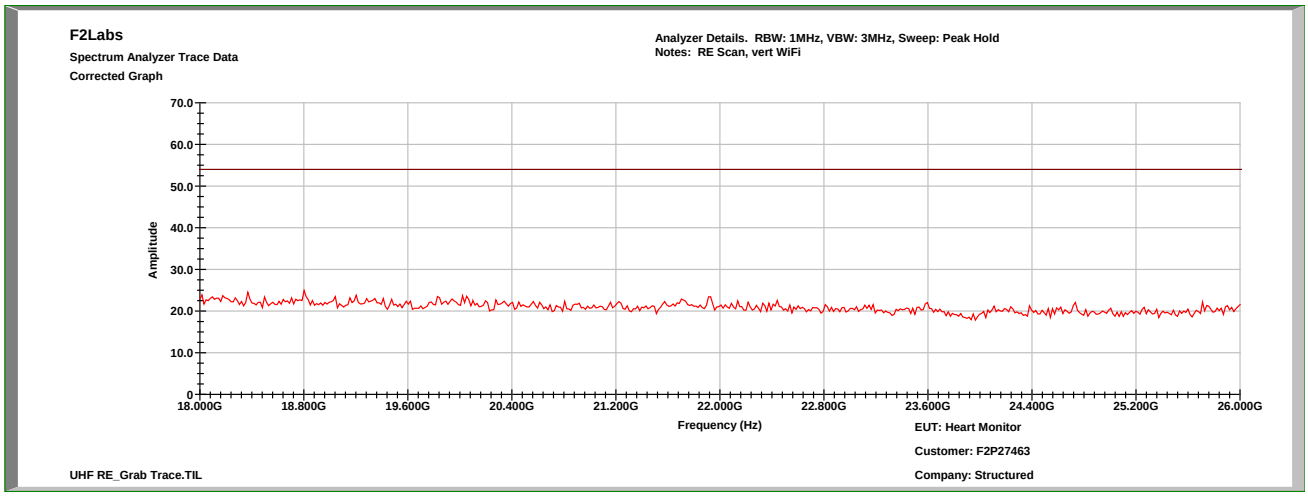
6 GHz to 18 GHz, Vertical



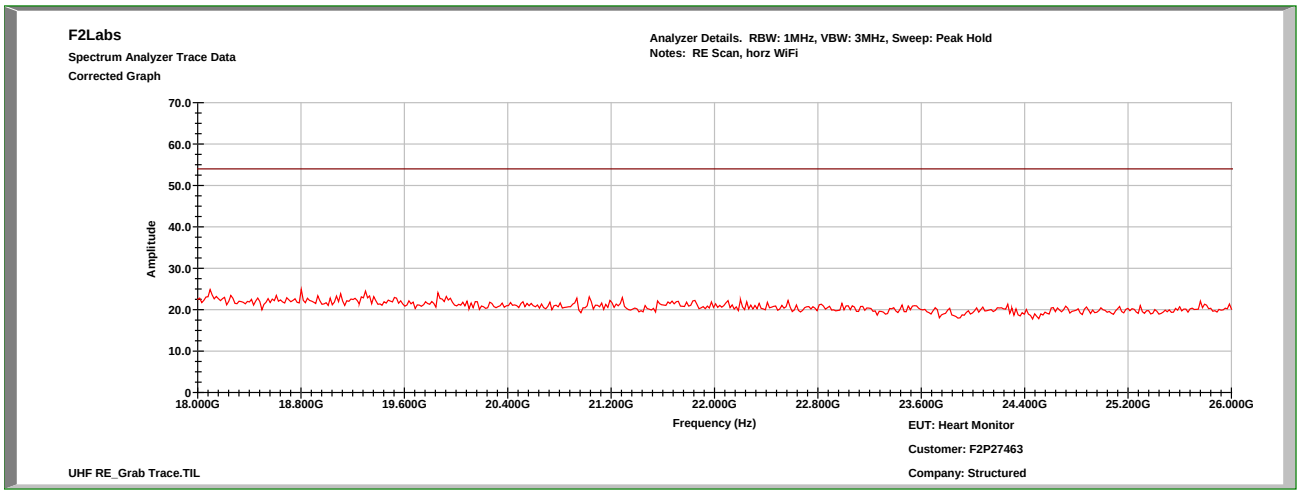
6 GHz to 18 GHz, Horizontal



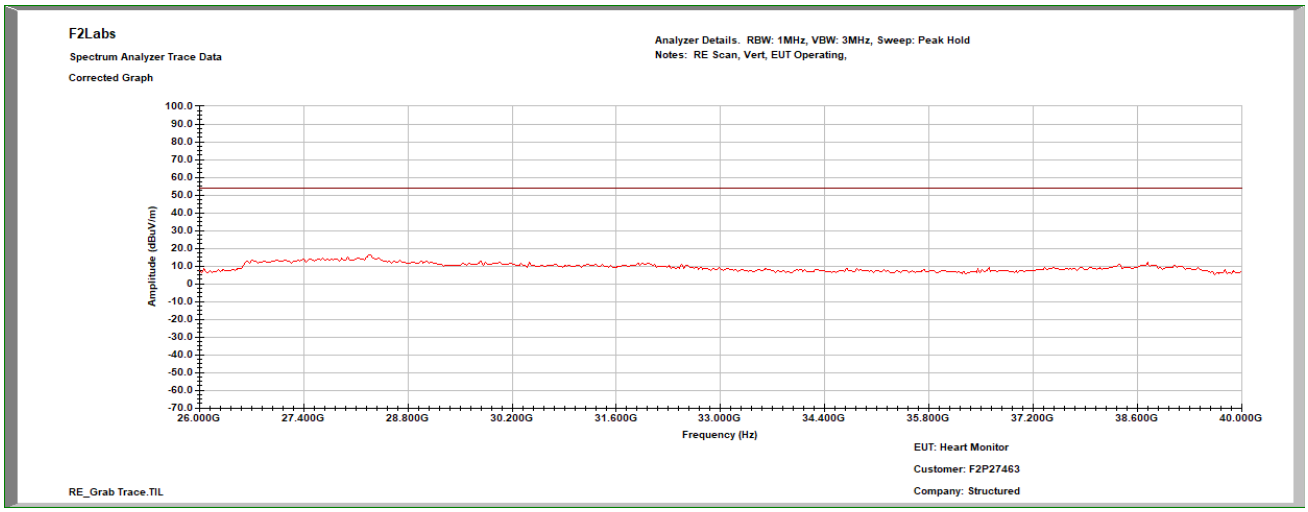
18 GHz to 26 GHz, Vertical



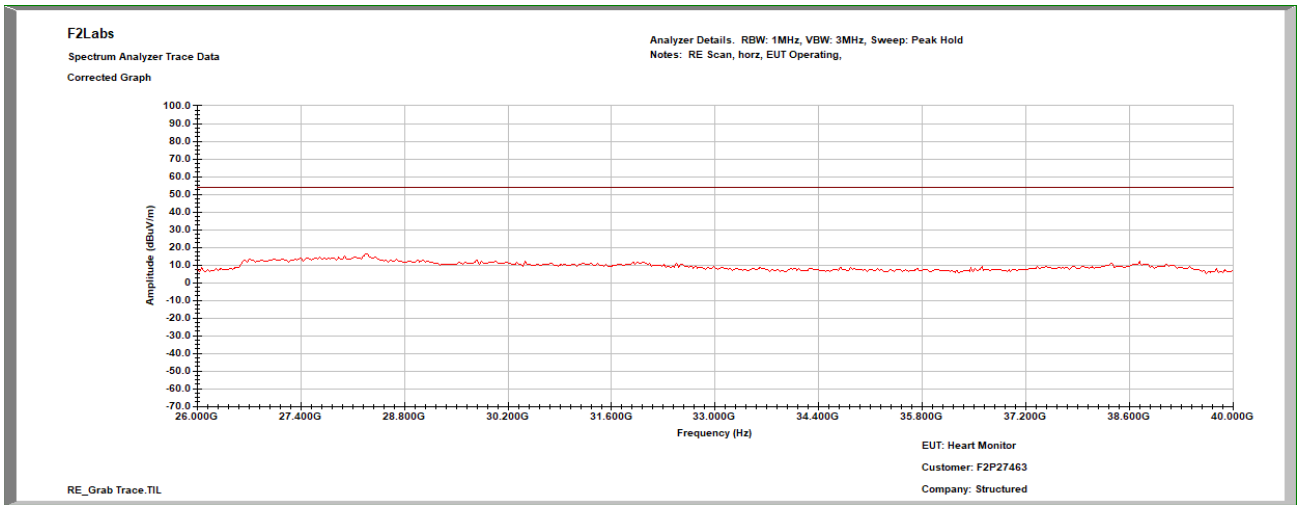
