



F2 Labs
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United States of America
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CERTIFICATION TEST REPORT

Manufacturer: Structured Mining Systems, Inc.
d.b.a. Cervis Inc.
170 Thorn Hill Road
Warrendale, Pennsylvania 15086
United States of America

Applicant: Same As Above

Product: Radio Module, DSSS, 2.4GHz, 100mW

Model: SRF305

FCC ID: LOBSRF305

Testing Commenced: Jan. 17, 2014

Testing Ended: Apr. 21, 2014

Summary of Test Results: Page 5

Standards:

- ❖ FCC Part 15 Subpart C, Section 15.247
- ❖ FCC Part 15, Subpart C, Section 15.207
- ❖ FCC Part 15, Subpart C, Section 15.209



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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 2003 version of ANSI C63.4 and recommended FCC procedure of measurement of DTS operating under Section 15.247 and in KDB558074. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

Radiated Emission

- Combined Uncertainty (+ or -) 2.67 dB
- Expanded Uncertainty (+ or -) 5.35 dB

Conducted Emissions

- Combined Uncertainty (+ or -) 1.88 dB
- Expanded Uncertainty (+ or -) 3.75 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2LQ5898A-01E	First Issue	Apr. 28, 2014	W. Fuster

**2 SUMMARY OF TEST RESULTS**

Test Name	Standard(s)	Results
-6dB Occupied Bandwidth	CFR 47 Part 15.247(a)(2) / KDB558074	Complies
Conducted Output Power	CFR 47 Part 15.247(b)(3) / KDB558074	Complies
Conducted Spurious Emissions	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Radiated Spurious Emission with 3.8dBi Integral Antenna	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Radiated Spurious Emission with 9dBi Whip Antenna	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Peak Power Spectral Density	CFR 47 Part 15.247(e) / KDB558074	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

Note: product was operated using AAA batteries. There is an option for the Host product to be powered from other DC sources, so Voltage Variation testing in 15.31(3)(e) was performed using 12VDC as the nominal voltage, and then the 85% and 115% of that voltage was tested also. The output power at the High, Mid, and Low channels was measured to verify how much the power and frequency was affected by the variation of the input power. No shift in frequency or power was measured at either of the varied voltages on any of the channels.

Modifications Made to the Equipment
None

**3 TABLE OF MEASURED RESULTS**

Test	High Channel 2.480GHz	Mid Channel 2.440GHz	Low Channel 2.405GHz
Conducted Output Power	97.50mW (19.89dBm)	98.86mW (19.95dBm)	95.72mW (19.81dBm)
Conducted Output Power Limit	1 Watt, (30dBm)	1 Watt, (30dBm)	1 Watt, (30dBm)
Conducted Output Power Limit with 3.8dBi Integral Antenna	233.88mW (23.69dBm)	237.14mW (23.75dBm)	229.61mW (23.61dBm)
E.I.R.P. with 9dBi Whip Antenna	774.46mW (28.89dBm)	785.24mW (28.95dBm)	760.33mW (28.81dBm)
E.I.R.P. Limit	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)
Peak Power Spectral Density	6.54 dBm	7.21 dBm	7.74 dBm
Peak Power Spectral Density Limit	8 dBm	8 dBm	8 dBm
-6dB Occupied Bandwidth	1.603MHz	1.593MHz	1.583MHz
-6dB Occupied Bandwidth Limit	≥ 500KHz	≥ 500KHz	≥ 500KHz



4 ENGINEERING STATEMENT

This report has been prepared on behalf of Cervis Inc. to provide documentation for the testing described herein. This equipment has been tested and found to comply with parts 15.247, 15.207 and 15.209 of the FCC Rules using ANSI C63.4 2009 and KDB558074 standards. 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: Radio Module, DSSS, 2.4GHz

Model: SRF305

Serial No.: None

FCC ID: LOBSRF305

5.2 Trade Name:

Structured Mining Systems, Inc. d.b.a. Cervis Inc.

5.3 Power Supply:

Non-rechargeable AAA Batteries

5.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

CFR 47, Part 15.207

CFR 47, Part 15.209

5.5 Equipment Category:

Radio Transmitter-DTS

5.6 Antenna:

3.8dBi gain Integral Antenna

9dBi gain Whip Antenna

5.7 Accessories:

N/A

5.8 Test Item Condition:

The equipment to be tested was received in good condition.

5.9 Testing Algorithm:

EUT was set up in a normal operating mode, with device transmitting in three different channels (low, mid, high).

**6 FCC PART 15.247(a)(2) – OCCUPIED BANDWIDTH****6.1 Requirements:**

The 6dB bandwidth shall be greater than 500 kHz.

Bandwidth measurements were made at the low (2.405 GHz), mid (2.440 GHz) and upper (2.480 GHz) frequencies. The bandwidth was measured using the analyzer's marker function.

6.2 Equipment Used:

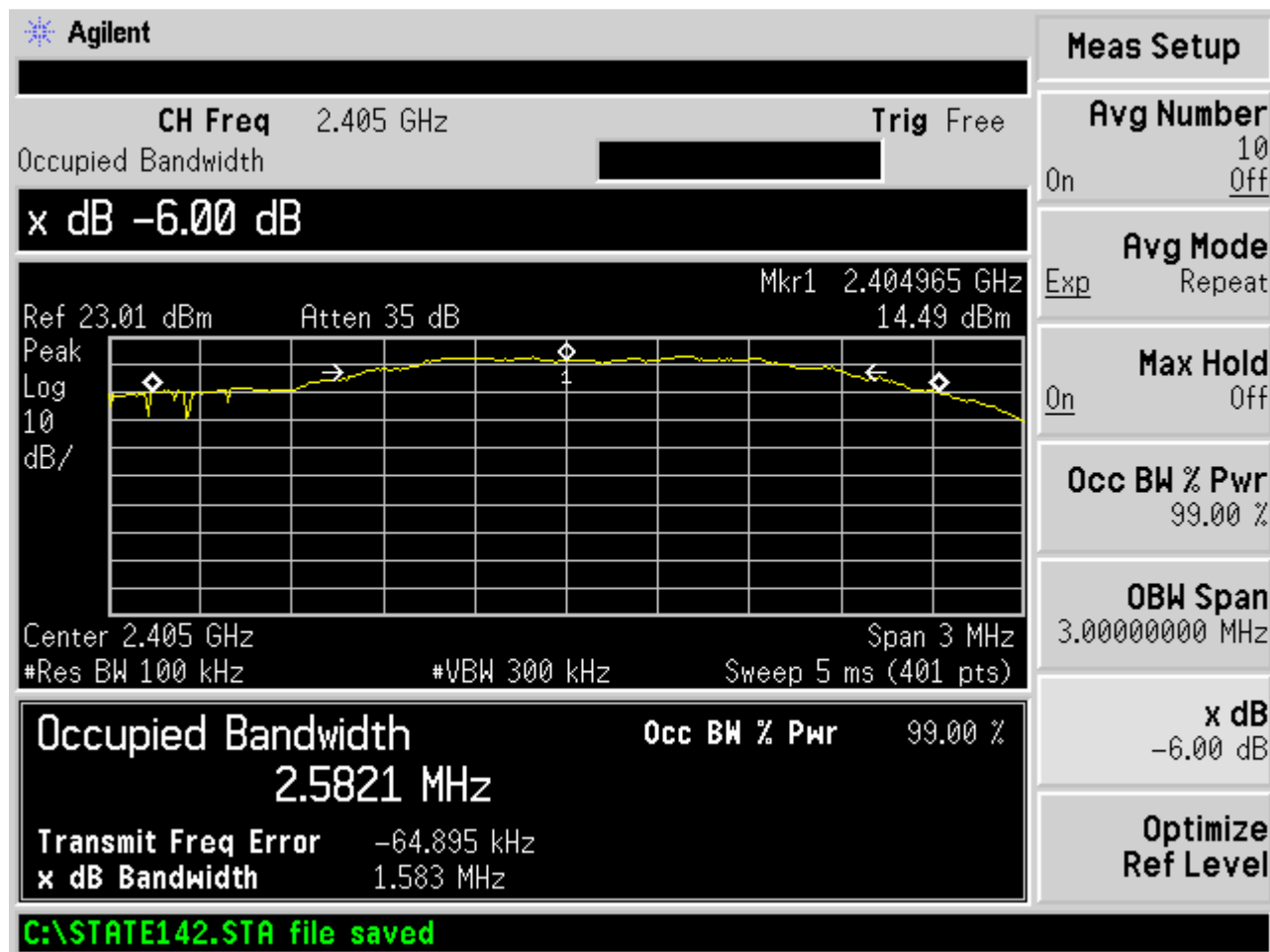
Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	Apr. 17, 2014
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 31, 2014
Cable: 0.3m Low Loss	CL116	A.H. Systems, Inc.	SAC-26G-0.3	206	Mar. 1, 2014
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Oct. 29, 2014



6.3 Occupied Bandwidth Test Data

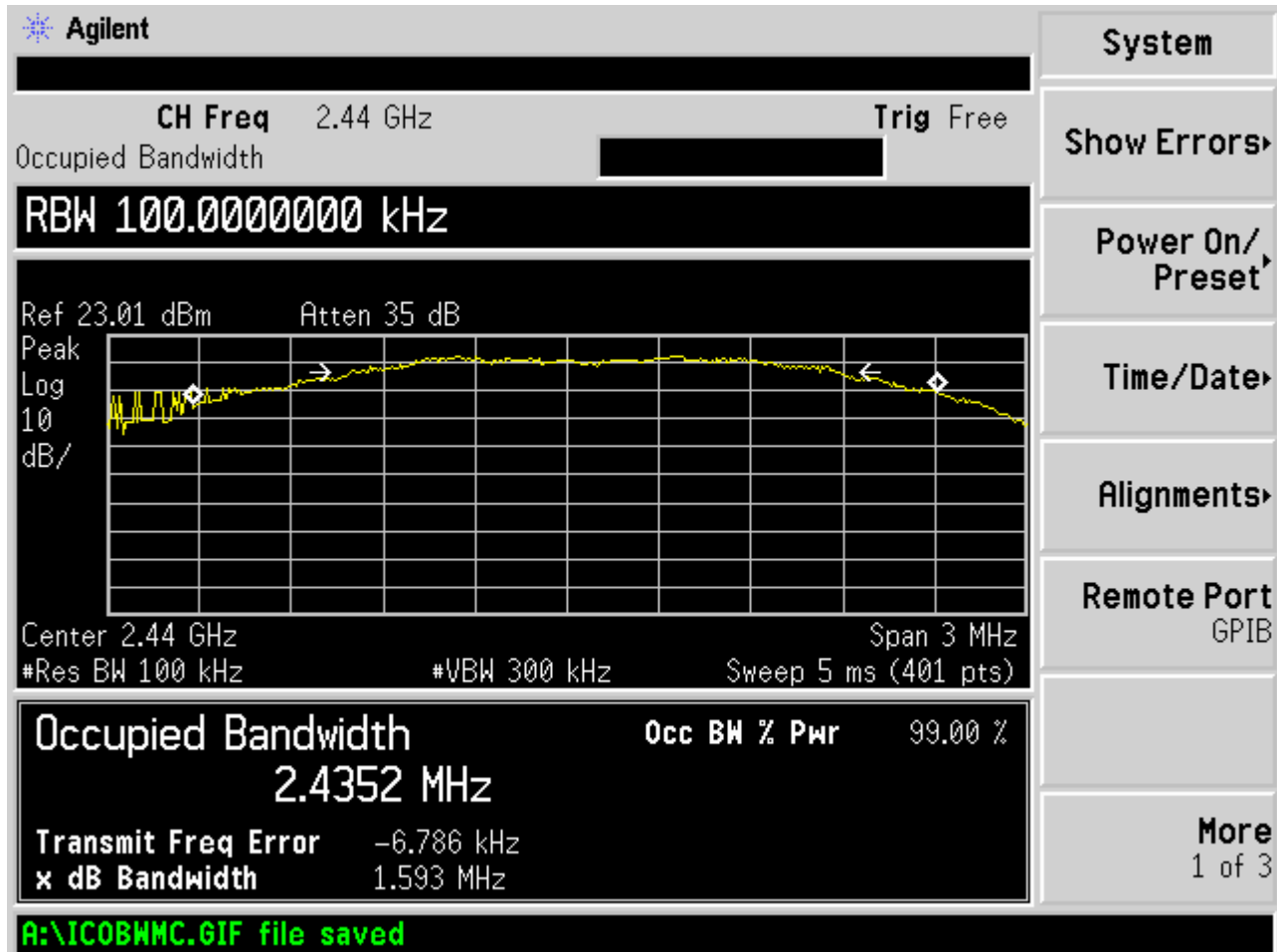
Test Date:	Jan. 17-30, 2014	Test Engineers:	M. Toth; K. Littell
Standards:	CFR 47 Part 15.247(a)(2); KDB558074	Air Temperature:	20.4°C
		Relative Humidity:	43%

Low Channel



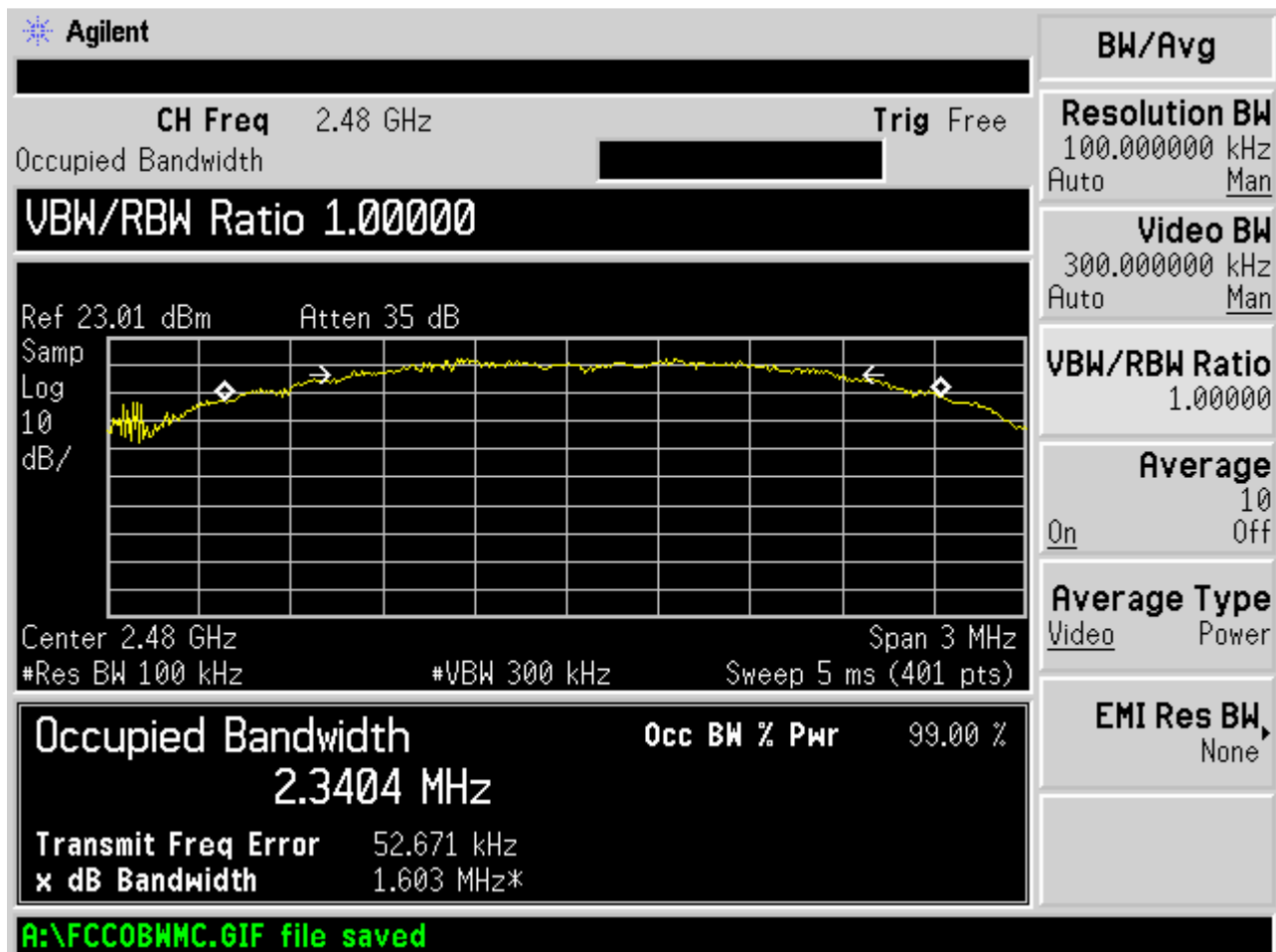


Mid Channel





High Channel



**7 FCC PART 15.247(b)(3) – CONDUCTED OUTPUT POWER**

The EUT antenna port was fitted with an SMA connector and directly connected to the input of the receiver. The peak power output was measured.

7.1 Requirements:

The peak power output shall be 1 watt (30 dBm) or less when using an antenna with a gain of less than 6dBi. For antennas having a gain of more than 6dBi, the limit is reduced by 1dB for every dB the antenna gain is over 6dBi.

7.2 Equipment Used:

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	Apr. 17, 2014
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 31, 2014
Cable: 0.3m Low Loss	CL116	A.H. Systems, Inc.	SAC-26G-0.3	206	Mar. 1, 2014

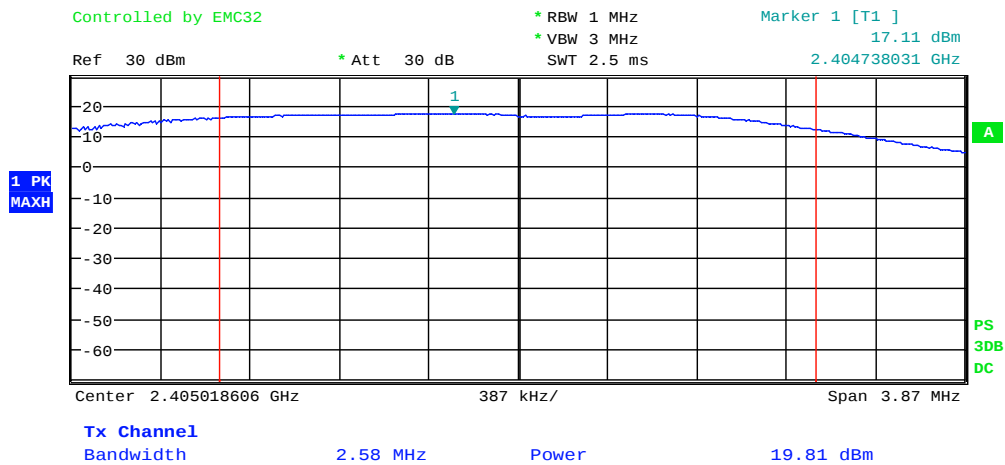


7.3

Conducted Output Power Test Data

Test Date:	Jan. 30, 2014	Test Engineers:	M. Toth; K. Littell
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	Air Temperature:	21.1°C
		Relative Humidity:	41%

Low Channel



Date: 30.JAN.2014 10:42:19

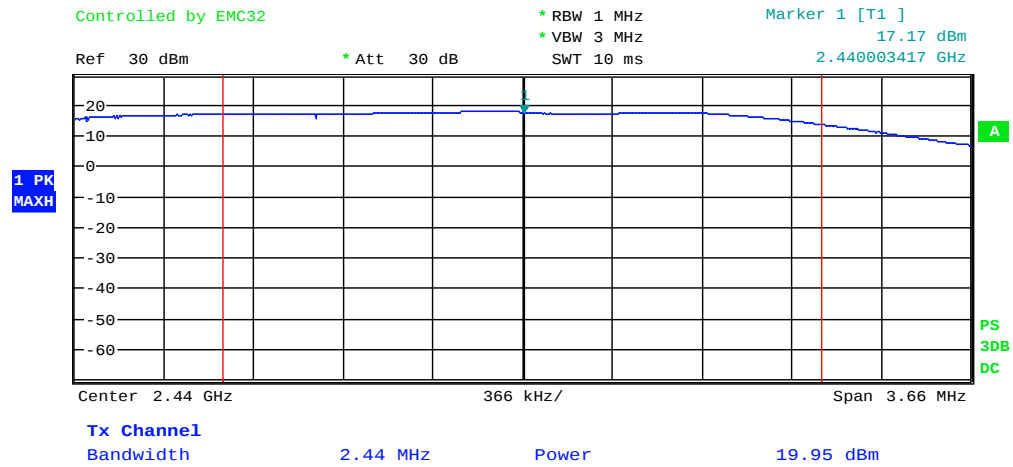


Order Number: F2LQ5898A

Client: Cervis Inc.

Model: SRF305

Mid Channel



Date: 30.JAN.2014 11:07:26

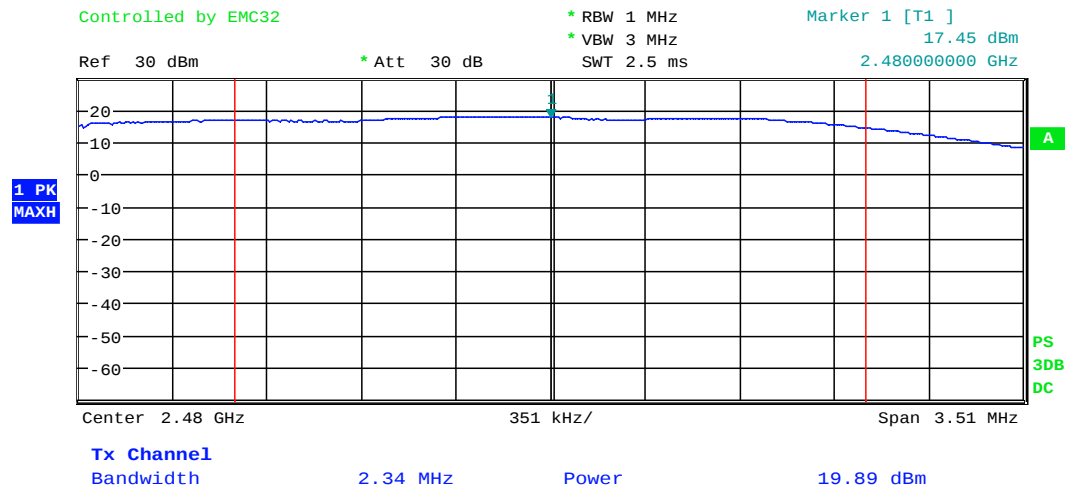


Order Number: F2LQ5898A

Client: Cervis Inc.

Model: SRF305

High Channel



Date: 30.JAN.2014 11:22:39



8 FCC Part 15.247(c) – CONDUCTED SPURIOUS EMISSIONS

The following tests were performed to demonstrate compliance.

RF Antenna Conducted Test

The EUT antenna port was fitted with an SMA connector and directly connected to the input of the spectrum analyzer.

8.1 Requirements:

All Spurious Emissions must be at least 20dB down from the highest emission level measured within the authorized band up through the tenth harmonic.

Spurious emissions measurements were made at the low, mid, and upper channels with the appropriate spectrum analyzer impulse bandwidth. Additionally, 20dB down points were measured for the low and high channels to verify band edge compliance.

8.2 Equipment Used:

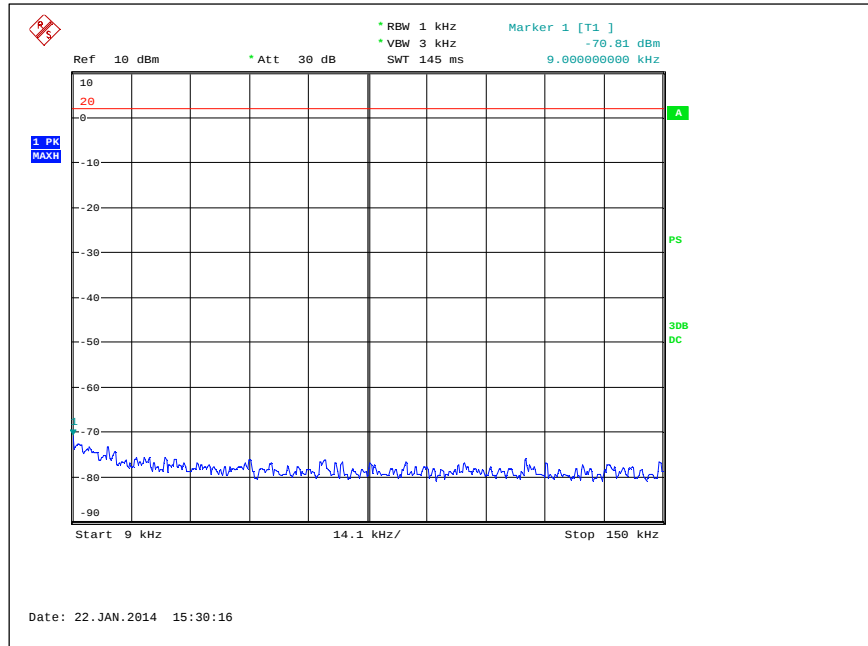
Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	Apr. 17, 2014
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Oct. 29, 2014
Cable: 0.3m Low Loss	CL116	A.H. Systems, Inc.	SAC-26G-0.3	206	Mar. 1, 2014



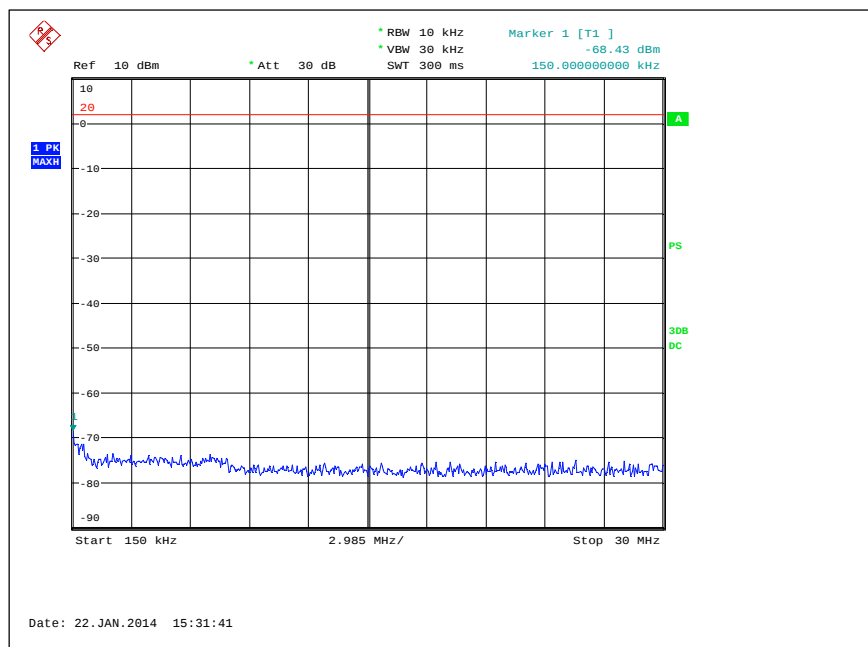
8.3 Test Data – CONDUCTED SPURIOUS EMISSIONS

Test Date:	Jan. 22, 2014	Test Engineers:	M. Toth; K. Littell
Standards:	CFR 47 Part 15.247(d) / Part 15.209; KDB558074	Air Temperature:	21.1°C
		Relative Humidity:	41%

