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:	**SmaRT 900 MHz 9H Radio Module**
Model:	**SRF309 (Type II)**
FCC ID:	**LOBSRF309**
Testing Commenced:	**July 29, 2014**
Testing Ended:	**July 30, 2014**
Summary of Test Results:	**Page 5**

Standards:

- **FCC Part 15 Subpart C, Section 15.247**
- **FCC Part 15, Subpart C, Section 15.209**

Evaluation Conducted by: Joe Knepper, EMC Proj. Eng.

Report Reviewed by: Ken Littell, EMC Tech. Mgr.

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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 2009 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
F2LQ5978-05E	First Issue	Aug. 18, 2014	K. Littell

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Conducted Output Power	CFR 47 Part 15.247(b)(3) / KDB558074	Complies
Radiated Spurious Emission with 9dBi Whip Antenna	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	High Channel 924 MHz	Mid Channel 916 MHz	Low Channel 906 MHz
Conducted Output Power	7.079mW (8.5dBm)	7.278mW (8.62dBm)	7.396mW (8.69dBm)
Conducted Output Power Limit	1 Watt, (30dBm)	1 Watt, (30dBm)	1 Watt, (30dBm)
E.I.R.P. with 9dBi Whip Antenna	56.234mW (17.5dBm)	57.810mW (17.62dBm)	58.749mW (17.69dBm)
E.I.R.P. Limit	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)

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 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: SmaRT 900 MHz 9H Radio Module
Model: SRF309 (Type II)
Serial No.: None
FCC ID: LOBSRF309

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 15.209

5.5 Equipment Category:

Radio Transmitter-DTS

5.6 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:

The EUT was configured to permit frequency changes from low-mid-upper transmission channel using digital modulation (required for digital transmission systems). For RF antenna conducted tests, the EUT was equipped with an SMA connector for connection to the measuring equipment. For radiated emissions tests, in a semi-anechoic chamber and on the OATS, the EUT was equipped with an external Whip antenna. The highest emissions were recorded in the data tables.

6 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	May 5, 2015
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 31, 2014
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Oct. 29, 2014
Shield Room	0175	Ray Proof	N/A	11645	Verified
OATS-3m	CL017	Compliance Labs	N/A	001	Dec. 12, 2014
Antenna 1-Chamber	0142	ETS/EMCO	3142B	9811-1330	Verified
Antenna 2-OATS	0105	Sunol Sciences	JB1	A101101	May 7, 2015
Pre-Amplifier	CL153	Agilent	83006A	MY39500900	Jan. 9, 2015
Cable	CL154	Pasternack	p/n PE350-240	N/A	Jan. 16, 2015
Software:	Tile Version 1.0		Software Verified: July 29, 2014		
Software:	EMC 32, Version 5.20.2		Software Verified: July 29, 2014		

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.

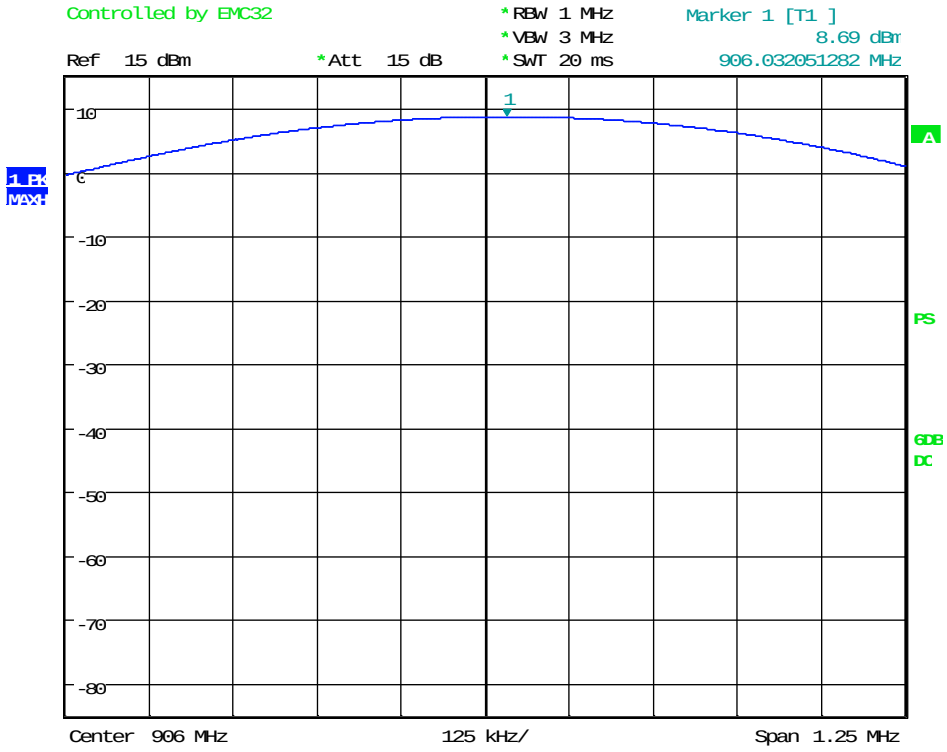
7.1 Requirements:

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 Conducted Output Power Test Data

Test Date:	July 30, 2014	**Test Engineer:**	J. Knepper
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	**Air Temperature:**	23.5ºC
		Relative Humidity:	50%

Low Channel



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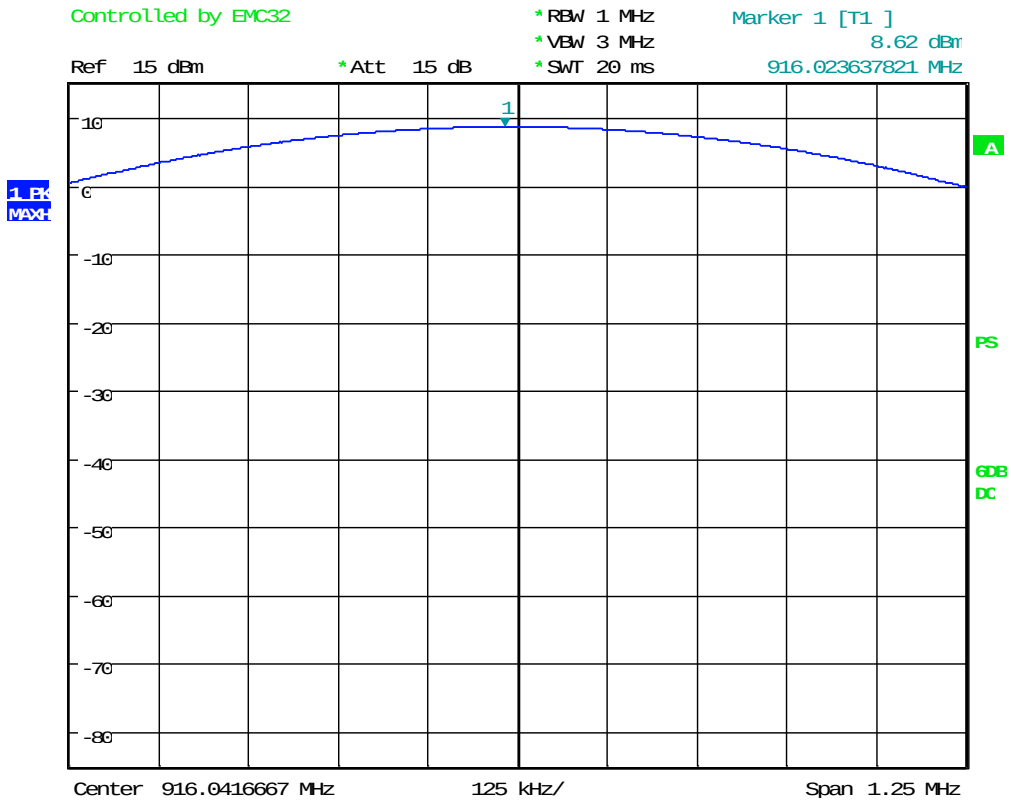
Mid Channel