18 GHz to 26 GHz, Horizontal



26 GHz to 40 GHz, Vertical



26 GHz to 40 GHz, Horizontal



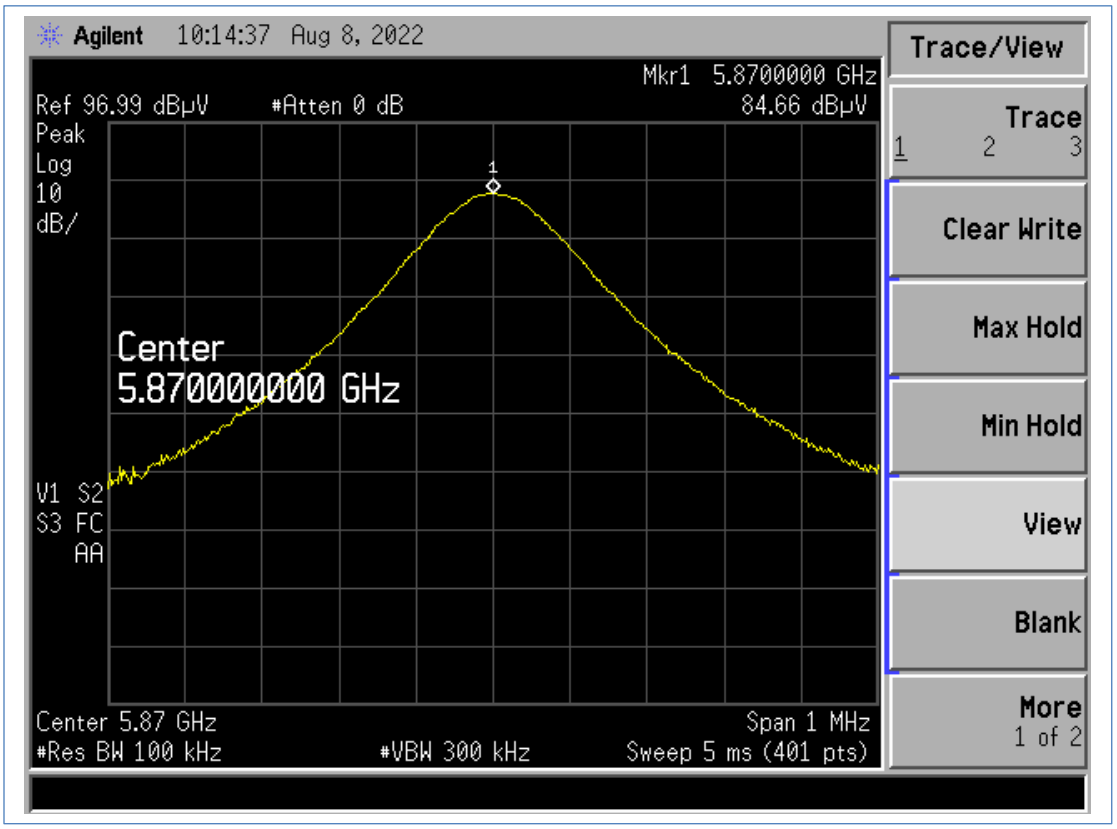
9 VOLTAGE VARIATIONS

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 93VAC and 117VAC were used as the 85% and 115% variations.