Low Channel: 9 kHz to 150 kHz

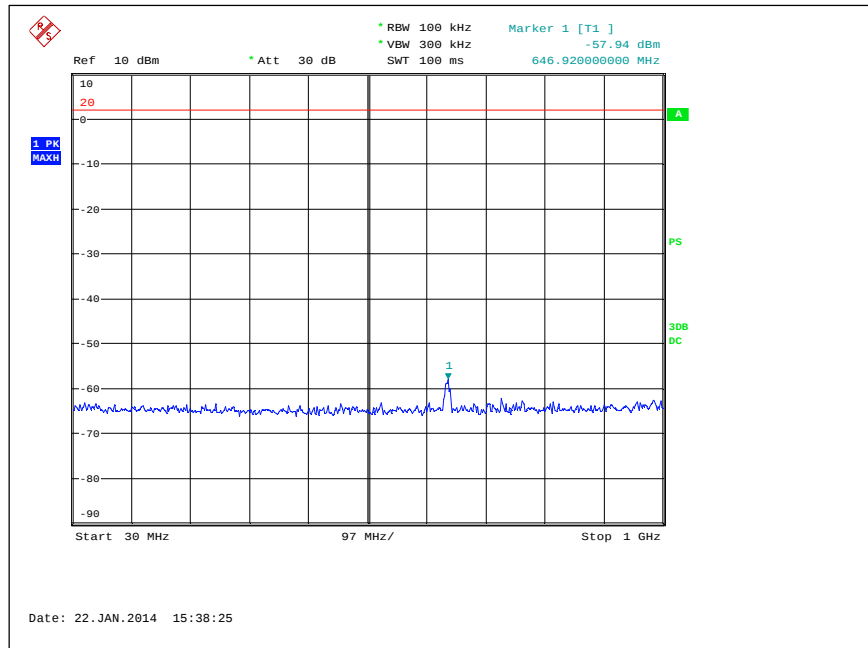


Low Channel: 150 kHz to 30 MHz

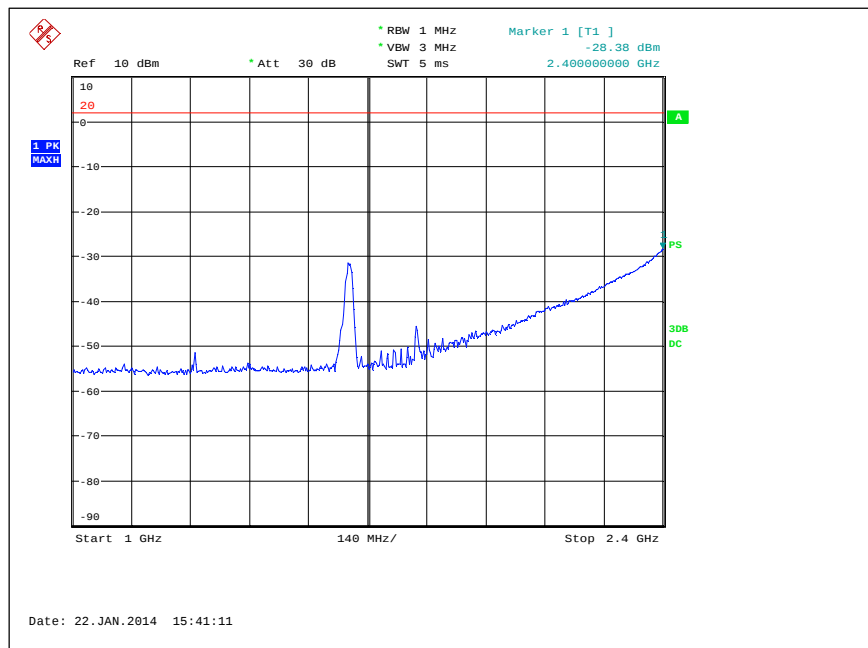




Low Channel: 30 MHz to 1 GHz

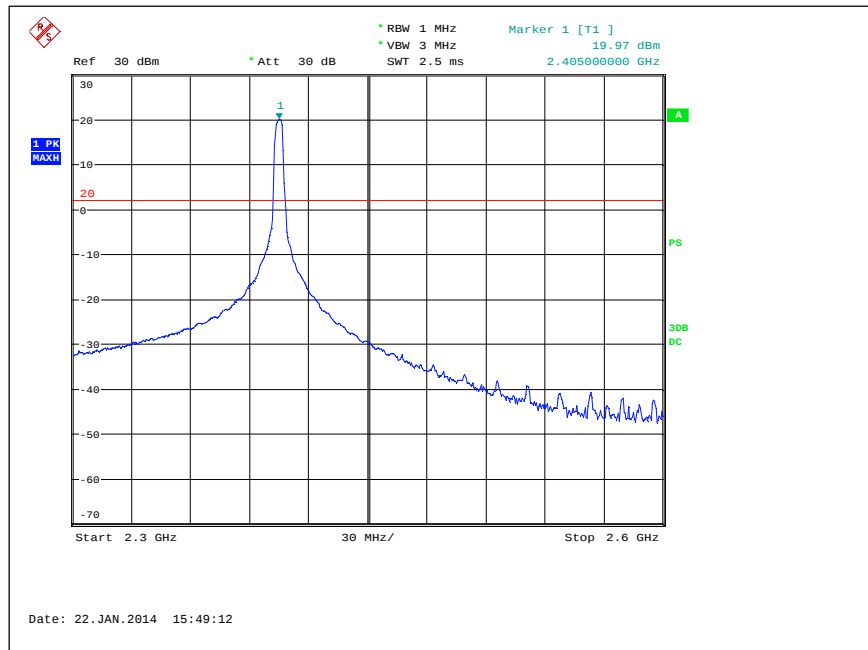


Low Channel: 1 GHz to 2.39 GHz

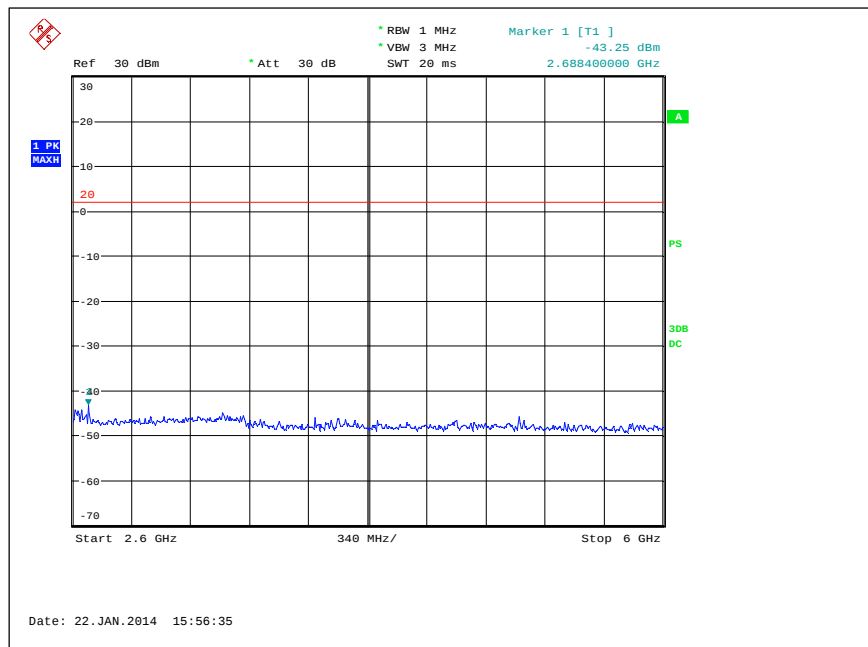




Low Channel: 2.3 GHz to 2.6 GHz

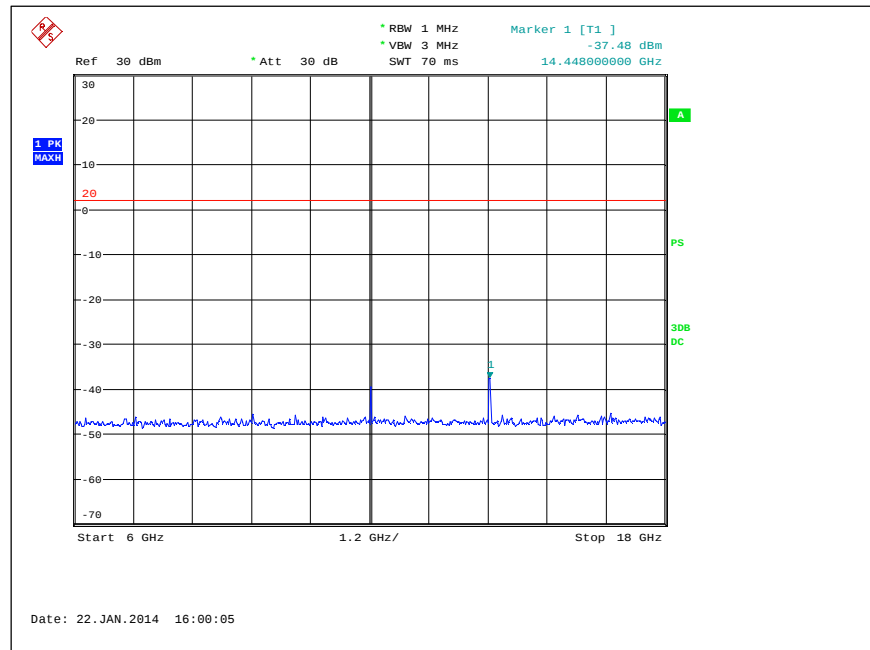


Low Channel: 2.6 GHz to 6 GHz

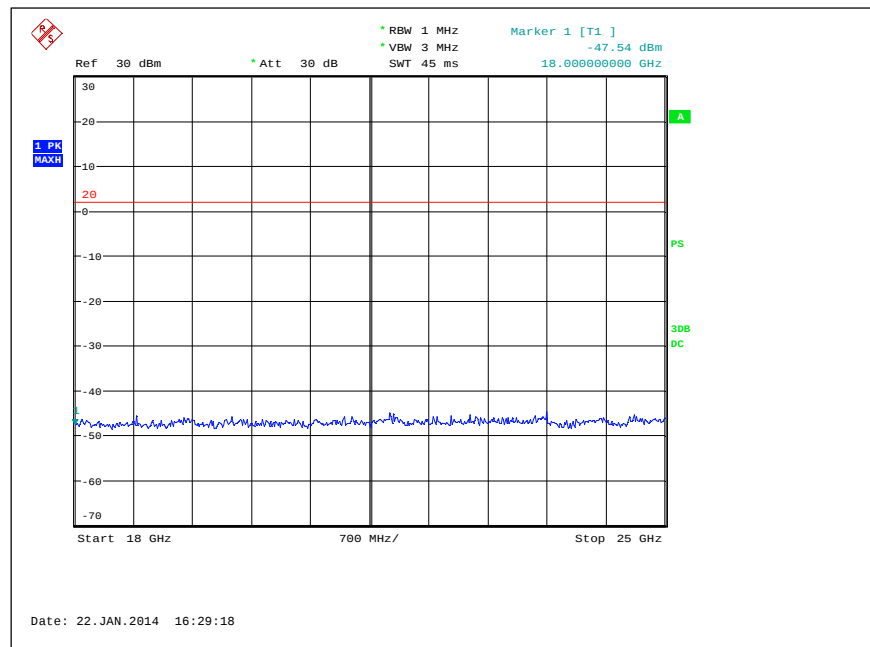




Low Channel: 6 GHz to 18 GHz

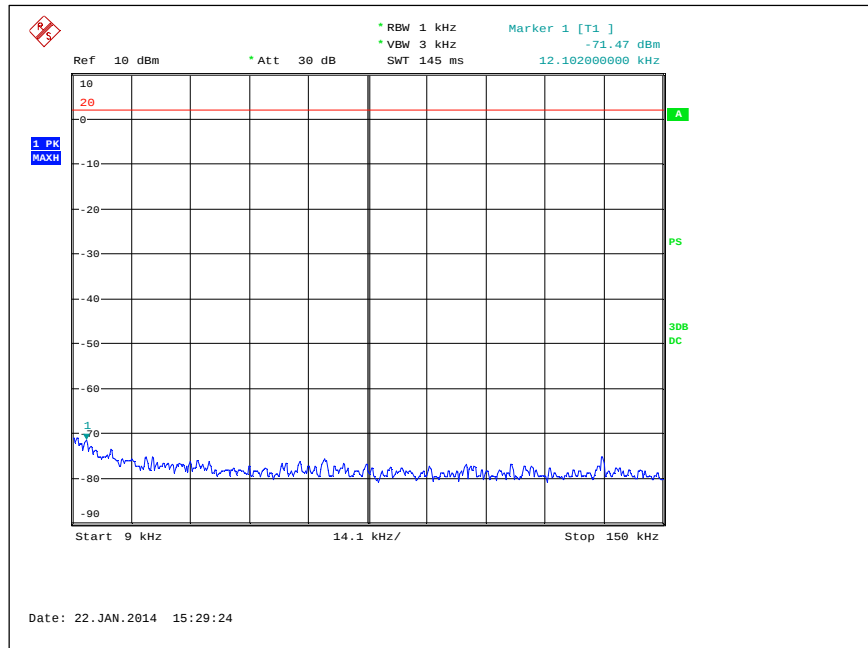


Low Channel: 18 GHz to 25 GHz

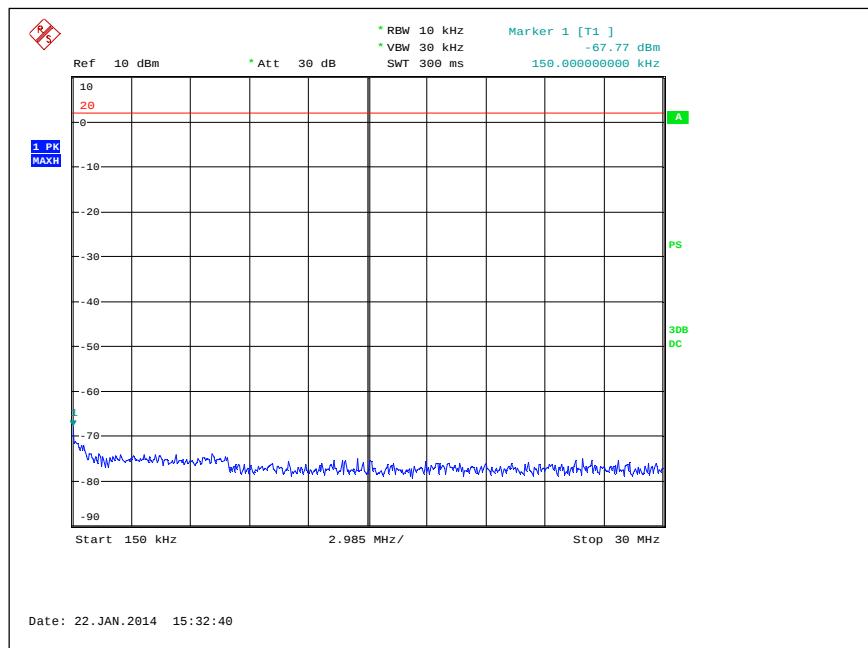




Mid Channel: 9 kHz to 150 kHz

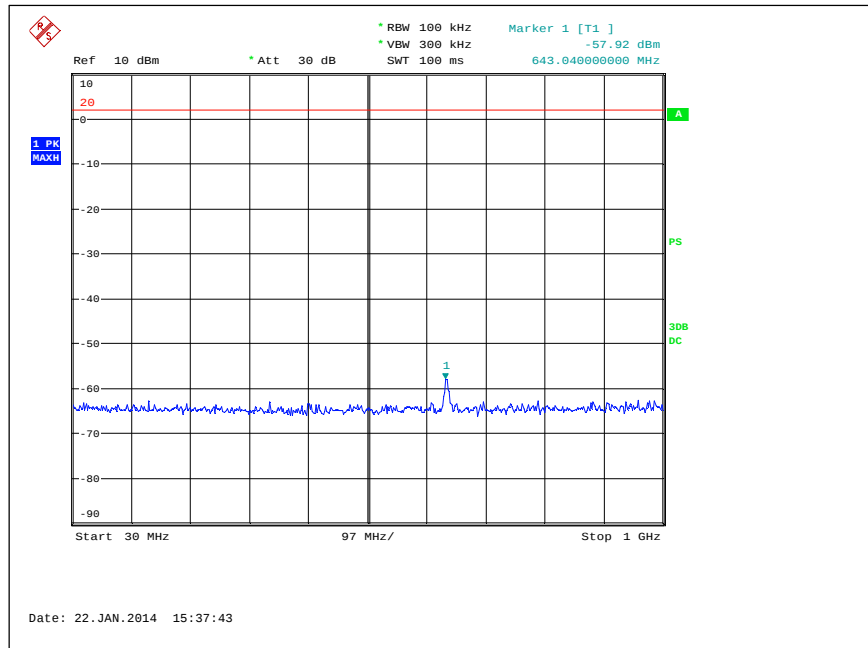


Mid Channel: 150 kHz to 30 MHz

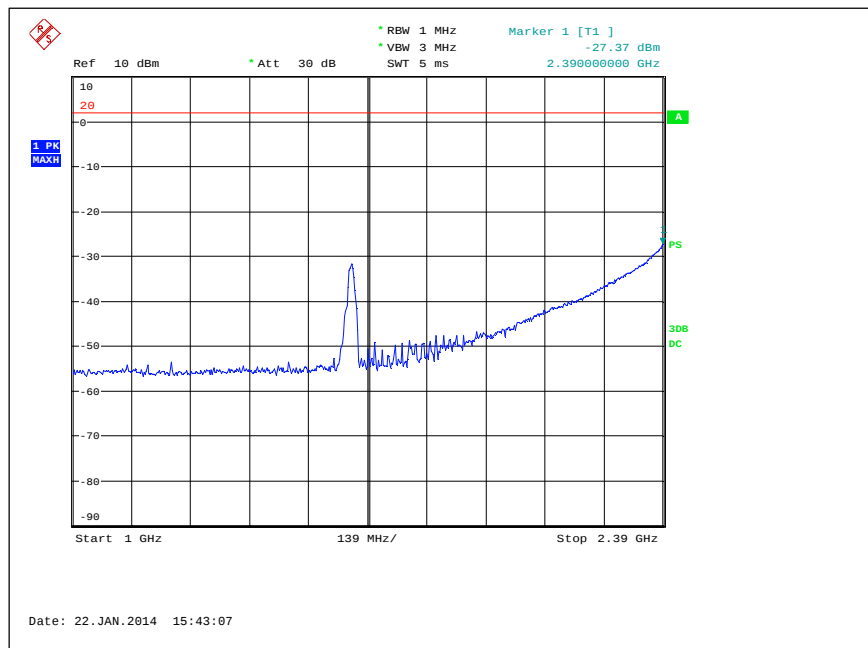




Mid Channel: 30 MHz to 1 GHz

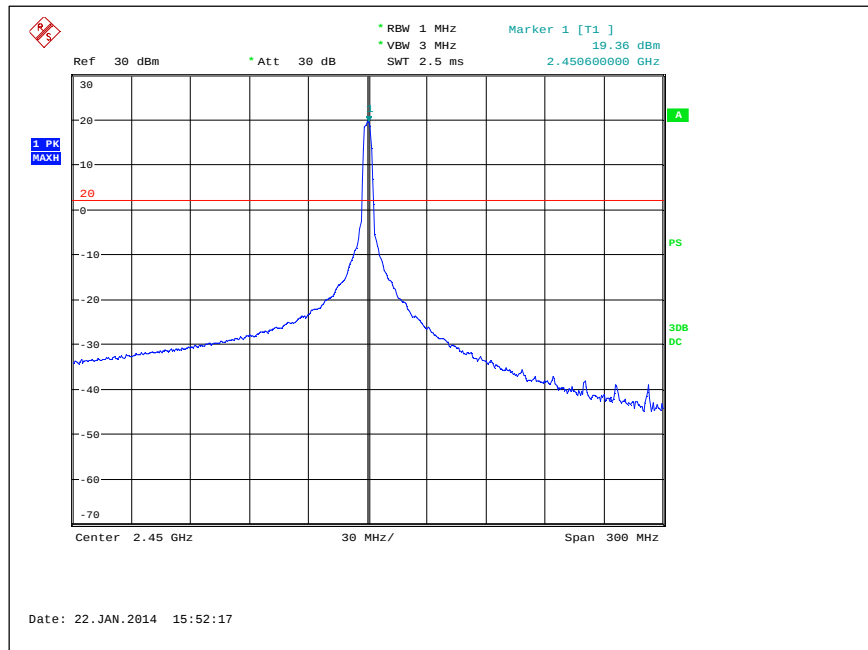


Mid Channel: 1 GHz to 2.39 GHz

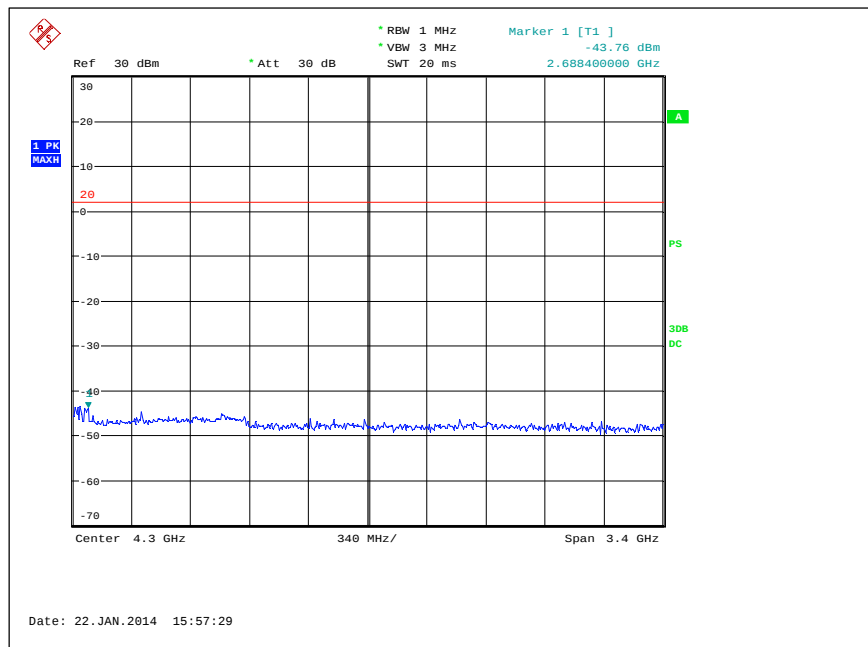




Mid Channel: 2.3 GHz to 2.6 GHz

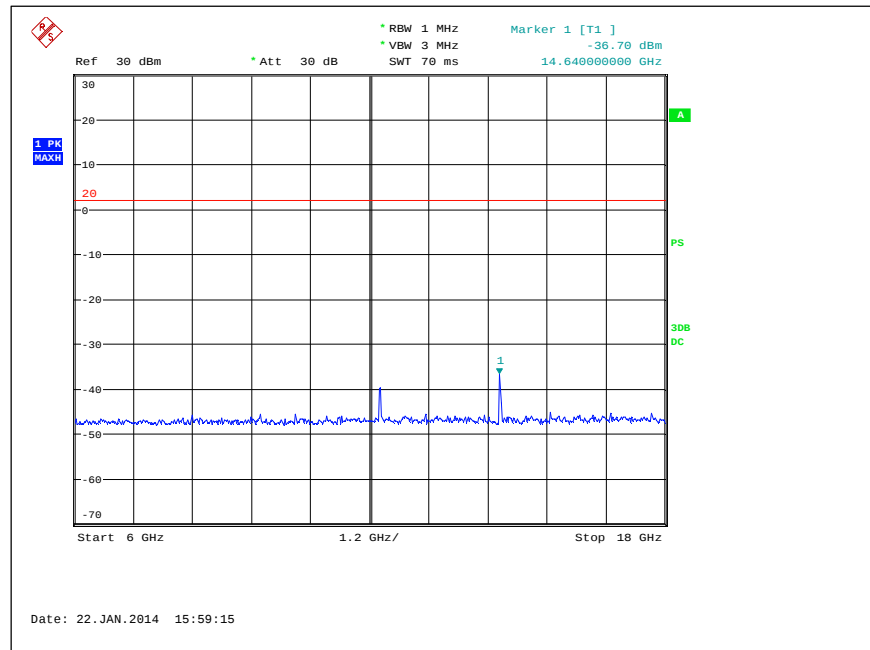


Mid Channel: 2.6 GHz to 6 GHz

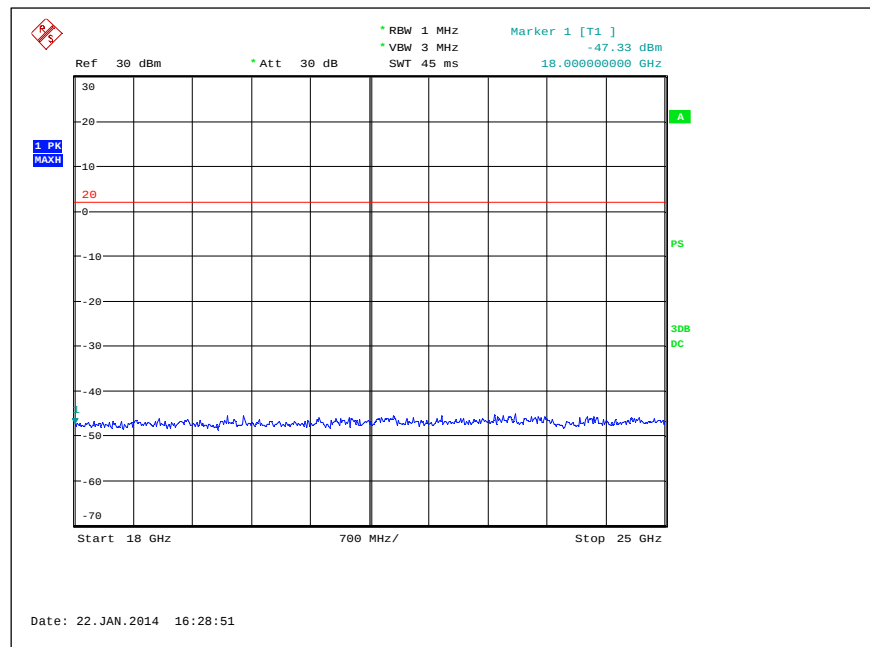




Mid Channel: 6 GHz to 18 GHz

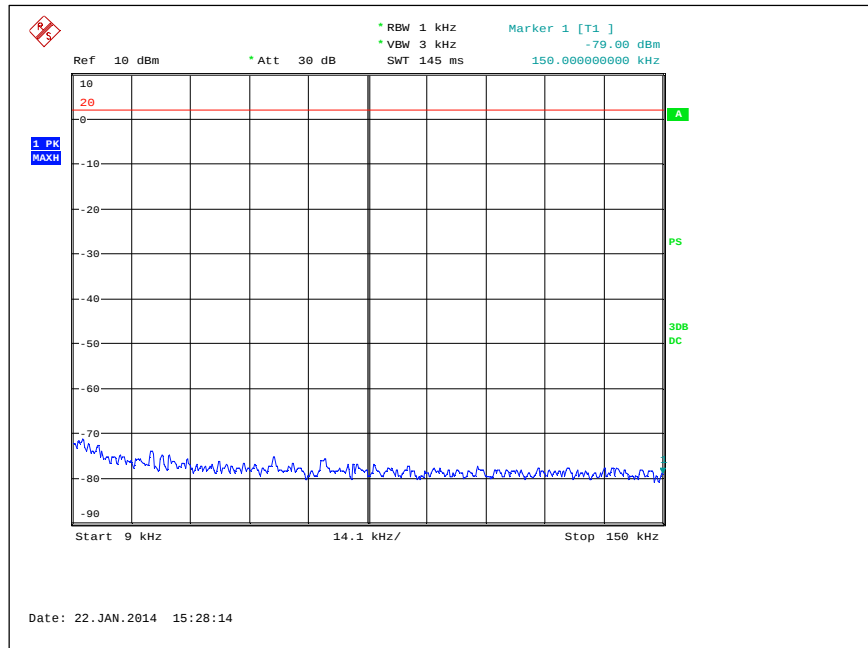


Mid Channel: 18 GHz to 25 GHz

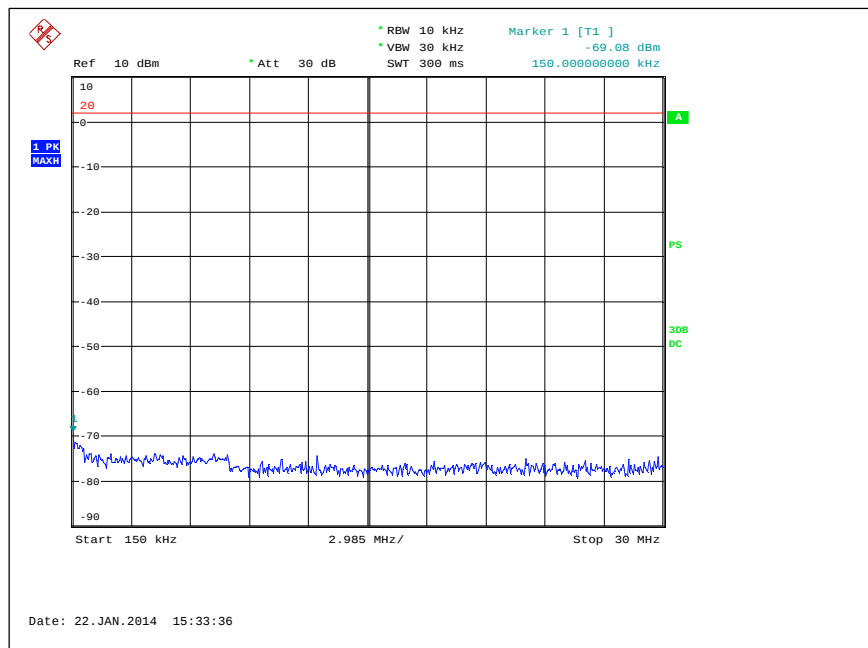




High Channel: 9 kHz to 150 kHz

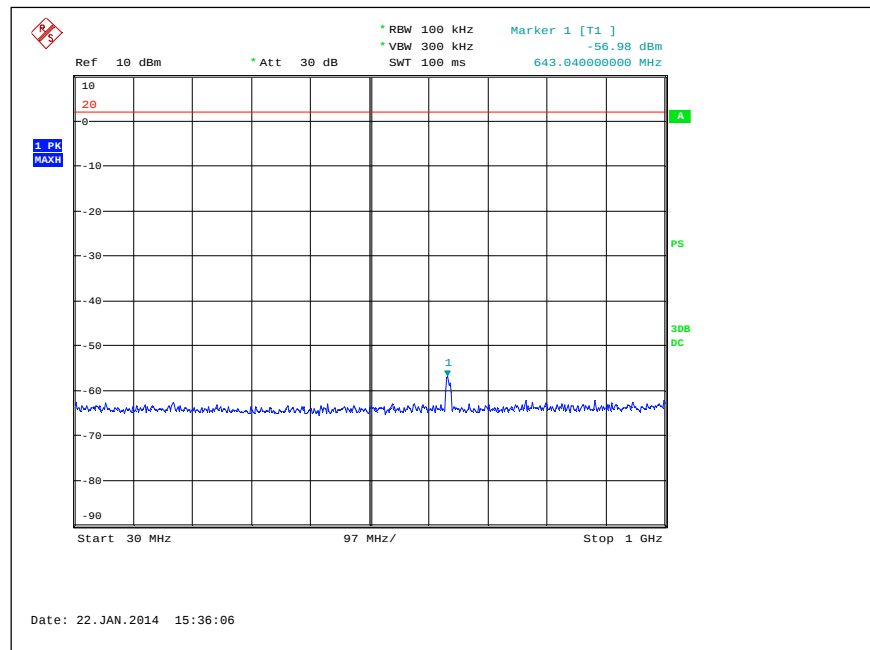


High Channel: 150 kHz to 30 MHz

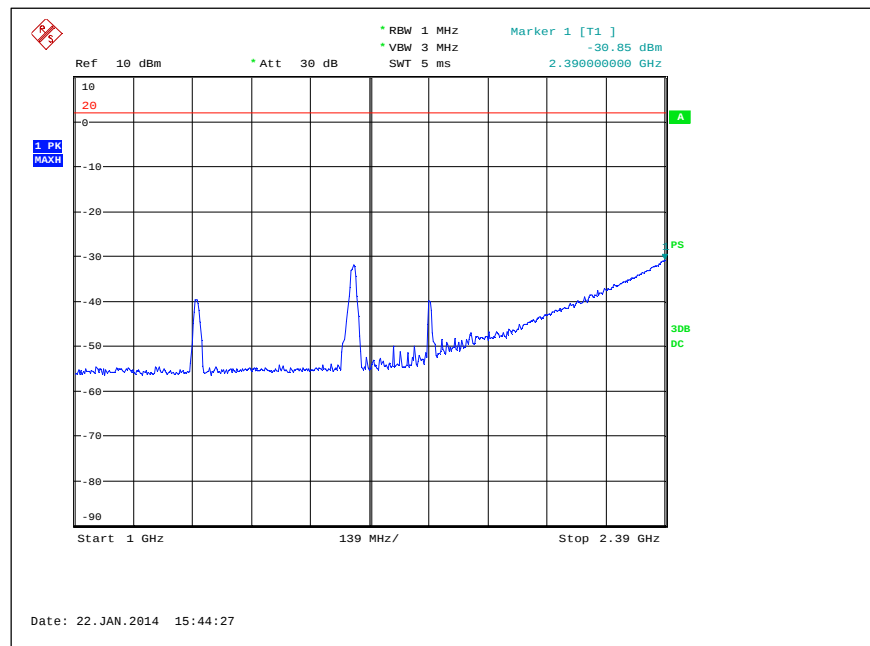




High Channel: 30 MHz to 1 GHz

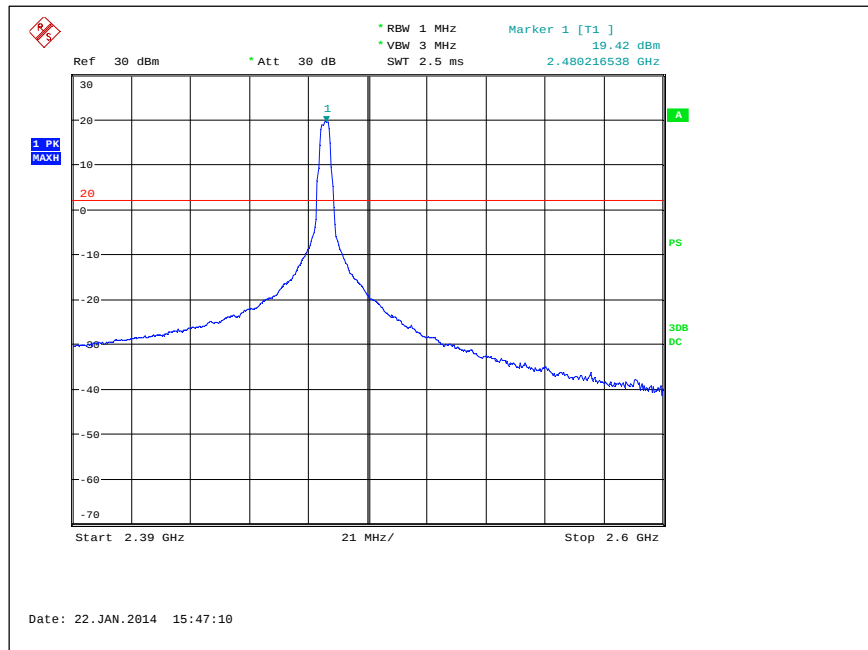


High Channel: 1 GHz to 2.39 GHz



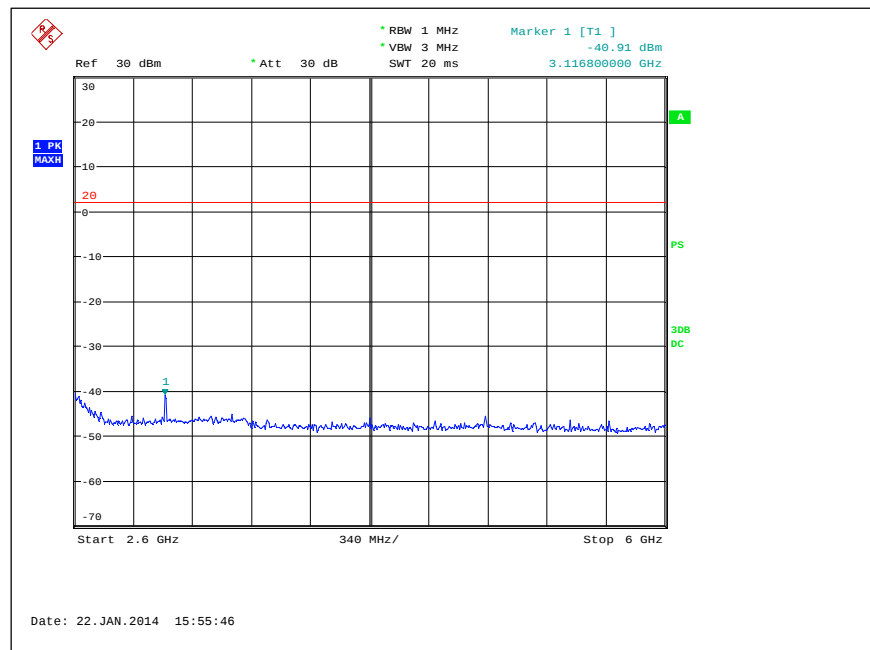


High Channel: 2.39 GHz to 2.6 GHz

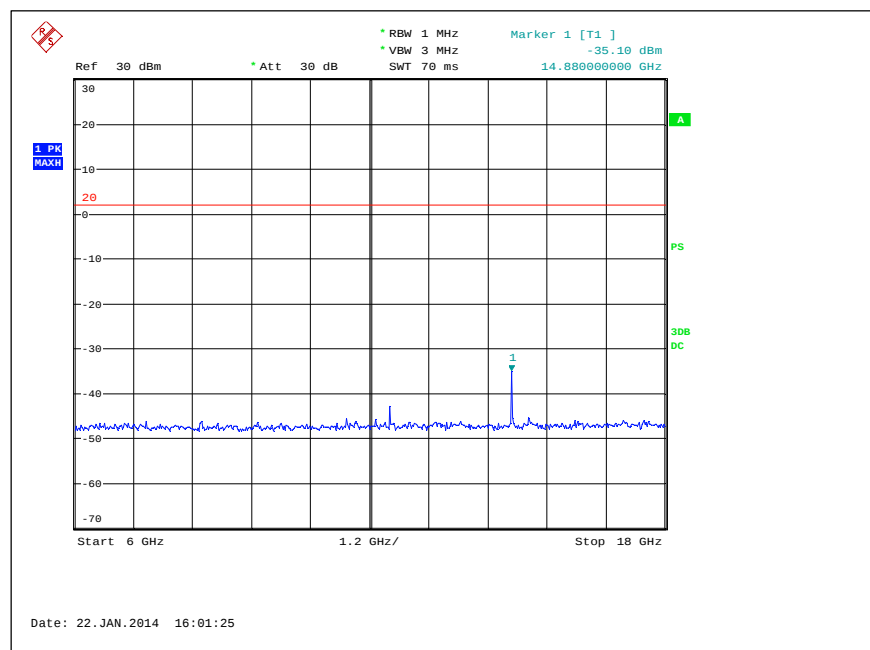




High Channel: 2.6 GHz to 6 GHz



High Channel: 6 GHz to 18 GHz



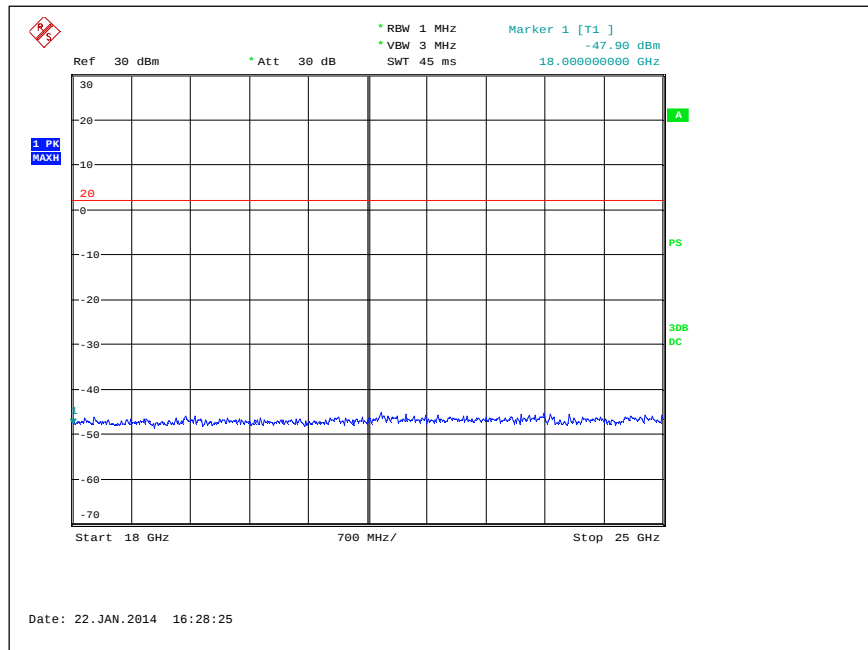


Order Number: F2LQ5898A

Client: Cervis Inc.

Model: SRF305

High Channel: 18 GHz to 25 GHz





9 RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its integral/internal chip and 9dBi whip antennae. Radiated emissions were measured on the Open Area Test Site (OATS). All emissions generated that fall in the restricted bands per FCC Part 15.205 were examined.

9.1 Requirements:

All emissions that fall in the restricted bands defined in FCC Part 15.205 shall not exceed the maximum field strength listed in FCC Part 15.209(a).

