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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 Portable Radio**
Model:	**HH-9H06**
FCC ID:	**LOB9H06**
Testing Commenced:	**Nov. 22, 2013**
Testing Ended:	**Dec. 23, 2013**
Summary of Test Results:	**4**

Standards:

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

Evaluation Conducted by: Ken Littell, EMC Tech. Mgr.

Report Reviewed by: Wendy Fuster, President

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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

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
F2LQ5836-01E	First Issue	Mar. 14, 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 1.49dBi Chip Antenna	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Peak Power Spectral Density	CFR 47 Part 15.247(e) / KDB558074	Complies

Note: Product was operated using AAA batteries.
Requirements of 15.31 were met by using new batteries.

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	High Channel 924.2 MHz	Mid Channel 916.1 MHz	Low Channel 906.2 MHz
Conducted Output Power	8.710mW (9.40dBm)	9.120mW (9.60dBm)	9.183mW (9.63dBm)
Conducted Output Power Limit	1 Watt, (30dBm)	1 Watt, (30dBm)	1 Watt, (30dBm)
E.I.R.P. with 1.49dBi Chip Antenna	12.274mW (10.89dBm)	12.853mW (11.09dBm)	12.942mW (11.12dBm)
E.I.R.P. Limit	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)
Peak Power Spectral Density	-1.07 dBm	-1.07 dBm	-0.9 dBm
Peak Power Spectral Density Limit	8 dBm	8 dBm	8 dBm
-6dB Occupied bandwidth	.504810 MHz	.504810 MHz	.504810 MHz
-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 Part 15.247 of the FCC Rules using ANSI C63.4 2003 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 Portable Radio
Model: HH-9H06
Serial No.: None
FCC ID: LOB9H06

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

5.5 Equipment Category:

Radio Transmitter-DTS

5.6 Antenna:

1.49dBi Chip 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 integral/internal chip 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
Shield Room	0175	Ray Proof	N/A	11645	Aug. 7, 2014
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	Apr. 17, 2014
OATS-3m	CL017	Compliance Labs	N/A	001	Dec. 13, 2014
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Oct. 29, 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
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
Software:	Tile Version 1.0		Software Verified:		Nov. 22, 2013
Software:	EMC 32, Version 5.20.2		Software Verified:		Nov. 22, 2013

7 FCC PART 15.247(a)(2) – OCCUPIED BANDWIDTH

7.1 Requirements:

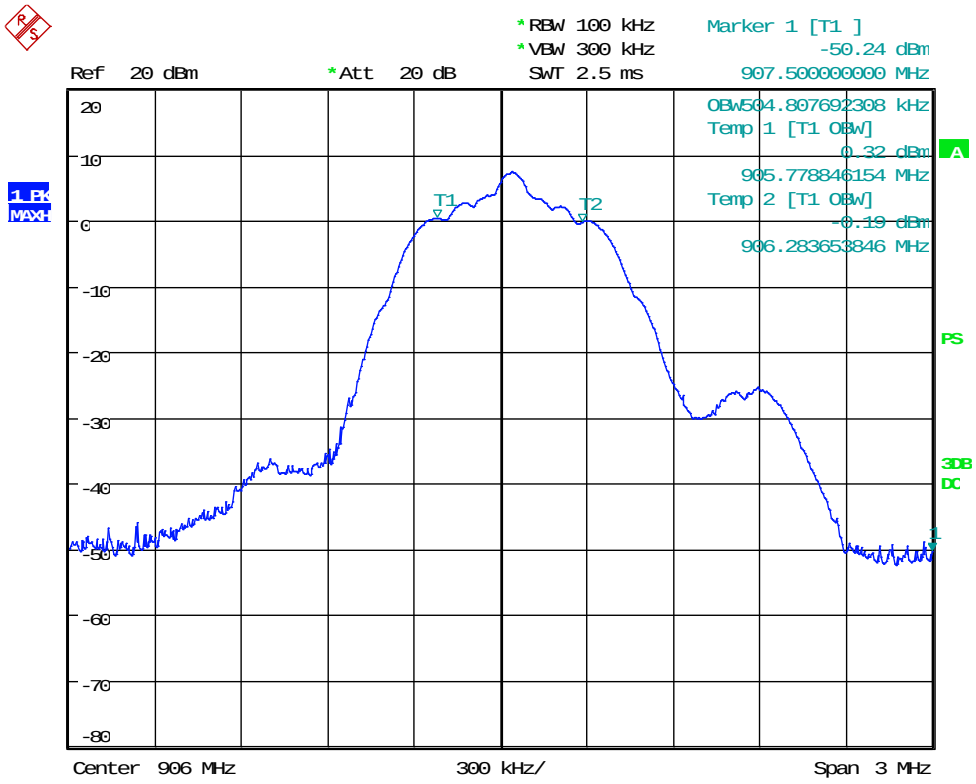
The 6dB bandwidth shall be greater than 500 kHz.