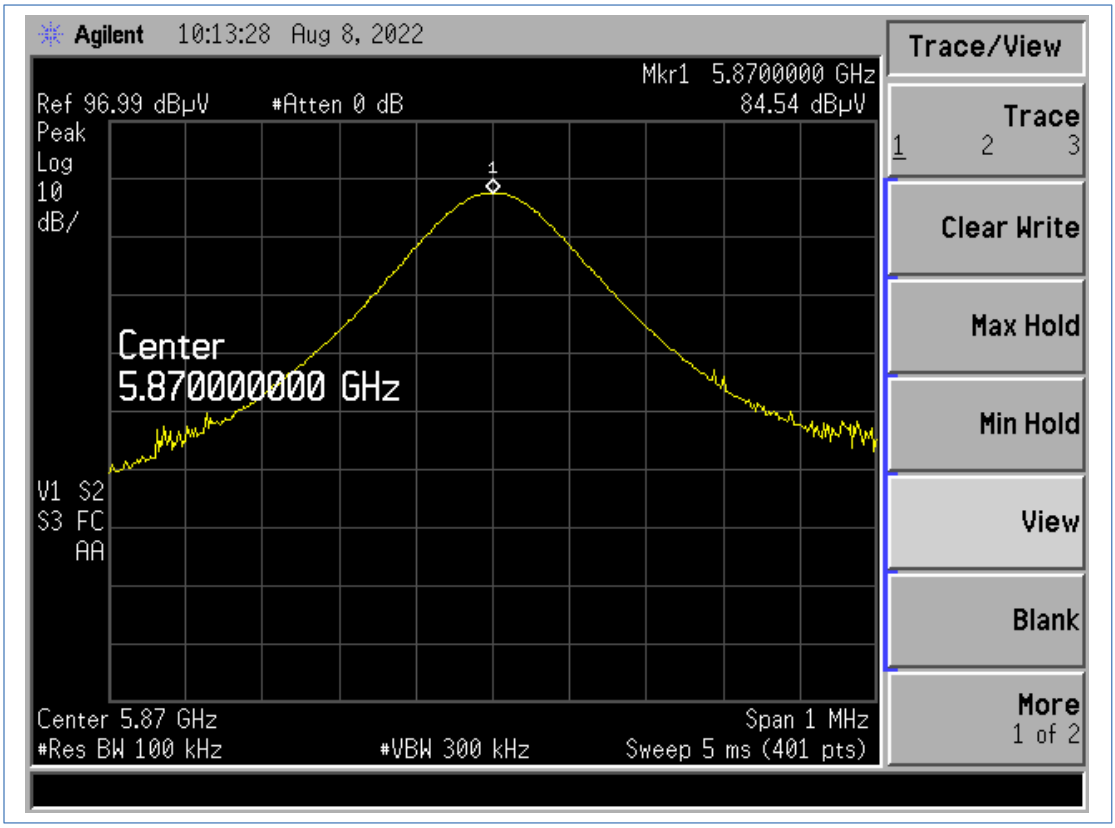
RESULTS: The results showed that the fundamental frequency did not move outside the frequency band and the field strength did not increase above the limit during the variations.