9.2 Equipment Used:

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shield Room	0175	Ray Proof	N/A	11645	Verified
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	Apr. 17, 2014
OATS-3m	CL017	Compliance Labs	N/A	001	Dec. 12, 2014
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 30, 2014
Antenna 1-Chamber	0142	ETS/EMCO	3142B	9811-1330	Verified
Antenna 2-OATS	0105	Sunol Sciences	JB1	A101101	May 7, 2015
Pre-Amplifier	0139	Hewlett Packard	83006A	3104A00500	Feb. 20, 2014
Active 18" Loop Antenna	CL082	A.H. Systems, Inc.	SAS-562B	241	Sept. 6, 2014
Antenna, Horn	CL098	Emco	3115	9809-5580	Dec. 3, 2015
Cable: 0.3m Low Loss	CL117	A.H. Systems, Inc.	SAC-26G-3	207	Jan. 16, 2015
Coaxial Cable	CL139	Thermax	M17/128-RG400	JB (Brown)	Feb., 21, 2014
Coaxial Cable	CL140	Thermax	M17/128-RG400	JC (Brown)	Feb. 21, 2014



9.3 Radiated Spurious Emission Test Data

Test Dates:	Jan. 22-28, 2014	Test Engineers:	J. Knepper; K. Littell
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	Air Temperature:	10.8°C
		Relative Humidity:	36%

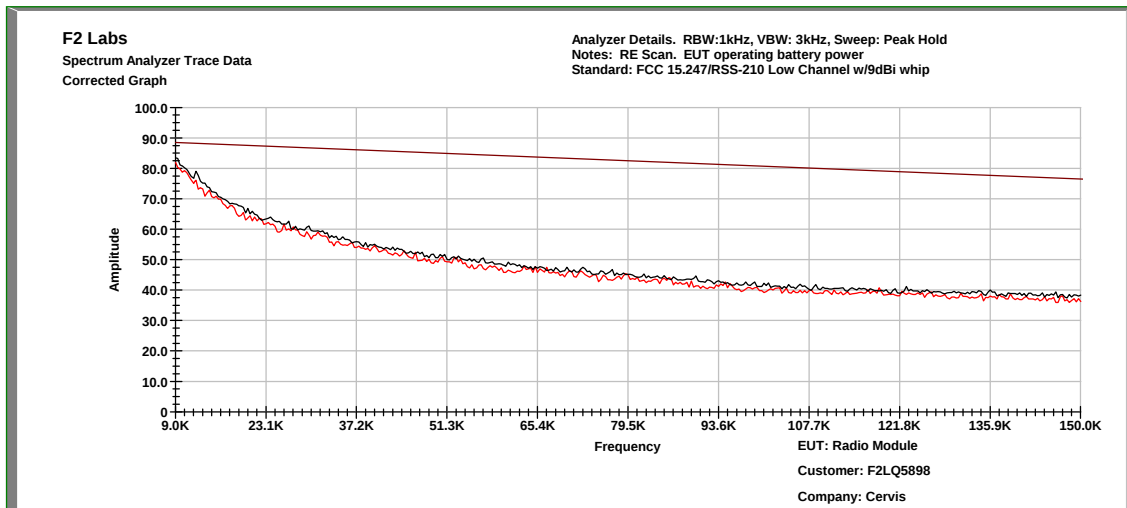
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some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

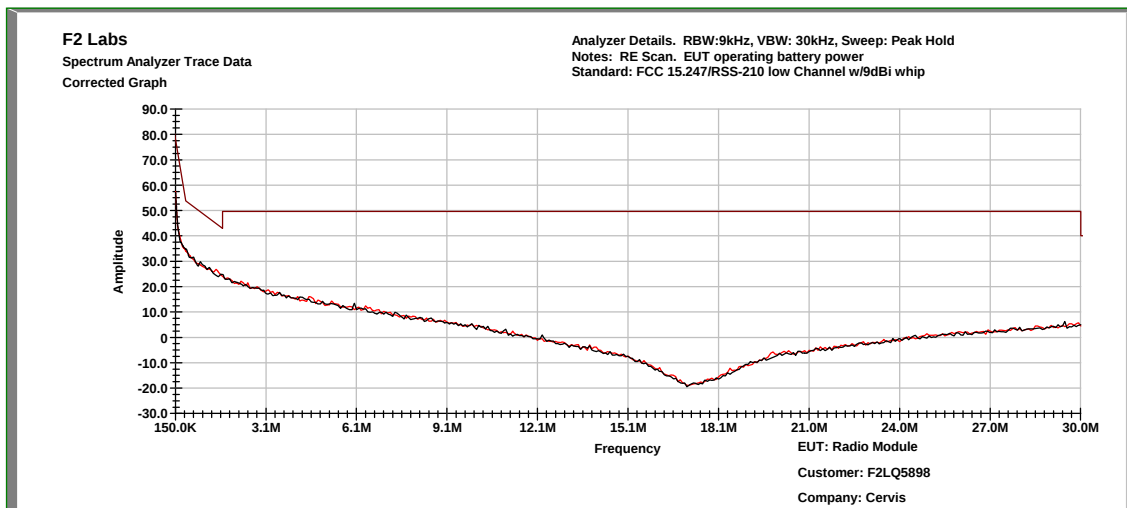
In the following plots, the black line indicates ambient noise and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.