Bandwidth measurements were made at the low (906MHz), mid (916MHz) and upper (924MHz) frequencies. The bandwidth was measured using the analyzer's marker function.

7.2 Occupied Bandwidth Test Data

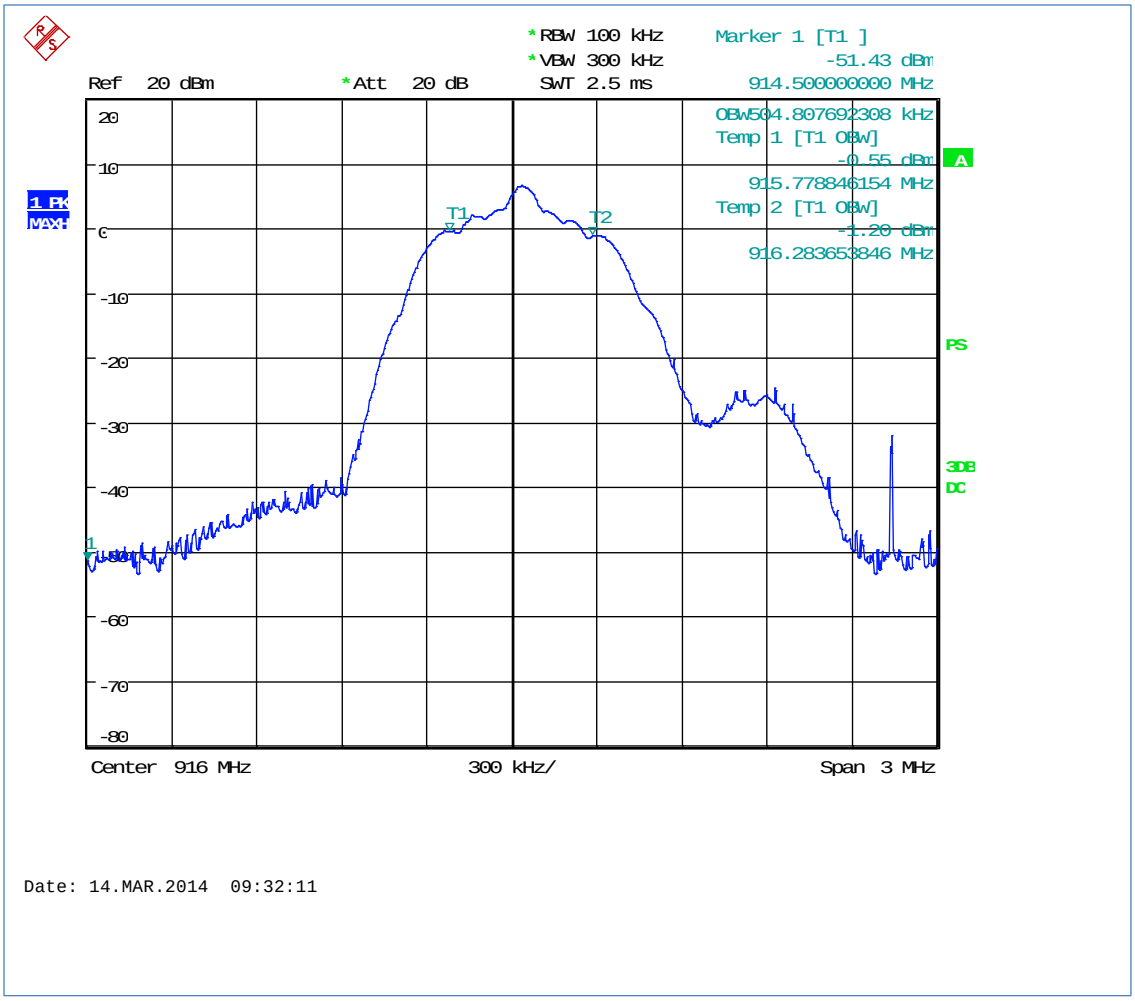
Test Date:	Nov. 23, 2013	Test Engineer:	K. Littell
Standards:	CFR 47 Part 15.247(a)(2); KDB558074	Air Temperature:	21.2ºC
		Relative Humidity:	47%