Test Date:	2022-08-08	**Test Engineer:**	J. Chiller
Rule:	CFR 47 Part 15.231(e)	**Air Temperature:**	21.9º C
Test Results:	Pass	**Relative Humidity:**	50%

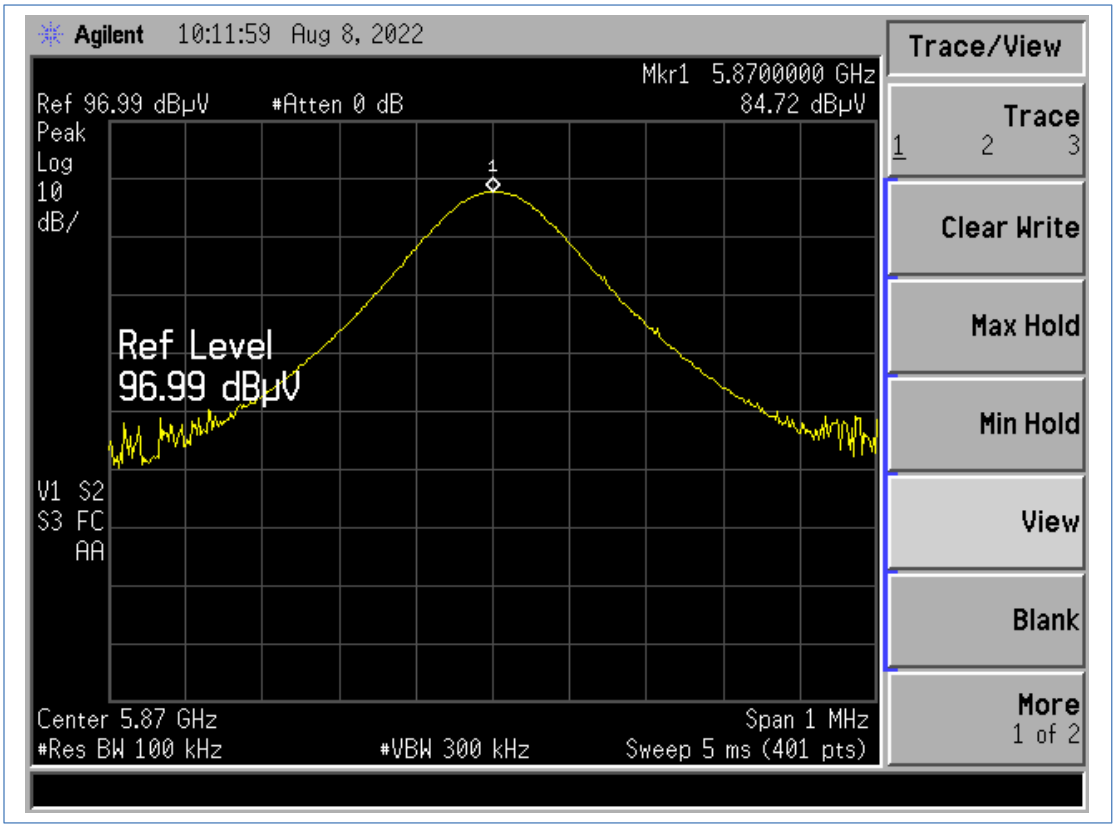
Nominal



-15%


Agilent 10:13:28 Aug 8, 2022
Mkr1 5.8700000 GHz
Ref 96.99 dBµV
#Atten 0 dB
84.54 dBµV
Peak
Log
10
dB/
Center
5.870000000 GHz
V1 S2
S3 FC
AA
Center 5.87 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 1 MHz
Sweep 5 ms (401 pts)
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

+15%


Agilent 10:11:59 Aug 8, 2022
Mkr1 5.8700000 GHz
Ref 96.99 dBµV
#Atten 0 dB
84.72 dBµV
Peak
Log
10
dB/
Ref Level
96.99 dBµV
V1 S2
S3 FC
AA
Center 5.87 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 1 MHz
Sweep 5 ms (401 pts)
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

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 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

*Decreases with the logarithm of the frequency.