9dBi Whip Antenna, Low Channel, .009 to 0.15 MHz

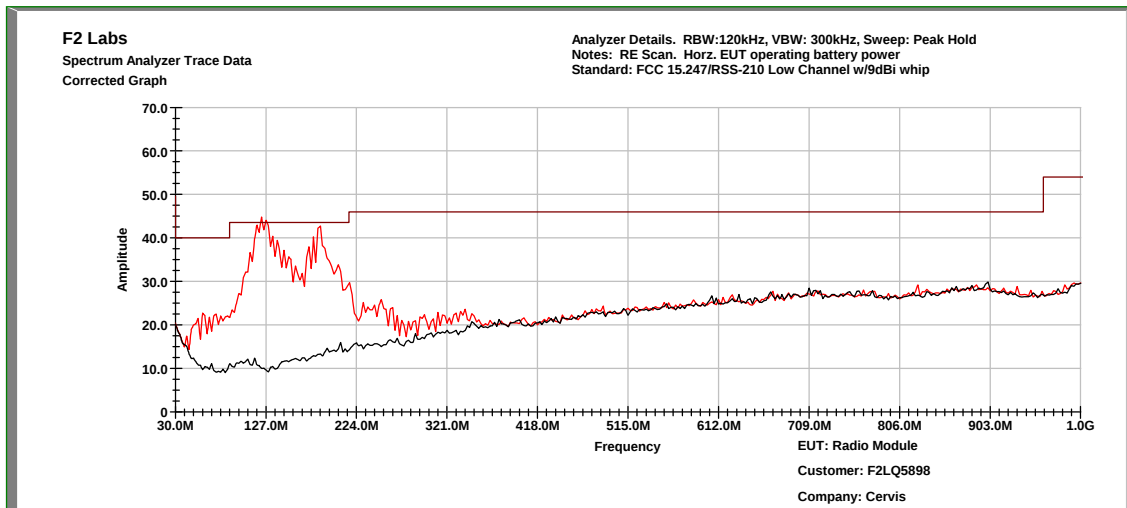


9dBi Whip Antenna, Low Channel, 0.15 MHz to 30 MHz

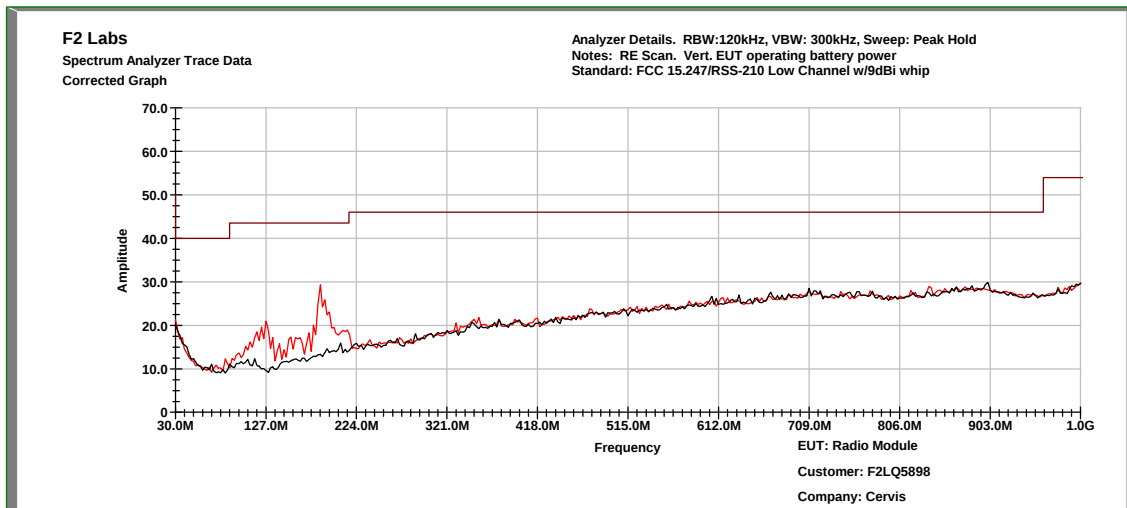




9dBi Whip Antenna, Low Channel, 30 MHz to 1 GHz, Horizontal

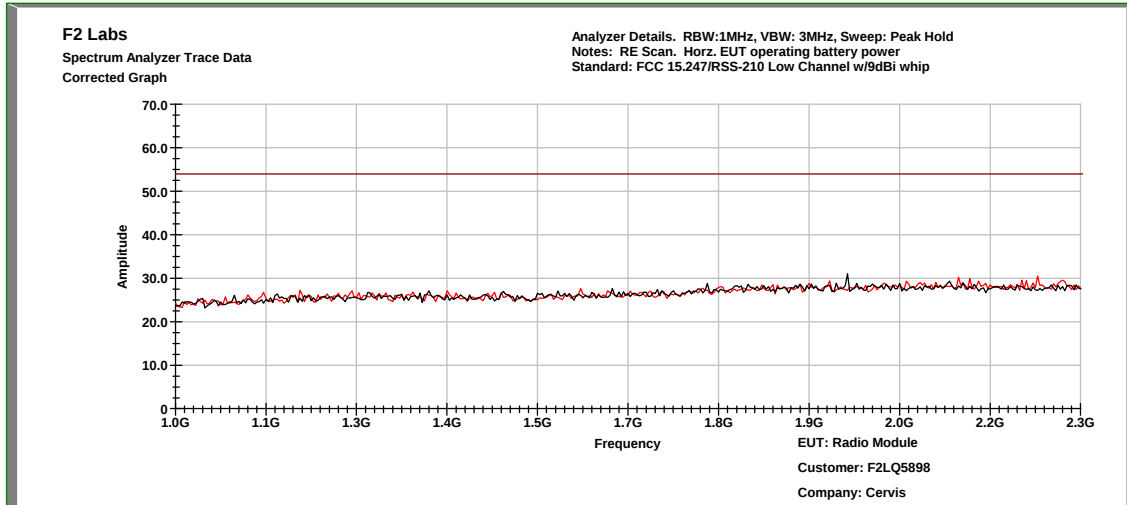


9dBi Whip Antenna, Low Channel, 30 MHz to 1 GHz, Vertical

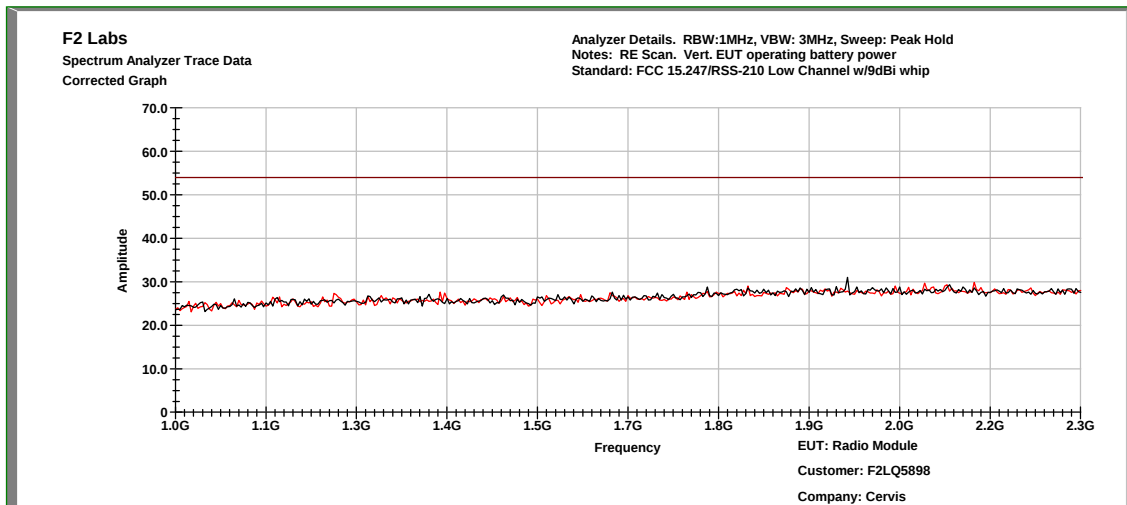




9dBi Whip Antenna, Low Channel, 1 GHz to 2.3 GHz, Horizontal

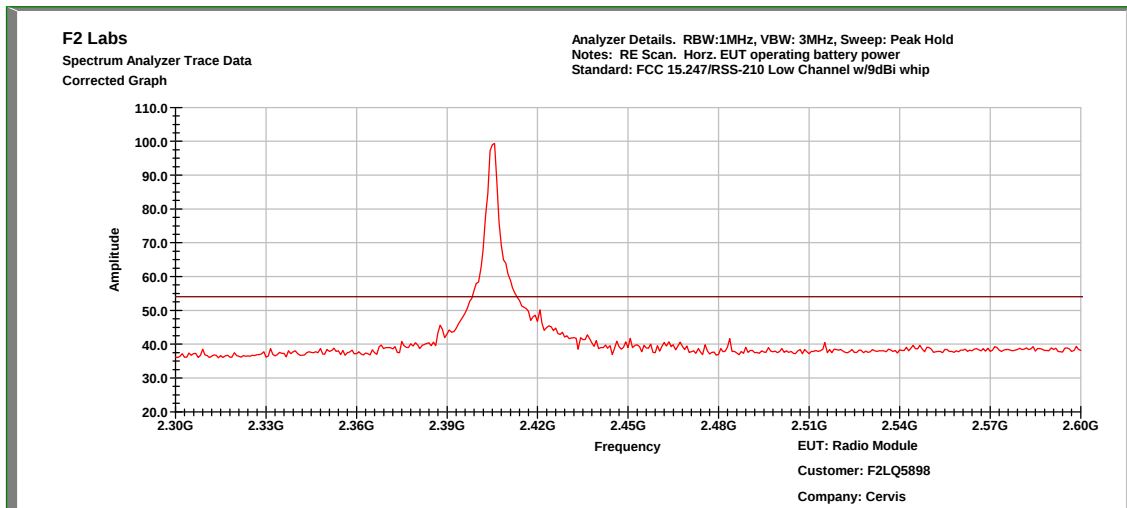


9dBi Whip Antenna, Low Channel, 1 GHz to 2.3 GHz, Vertical

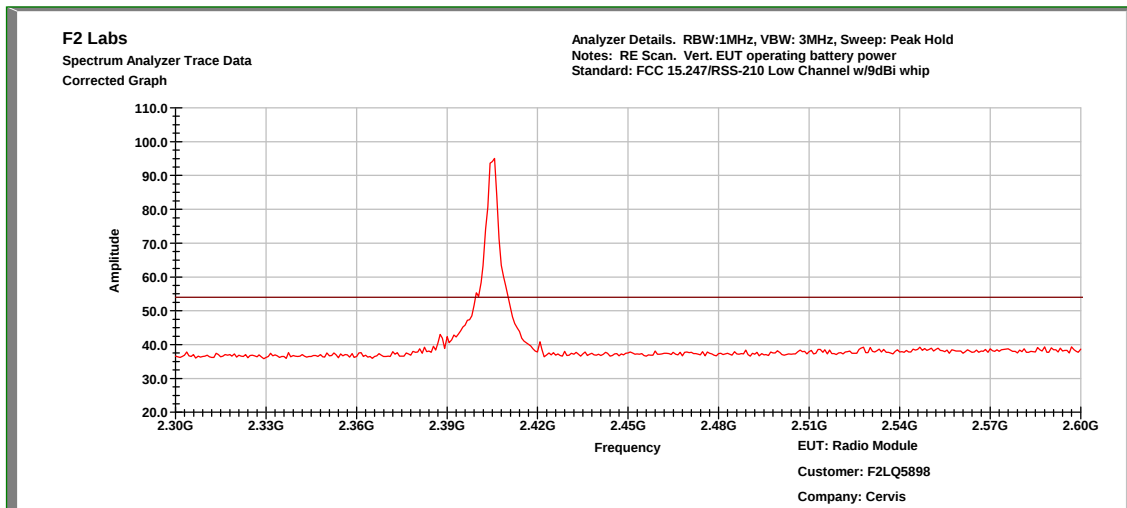




9dBi Whip Antenna, Low Channel, 2.3 GHz to 2.6 GHz, Horizontal

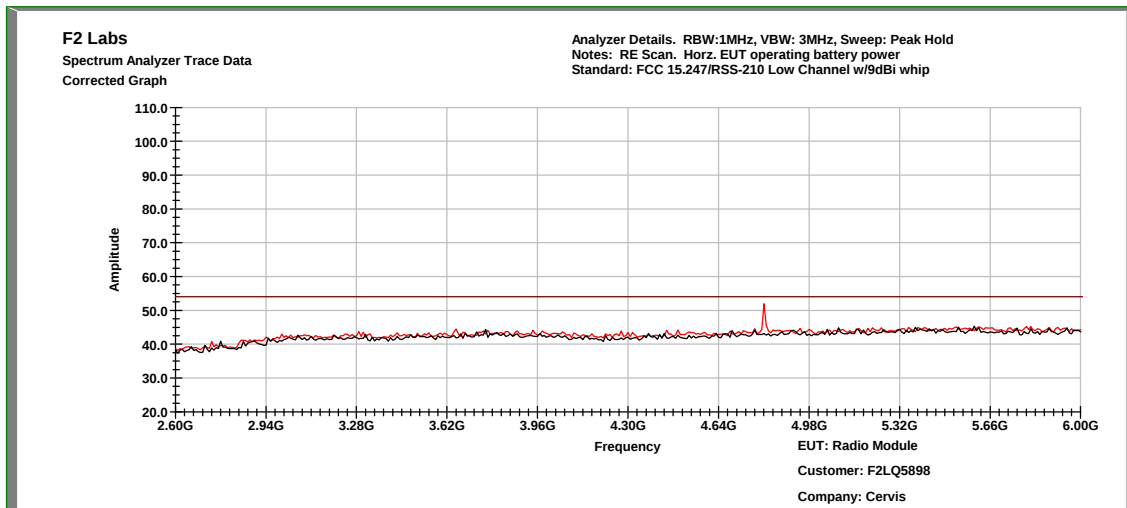


9dBi Whip Antenna, Low Channel, 2.3 GHz to 2.6 GHz, Vertical

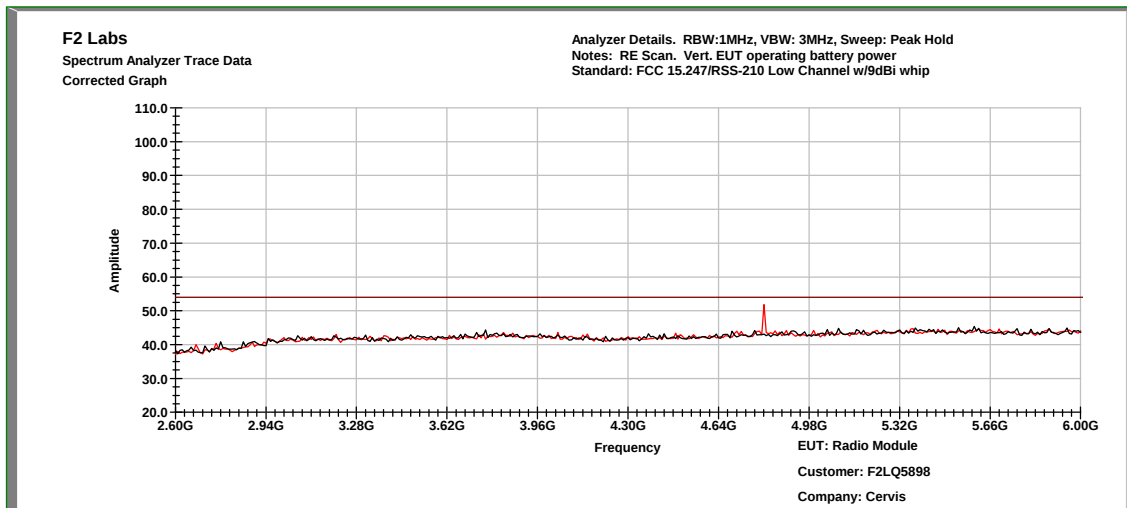




9dBi Whip Antenna, Low Channel, 2.6 GHz to 6 GHz, Horizontal

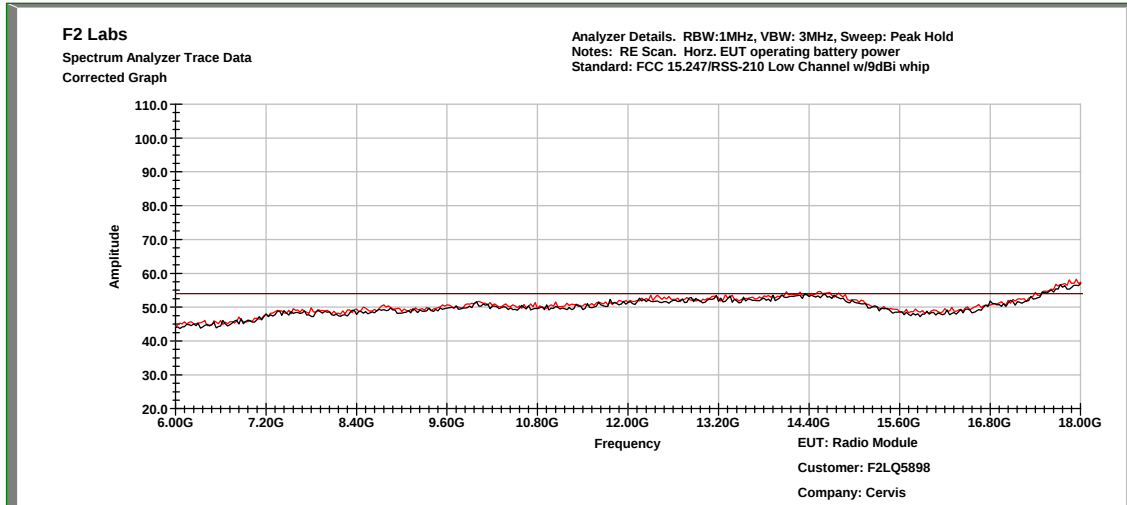


9dBi Whip Antenna, Low Channel, 2.6 GHz to 6 GHz, Vertical

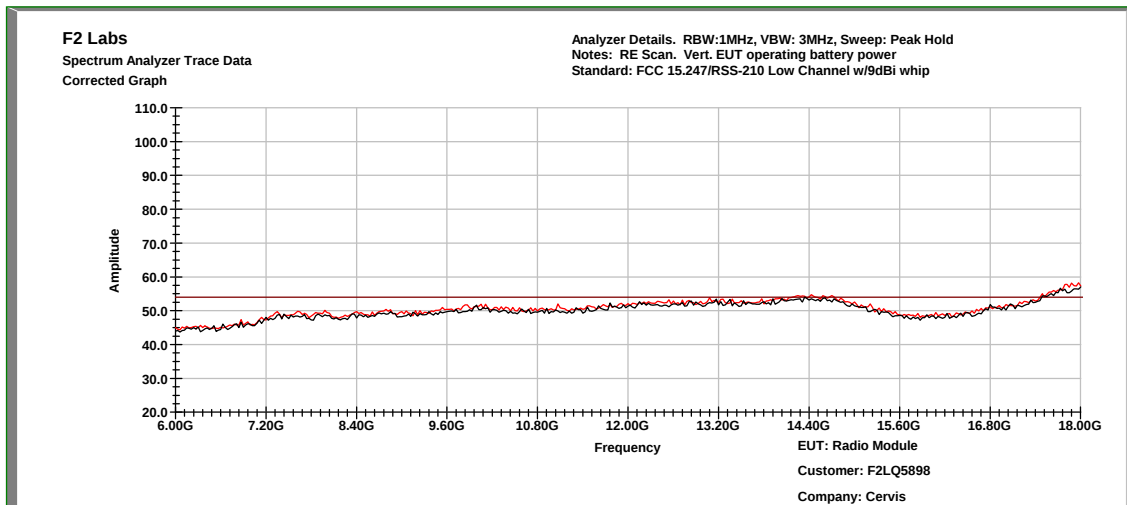




9dBi Whip Antenna, Low Channel, 6 GHz to 18 GHz, Horizontal

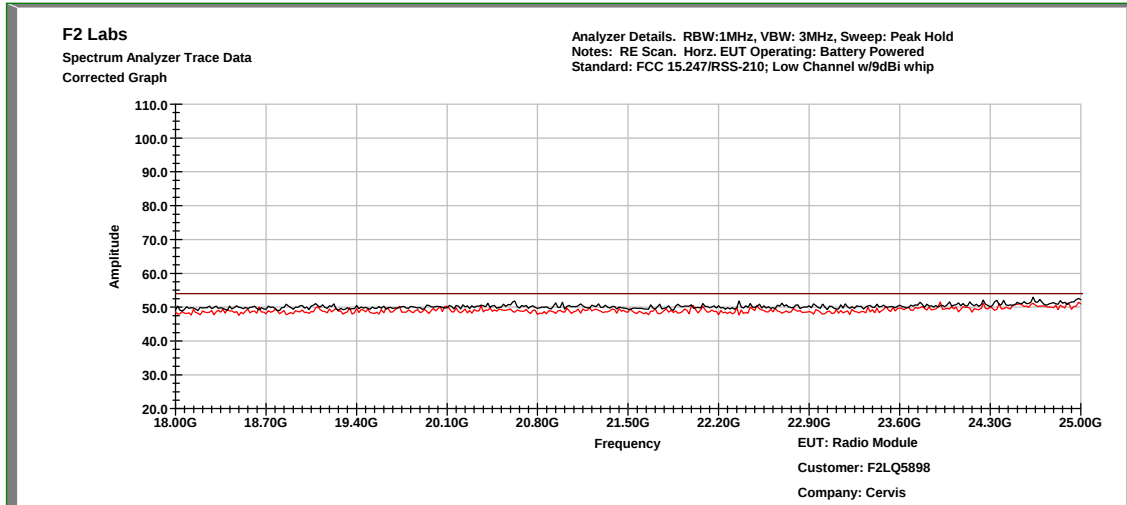


9dBi Whip Antenna, Low Channel, 6 GHz to 18 GHz, Vertical

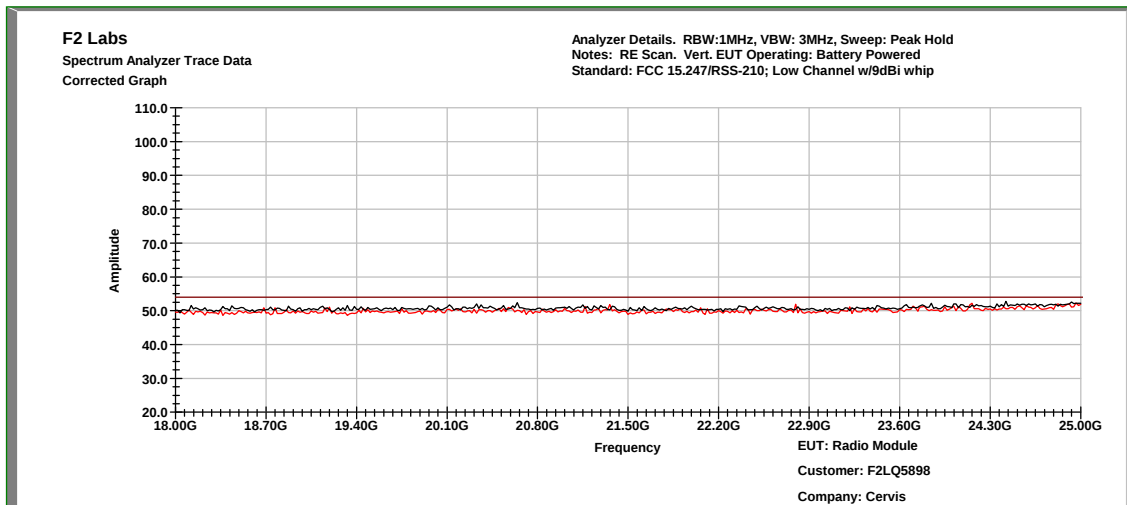




9dBi Whip Antenna, Low Channel, 18 GHz to 25 GHz, Horizontal

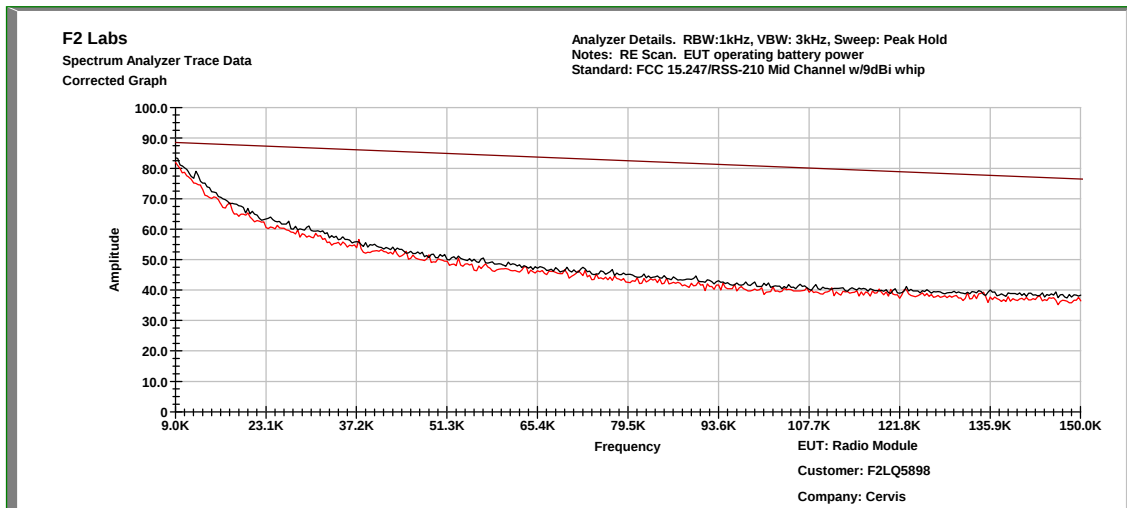


9dBi Whip Antenna, Low Channel, 18 GHz to 25 GHz, Vertical

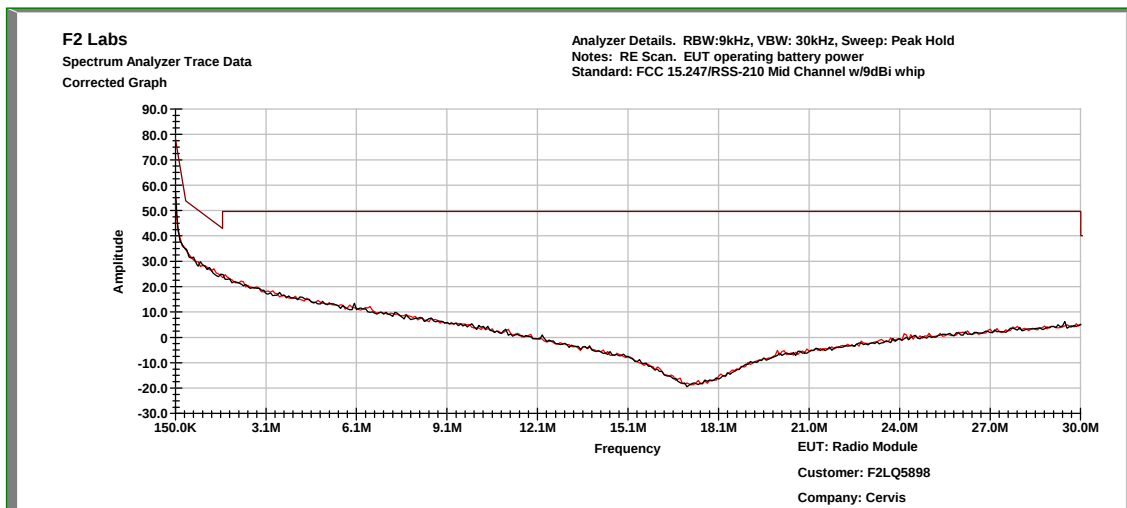




9dBi Whip Antenna, Mid Channel, .009 to 0.15 MHz

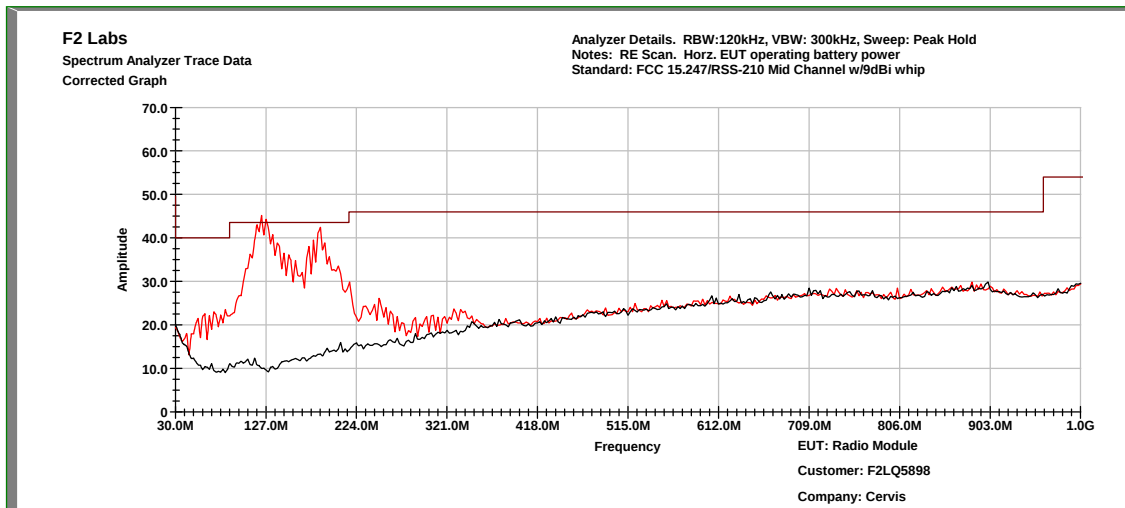


9dBi Whip Antenna, Mid Channel, 0.15 MHz to 30 MHz

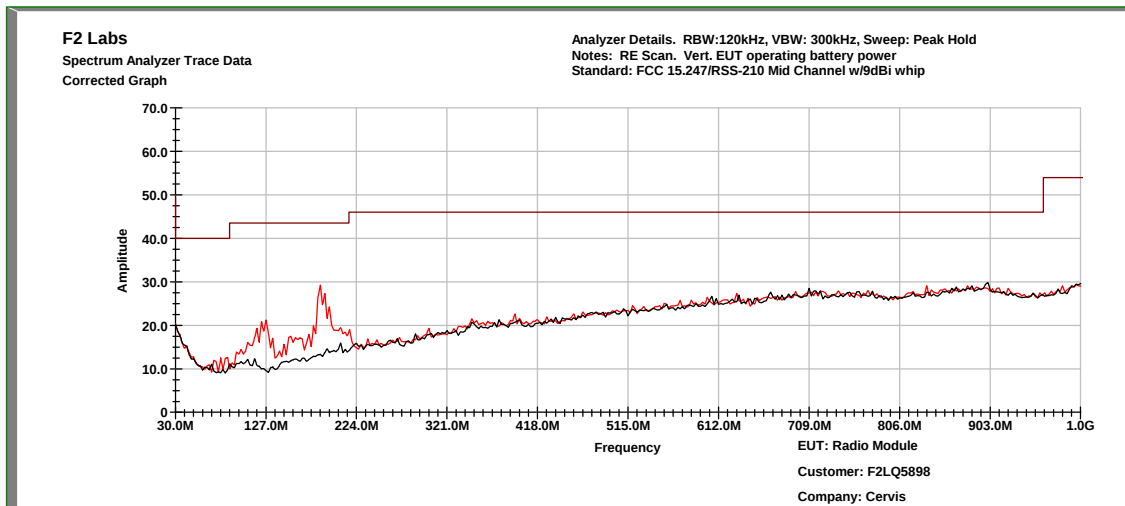




9dBi Whip Antenna, Mid Channel, 30 MHz to 1 GHz, Horizontal

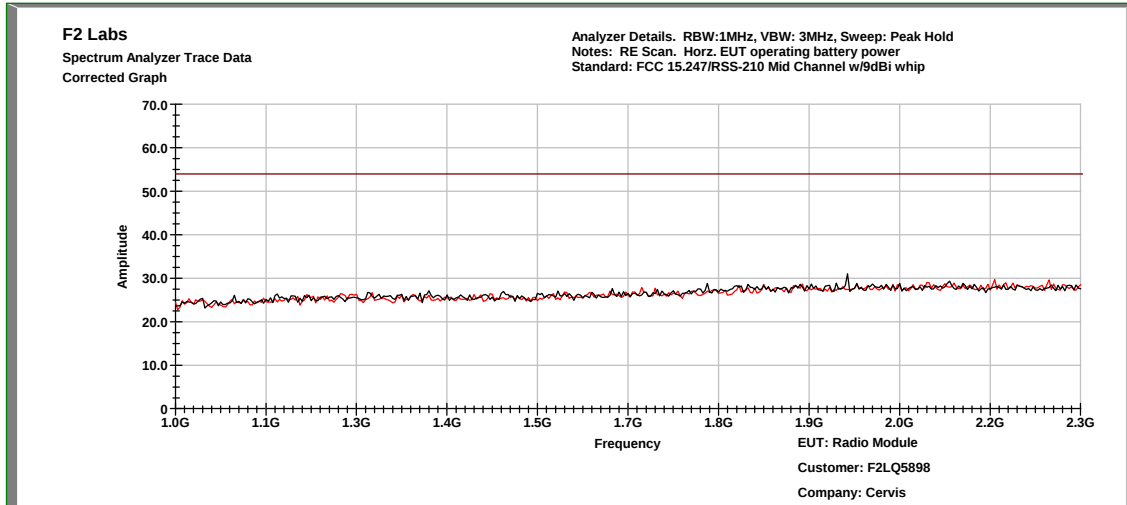


9dBi Whip Antenna, Mid Channel, 30 MHz to 1 GHz, Vertical

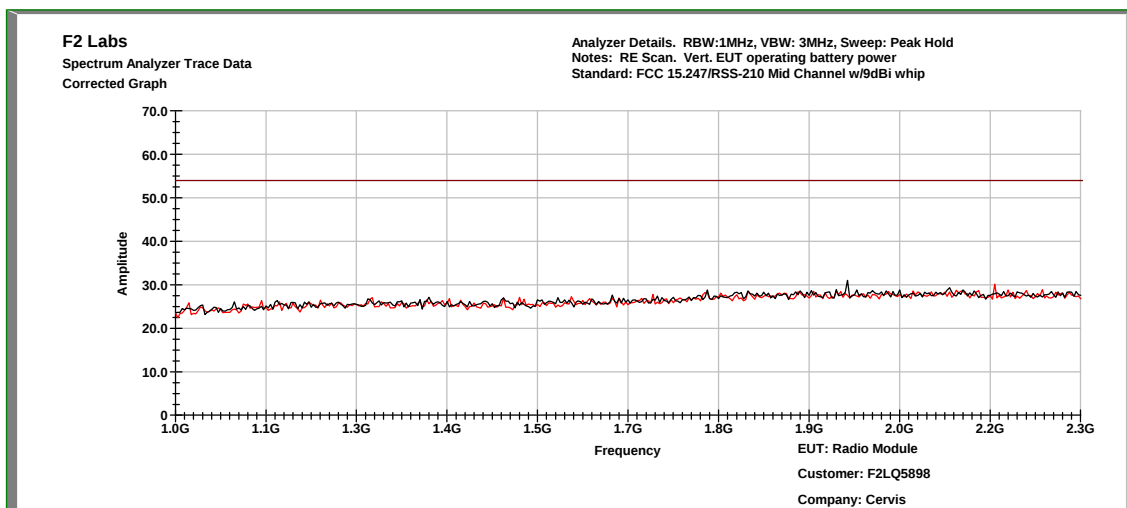




9dBi Whip Antenna, Mid Channel, 1 GHz to 2.3 GHz, Horizontal

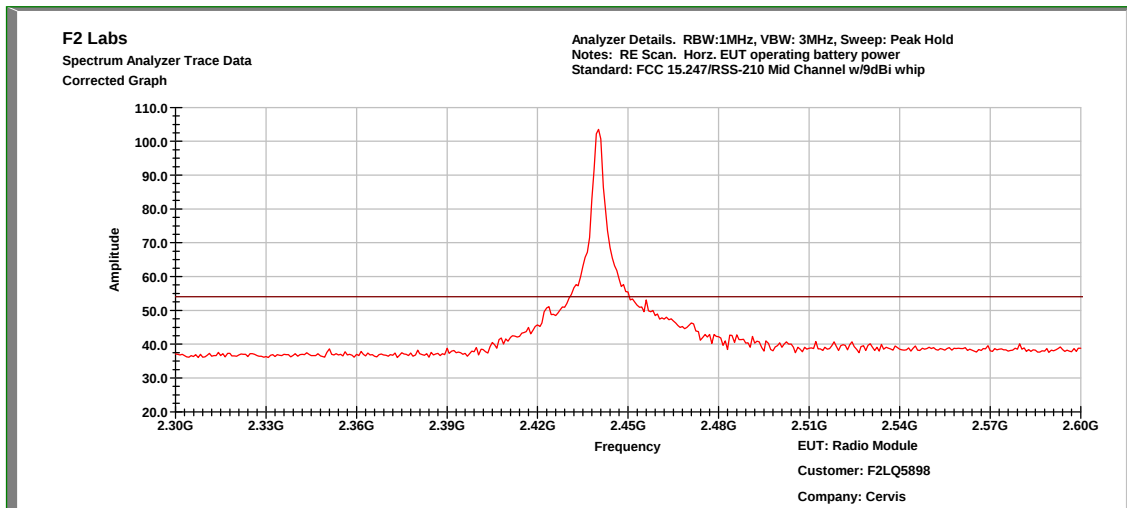


9dBi Whip Antenna, Mid Channel, 1 GHz to 2.3 GHz, Vertical

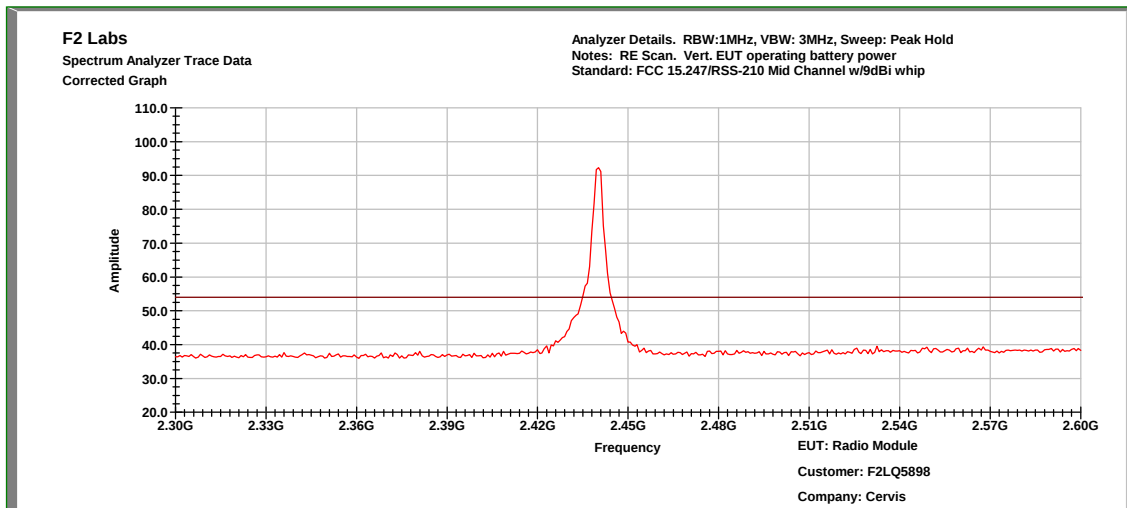




9dBi Whip Antenna, Mid Channel, 2.3 GHz to 2.6 GHz, Horizontal

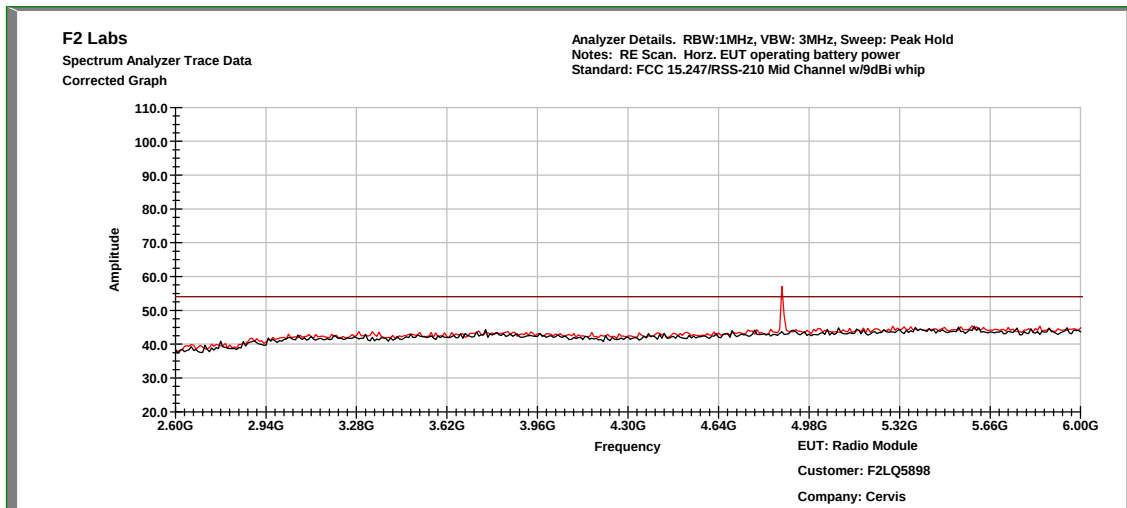


9dBi Whip Antenna, Mid Channel, 2.3 GHz to 2.6 GHz, Vertical

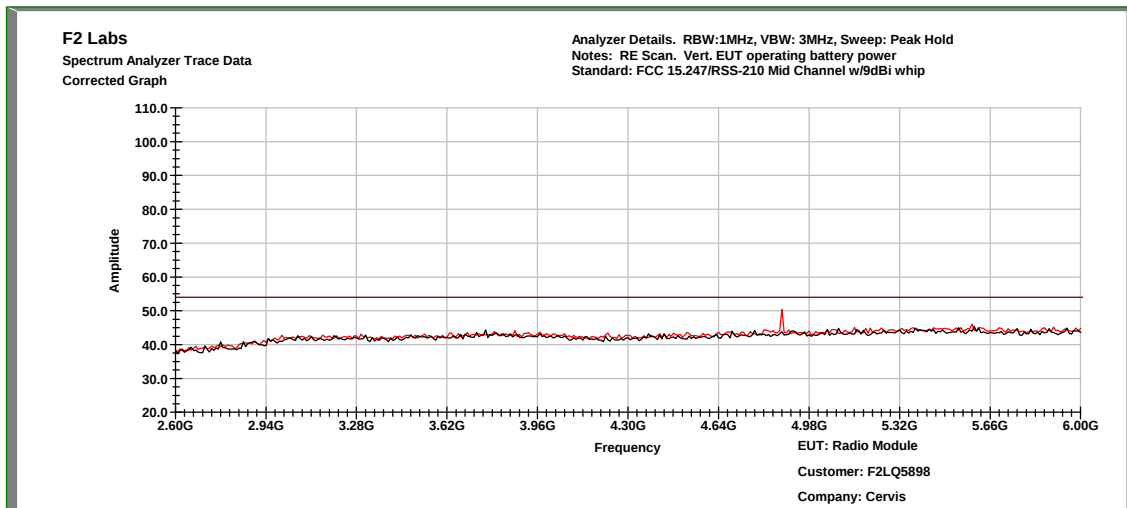




9dBi Whip Antenna, Mid Channel, 2.6 GHz to 6 GHz, Horizontal

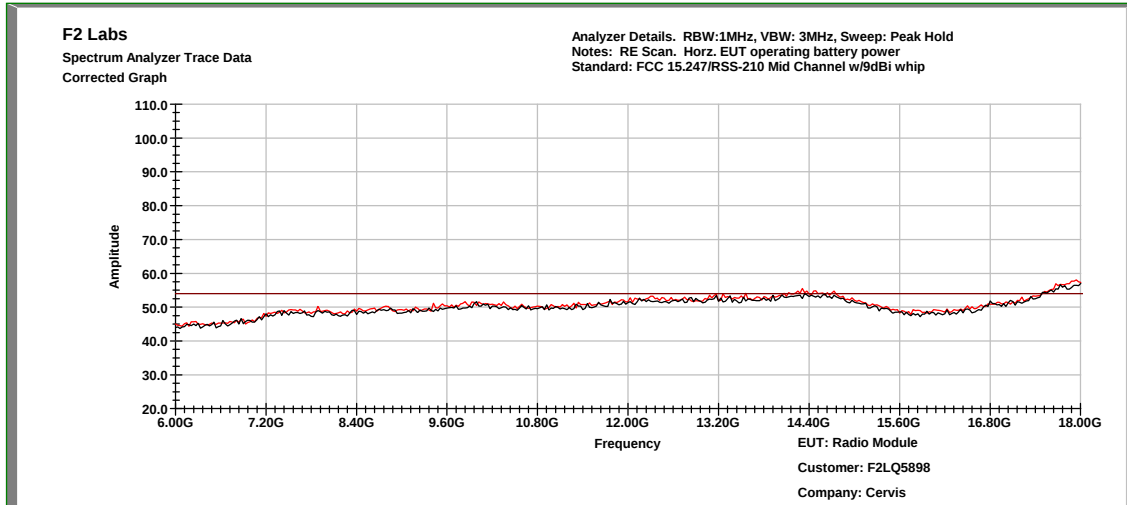


9dBi Whip Antenna, Mid Channel, 2.6 GHz to 6 GHz, Vertical

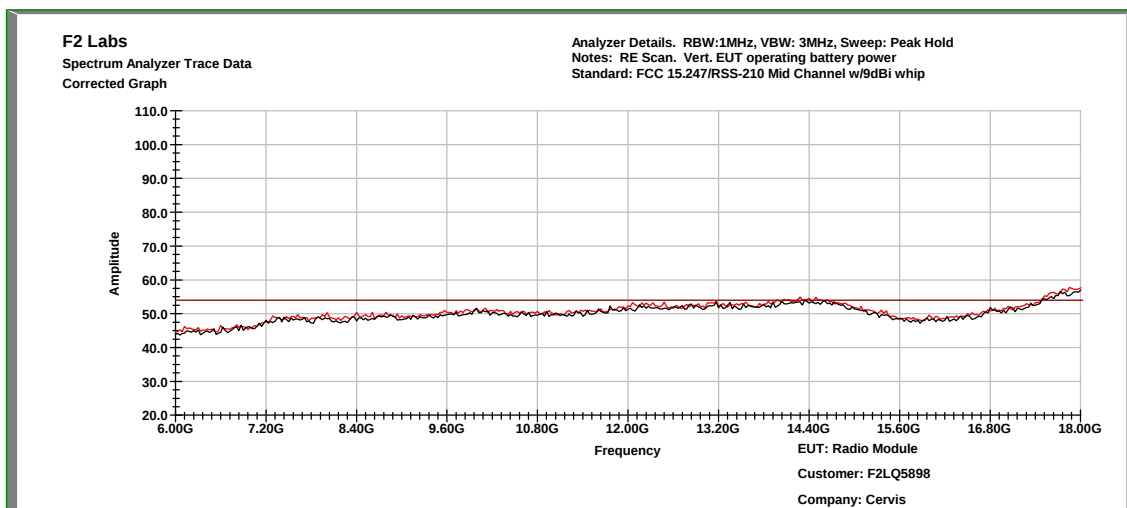




9dBi Whip Antenna, Mid Channel, 6 GHz to 18 GHz, Horizontal

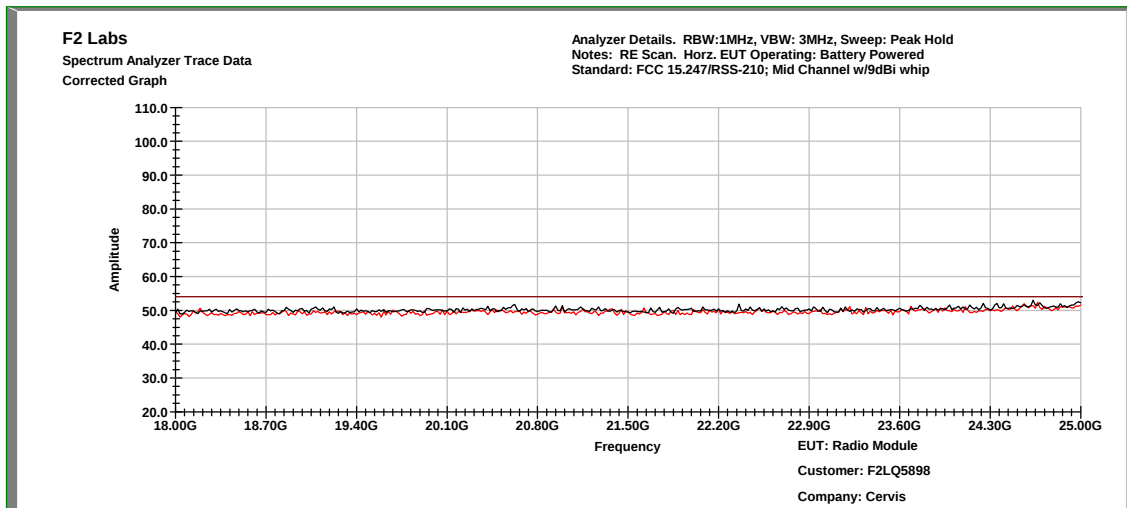


9dBi Whip Antenna, Mid Channel, 6 GHz to 18 GHz, Vertical

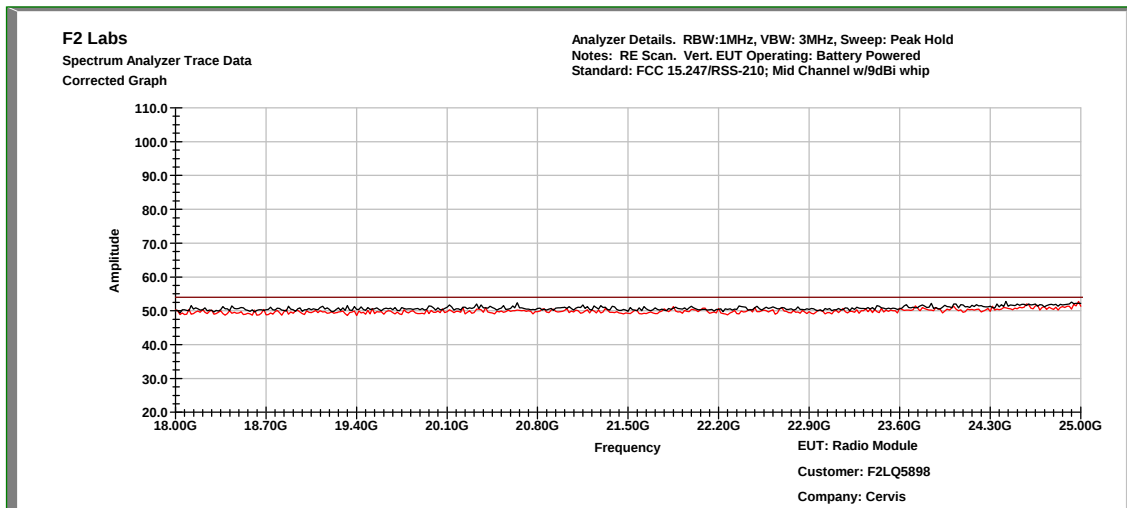




9dBi Whip Antenna, Mid Channel, 18 GHz to 25 GHz, Horizontal

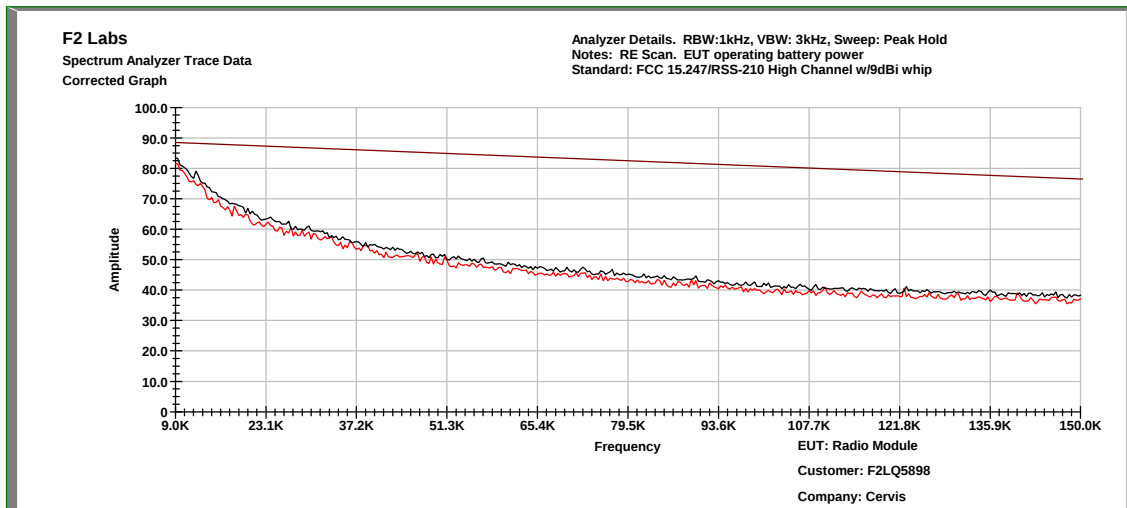


9dBi Whip Antenna, Mid Channel, 18 GHz to 25 GHz, Vertical

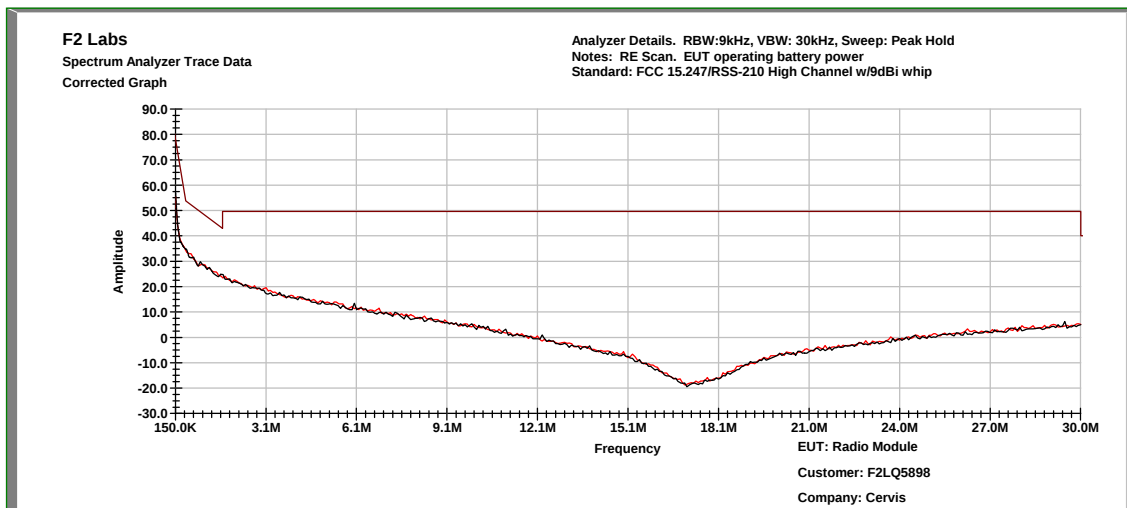




9dBi Whip Antenna, High Channel, .009 to 0.15 MHz

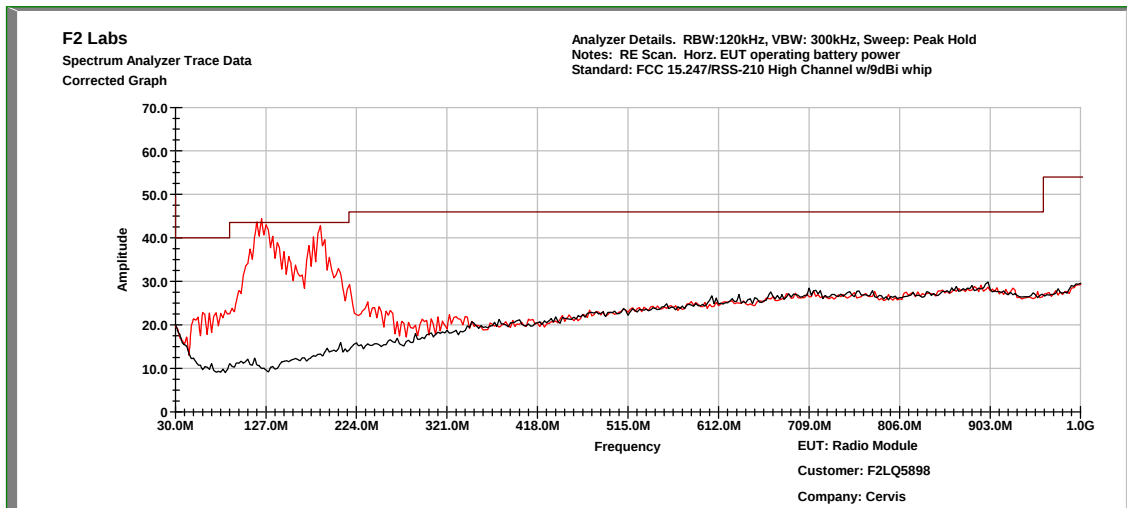


9dBi Whip Antenna, High Channel, 0.15 MHz to 30 MHz

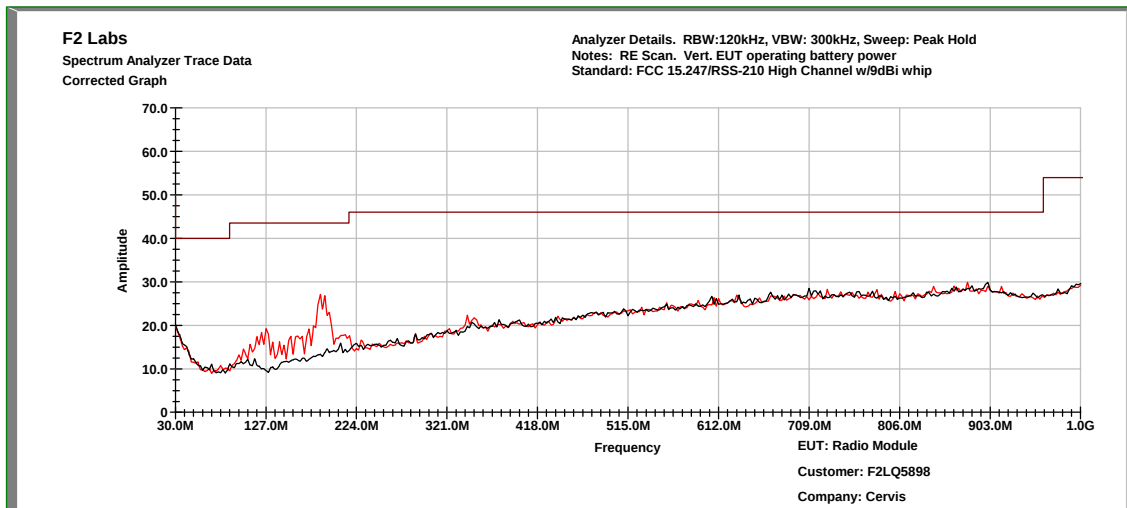




9dBi Whip Antenna, High Channel, 30 MHz to 1 GHz, Horizontal

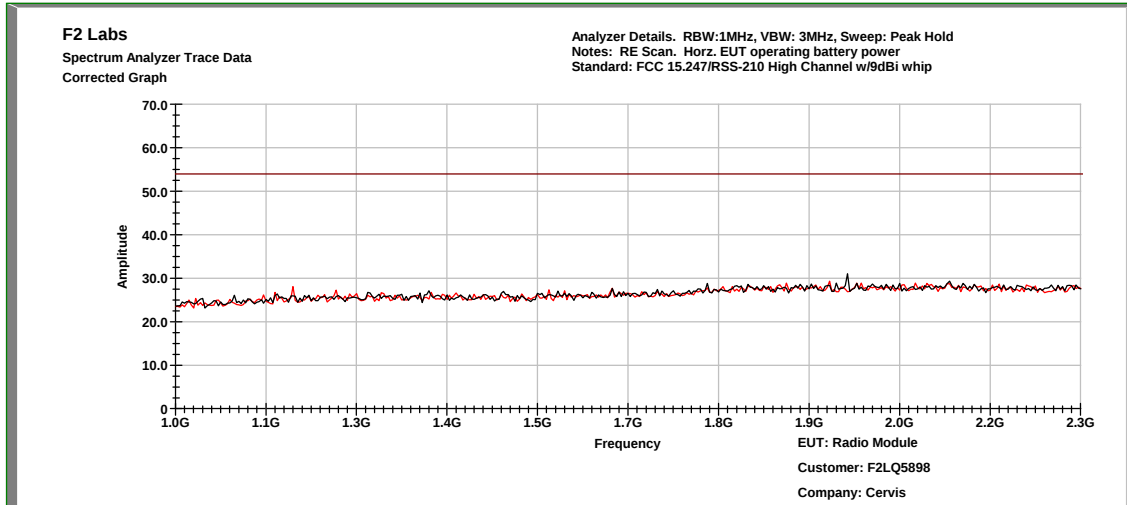


9dBi Whip Antenna, High Channel, 30 MHz to 1 GHz, Vertical

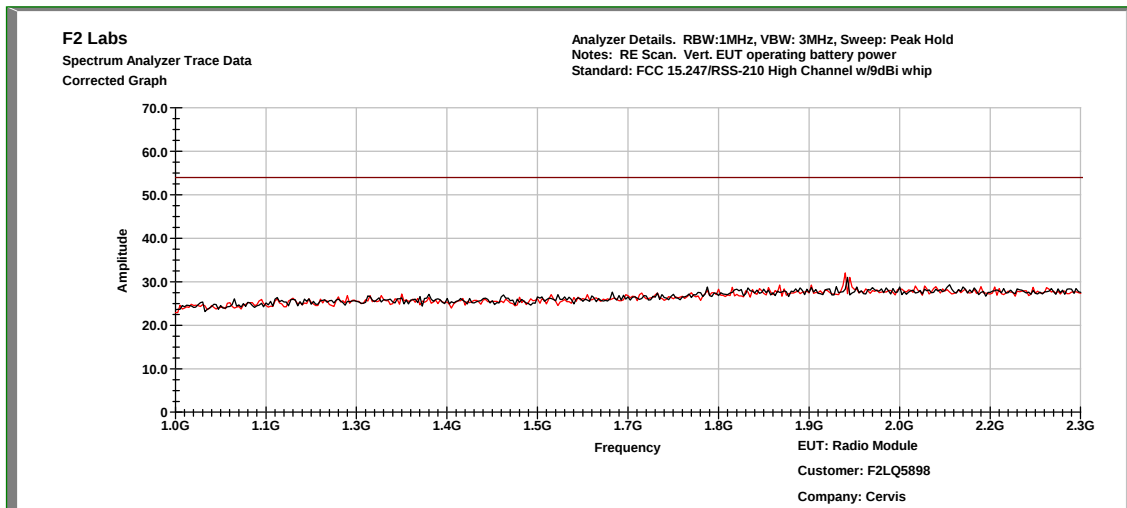




9dBi Whip Antenna, High Channel, 1 GHz to 2.3 GHz, Horizontal

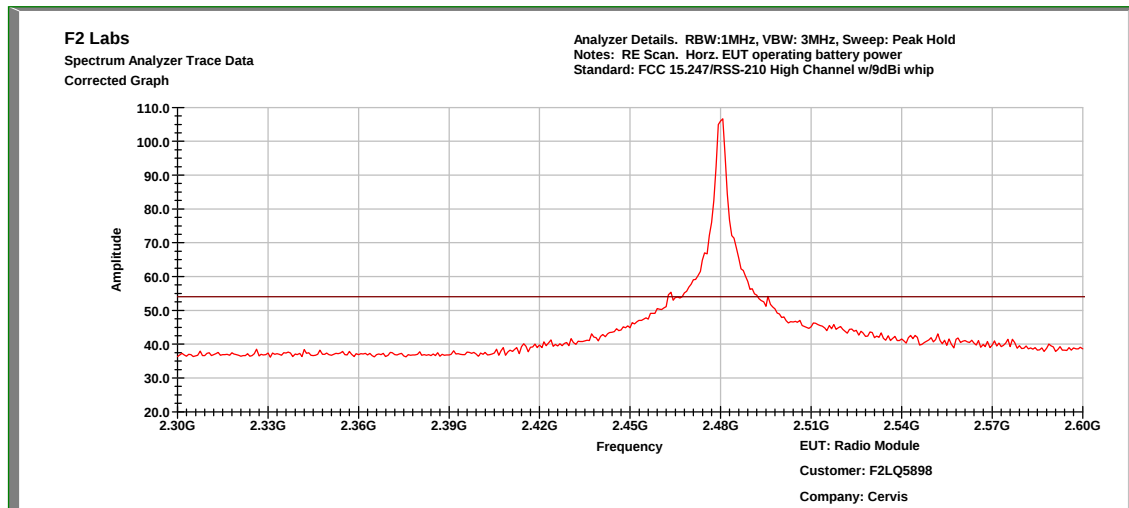


9dBi Whip Antenna, High Channel, 1 GHz to 2.3 GHz, Vertical

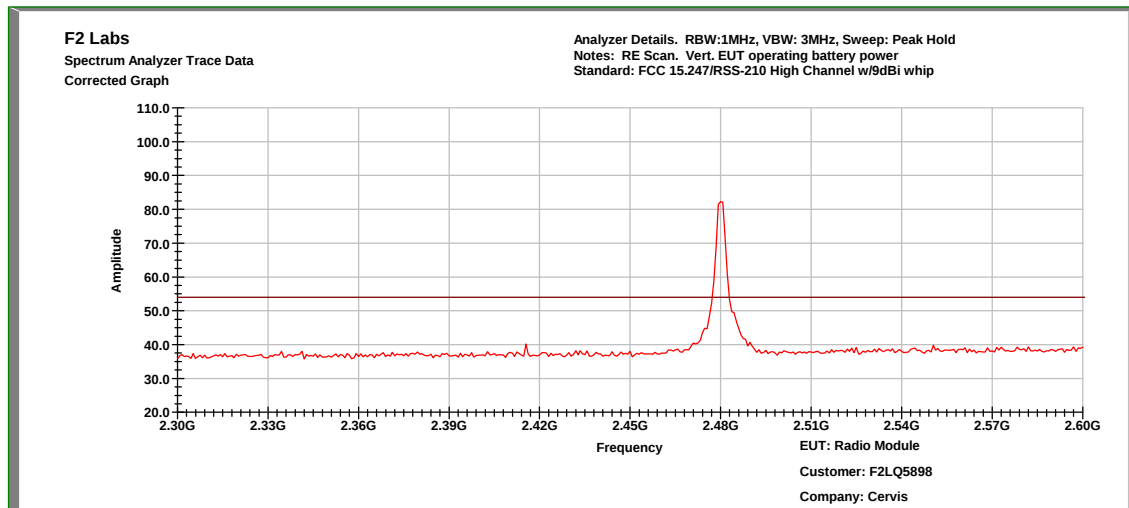




9dBi Whip Antenna, High Channel, 2.3 GHz to 2.6 GHz, Horizontal

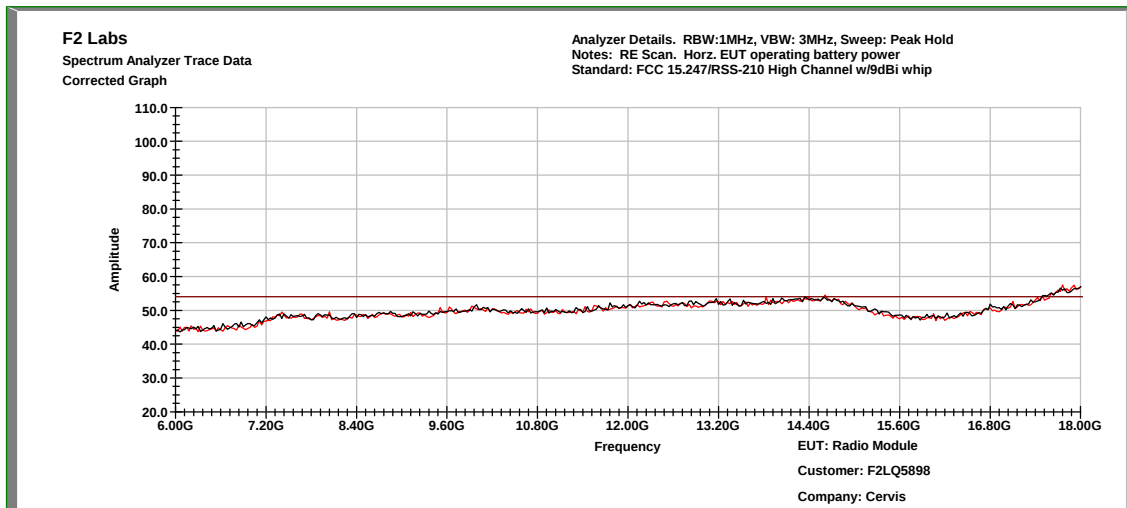


9dBi Whip Antenna, High Channel, 2.3 GHz to 2.6 GHz, Vertical

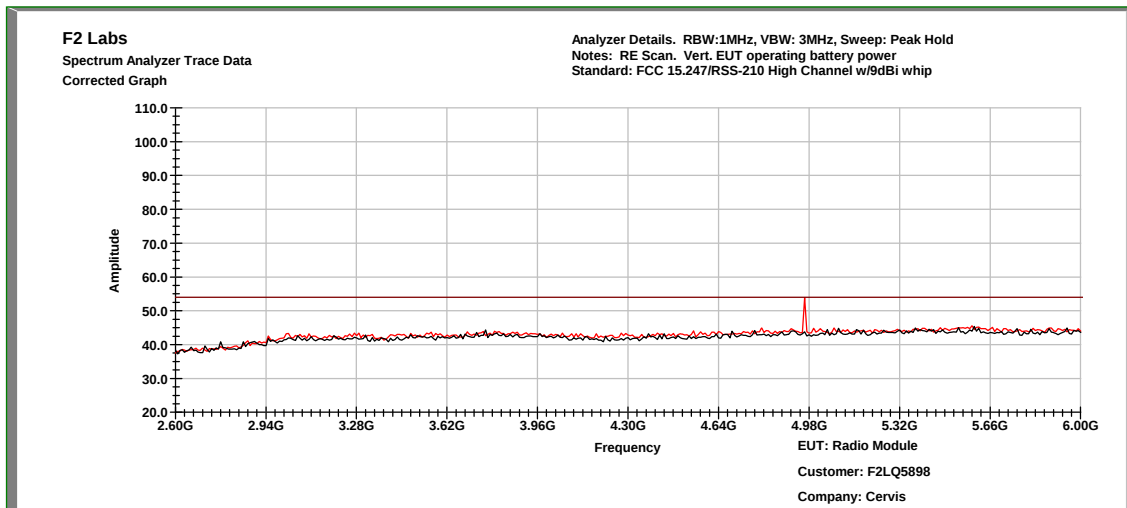




9dBi Whip Antenna, High Channel, 2.6 GHz to 6 GHz, Horizontal

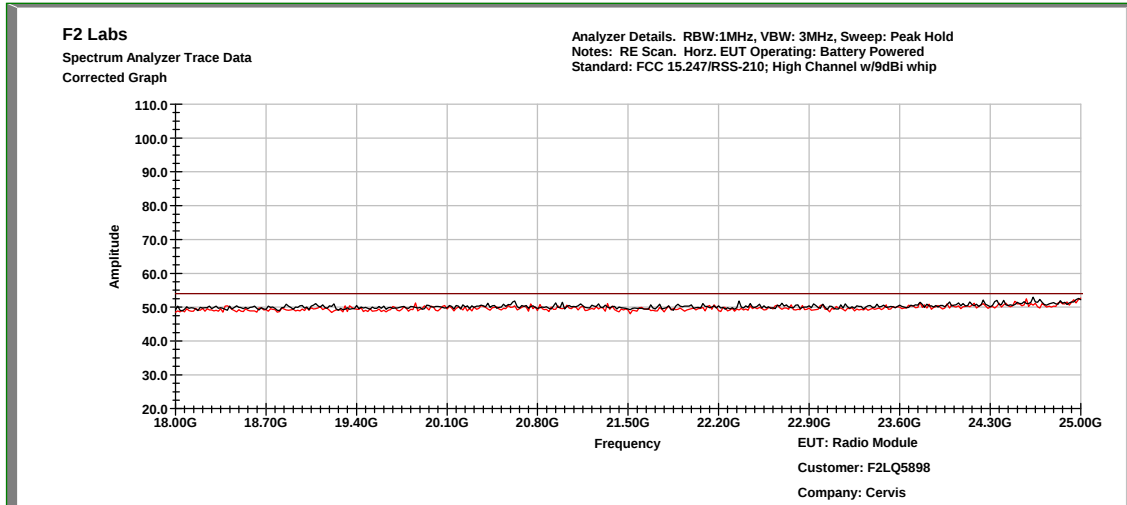


9dBi Whip Antenna, High Channel, 2.6 GHz to 6 GHz, Vertical

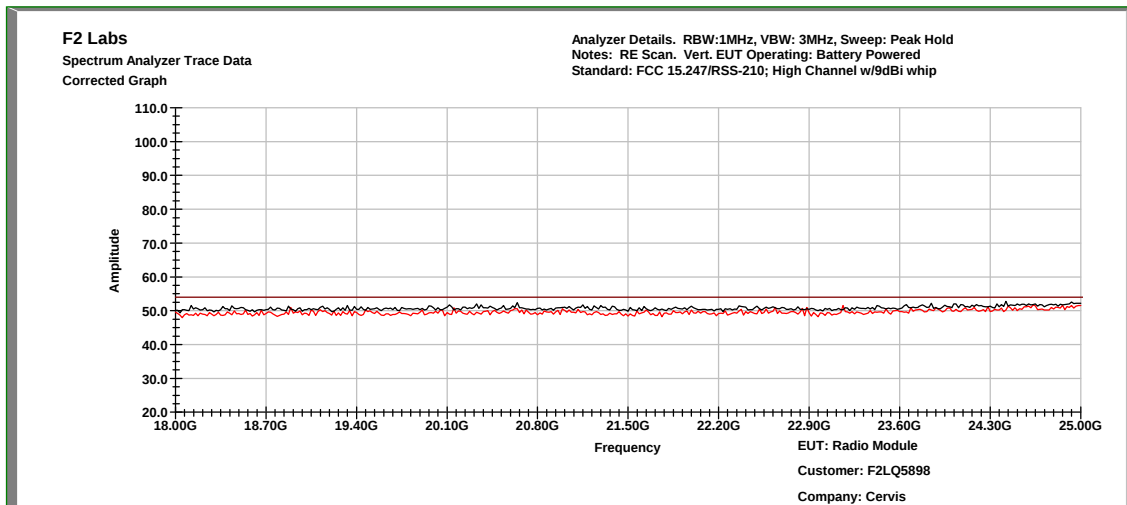




9dBi Whip Antenna, High Channel, 6 GHz to 18 GHz, Horizontal