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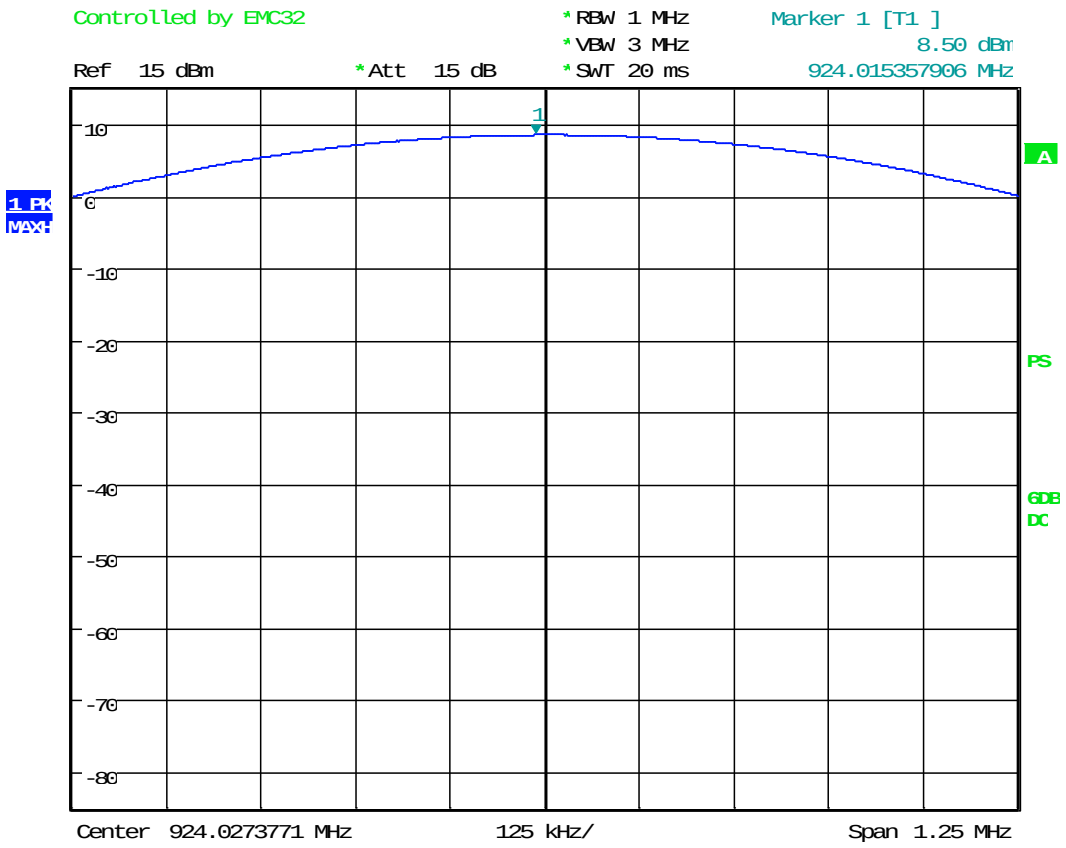
High Channel



Date: 30.JUL.2014 08:55:31

8 RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its 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.

8.1 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).

8.2 Radiated Spurious Emission Test Data

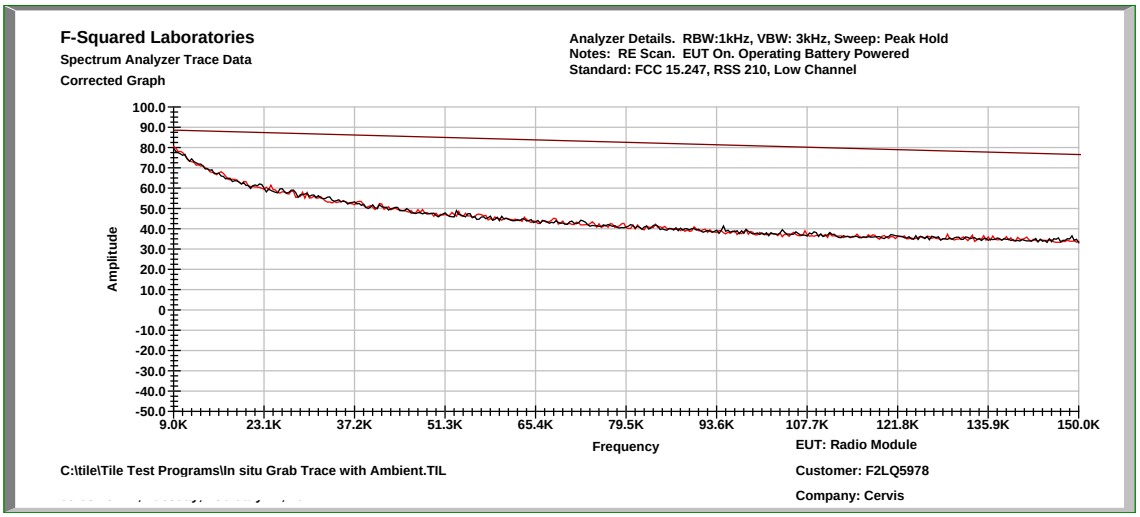
Test Dates:	July 29-30, 2014	**Test Engineer:**	J. Knepper
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	26.8ºC
		Relative Humidity:	50%

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. Out of the three orthogonal positions, 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.

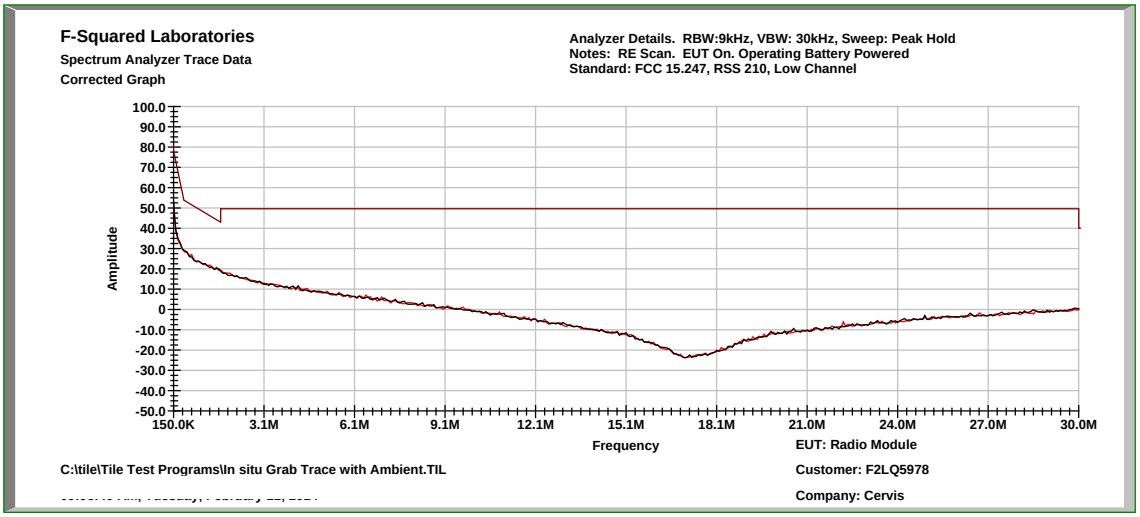
At least 6 of the highest frequencies were measured per ANSI 63.4 on the Open Area Test Site. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies 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.

The equipment was fully exercised with all cabling attached to the EUT and was positioned for maximum emissions. The EUT antenna was positioned flat against the plastic tabletop and it was verified, by placing a foam support between the table and the antenna, that the table had no effect on the emissions at these frequency ranges.

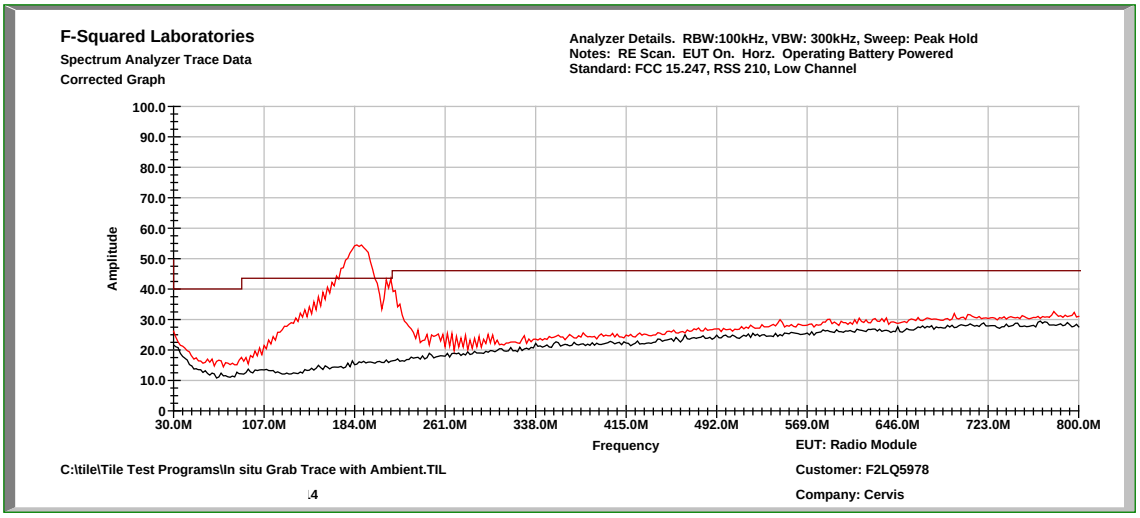
9dBi Antenna, Low Channel, .009 MHz to 0.15 MHz



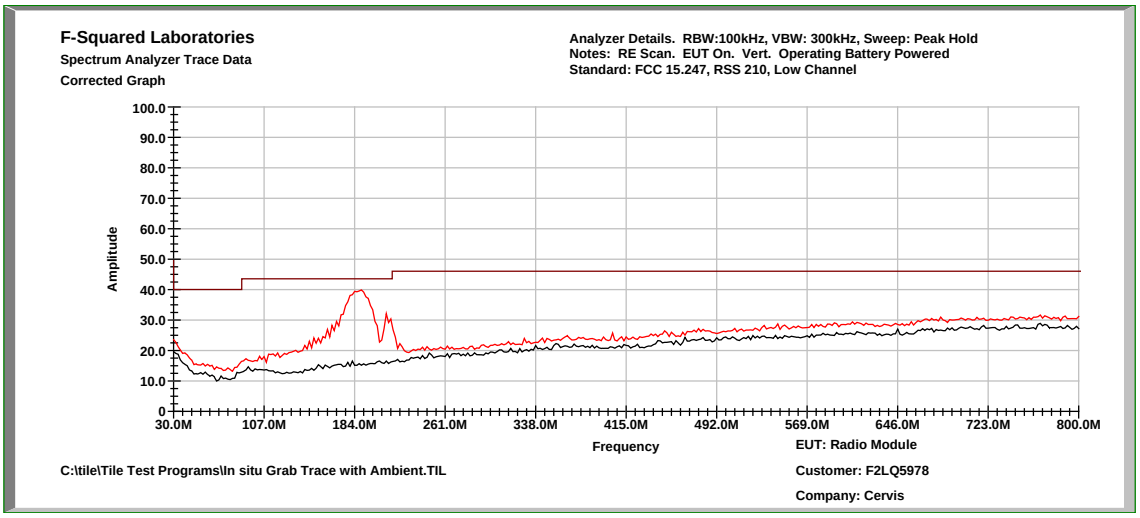
9dBi Antenna, Low Channel, 0.15 MHz to 30 MHz