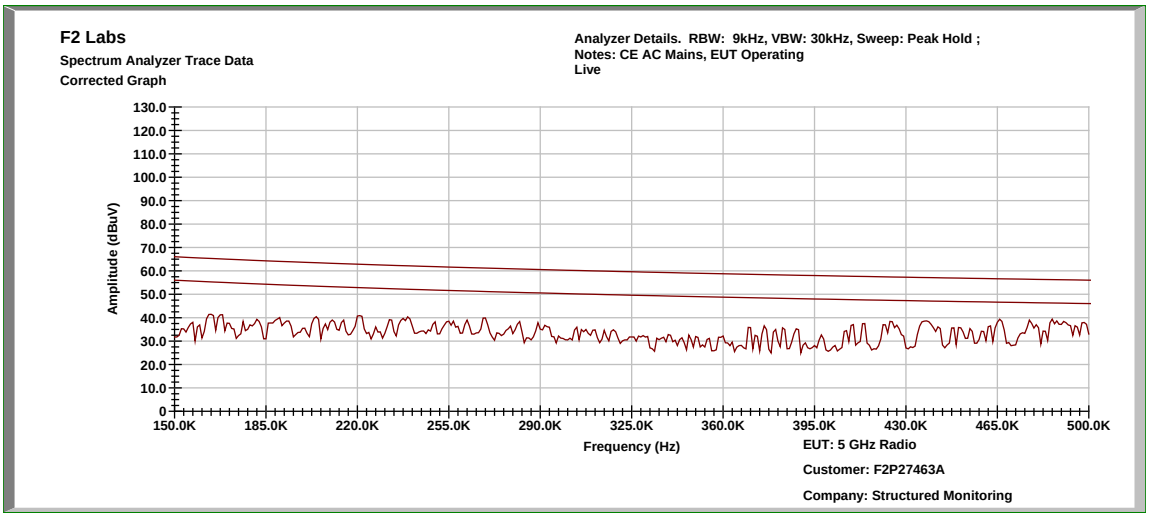
10.2 Procedure

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.

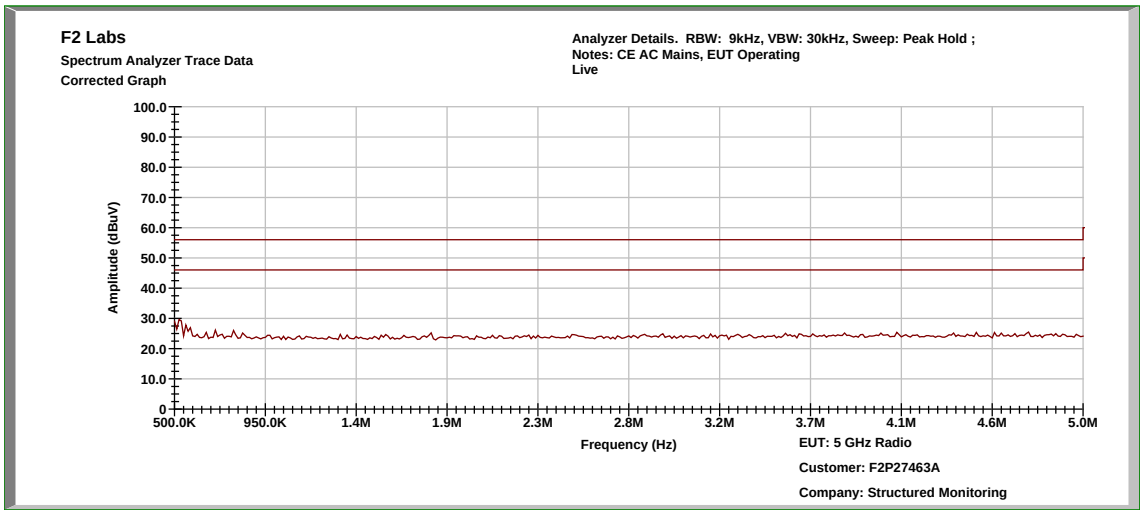
10.3 Conducted Emissions Test Data

Test Date(s):	2022-08-12	**Test Engineer:**	J. Chiller
Rule:	15.207	**Air Temperature:**	21.2º C
Test Results:	Complies	**Relative Humidity:**	48%