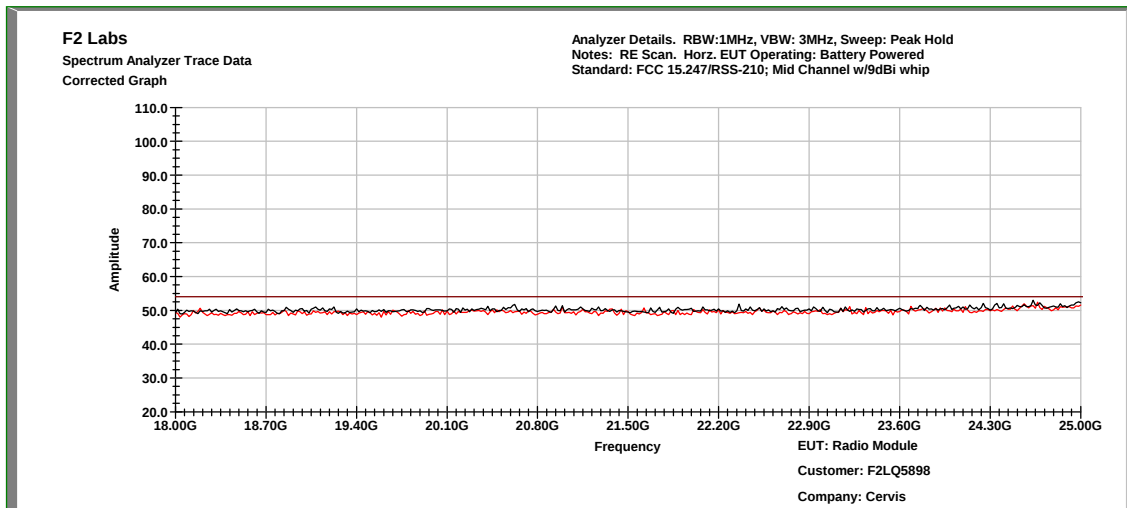


9dBi Whip Antenna, High Channel, 6 GHz to 18 GHz, Vertical

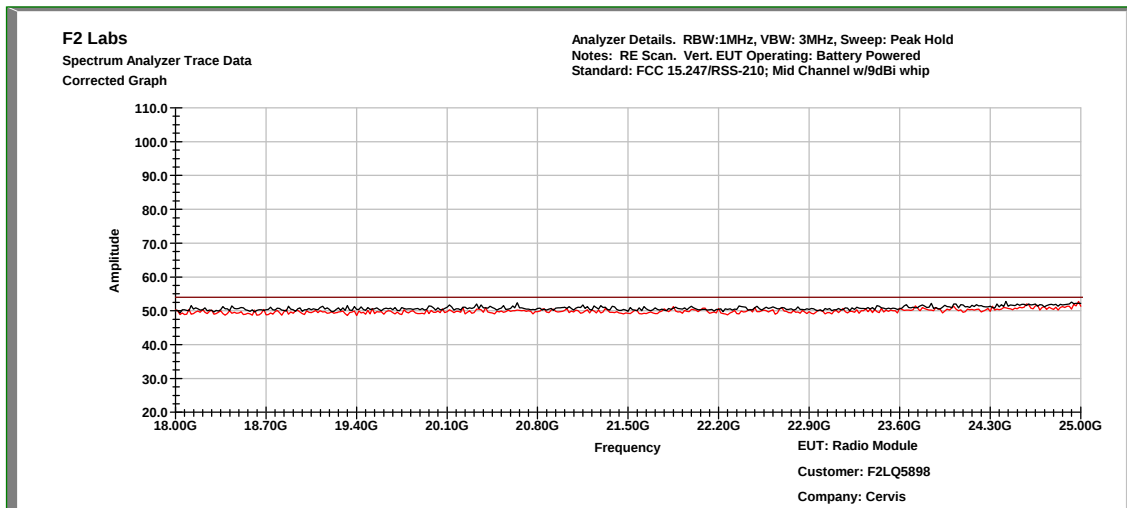




9dBi Whip Antenna, High Channel, 18 GHz to 25 GHz, Horizontal



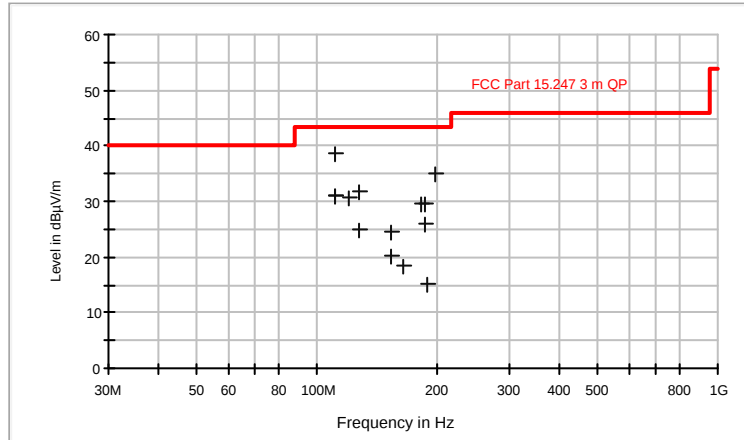
9dBi Whip Antenna, High Channel, 18 GHz to 25 GHz, Vertical





Measurements

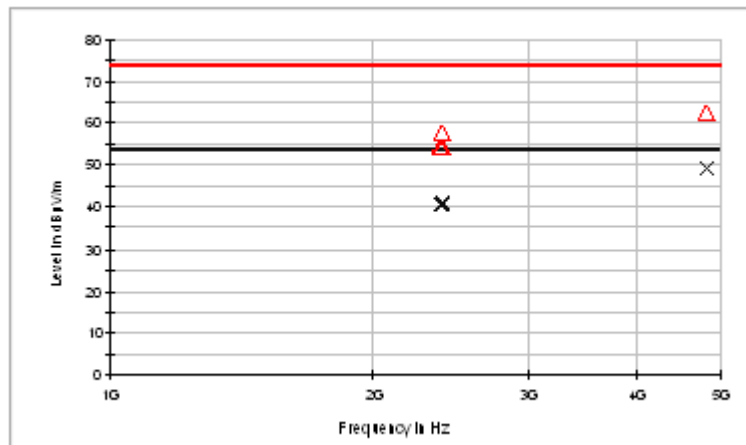
9dBi Whip Antenna, Low Channel



Frequency (MHz)	QuasiPeak (dBμV/m)	Limits (dBμV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
110.010000	38.6	43.5	120.000	H	14.2
110.700000	31.2	43.5	120.000	V	14.6
110.700000	31.2	43.5	120.000	V	14.6
119.500000	30.6	43.5	120.000	V	15.9
127.410000	24.9	43.5	120.000	V	15.7
127.410000	31.9	43.5	120.000	H	15.2
151.880000	20.2	43.5	120.000	V	14.2
151.880000	24.6	43.5	120.000	H	14.0
164.030000	18.3	43.5	120.000	V	14.1
182.010000	29.6	43.5	120.000	H	12.8
185.090000	25.9	43.5	120.000	V	12.9
185.490000	29.7	43.5	120.000	H	12.9
188.700000	15.2	43.5	120.000	V	12.8
197.220000	35.0	43.5	120.000	H	14.5



9dBi Whip Antenna, Low Channel, cont'd

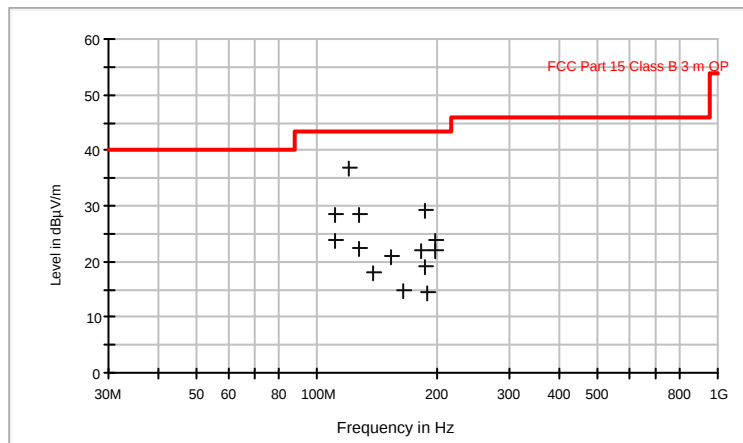


X = AVG; Δ = Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limits (dBµV/m)	Average (dBµV/m)	Limits (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
2384.96000	54.4	74.0	40.4	54.0	1000.000	H	28.3
2390.00000	54.5	74.0	40.5	54.0	1000.000	H	28.3
2390.00000	54.5	74.0	40.5	54.0	1000.000	H	28.3
2390.24000	57.8	74.0	40.8	54.0	1000.000	H	28.3
4811.28000	62.7	74.0	49.3	54.0	1000.000	H	32.9
4819.00000	62.6	74.0	49.1	54.0	1000.000	H	32.9



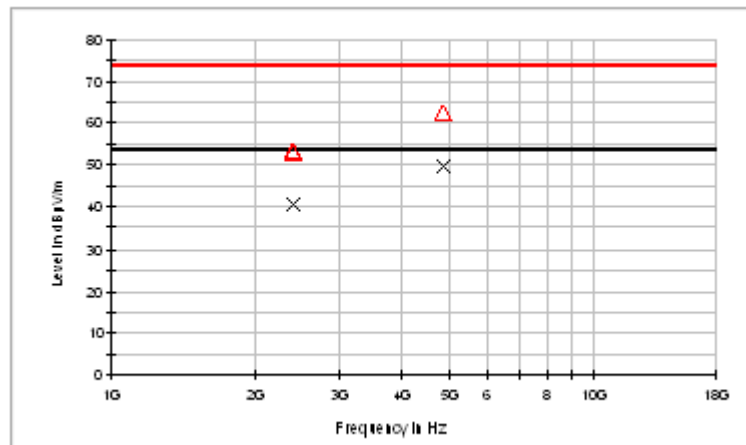
9dBi Whip Antenna, Mid Channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limits (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
110.010000	28.4	43.5	120.000	V	14.4
110.700000	23.8	43.5	120.000	H	14.5
119.500000	36.8	43.5	120.000	H	15.5
127.410000	22.5	43.5	120.000	V	15.7
127.410000	28.5	43.5	120.000	H	15.2
136.800000	18.2	43.5	120.000	H	14.6
151.880000	20.8	43.5	120.000	V	14.2
164.030000	14.7	43.5	120.000	H	13.9
182.010000	22.1	43.5	120.000	V	13.0
185.090000	29.2	43.5	120.000	H	12.8
185.490000	19.0	43.5	120.000	V	13.0
188.700000	14.6	43.5	120.000	H	12.8
197.220000	22.1	43.5	120.000	V	14.2
197.220000	23.9	43.5	120.000	V	14.2



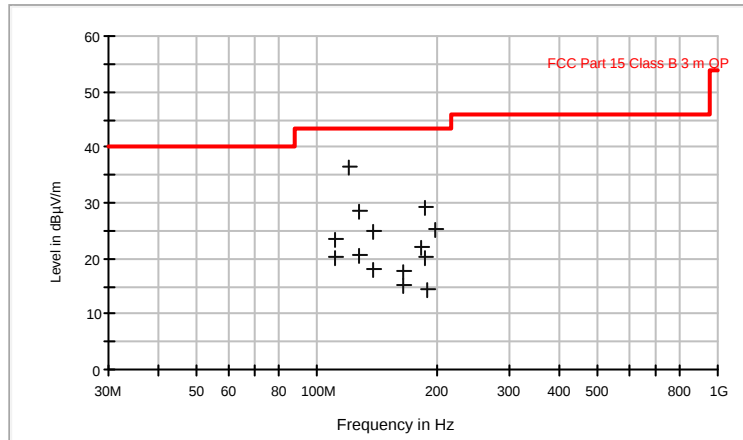
9dBi Whip Antenna, Mid Channel, cont'd

X = AVG; Δ = Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limits (dBµV/m)	Average (dBµV/m)	Limits (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
2385.08000	53.2	74.0	40.6	54.0	1000.000	V	28.3
2385.36000	53.3	74.0	40.5	54.0	1000.000	H	28.3
2391.08000	53.5	74.0	40.6	54.0	1000.000	V	28.3
4889.28000	62.6	74.0	49.7	54.0	1000.000	V	33.1



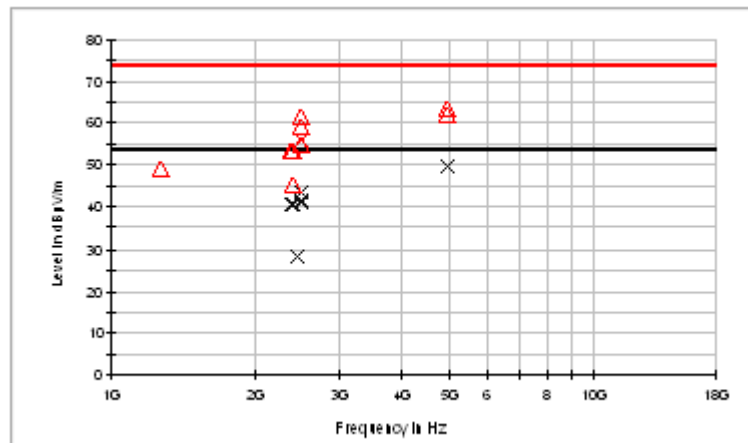
9dBi Whip Antenna, High Channel



Frequency (MHz)	QuasiPeak (dBμV/m)	Limits (dBμV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
110.010000	20.4	43.5	120.000	V	14.4
110.700000	23.5	43.5	120.000	H	14.5
119.500000	36.6	43.5	120.000	H	15.5
127.410000	28.6	43.5	120.000	H	15.2
127.410000	20.4	43.5	120.000	V	15.7
136.800000	24.8	43.5	120.000	V	14.6
136.800000	18.2	43.5	120.000	H	14.6
164.030000	17.9	43.5	120.000	V	14.1
164.030000	15.3	43.5	120.000	H	13.9
182.010000	22.0	43.5	120.000	V	13.0
185.090000	29.4	43.5	120.000	H	12.8
185.490000	20.4	43.5	120.000	V	13.0
188.700000	14.5	43.5	120.000	H	12.8
197.220000	25.1	43.5	120.000	V	14.2



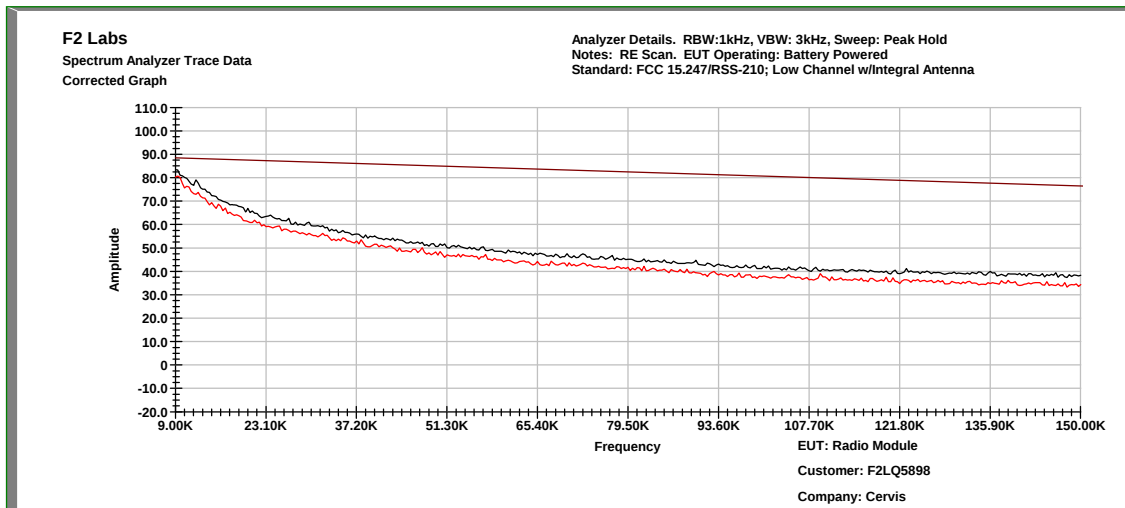
9dBi Whip Antenna, High Channel, cont'd

X = AVG; Δ = Max Peak

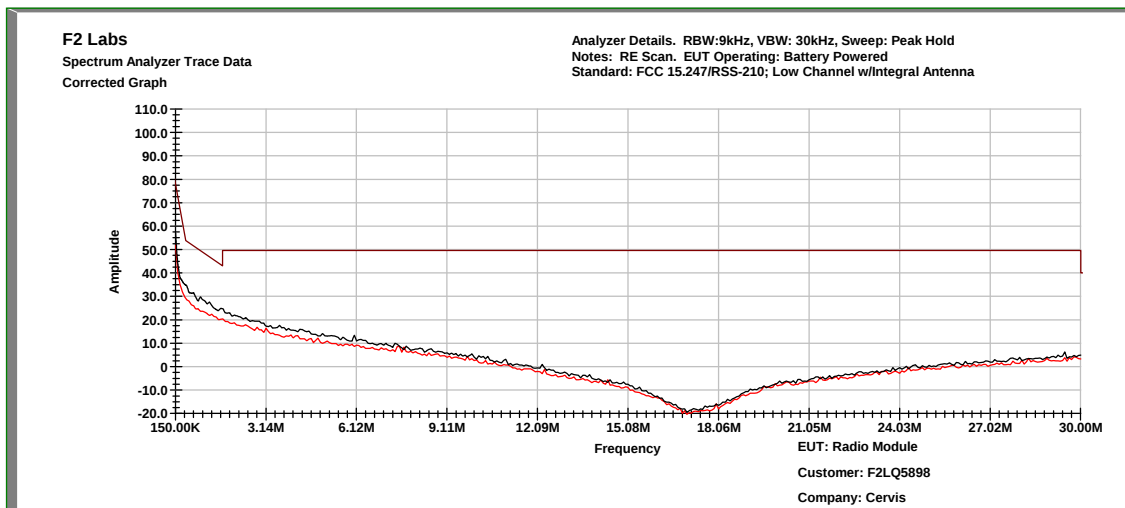
Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
1270.00000	49.3	74.0	36.7	54.0	1000.000	H	25.5
2380.00000	53.6	74.0	40.4	54.0	1000.000	H	28.2
2384.88000	53.5	74.0	40.4	54.0	1000.000	V	28.3
2483.76000	44.9	74.0	27.3	54.0	1000.000	H	28.4
2483.76000	59.3	74.0	43.4	54.0	1000.000	V	28.4
2500.00000	61.8	74.0	41.4	54.0	1000.000	H	28.4
2500.00000	55.0	74.0	40.9	54.0	1000.000	V	28.4
4959.08000	62.2	74.0	49.6	54.0	1000.000	H	33.2
4959.08000	63.7	74.0	49.6	54.0	1000.000	V	33.2