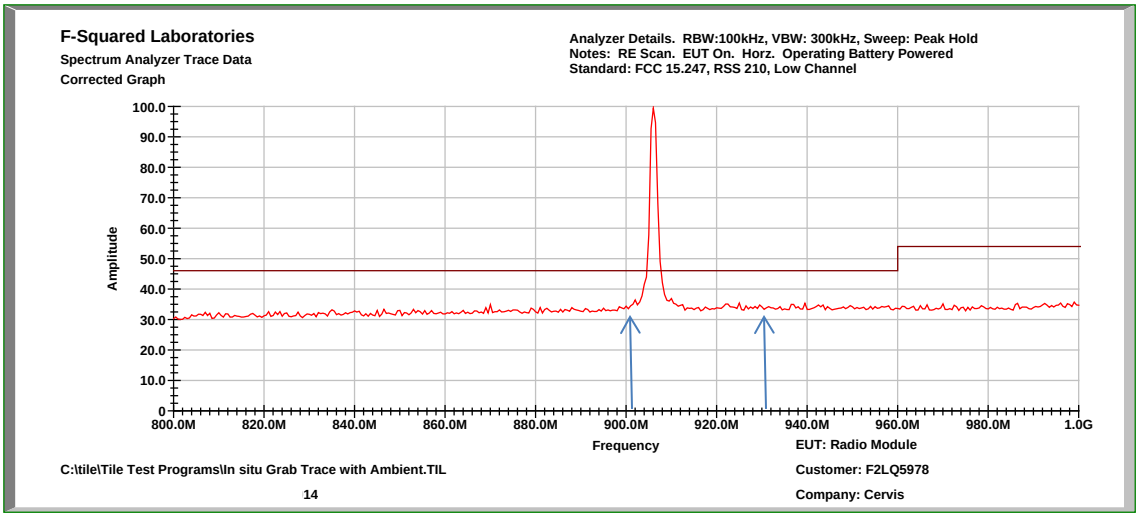
9dBi Antenna, Low Channel, 30 MHz to 800 MHz, Horizontal



9dBi Antenna, Low Channel, 30 MHz to 800 MHz, Vertical

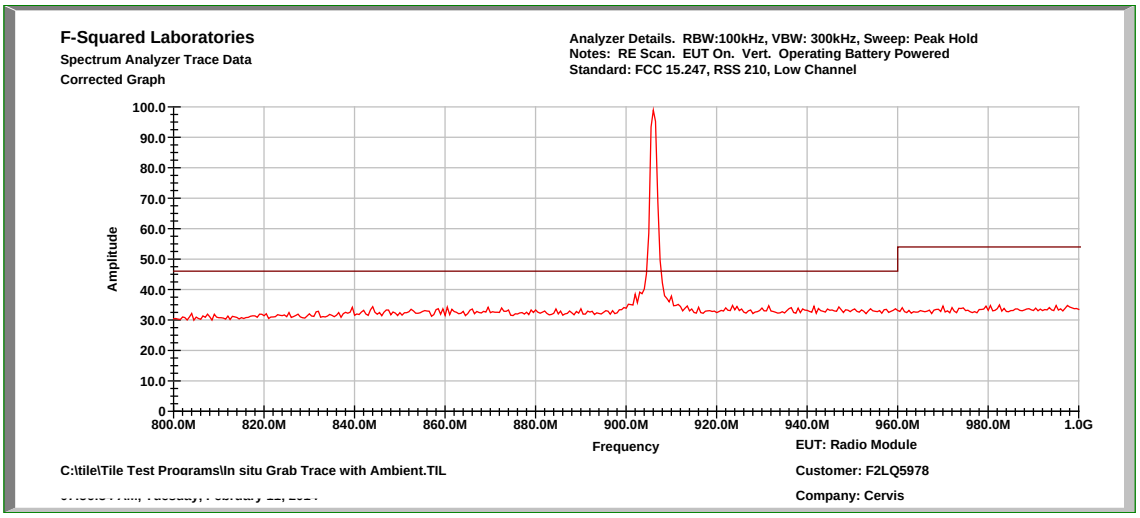


9dBi Antenna, Low Channel, 800 MHz to 1 GHz, Horizontal

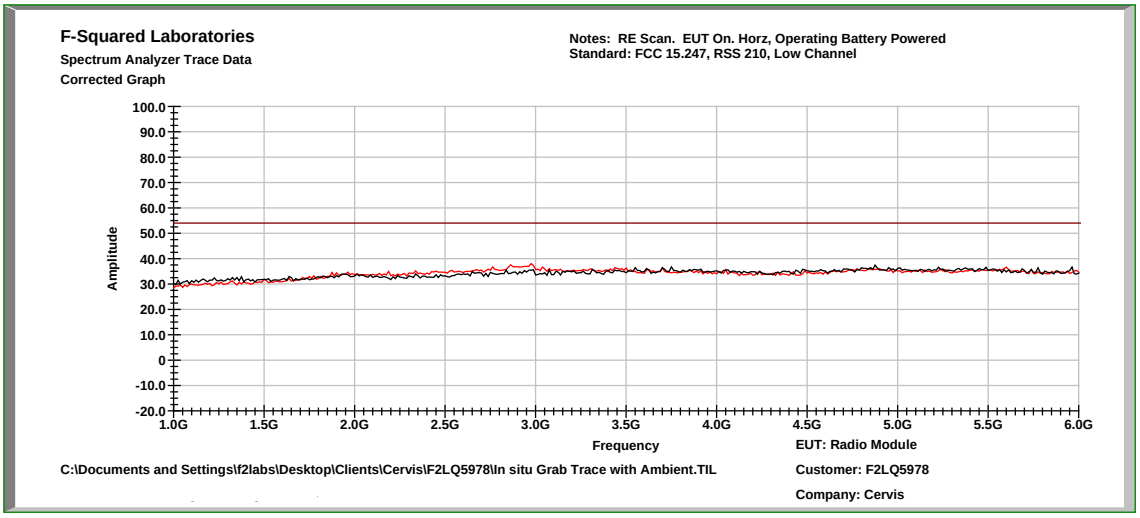


In the graph above, the blue arrows indicate the band edges and display that the band edges are more than 20dB below the limit line of 15.209.

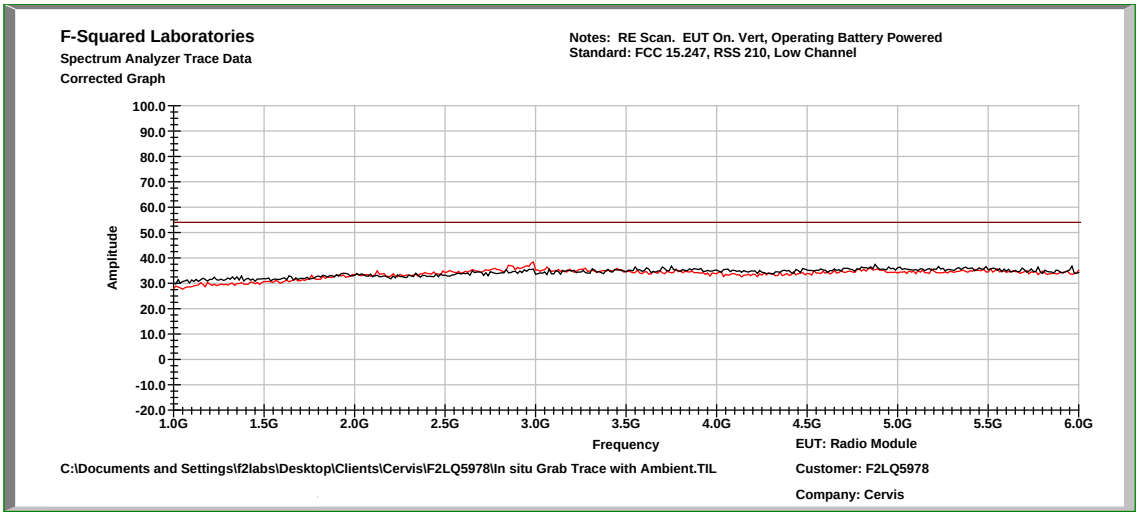
9dBi Antenna, Low Channel, 800 MHz to 1 GHz, Vertical