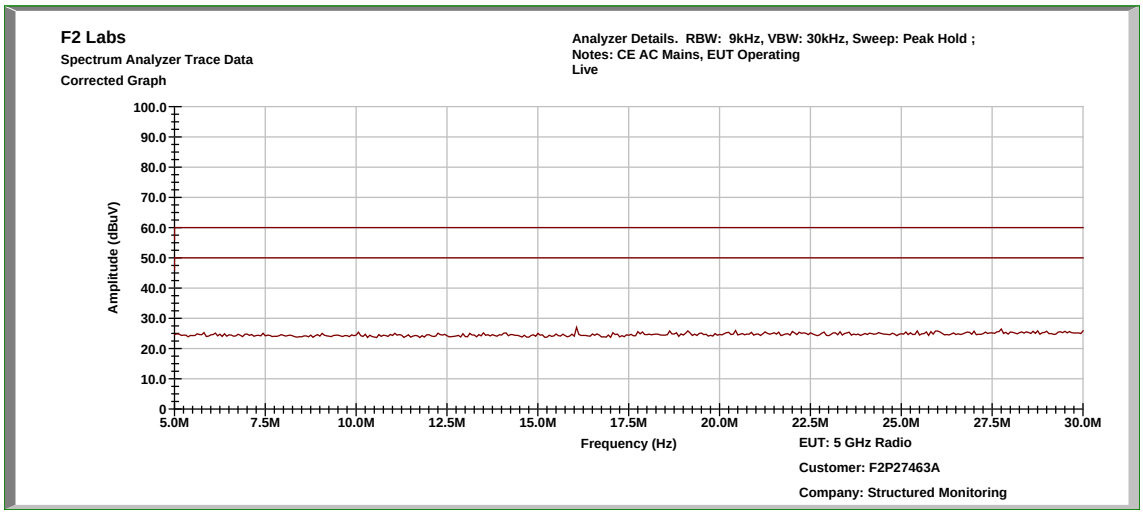
Conducted Test – Live: 0.15 MHz to 0.5 MHz