3.8dBi Integral Antenna, Low Channel, .009 to 0.15 MHz

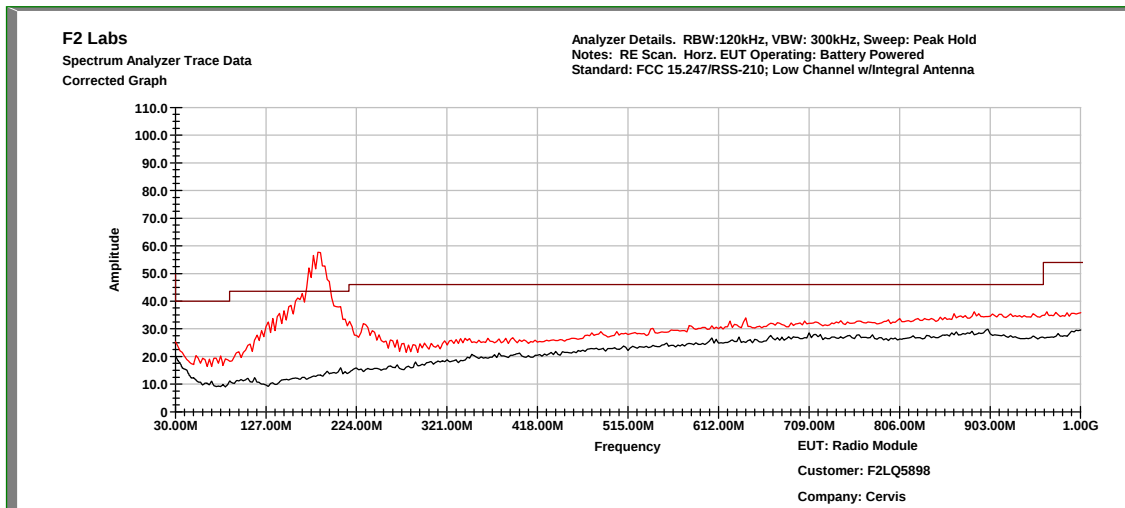


3.8dBi Integral Antenna, Low Channel, 0.15 MHz to 30 MHz

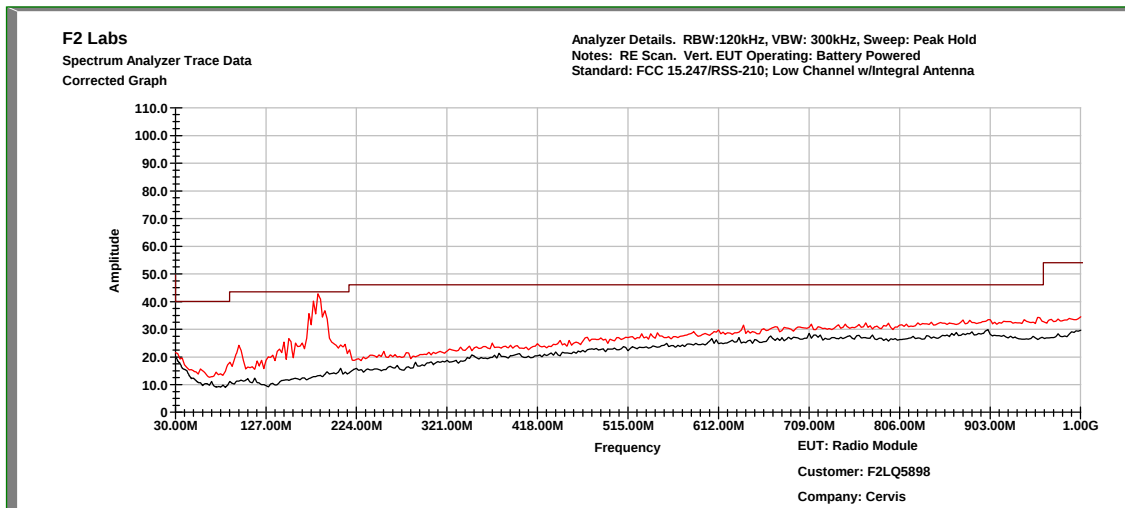




3.8dBi Integral Antenna, Low Channel, 30 MHz to 1 GHz, Horizontal

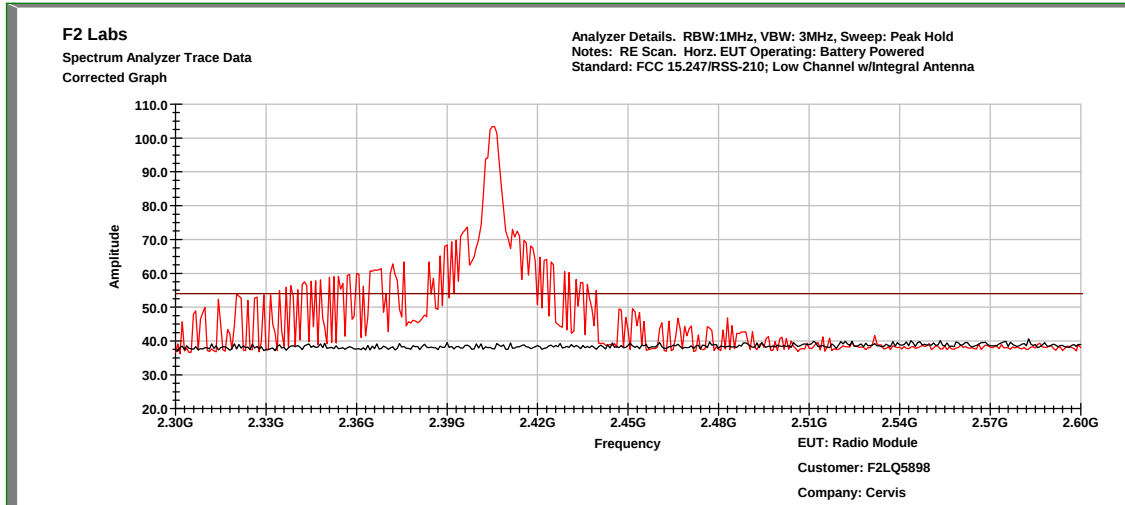


3.8dBi Integral Antenna, Low Channel, 30 MHz to 1 GHz, Vertical

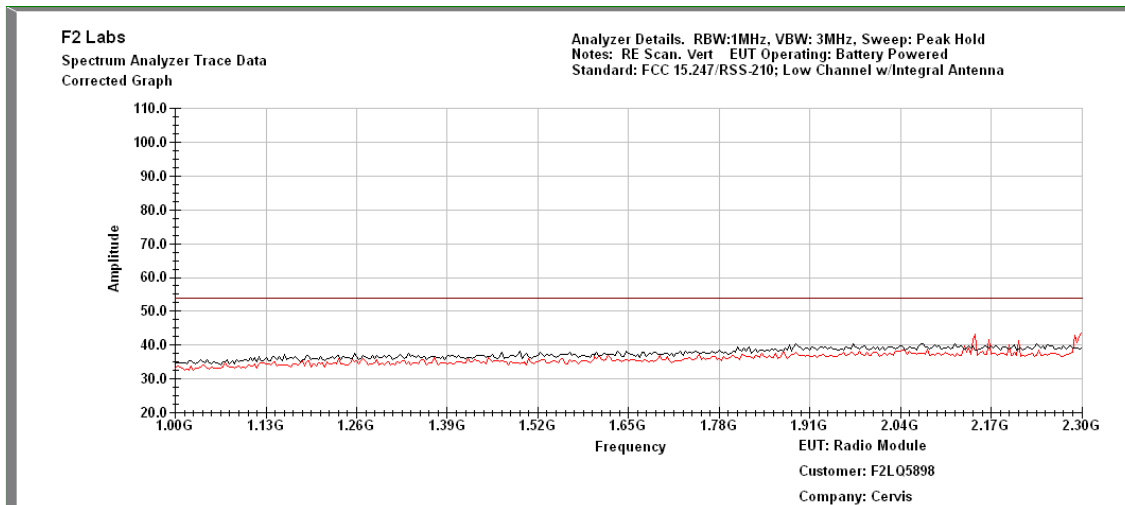




3.8dBi Integral Antenna, Low Channel, 1 GHz to 2.3 GHz, Horizontal

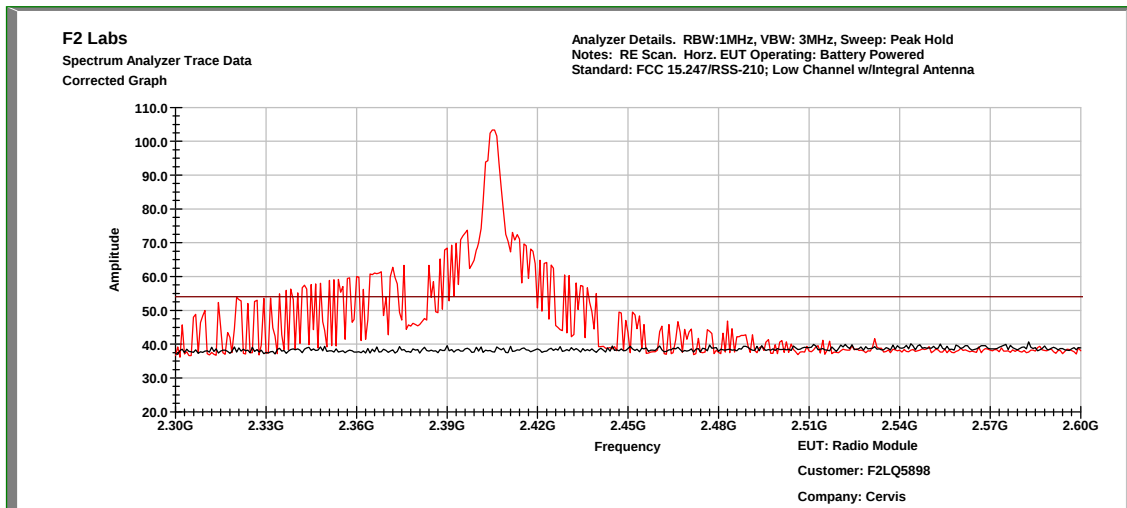


3.8dBi Integral Antenna, Low Channel, 1 GHz to 2.3 GHz, Vertical

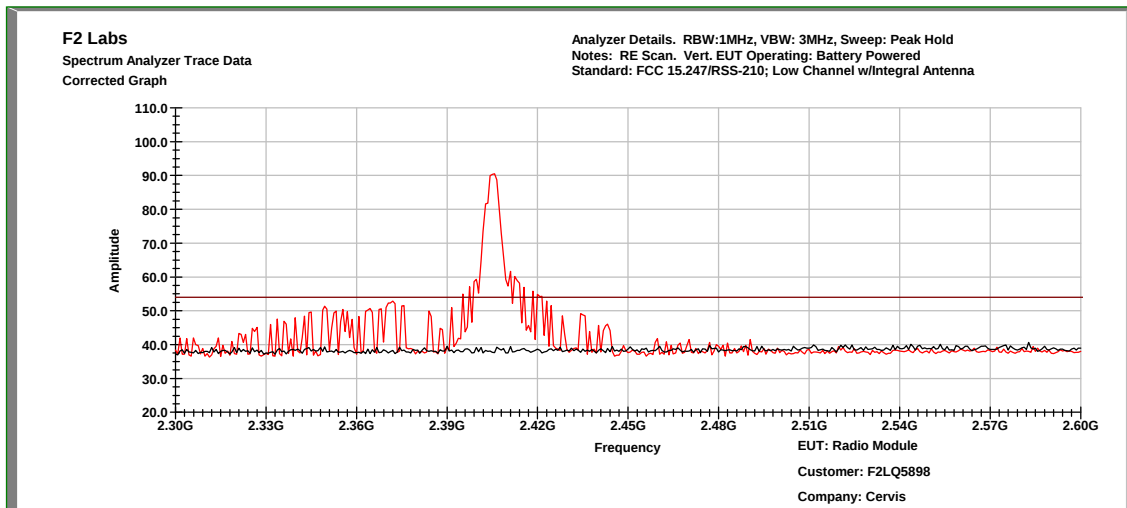




3.8dBi Integral Antenna, Low Channel, 2.3 GHz to 2.6 GHz, Horizontal

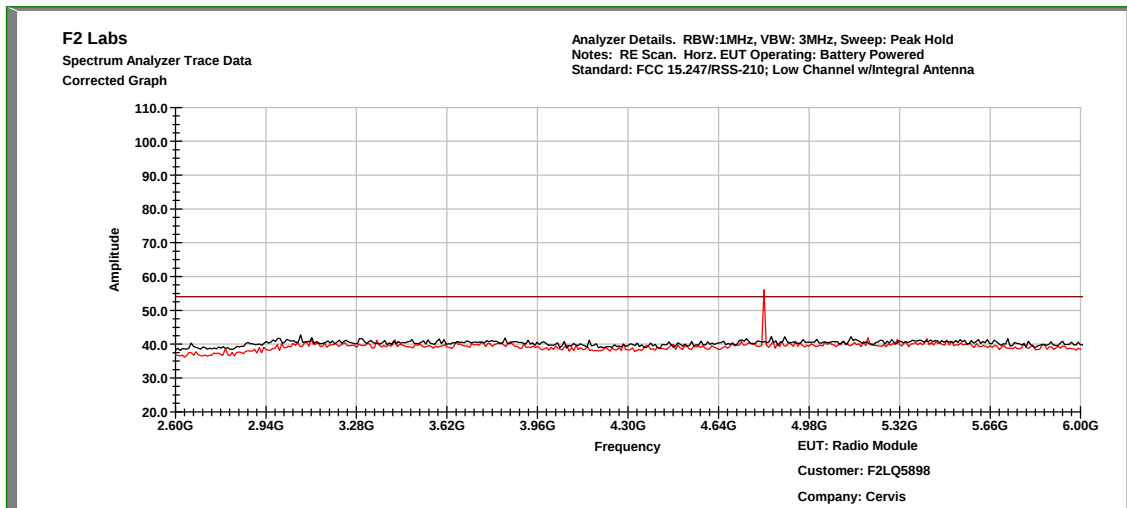


3.8dBi Integral Antenna, Low Channel, 2.3 GHz to 2.6 GHz, Vertical

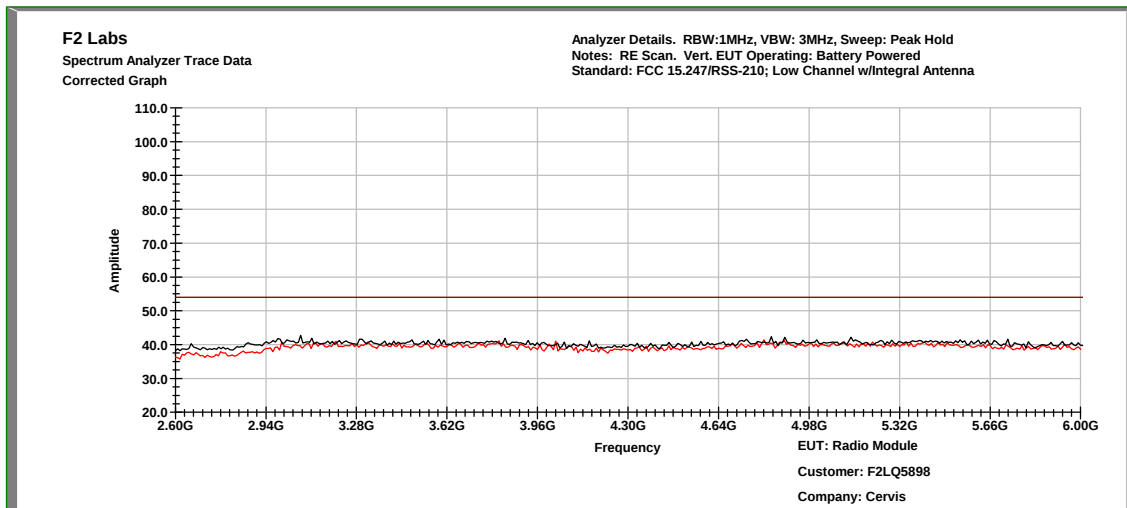




3.8dBi Integral Antenna, Low Channel, 2.6 GHz to 6 GHz, Horizontal

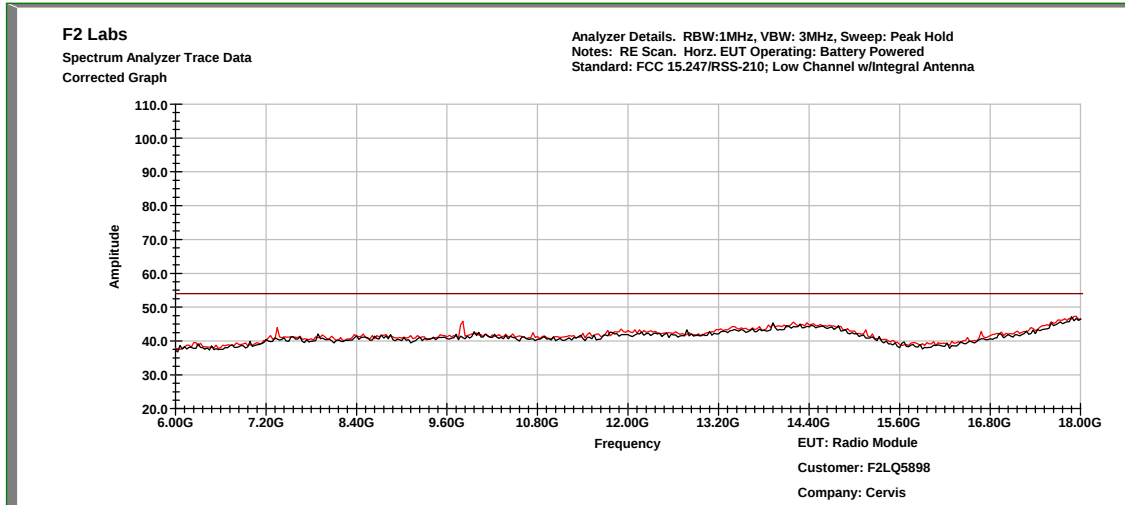


3.8dBi Integral Antenna, Low Channel, 2.6 GHz to 6 GHz, Vertical

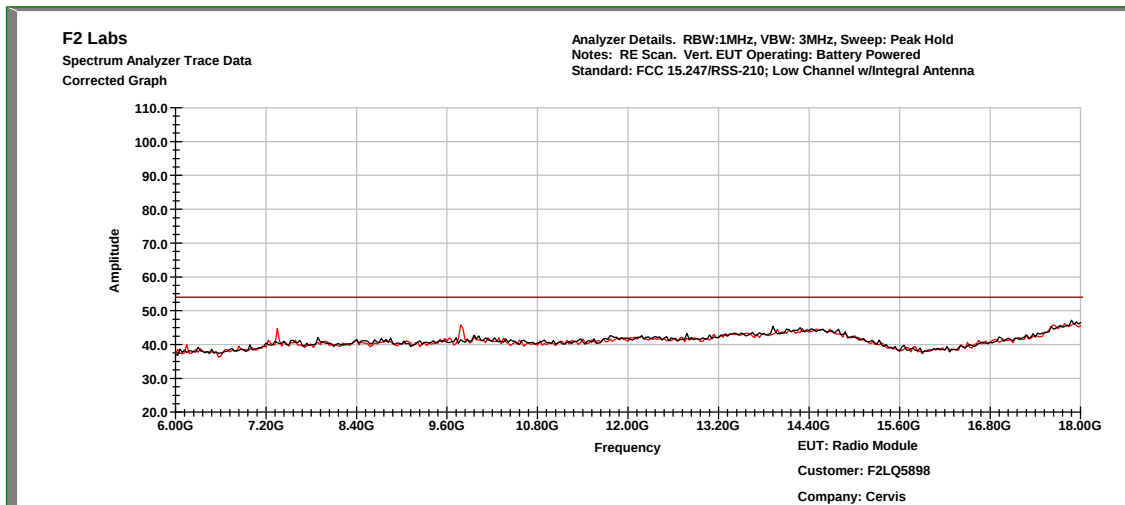




3.8dBi Integral Antenna, Low Channel, 6 GHz to 18 GHz, Horizontal

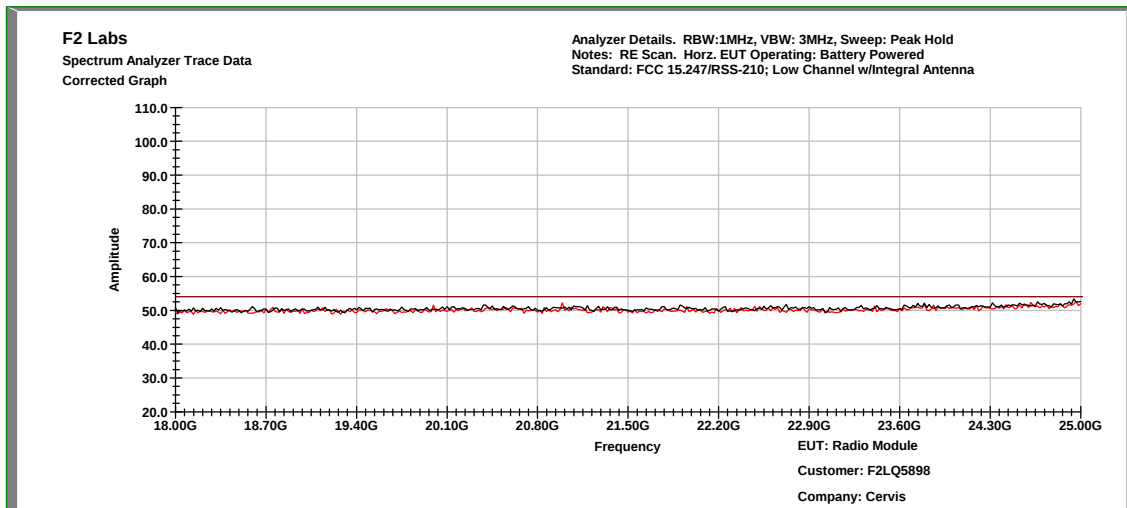


3.8dBi Integral Antenna, Low Channel, 6 GHz to 18 GHz, Vertical

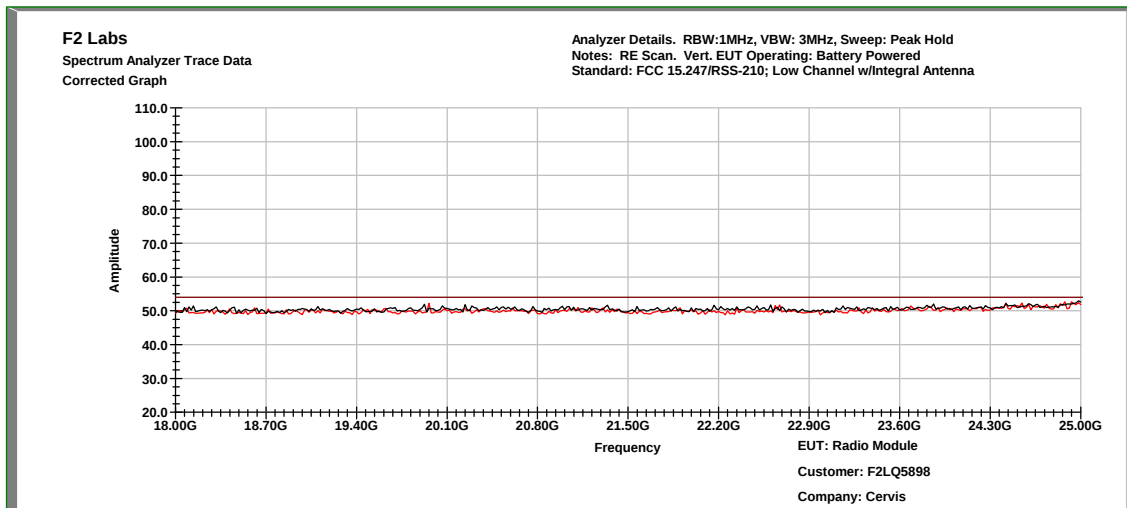




3.8dBi Integral Antenna, Low Channel, 18 GHz to 25 GHz, Horizontal

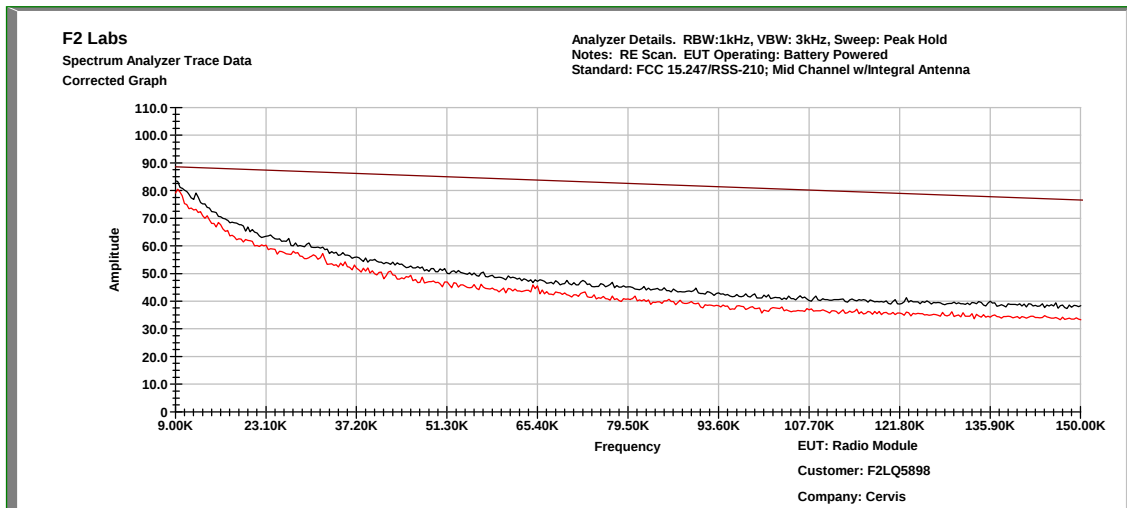


3.8dBi Integral Antenna, Low Channel, 18 GHz to 25 GHz, Vertical

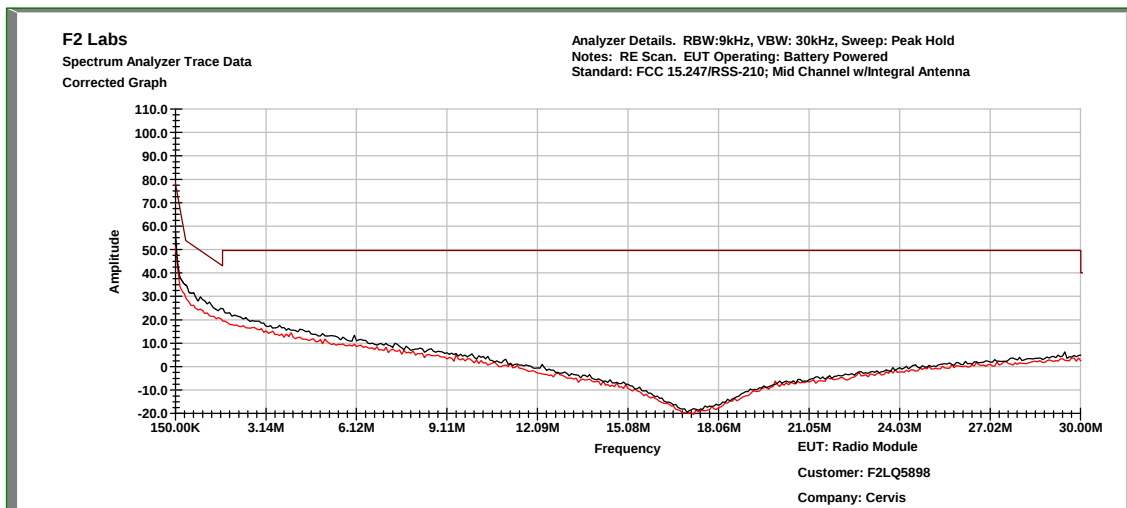




3.8dBi Integral Antenna, Mid Channel, .009 to 0.15 MHz

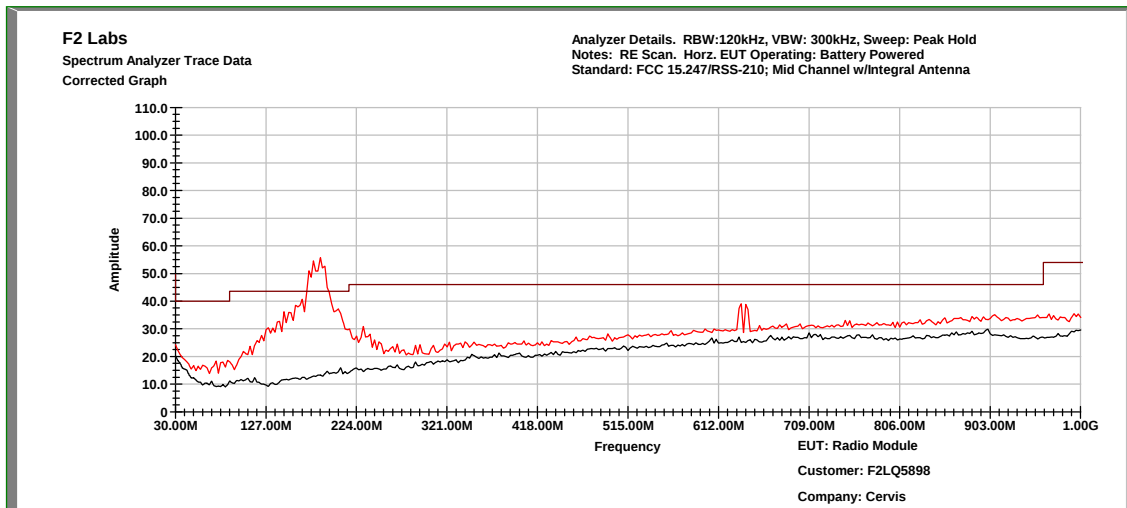


3.8dBi Integral Antenna, Mid Channel, 0.15 MHz to 30 MHz

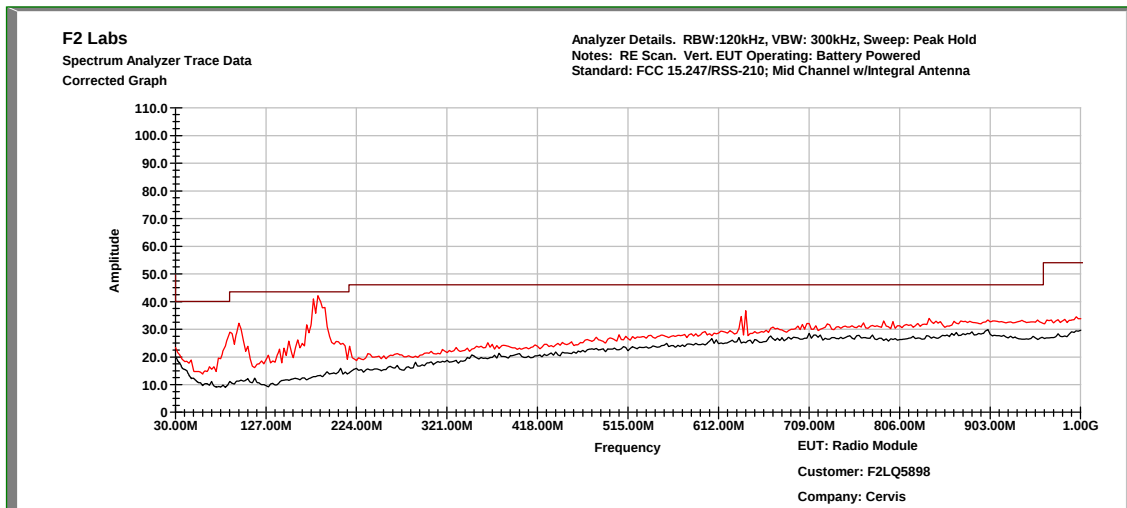




3.8dBi Integral Antenna, Mid Channel, 30 MHz to 1 GHz, Horizontal

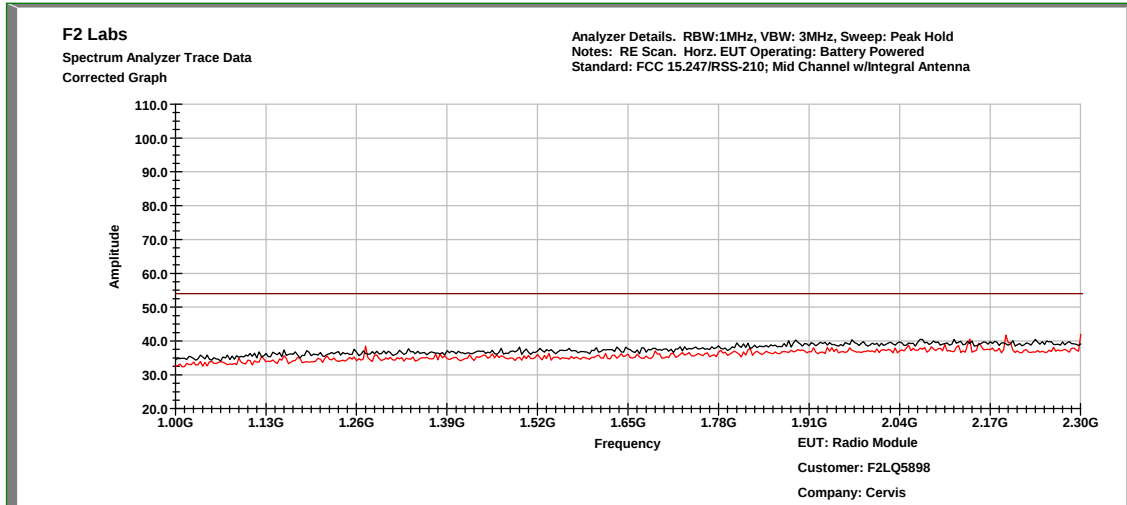


3.8dBi Integral Antenna, Mid Channel, 30 MHz to 1 GHz, Vertical

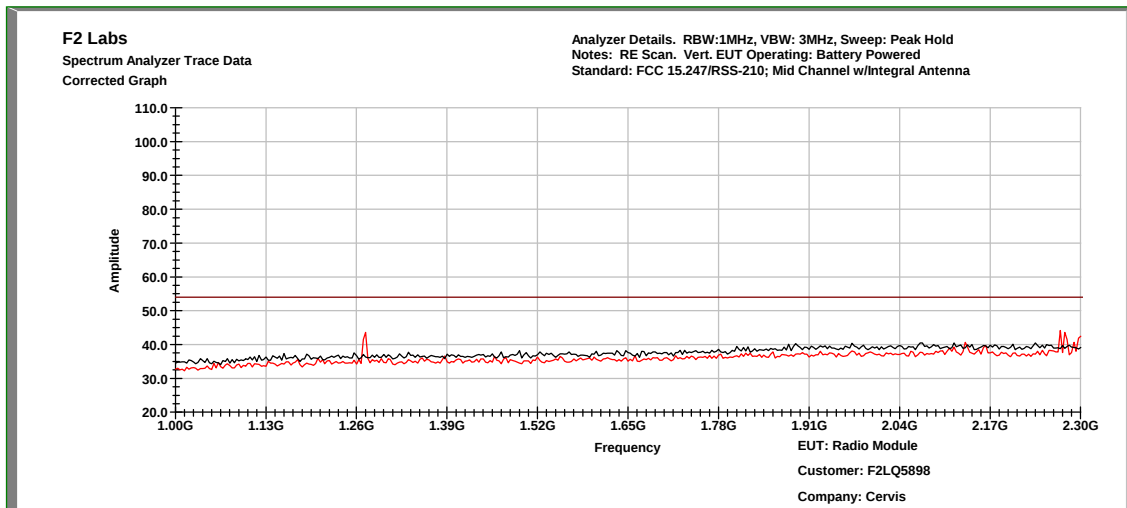




3.8dBi Integral Antenna, Mid Channel, 1 GHz to 2.3 GHz, Horizontal

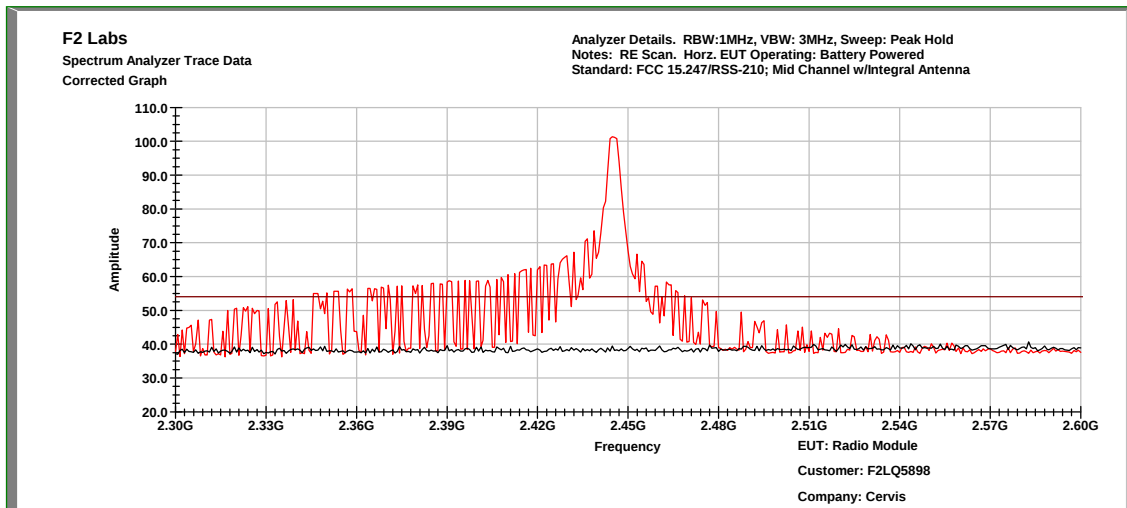


3.8dBi Integral Antenna, Mid Channel, 1 GHz to 2.3 GHz, Vertical

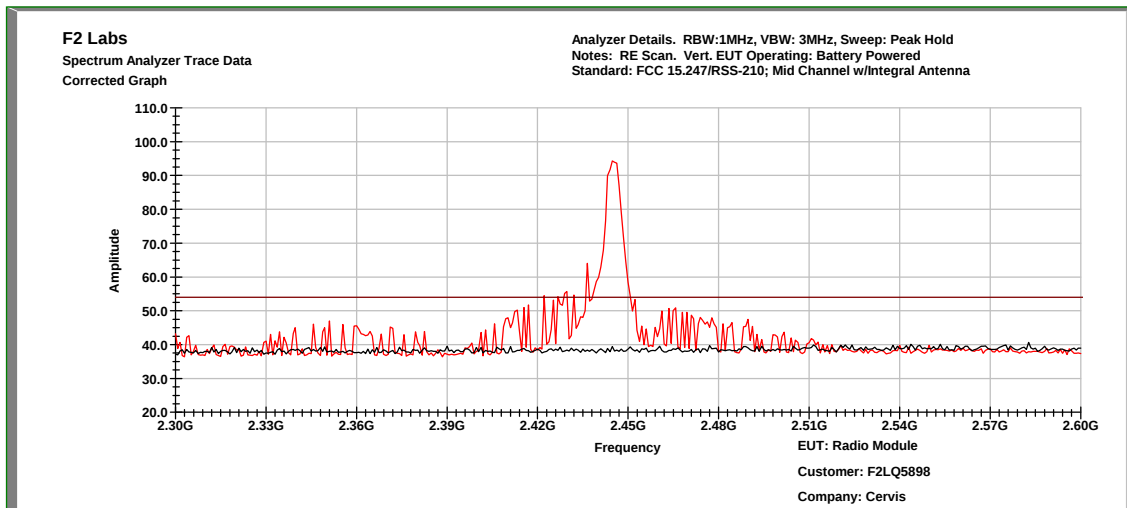




3.8dBi Integral Antenna, Mid Channel, 2.3 GHz to 2.6 GHz, Horizontal

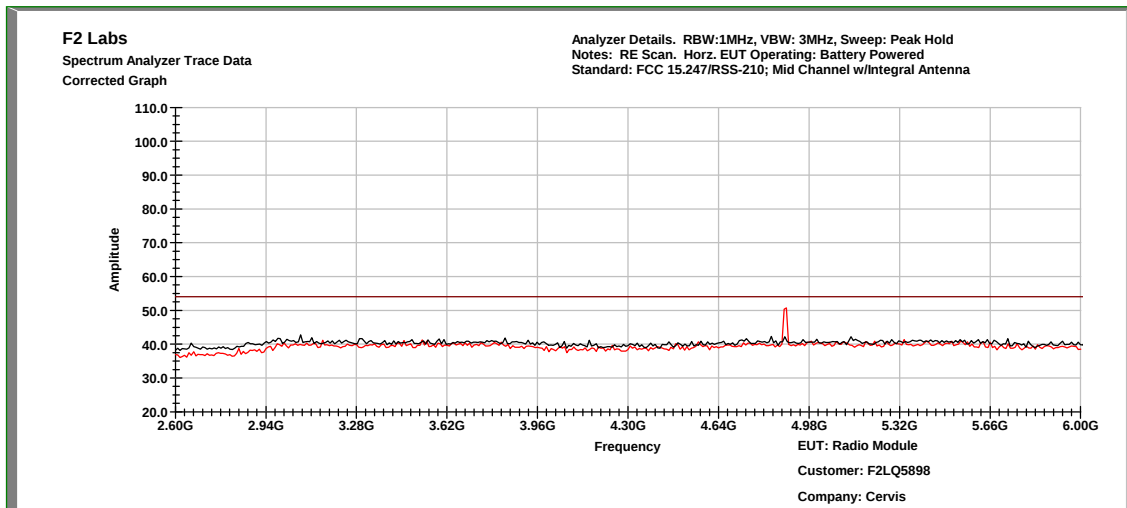