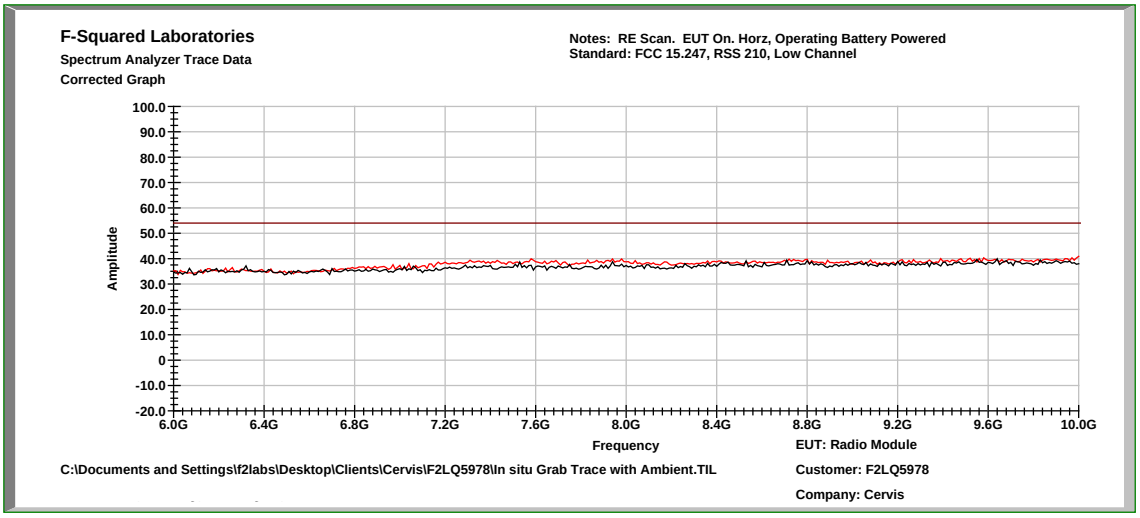
9dBi Antenna, Low Channel, 1 GHz to 6 GHz Horizontal



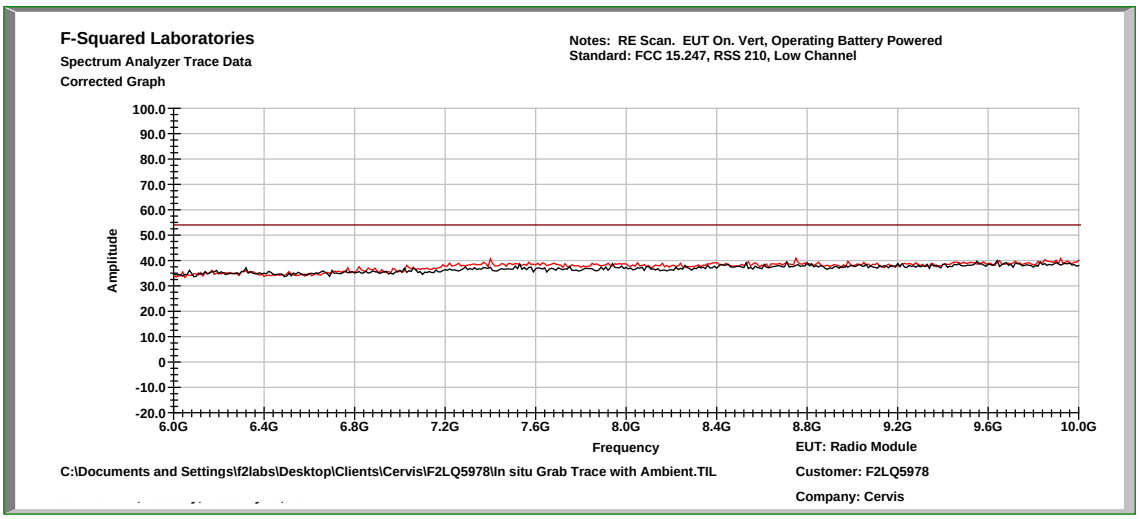
9dBi Antenna, Low Channel, 1 GHz to 6 GHz, Vertical



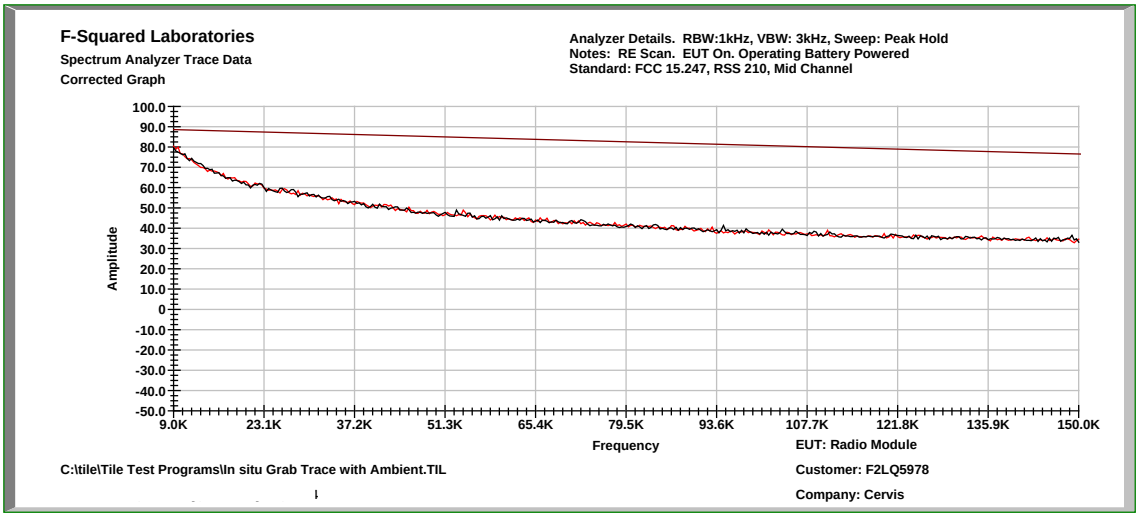
9dBi Antenna, Low Channel, 6 GHz to 10 GHz, Horizontal



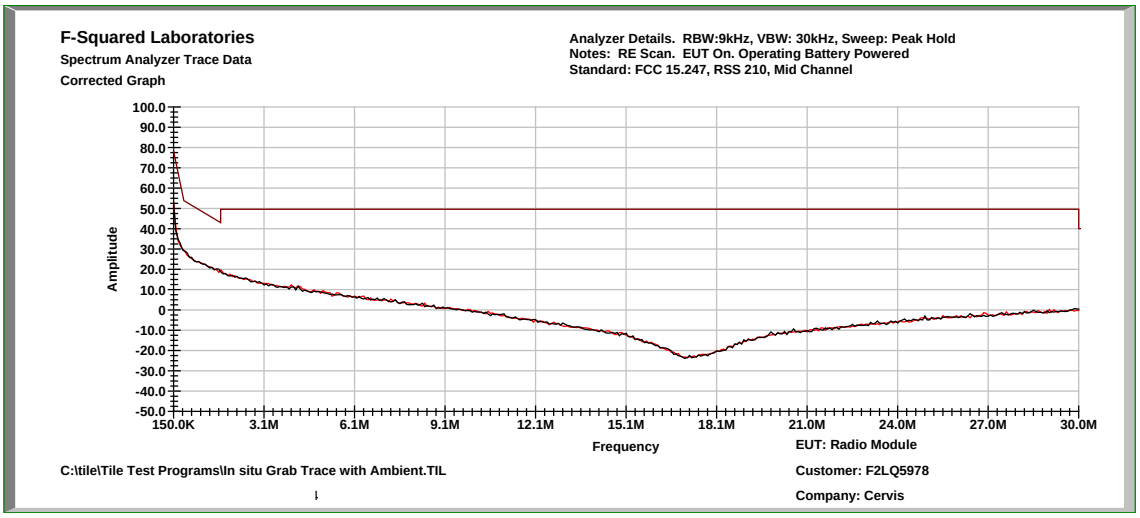
9dBi Antenna, Low Channel, 6 GHz to 10 GHz, Vertical



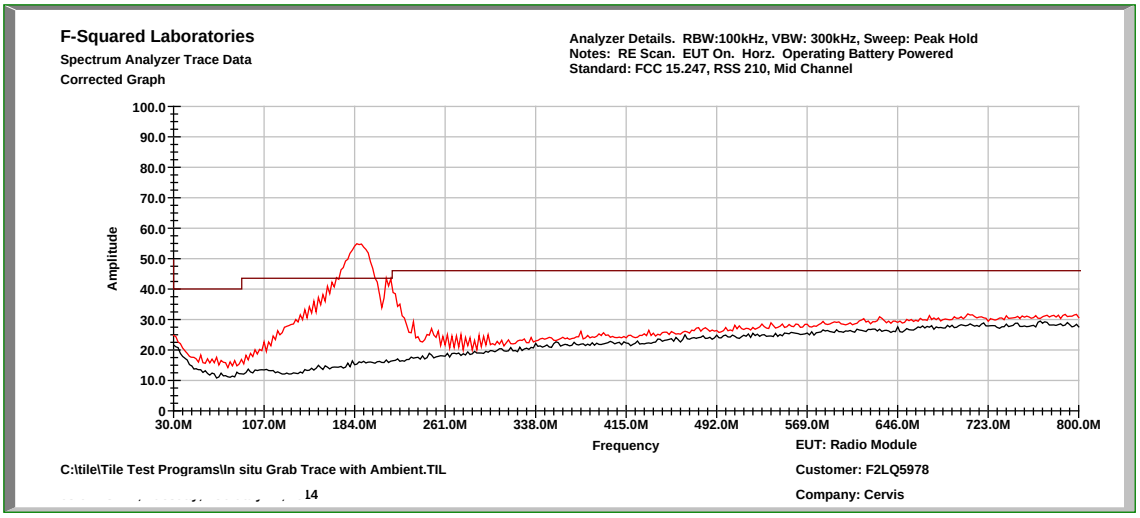
9dBi Antenna, Mid Channel, .009 MHz to 0.15 MHz