Conducted Test – Live: 0.5 MHz to 5.0 MHz

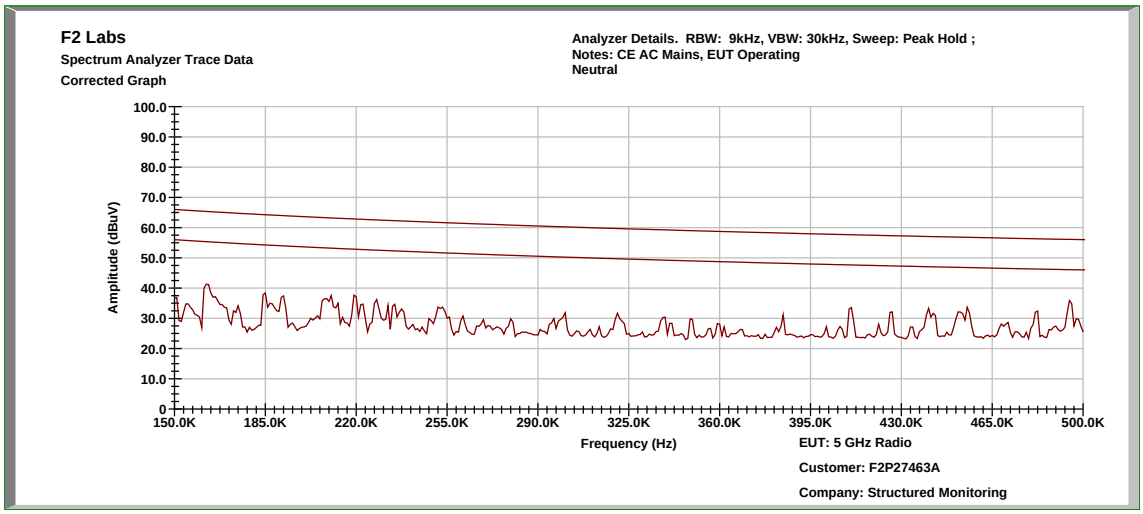


Conducted Test – Live: 5.0 MHz to 30.0 MHz

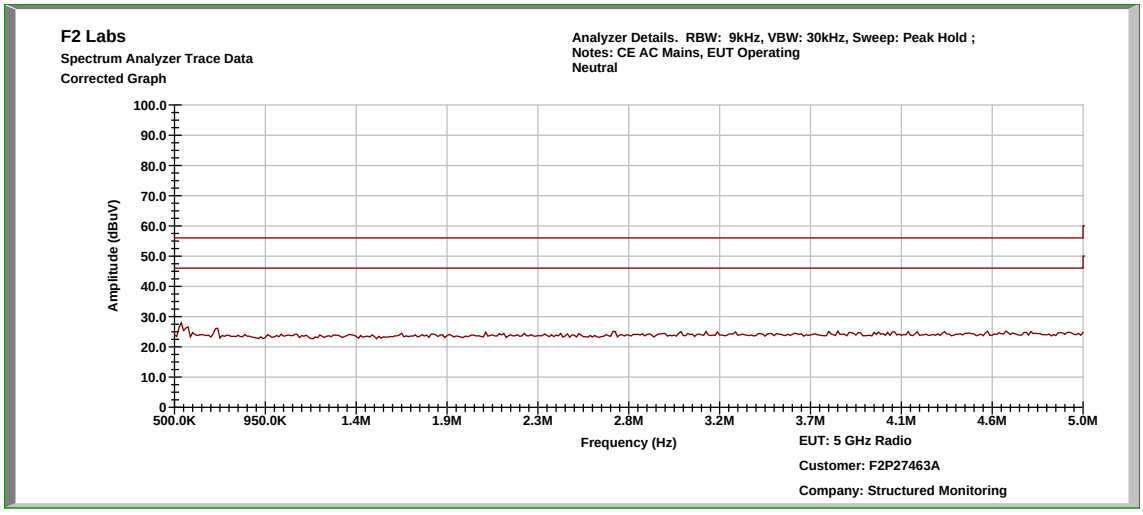


Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Live	0.2069	Quasi-Peak	21.78	11.0	32.78	63.33	-30.6
			Average	9.62	11.0	20.62	53.33	-32.7
2	Live	0.405	Quasi-Peak	18.25	11.0	29.25	56.88	-27.6
			Average	5.60	11.0	16.60	46.88	-30.3

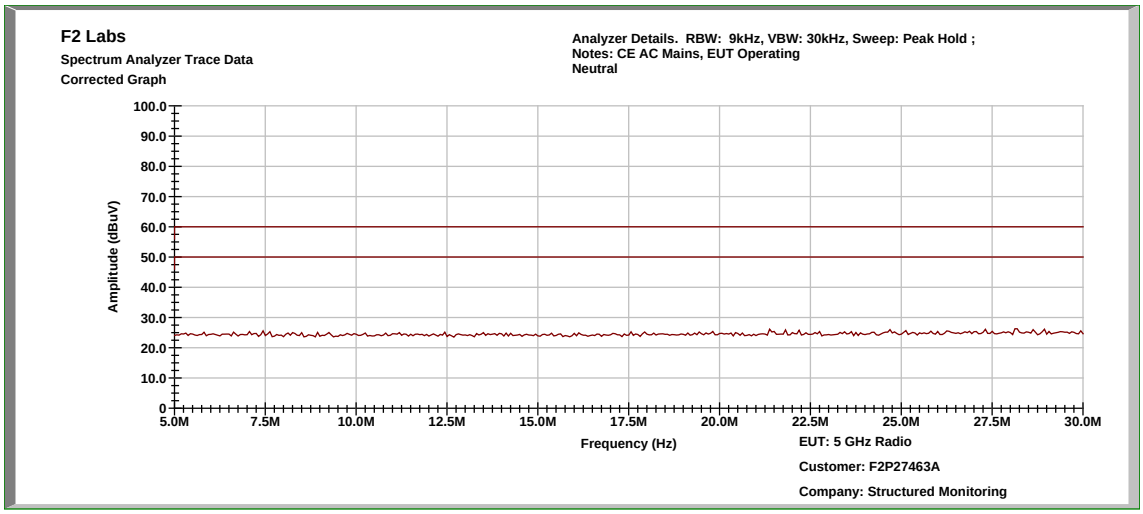
Conducted Test – Neutral: 0.15 MHz to 0.5 MHz