3.8dBi Integral Antenna, Mid Channel, 2.3 GHz to 2.6 GHz, Vertical

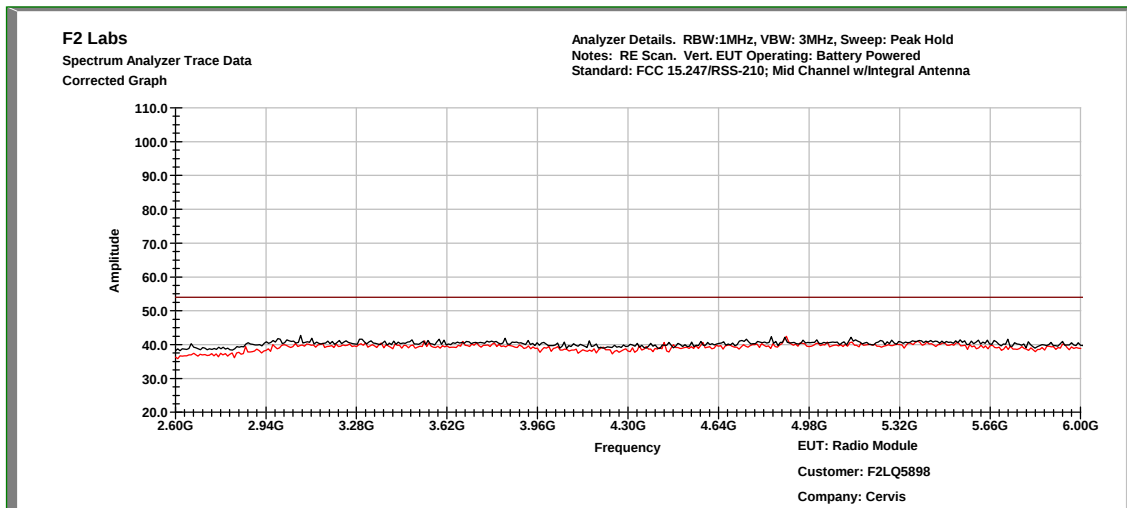




3.8dBi Integral Antenna, Mid Channel, 2.6 GHz to 6 GHz, Horizontal

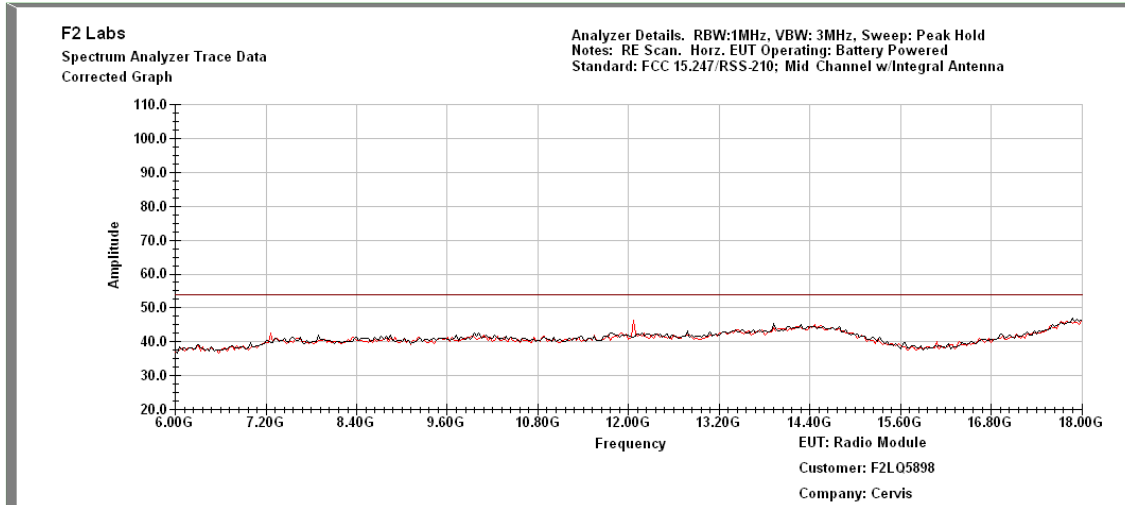


3.8dBi Integral Antenna, Mid Channel, 2.6 GHz to 6 GHz, Vertical

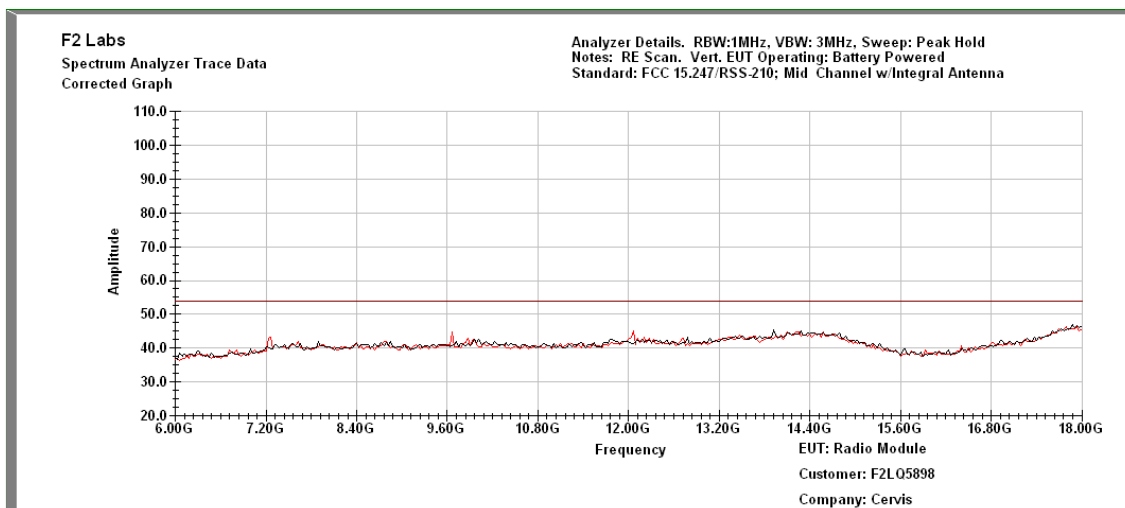




3.8dBi Integral Antenna, Mid Channel, 6 GHz to 18 GHz, Horizontal

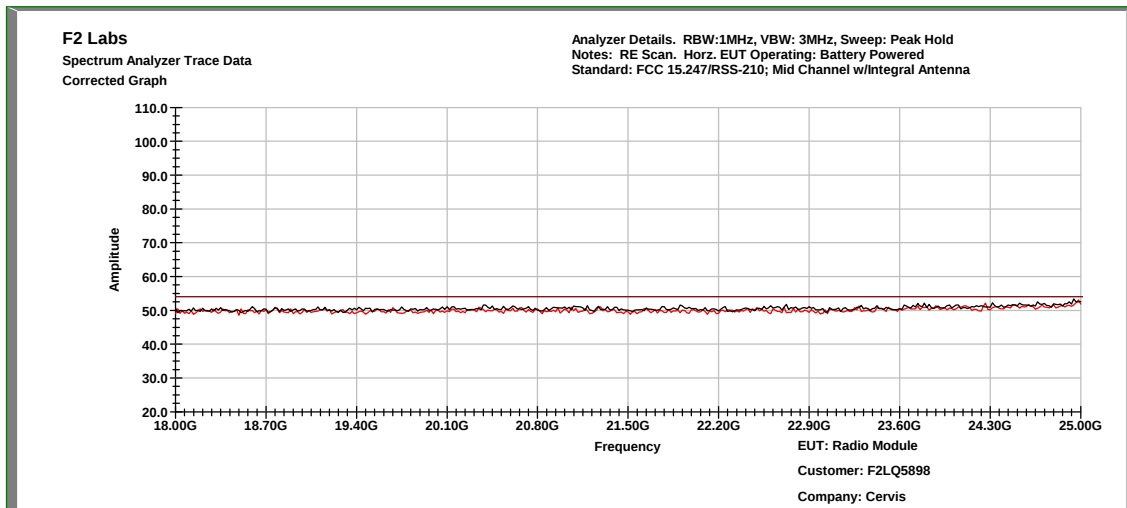


3.8dBi Integral Antenna, Mid Channel, 6 GHz to 18 GHz, Vertical

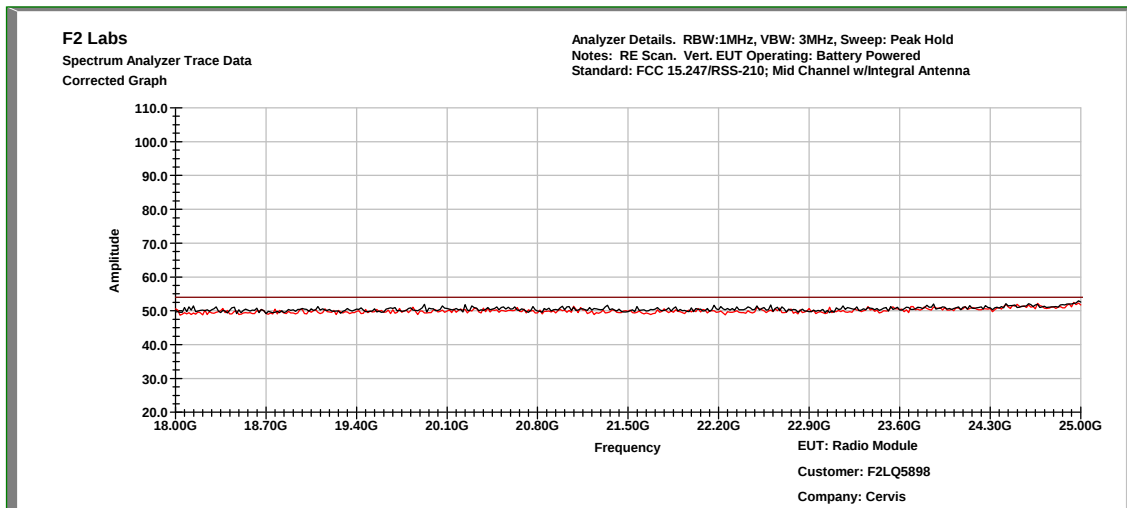




3.8dBi Integral Antenna, Mid Channel, 18 GHz to 25 GHz, Horizontal

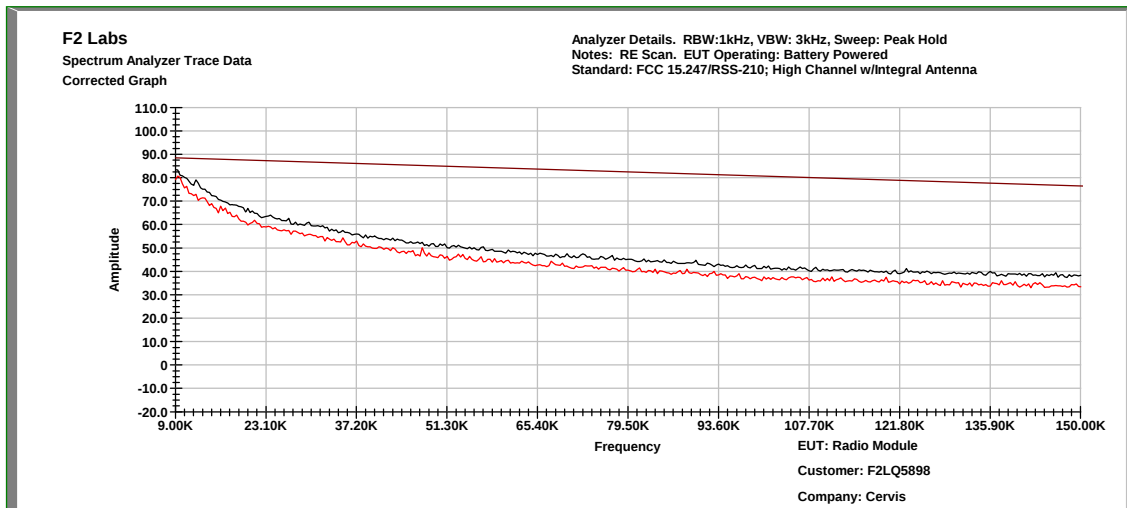


3.8dBi Integral Antenna, Mid Channel, 18 GHz to 25 GHz, Vertical

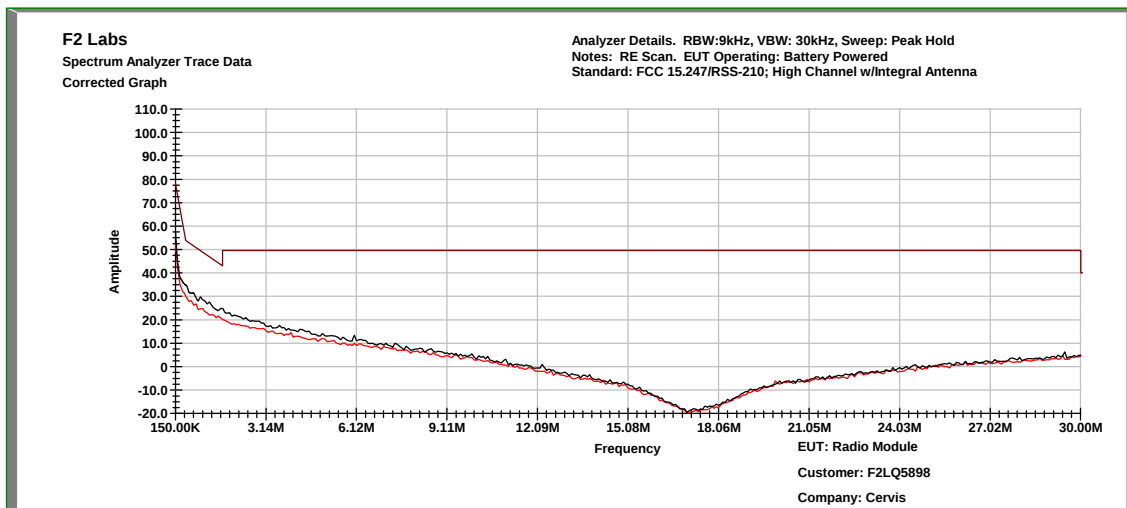




3.8dBi Integral Antenna, High Channel, .009 to 0.15 MHz

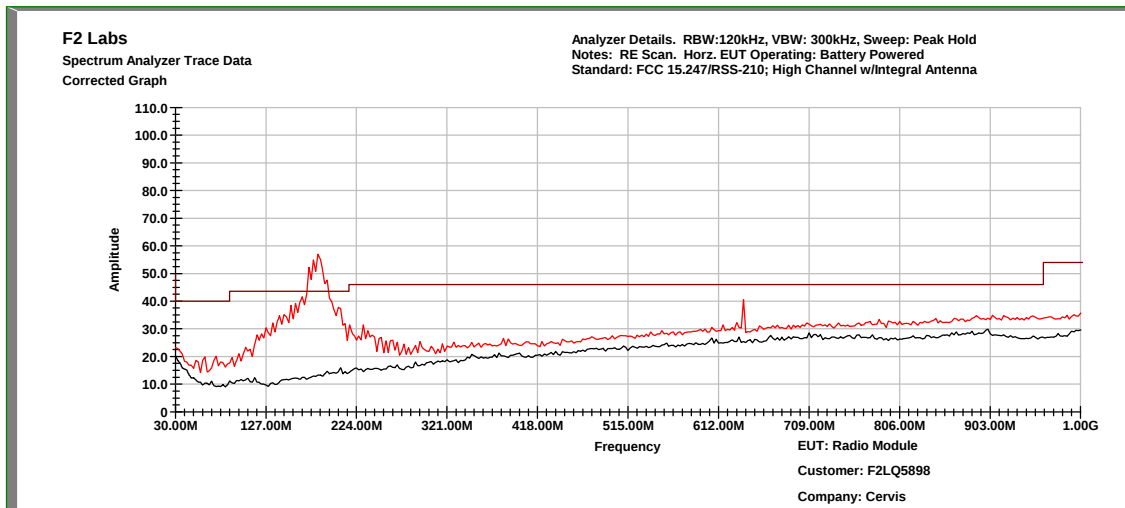


3.8dBi Integral Antenna, High Channel, 0.15 MHz to 30 MHz

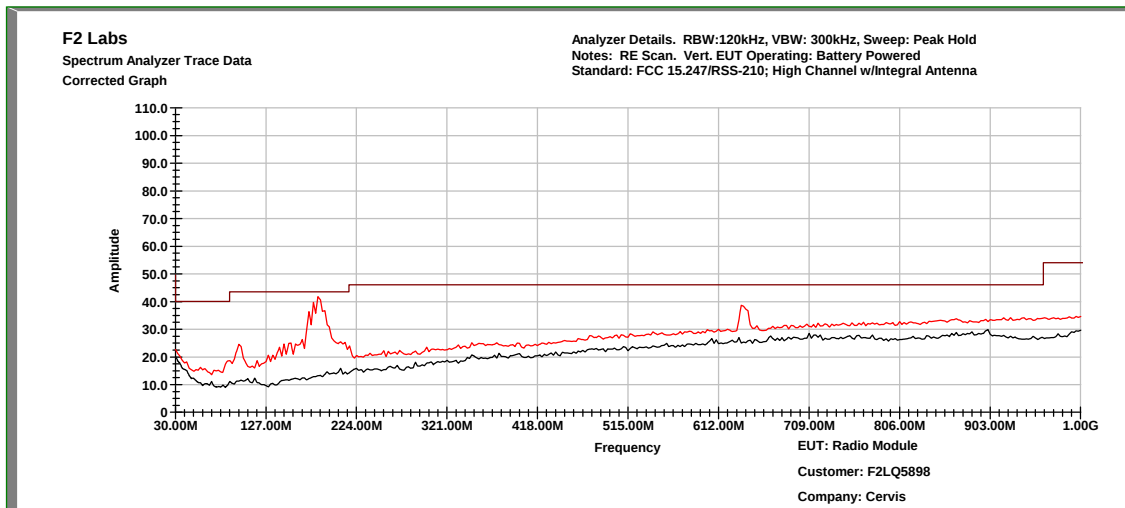




3.8dBi Integral Antenna, High Channel, 30 MHz to 1 GHz, Horizontal

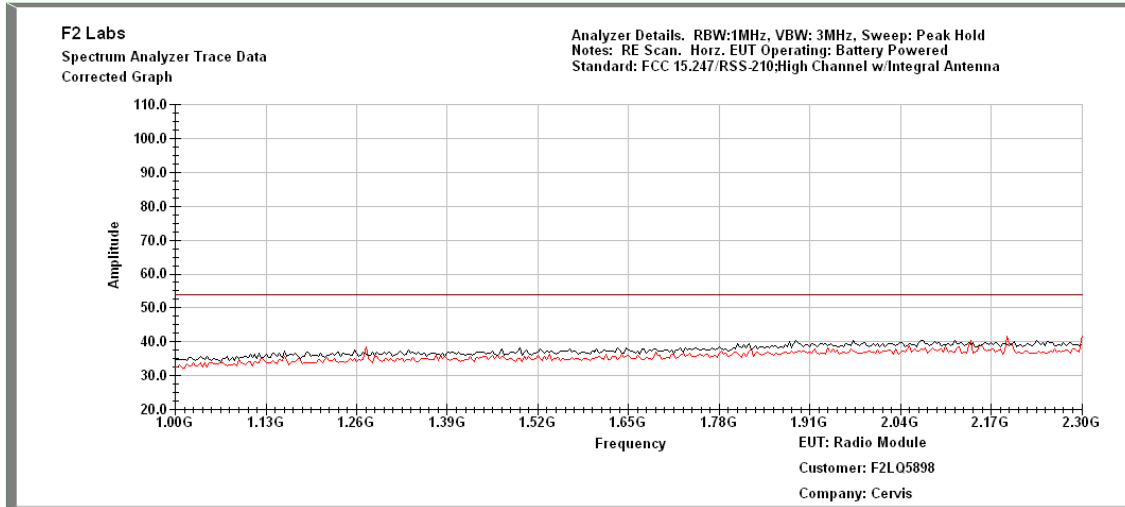


3.8dBi Integral Antenna, High Channel, 30 MHz to 1 GHz, Vertical

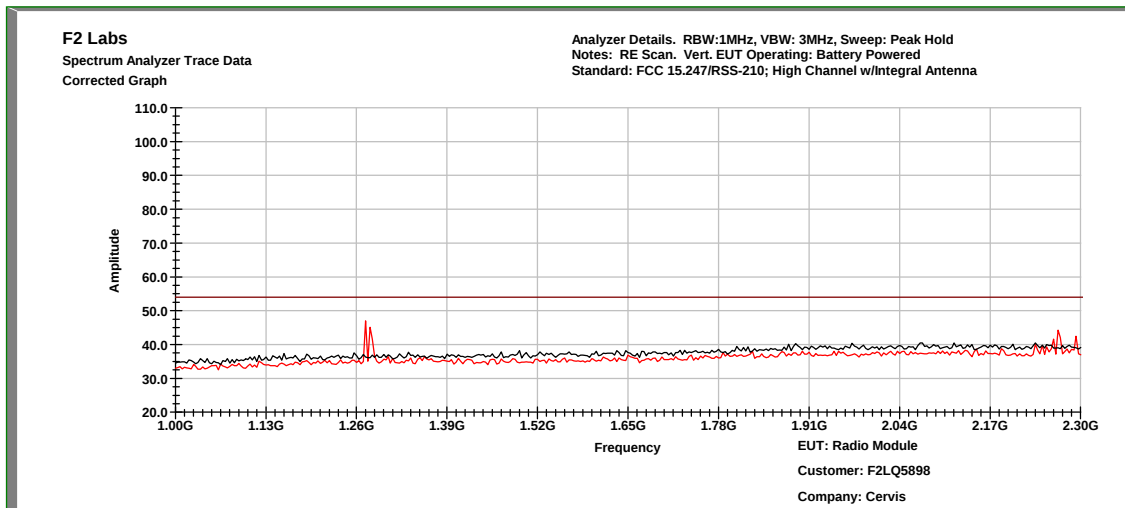




3.8dBi Integral Antenna, High Channel, 1 GHz to 2.3 GHz, Horizontal

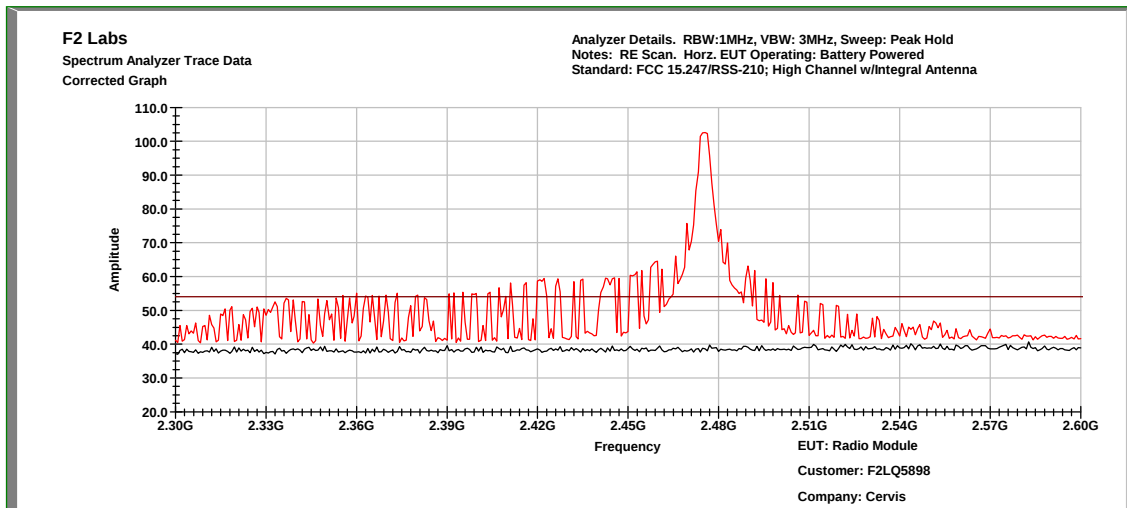


3.8dBi Integral Antenna, High Channel, 1 GHz to 2.3 GHz, Vertical

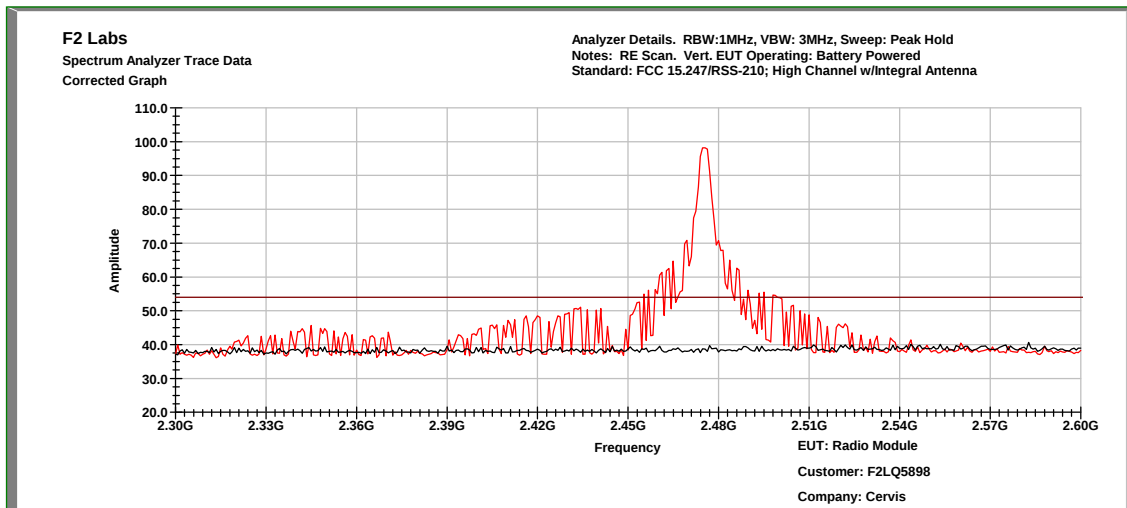




3.8dBi Integral Antenna, High Channel, 2.3 GHz to 2.6 GHz, Horizontal

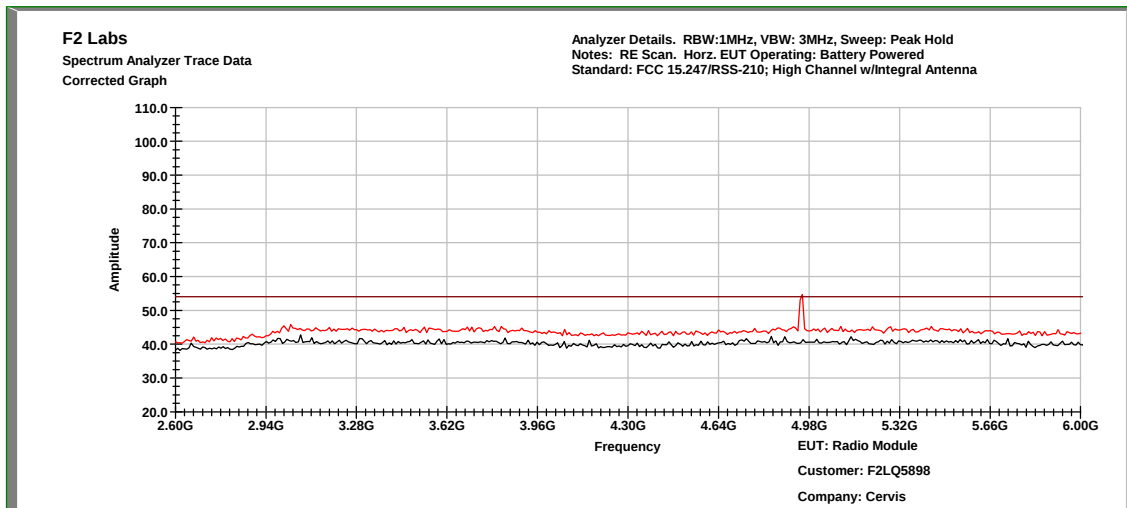


3.8dBi Integral Antenna, High Channel, 2.3 GHz to 2.6 GHz, Vertical

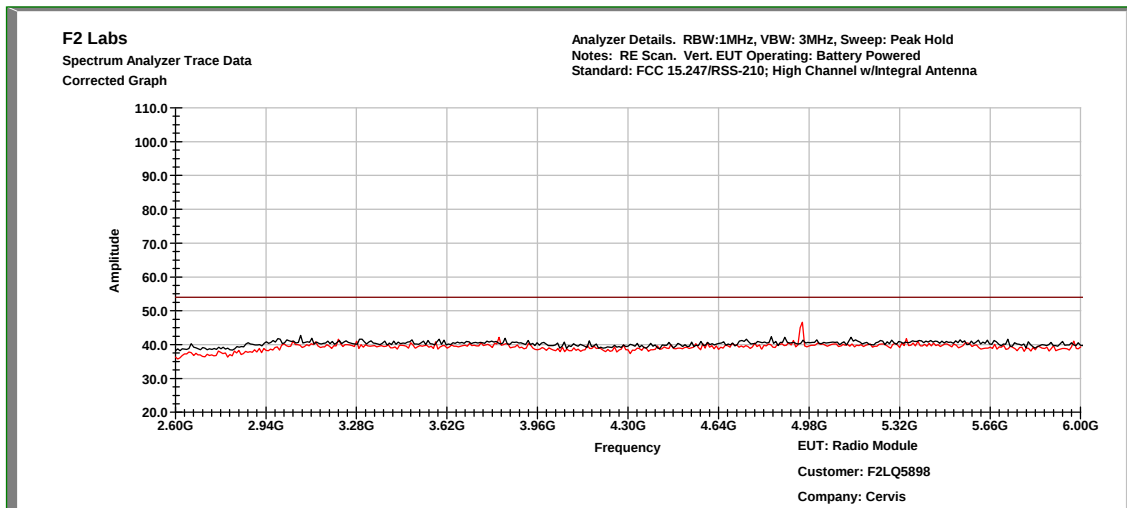




3.8dBi Integral Antenna, High Channel, 2.6 GHz to 6 GHz, Horizontal

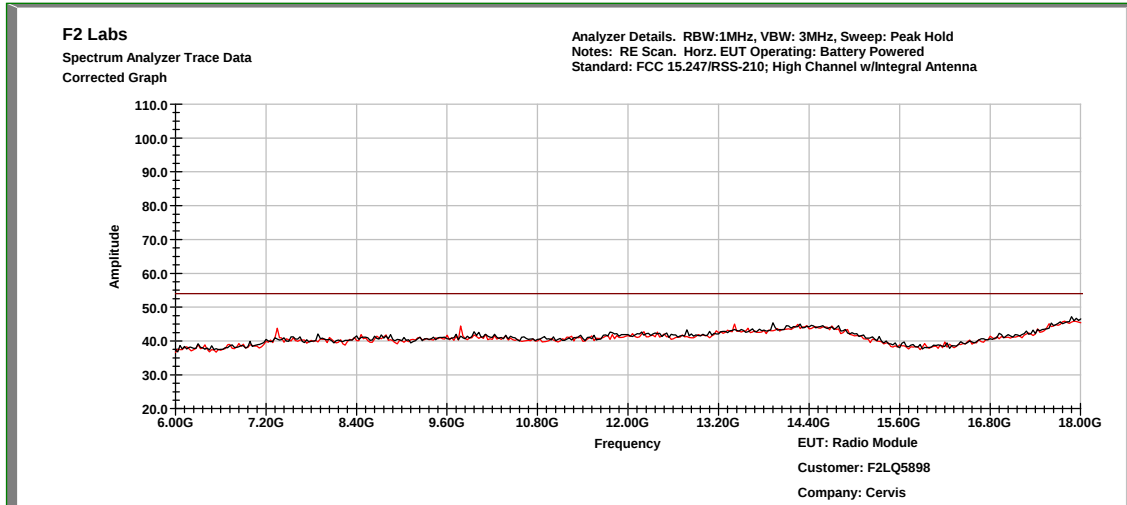


3.8dBi Integral Antenna, High Channel, 2.6 GHz to 6 GHz, Vertical

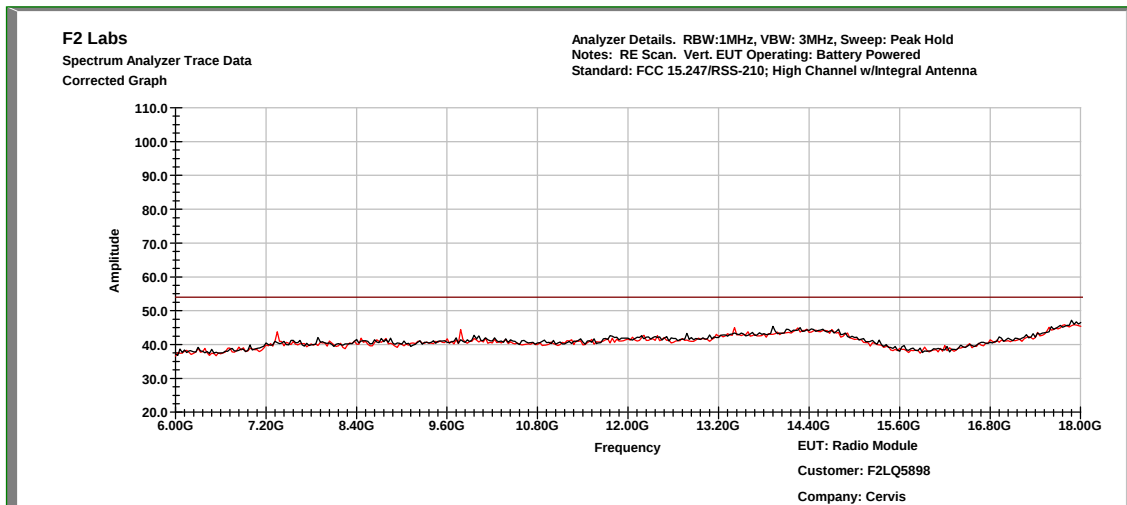




3.8dBi Integral Antenna, High Channel, 6 GHz to 18 GHz, Horizontal

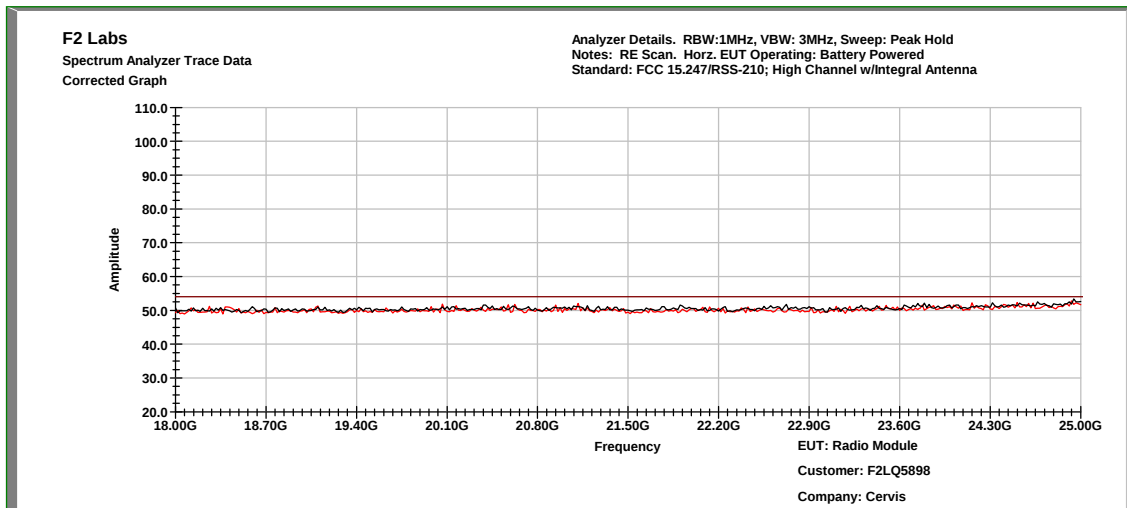


3.8dBi Integral Antenna, High Channel, 6 GHz to 18 GHz, Vertical

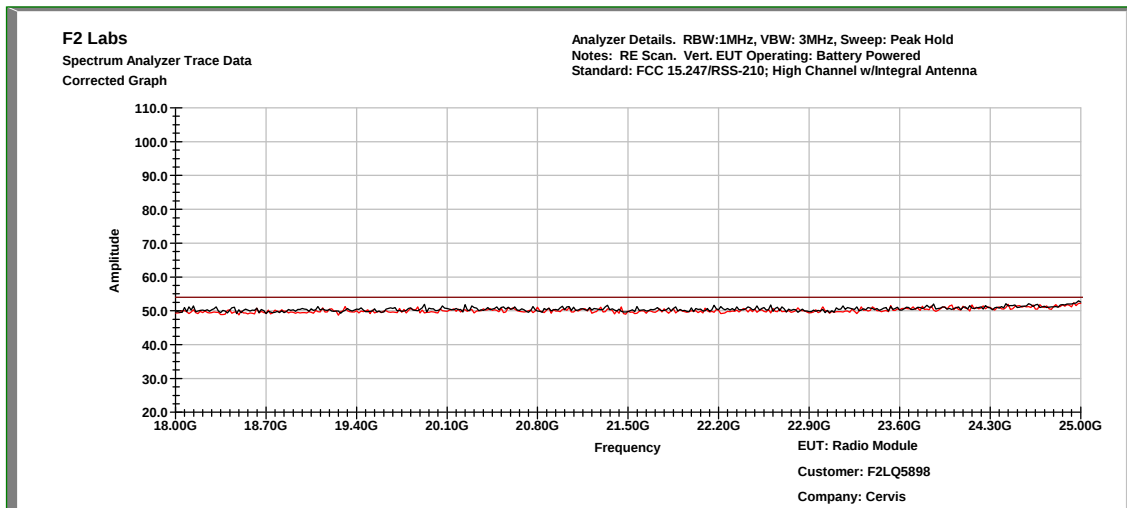




3.8dBi Integral Antenna, High Channel, 18 GHz to 25 GHz, Horizontal



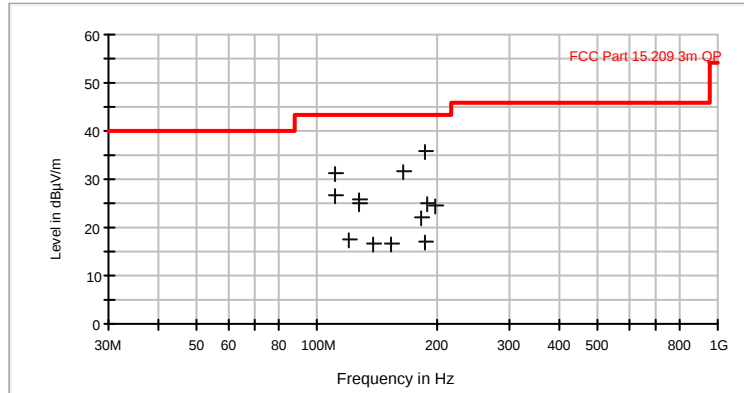
3.8dBi Integral Antenna, High Channel, 18 GHz to 25 GHz, Vertical