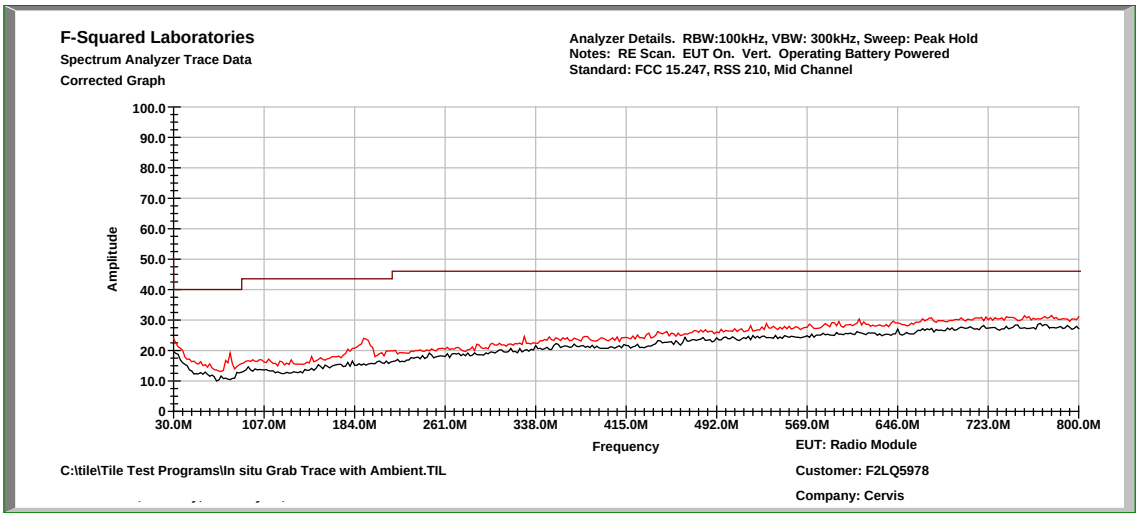
9dBi Antenna, Mid Channel, 0.15 MHz to 30 MHz



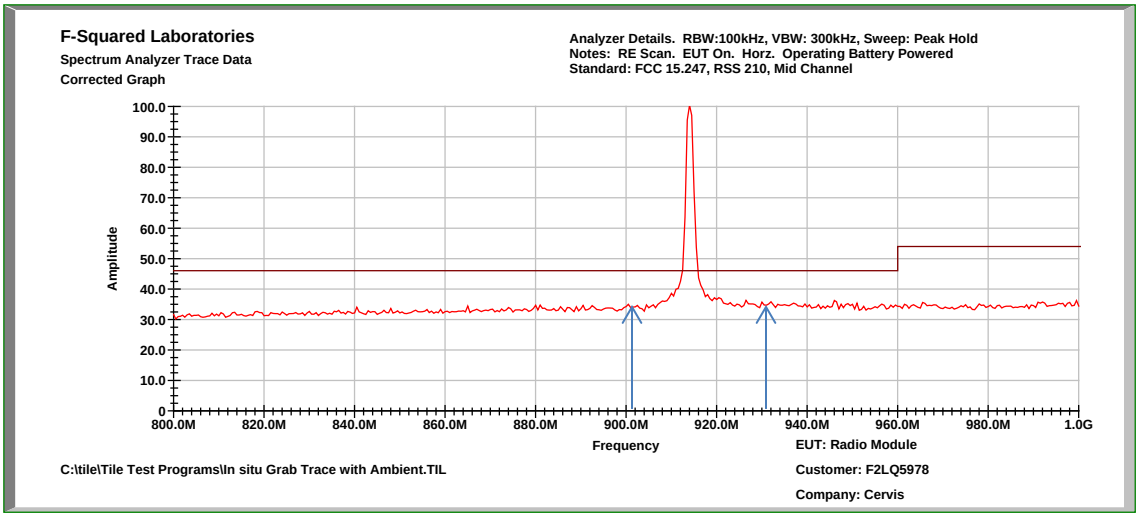
9dBi Antenna, Mid Channel, 30 MHz to 800 MHz, Horizontal



9dBi Antenna, Mid Channel, 30 MHz to 800 MHz, Vertical

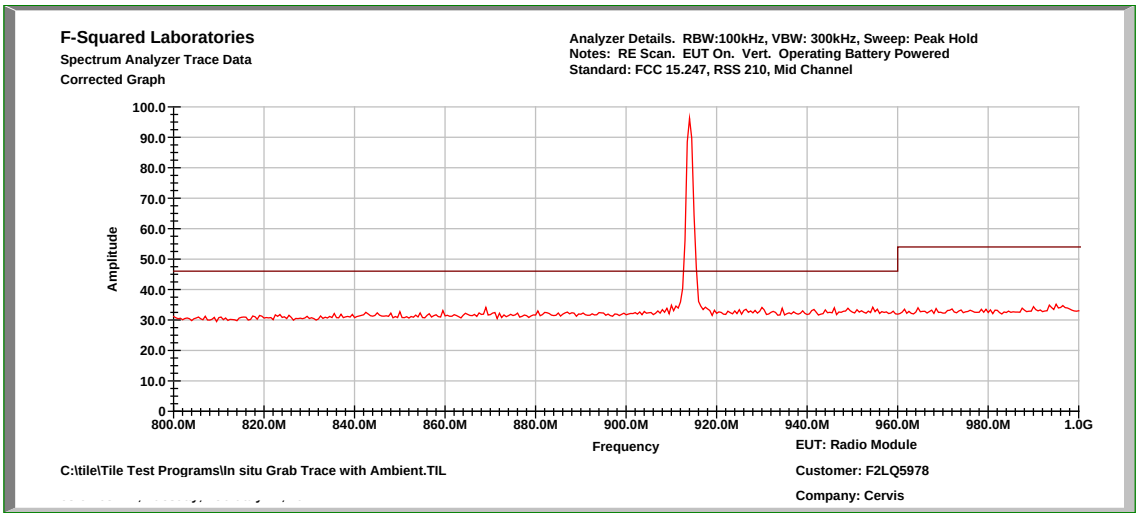


9dBi Antenna, Mid Channel, 800 MHz to 1 GHz, Horizontal

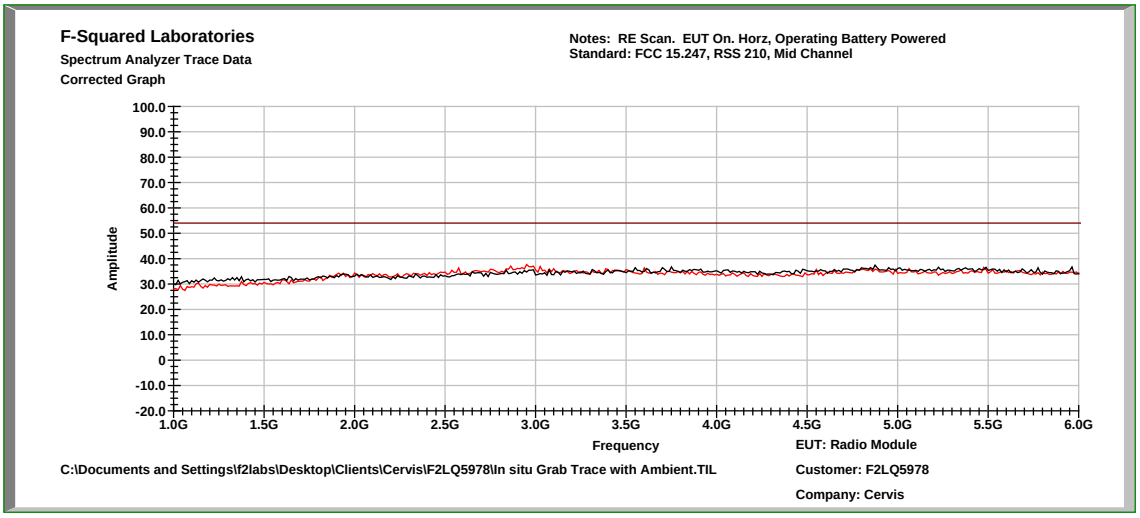


In the graph above, the blue arrows indicate the band edges and display that the band edges are more than 20dB below the limit line of 15.209.