Conducted Test –Neutral: 0.5 MHz to 5.0 MHz



Conducted Test – Neutral: 5.0 MHz to 30.0 MHz

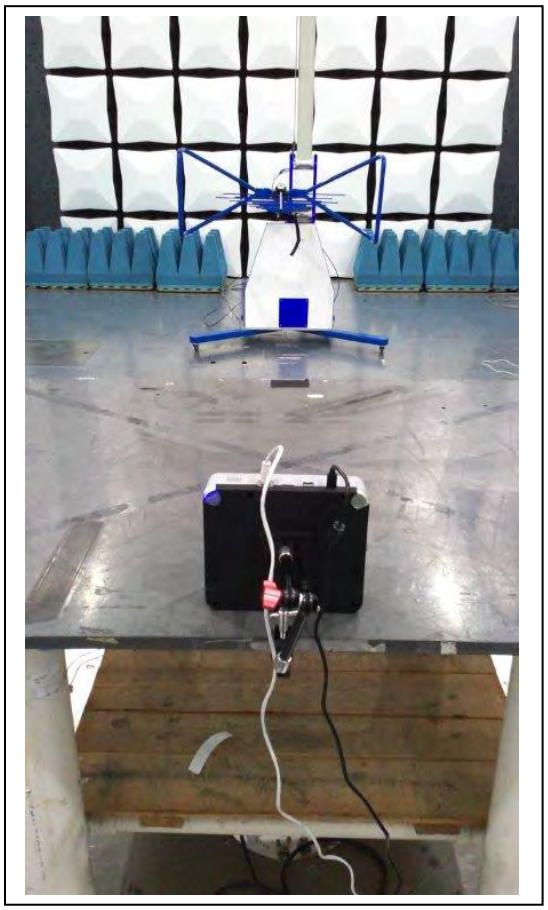


Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Neutral	0.1623	Quasi-Peak	34.97	11.0	45.97	65.35	-19.4
			Average	8.78	11.0	19.78	55.35	-35.6
2	Neutral	0.4948	Quasi-Peak	17.84	11.0	28.84	56.09	-27.3
			Average	3.33	11.0	14.33	46.09	-31.8

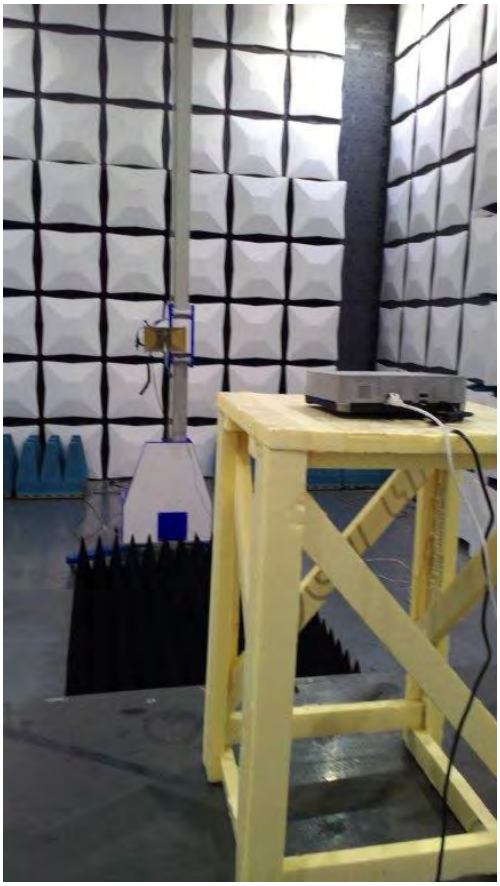
11 PHOTOGRAPHS - TEST SETUPS

Loop Antenna

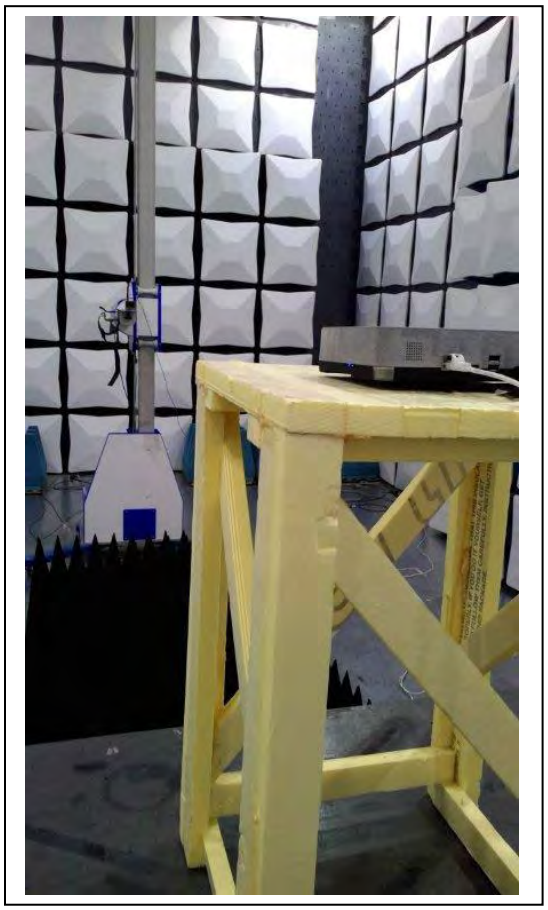
Radiated Spurious Emissions: 30 MHz to 1000 MHz



Radiated Spurious Emissions:
Occupied Bandwidth, Field Strength



Radiated Spurious Emissions: Above 1 GHz



Conducted Emissions