Measurements

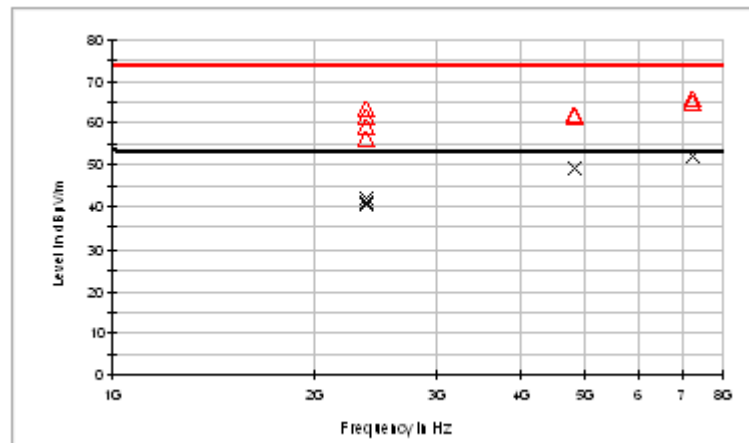
3.8dBi Integral Antenna, Low Channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
110.010000	31.0	43.5	120.000	V	14.4
110.700000	26.5	43.5	120.000	H	14.5
119.500000	17.4	43.5	120.000	H	15.5
127.410000	24.9	43.5	120.000	V	15.7
127.410000	25.8	43.5	120.000	H	15.8
136.800000	16.7	43.5	120.000	H	14.6
151.880000	16.8	43.5	120.000	V	14.2
164.030000	31.9	43.5	120.000	H	13.9
182.010000	22.1	43.5	120.000	V	13.0
185.090000	36.0	43.5	120.000	H	12.8
185.490000	17.1	43.5	120.000	V	13.0
188.700000	25.1	43.5	120.000	H	12.8
197.220000	24.7	43.5	120.000	V	14.2



3.8dBi Integral Antenna, Low Channel, cont'd

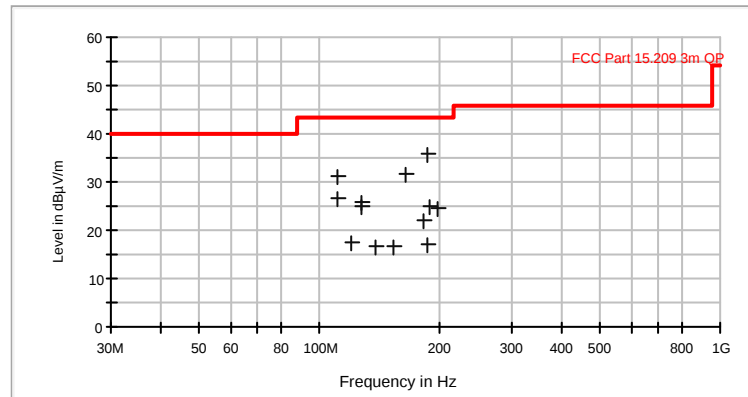


X = AVG; Δ = Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
2385.00000	56.2	74.0	40.5	54.0	1000.000	V	28.3
2385.00000	61.9	74.0	40.9	54.0	1000.000	H	28.3
2390.00000	59.1	74.0	40.8	54.0	1000.000	V	28.3
2390.00000	63.7	74.0	41.7	54.0	1000.000	H	28.3
4810.00000	62.4	74.0	49.1	54.0	1000.000	V	32.9
4810.00000	61.9	74.0	49.1	54.0	1000.000	H	32.9
7216.48000	65.1	74.0	50.9	54.0	1000.000	H	35.7
7216.64000	65.8	74.0	50.2	54.0	1000.000	V	35.7



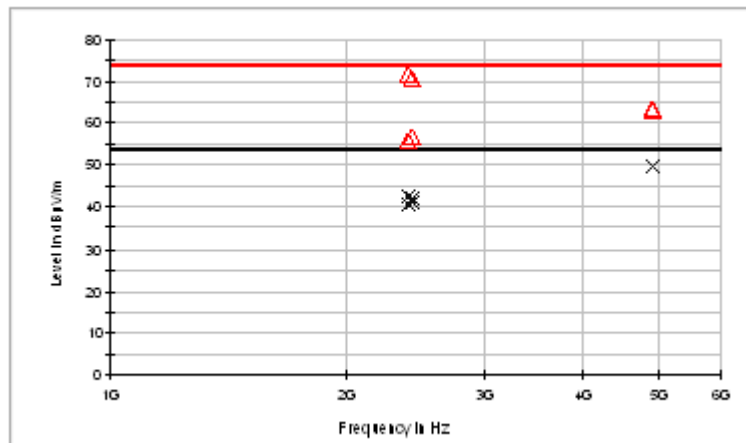
3.8dBi Integral Antenna, Mid Channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
110.010000	32.1	43.5	120.000	V	14.4
110.700000	26.0	43.5	120.000	H	14.5
119.500000	18.9	43.5	120.000	H	15.5
127.410000	23.5	43.5	120.000	V	15.7
127.410000	25.2	43.5	120.000	H	15.8
136.800000	18.1	43.5	120.000	H	14.6
151.880000	17.6	43.5	120.000	V	14.2
164.030000	32.0	43.5	120.000	H	13.9
182.010000	24.1	43.5	120.000	V	13.0
185.090000	35.7	43.5	120.000	H	12.8
185.490000	18.3	43.5	120.000	V	13.0
188.700000	26.4	43.5	120.000	H	12.8
197.220000	25.7	43.5	120.000	V	14.2



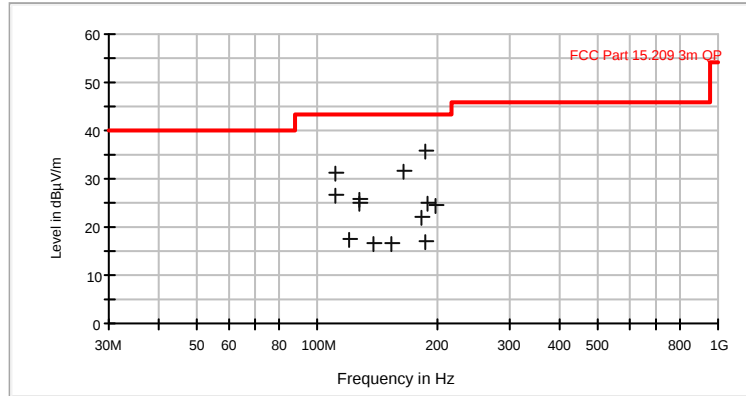
3.8dBi Integral Antenna, Mid Channel, cont'd

X = AVG; Δ = Max Peak

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
2389.40000	71.6	74.0	42.4	54.0	1000.000	V	28.3
2389.40000	55.8	74.0	40.6	54.0	1000.000	H	28.3
2418.68000	56.9	74.0	40.8	54.0	1000.000	V	28.3
2418.68000	70.8	74.0	42.1	54.0	1000.000	H	28.3
4901.28000	63.4	74.0	49.8	54.0	1000.000	H	33.1
4901.28000	63.3	74.0	49.6	54.0	1000.000	V	33.1



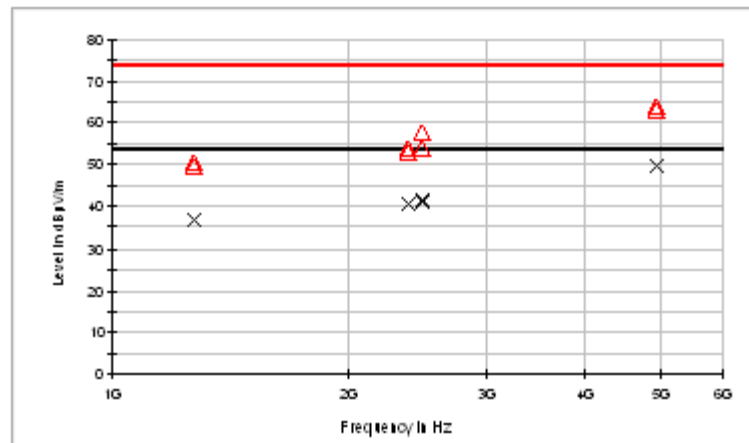
3.8dBi Integral Antenna, High Channel



Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
110.010000	28.7	43.5	120.000	V	14.4
110.700000	25.1	43.5	120.000	H	14.5
119.500000	18.1	43.5	120.000	H	15.5
127.410000	23.8	43.5	120.000	V	15.7
127.410000	26.9	43.5	120.000	H	15.8
136.800000	15.4	43.5	120.000	H	14.6
151.880000	17.3	43.5	120.000	V	14.2
164.030000	30.7	43.5	120.000	H	13.9
182.010000	23.2	43.5	120.000	V	13.0
185.090000	34.7	43.5	120.000	H	12.8
185.490000	18.2	43.5	120.000	V	13.0
188.700000	26.0	43.5	120.000	H	12.8
197.220000	22.3	43.5	120.000	V	14.2



3.8dBi Integral Antenna, High Channel, cont'd



X = AVG; Δ = Max Peak

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Bandwidth (kHz)	Polarity	Corr. (dB)
1270.00000	50.6	74.0	36.7	54.0	1000.000	H	25.5
1270.00000	49.5	74.0	36.7	54.0	1000.000	V	25.5
2380.00000	53.2	74.0	40.4	54.0	1000.000	V	28.2
2380.00000	53.7	74.0	40.4	54.0	1000.000	H	28.2
2483.76000	54.0	74.0	41.1	54.0	1000.000	V	28.4
2483.76000	57.9	74.0	41.5	54.0	1000.000	H	28.4
4951.04000	63.0	74.0	49.6	54.0	1000.000	V	33.2
4951.04000	64.0	74.0	49.7	54.0	1000.000	H	33.2

**10 FCC PART 15.247 – PEAK POWER SPECTRAL DENSITY (PSD)**

Peak power spectral density measurements were performed.

10.1 Requirements:

The peak power spectral density shall not exceed +8dBm in any 3 kHz band during any time interval of continuous transmission.

Power spectral density measurements were performed at a resolution bandwidth of 3 kHz (video bandwidth set at 10 KHz). The peak spectral densities were measured at the low, mid, and upper channels.

10.2 Equipment Used:

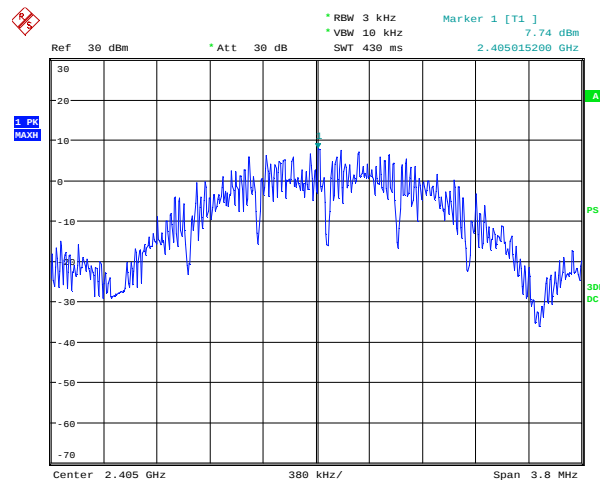
Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	Apr. 17, 2014
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 31, 2014
Cable: 0.3m Low Loss	CL116	A.H. Systems, Inc.	SAC-26G-0.3	206	Mar. 1, 2014



10.3 Peak Power Spectral Density Test Data

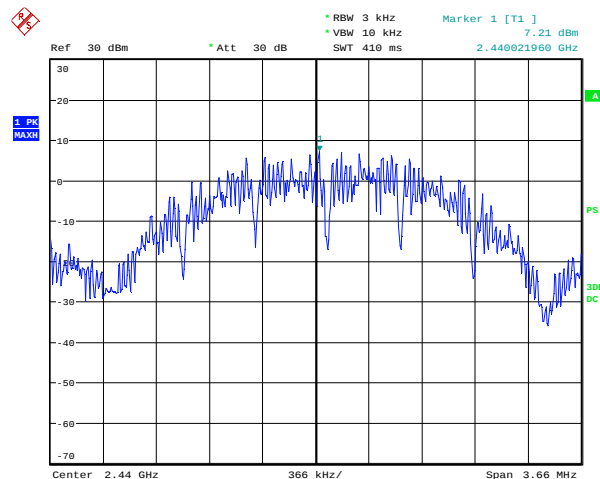
Test Date:	Jan. 21, 2014	Test Engineers:	M. Toth; K. Littell
Standards:	CFR 47 Part 15.247; KDB558074	Air Temperature:	21.2°C
		Relative Humidity:	36%

Low Channel



Date: 21.JAN.2014 20:45:53

Mid Channel



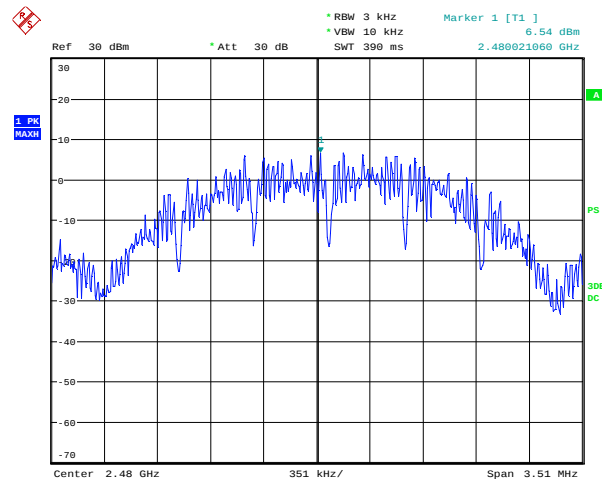
Date: 21.JAN.2014 20:51:06



Order Number: F2LQ5898A

Client: Cervis Inc.
Model: SRF305

High Channel



Date: 21.JAN.2014 21:00:20



11 CONDUCTED EMISSIONS

11.1 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.

11.2 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.

**11.3 Equipment Used:**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Temp/Hum. Rec.	CL119	Extech	RH520	H005869	Jan. 8, 2015
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	Feb. 11, 2015
LISN 2	0147	Solar	8028-50-TS-24-BNC	1128	Jan. 16, 2017
LISN 4	0146	Solar	8028-50-TS-24-BNC	1127	Jan. 16, 2017
Spectrum Analyzer	CL147	Agilent	E7402A	MY45101241	Oct. 24, 2014
Software:	Tile Version 1.0		Software Verified: Apr. 21, 2014		

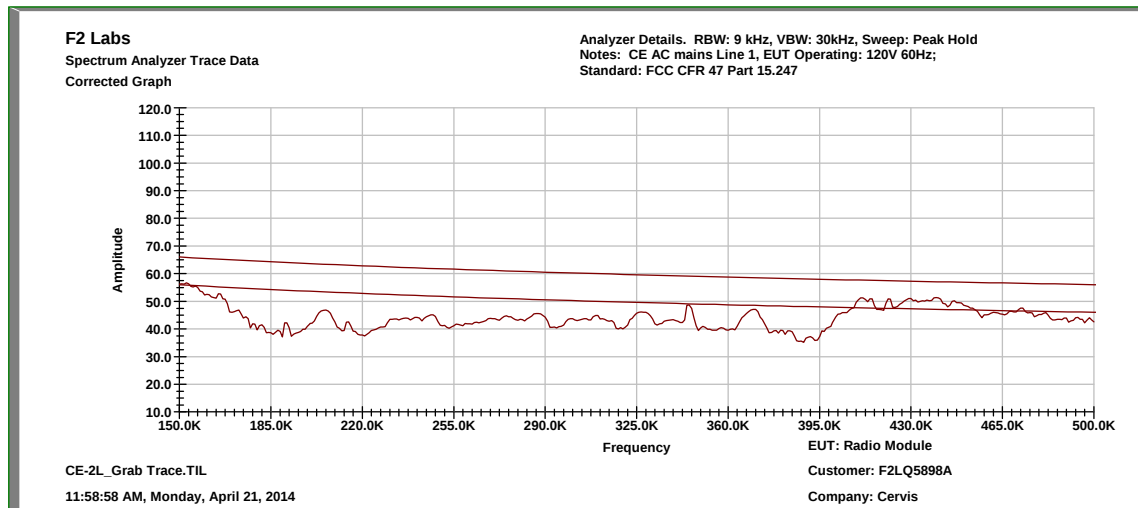


11.4 Conducted Emissions Test Data

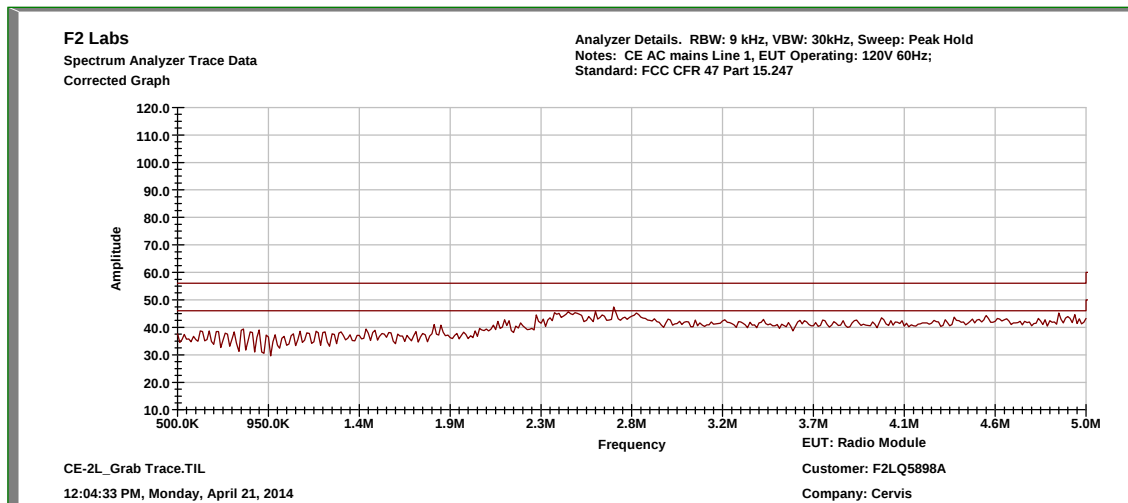
Test Date:	Apr. 21, 2014	Test Engineer:	J. Knepper
Rule:	15.207(a)	Air Temperature:	24.4° C
Test Results:	Pass	Relative Humidity:	46.2%

Note: The data below represents worst case results of all three channels.

Conducted Test – Line 1: 0.15 MHz to 0.5 MHz

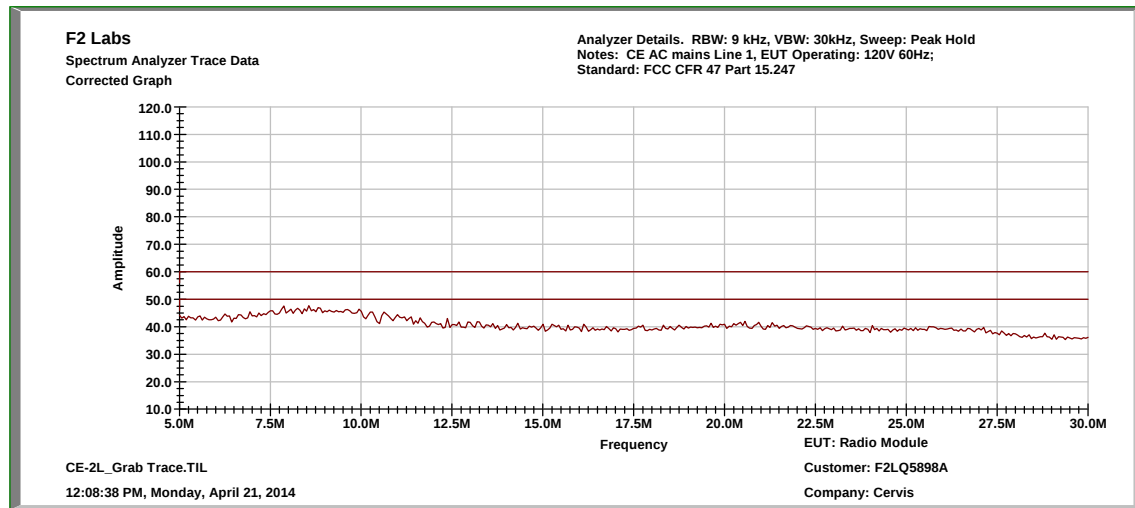


Conducted Test – Line 1: 0.5 MHz to 5.0 MHz





Conducted Test – Line 1: 5.0 MHz to 30.0 MHz

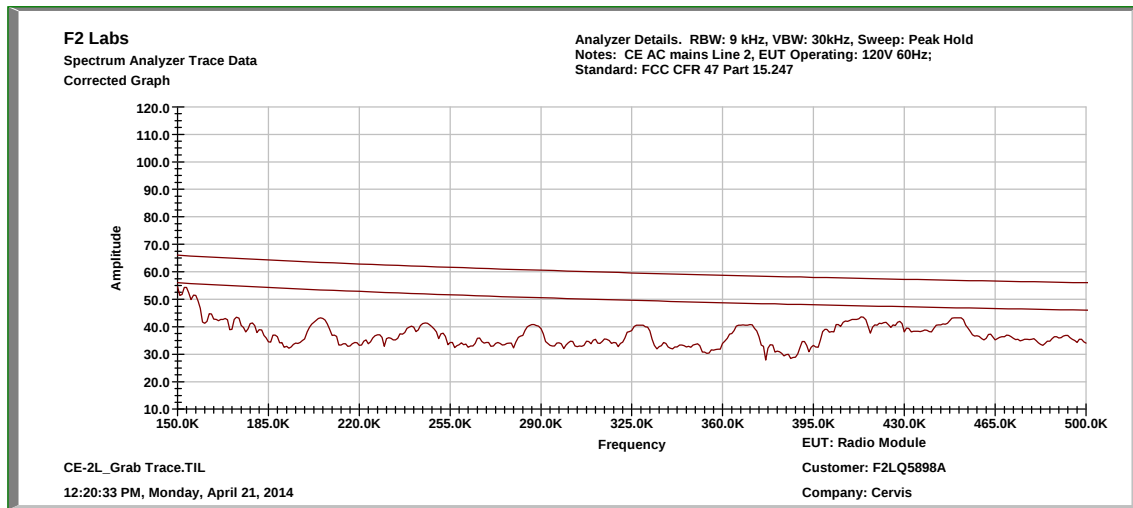


Top Discrete Measurements

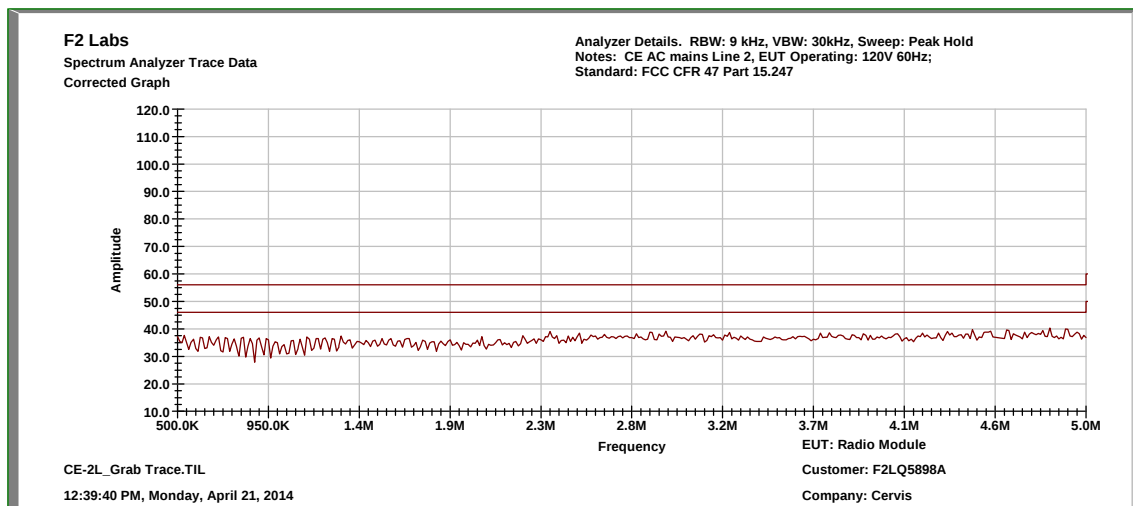
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Line 1	0.152	Quasi-Peak	36.67	11.0	47.67	65.87	-18.2
			Average	11.71	11.0	22.71	55.87	-33.2
2	Line 1	0.344	Quasi-Peak	19.54	11.0	30.54	59.1	-28.6
			Average	10.69	11.0	21.69	49.1	-27.4
3	Line 1	0.411	Quasi-Peak	28.05	11.0	39.05	57.63	-18.6
			Average	19.51	11.0	30.51	47.63	-17.1
4	Line 1	0.440	Quasi-Peak	28.8	11.0	39.8	57.06	-17.3
			Average	20.38	11.0	31.38	47.06	-15.7
5	Line 1	0.450	Quasi-Peak	28.84	11.0	39.84	56.88	-17.0
			Average	20.33	11.0	31.33	46.88	-15.6
6	Line 1	2.36	Quasi-Peak	27.48	11.0	38.48	56	-17.5
			Average	14.91	11.0	25.91	46	-20.1
7	Line 1	2.66	Quasi-Peak	28.78	11.0	39.78	56	-16.2
			Average	19.44	11.0	30.44	46	-15.6
8	Line 1	8.56	Quasi-Peak	31.78	11.0	42.78	60	-17.2
			Average	21.74	11.0	32.74	50	-17.3



Conducted Test – Line 2: 0.15 MHz to 0.5 MHz

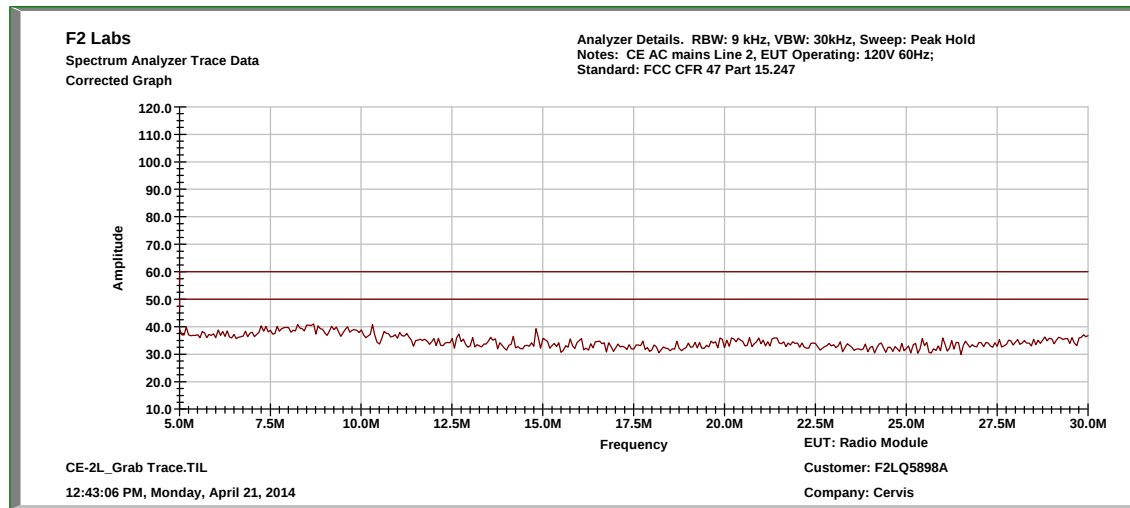


Conducted Test – Line 2: 0.5 MHz to 5.0 MHz





Conducted Test – Line 2: 5.0 MHz to 30.0 MHz

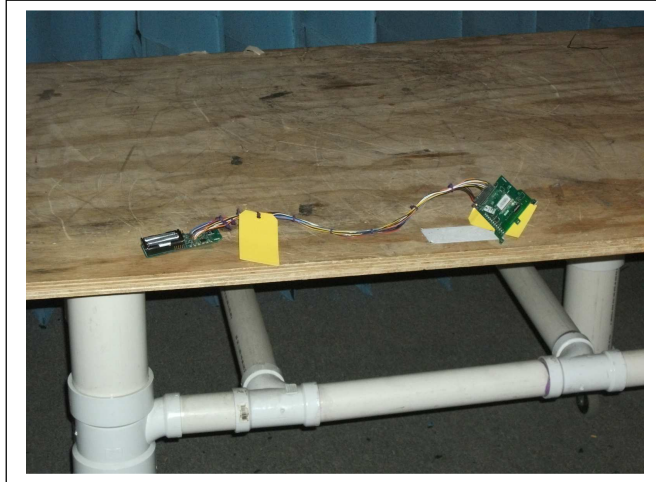


Top Discrete Measurements

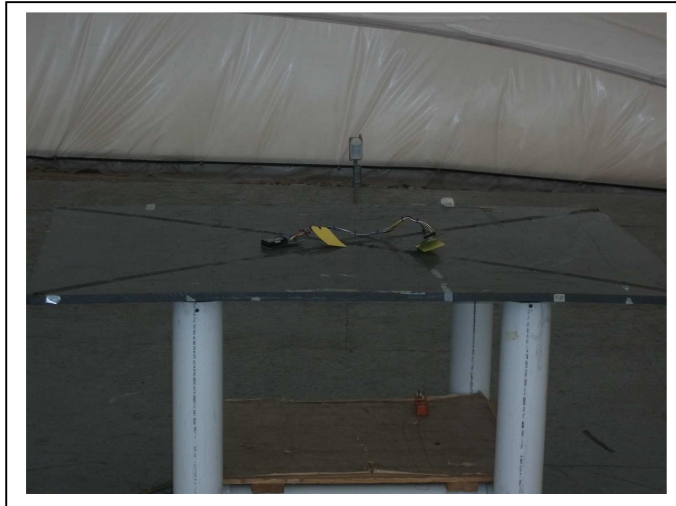
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Line 2	0.153	Quasi-Peak	38.1	11.0	49.1	65.81	-16.7
			Average	12.22	11.0	23.22	55.81	-32.6
2	Line 2	0.414	Quasi-Peak	29.87	11.0	40.87	57.56	-16.7
			Average	21.46	11.0	32.46	47.56	-15.1
3	Line 2	0.449	Quasi-Peak	28.16	11.0	39.16	56.89	-17.7
			Average	21.3	11.0	32.3	46.89	-14.6
4	Line 2	4.82	Quasi-Peak	21.67	11.0	32.67	56	-23.3
			Average	14.46	11.0	25.46	46	-20.5
5	Line 2	7.75	Quasi-Peak	24.44	11.0	35.44	60	-24.6
			Average	16.73	11.0	27.73	50	-22.3

12 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Radiated Spurious Emission with 3.8dBi Integral Antenna: Prescan



Radiated Spurious Emission with 3.8dBi Integral Antenna: OATS



Radiated Spurious Emission with 9dBi Whip Antenna: Prescan

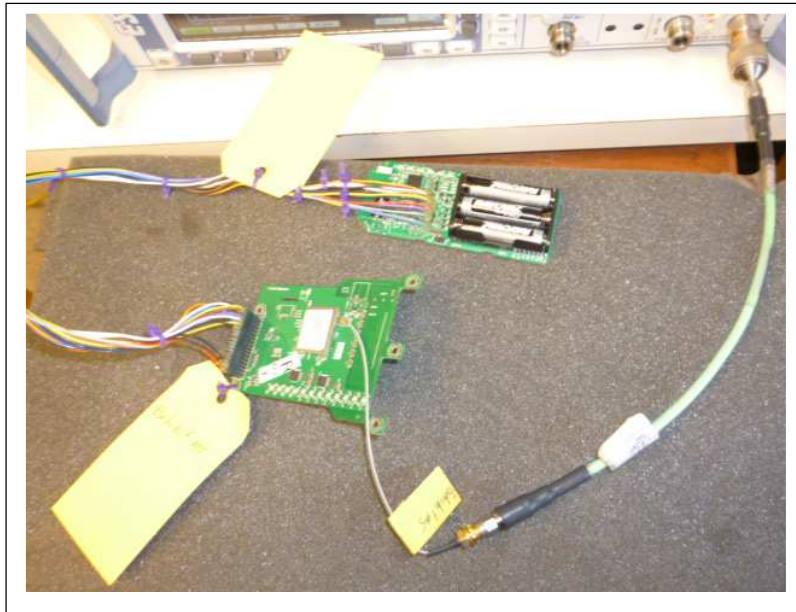


Radiated Spurious Emission with 9dBi Whip Antenna: OATS





**Conducted Output Power, Occupied Bandwidth,
Conducted Spurious, Peak Power Spectral Density**





Conducted Emissions