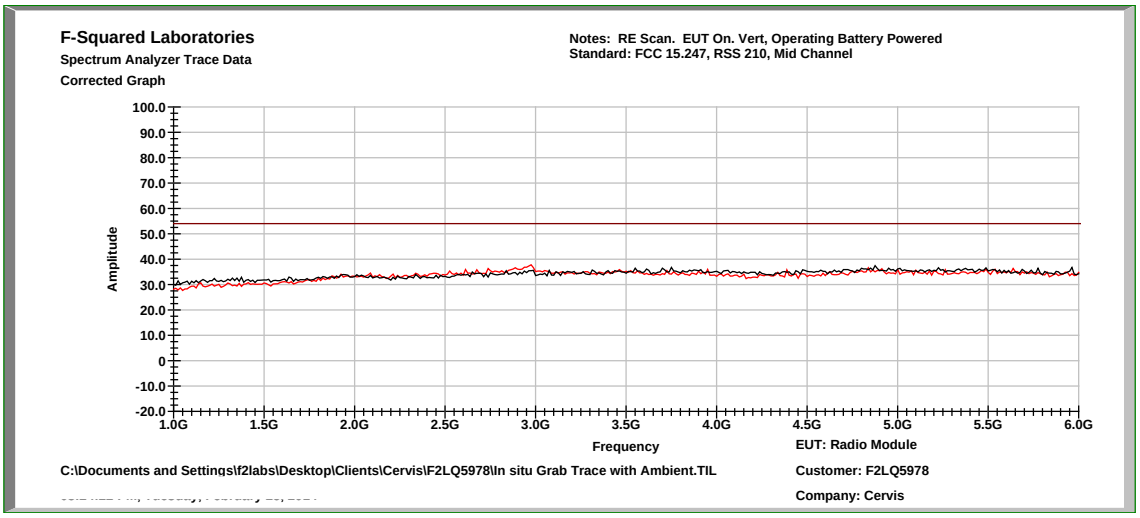
9dBi Antenna, Mid Channel, 800 MHz to 1 GHz, Vertical



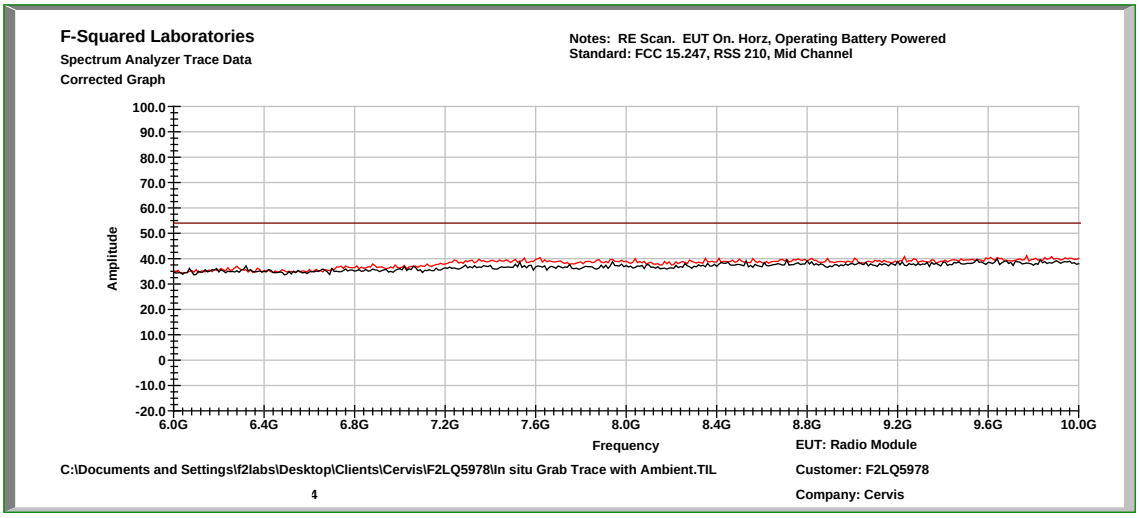
9dBi Antenna, Mid Channel, 1 GHz to 6 GHz, Horizontal



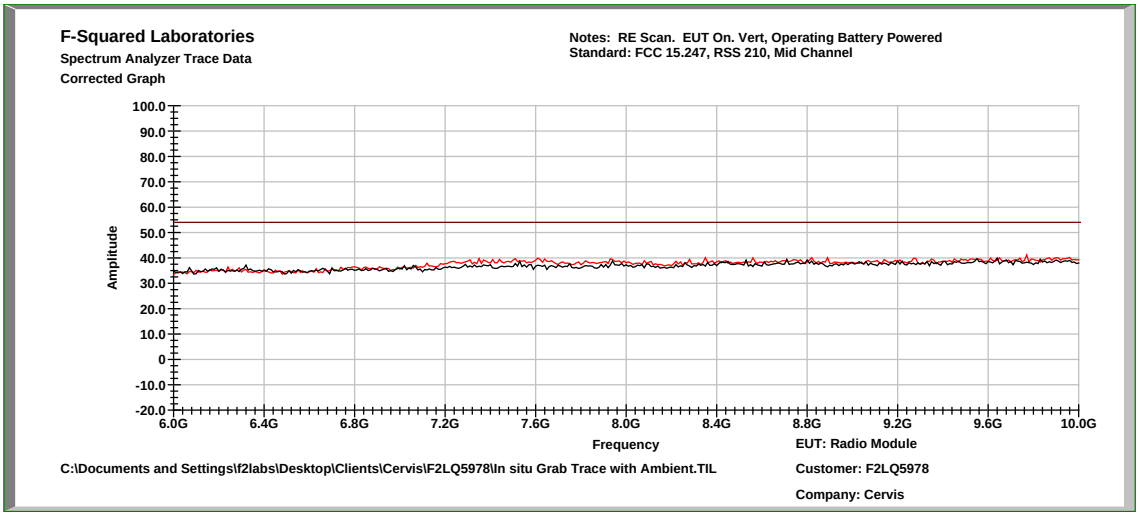
9dBi Antenna, Mid Channel, 1 GHz to 6 GHz, Vertical



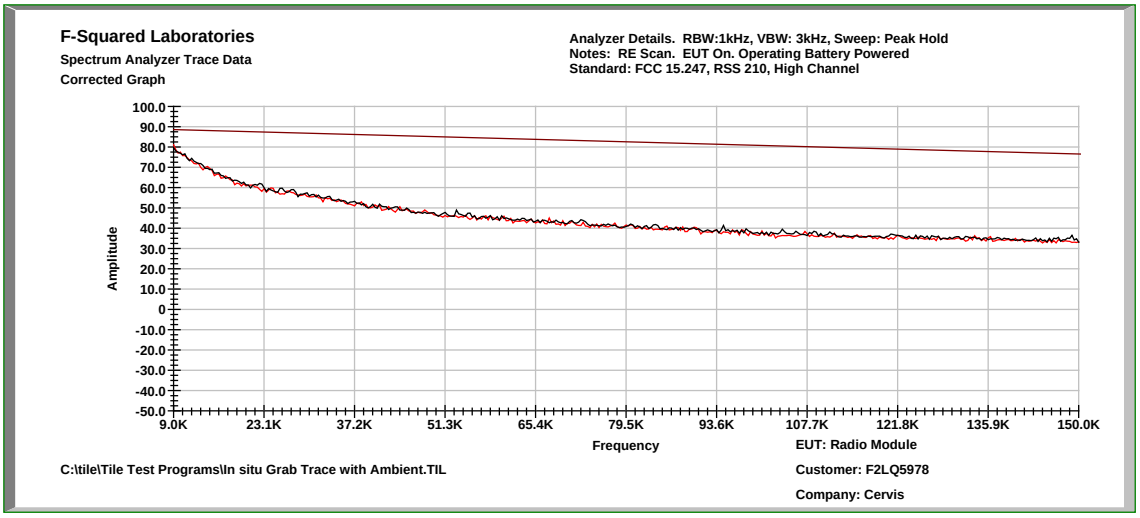
9dBi Antenna, Mid Channel, 6 GHz to 10 GHz, Horizontal



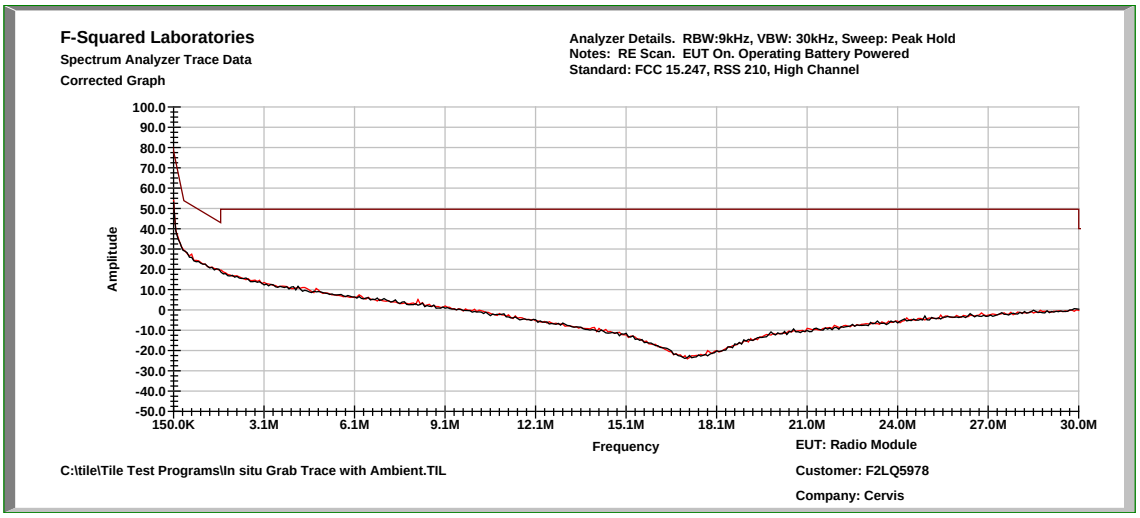
9dBi Antenna, Mid Channel, 6 GHz to 10 GHz, Vertical



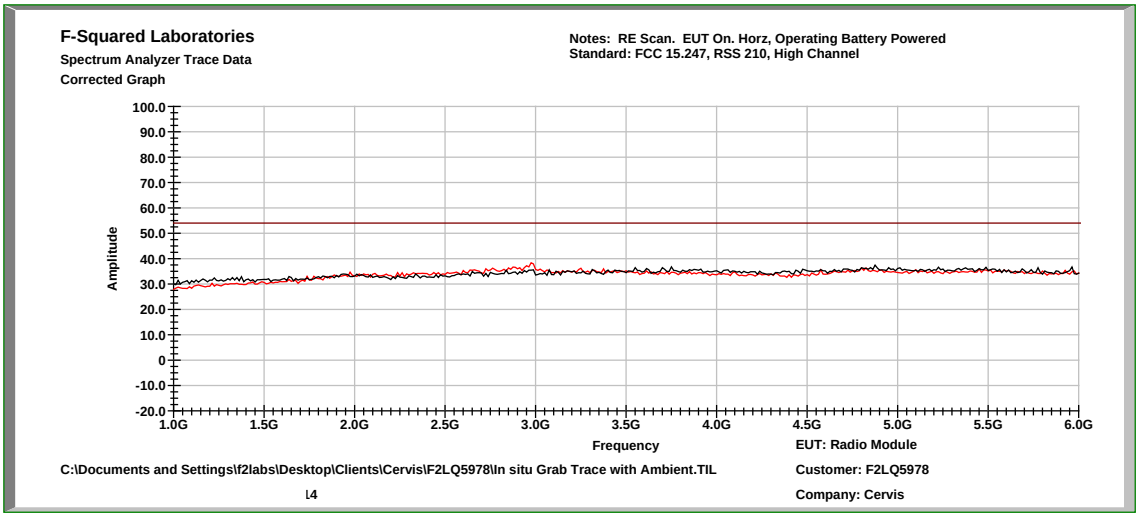
9dBi Antenna, High Channel, .009 MHz to 0.15 MHz



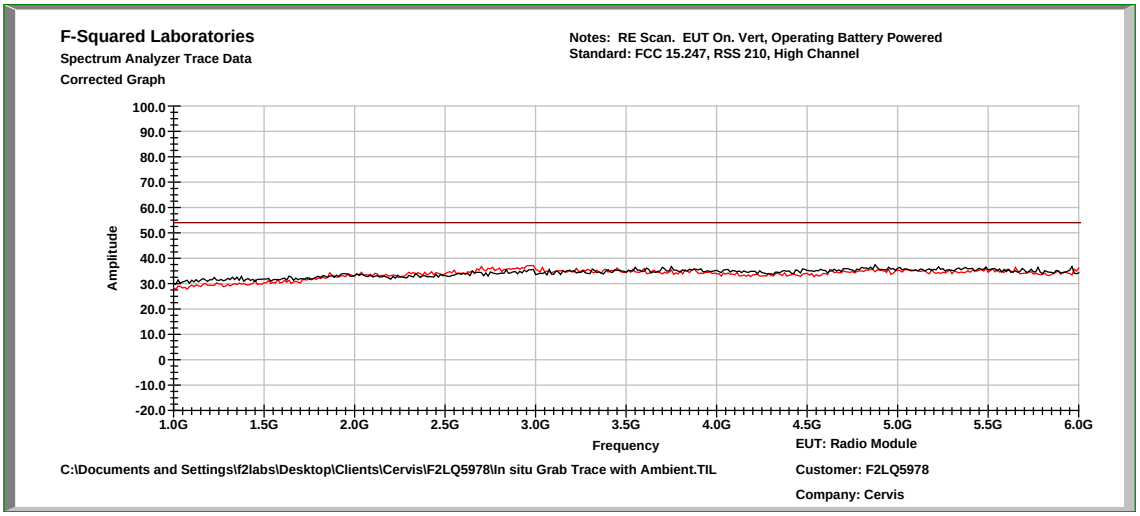
9dBi Antenna, High Channel, 0.15 MHz to 30 MHz



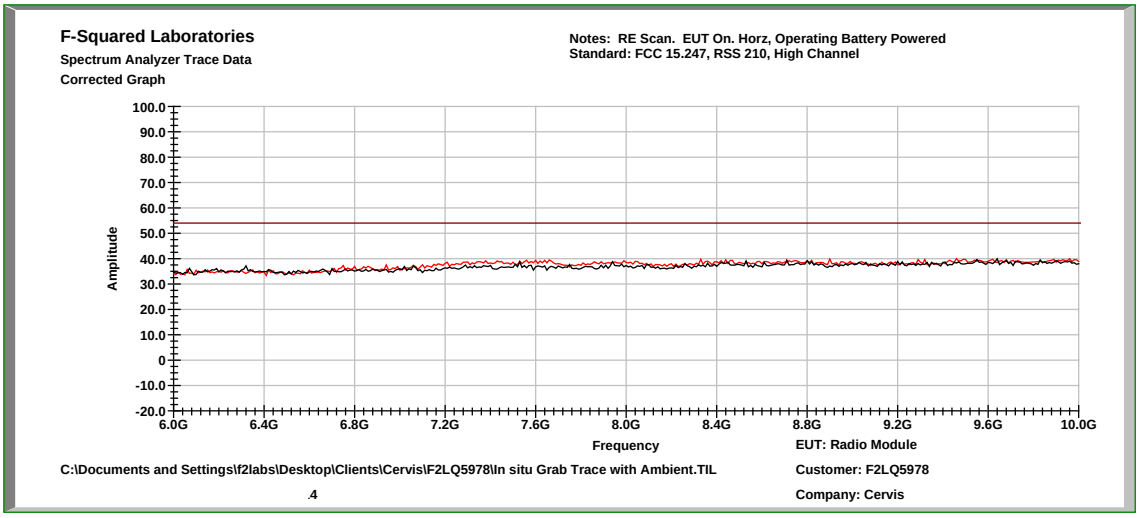
9dBi Antenna, High Channel, 1 GHz to 6 GHz, Horizontal



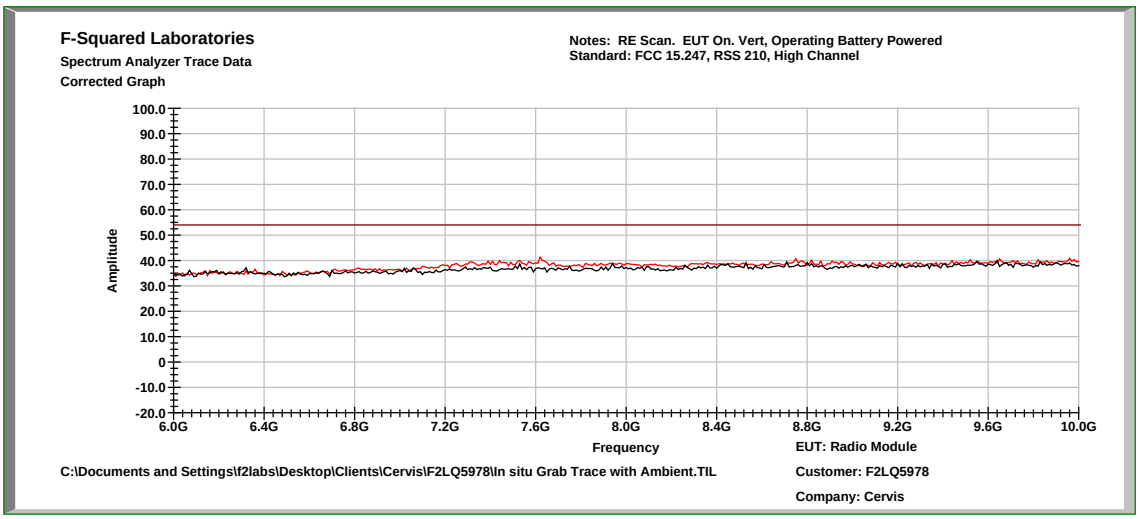
9dBi Antenna, High Channel, 1 GHz to 6 GHz, Vertical



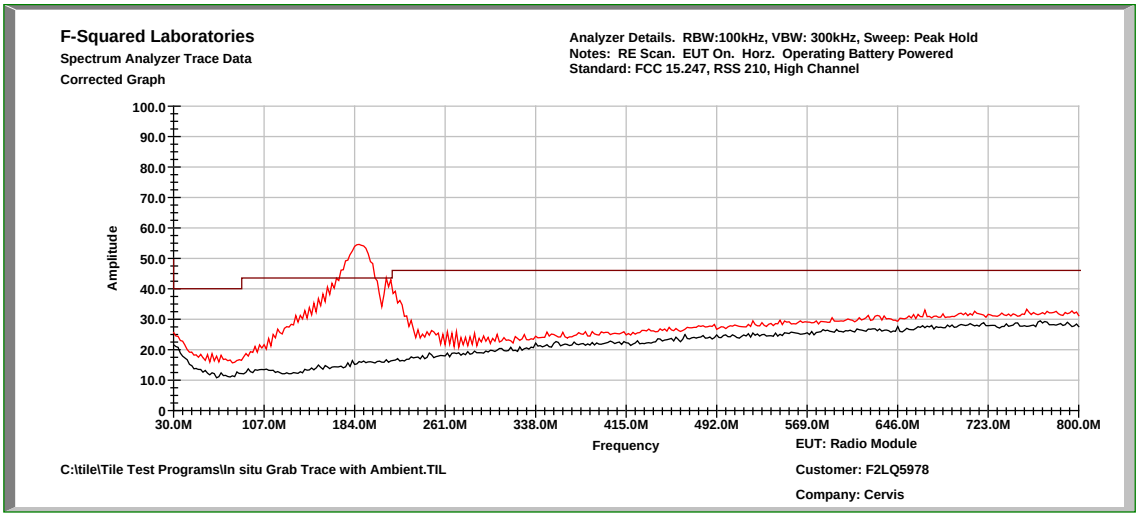
9dBi Antenna, High Channel, 6 GHz to 10 MHz, Horizontal



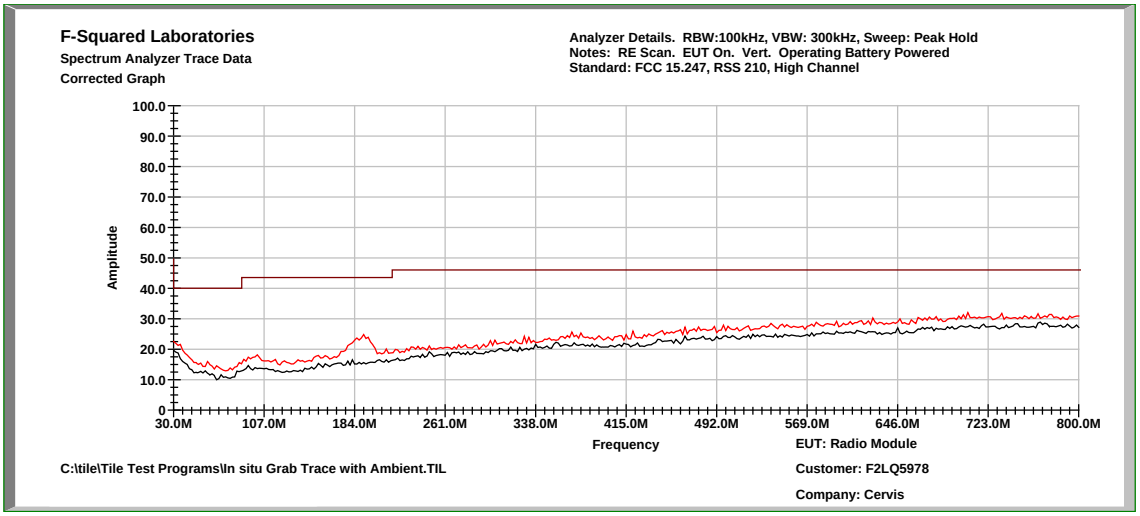
9dBi Antenna, High Channel, 6 GHz to 10 GHz, Vertical



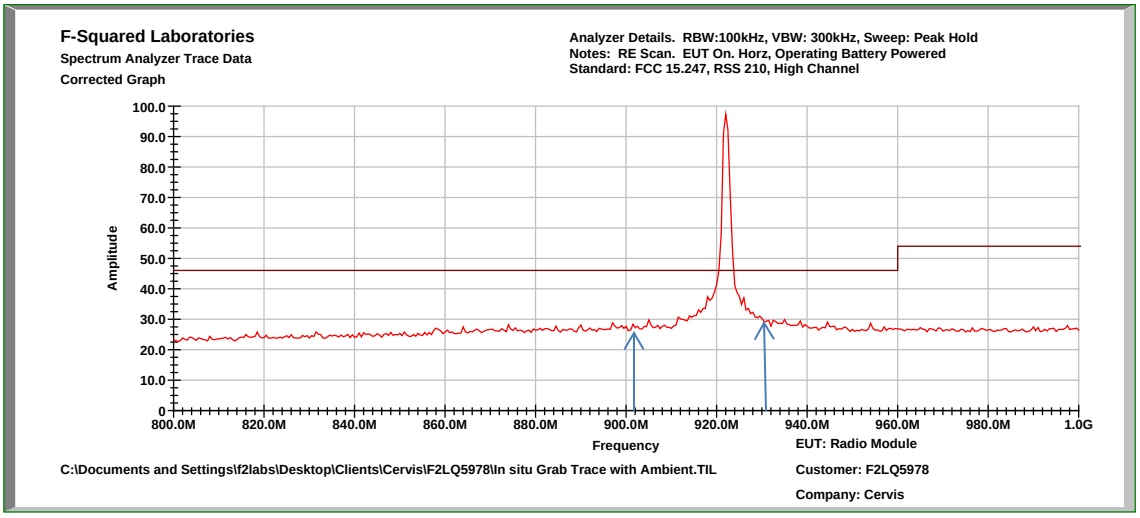
9dBi Antenna, High Channel, 30 MHz to 800 MHz, Horizontal



9dBi Antenna, High Channel, 30 MHz to 800 MHz, Vertical

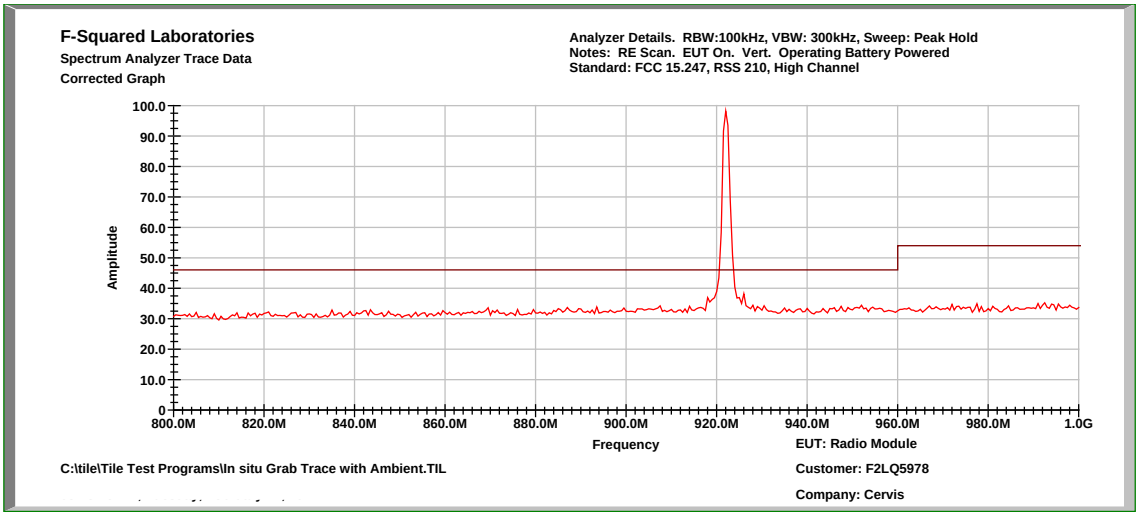


9dBi Antenna, High Channel, 800 MHz to 1 GHz, Horizontal



In the graph above, the blue arrows indicate the band edges and display that the band edges are more than 20dB below the limit line of 15.209.

9dBi Antenna, High Channel, 800 MHz to 1 GHz, Vertical



Measurements

9dBi Whip Antenna, Low Channel

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Polarization	Corr. (dB)	Emission (dBµV/m)	Limit QPK (dBµV/m)	Margin QPK (dB)
173.360000	8.8	120.000	H	14.4	23.2	43.5	-20.3
174.170000	7.1	120.000	V	14.3	21.4	43.5	-22.1
180.320000	15.6	120.000	H	14.1	29.7	43.5	-13.8
180.770000	8.9	120.000	V	14.2	23.1	43.5	-20.4
185.290000	14.3	120.000	H	14.1	28.4	43.5	-15.1
186.220000	7.3	120.000	V	14.0	21.3	43.5	-22.2
901.900000	8.4	120.000	V	28.9	37.3	46.0	-8.7
901.900000	8.5	120.000	H	28.5	37.0	46.0	-9.0
928.000000	8.6	120.000	H	28.4	37.0	46.0	-9.0
928.000000	8.7	120.000	V	29.2	37.9	46.0	-8.1

9dBi Whip Antenna, Mid Channel

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Polarization	Corr. (dB)	Emission (dBµV/m)	Limit QPK (dBµV/m)	Margin QPK (dB)
173.360000	9.5	120.000	H	14.4	23.9	43.5	-19.6
174.170000	7.1	120.000	V	14.3	21.4	43.5	-22.1
180.320000	15.5	120.000	H	14.1	29.6	43.5	-13.9
180.770000	9.2	120.000	V	14.2	23.4	43.5	-20.1
185.290000	14.4	120.000	H	14.1	28.5	43.5	-15.0
186.220000	7.6	120.000	V	14.0	21.6	43.5	-21.9
901.900000	9.0	120.000	V	28.9	37.9	46.0	-8.1
901.900000	8.9	120.000	H	28.5	37.4	46.0	-8.6
928.000000	8.9	120.000	H	28.4	37.3	46.0	-8.7
928.000000	8.0	120.000	V	29.2	37.2	46.0	-8.8

9dBi Whip Antenna, High Channel

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Polarization	Corr. (dB)	Emission (dBµV/m)	Limit QPK (dBµV/m)	Margin QPK (dB)
173.360000	8.9	120.000	H	14.4	23.3	43.5	-20.2
174.170000	7.6	120.000	V	14.3	21.9	43.5	-21.6
180.320000	15.3	120.000	H	14.1	29.4	43.5	-14.1
180.770000	9.4	120.000	V	14.2	23.6	43.5	-19.9
185.290000	14.3	120.000	H	14.1	28.4	43.5	-15.1
186.220000	7.6	120.000	V	14.0	21.6	43.5	-21.9
901.900000	8.2	120.000	V	28.9	37.1	46.0	-8.9
901.900000	9.4	120.000	H	28.5	37.9	46.0	-8.1
928.000000	9.0	120.000	H	28.4	37.4	46.0	-8.6
928.000000	8.1	120.000	V	29.2	37.3	46.0	-8.7

9 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Radiated Spurious Emission Pre-scan

OATS: 9dBi

Conducted Output Power