Low Channel

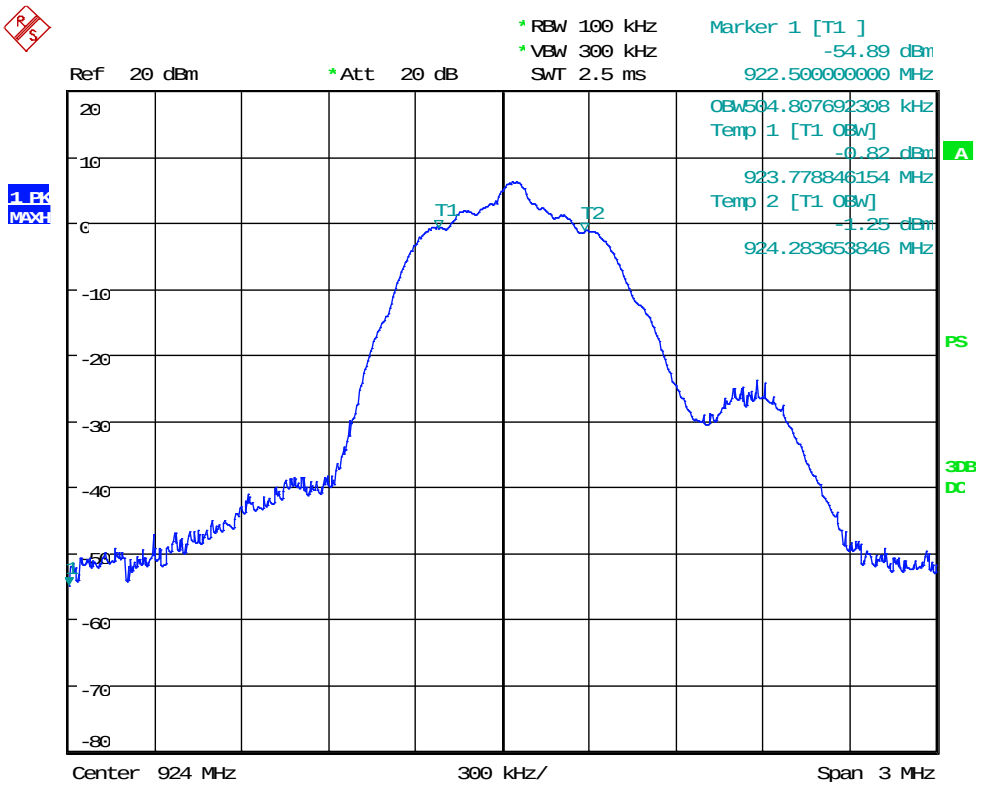


Date: 14.MAR.2014 09:39:50

Mid Channel


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 20 dB
SWT 2.5 ms
Marker 1 [T1]
-51.43 dBm
914.500000000 MHz
OBW504.807692308 kHz
Temp 1 [T1 OBW]
-0.55 dBm
915.778846154 MHz
Temp 2 [T1 OBW]
-1.20 dBm
916.283653846 MHz
T1
T2
1 PK
MAXH
A
PS
3DB
DC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 916 MHz
300 kHz/
Span 3 MHz
Date: 14.MAR.2014 09:32:11

High Channel



Date: 14.MAR.2014 09:41:09

8 PART 15.247(b)(3) – CONDUCTED OUTPUT POWER

8.1 Procedure:

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 and the power was integrated over the full 6db bandwidth by using a 1MHz Resolution bandwidth.

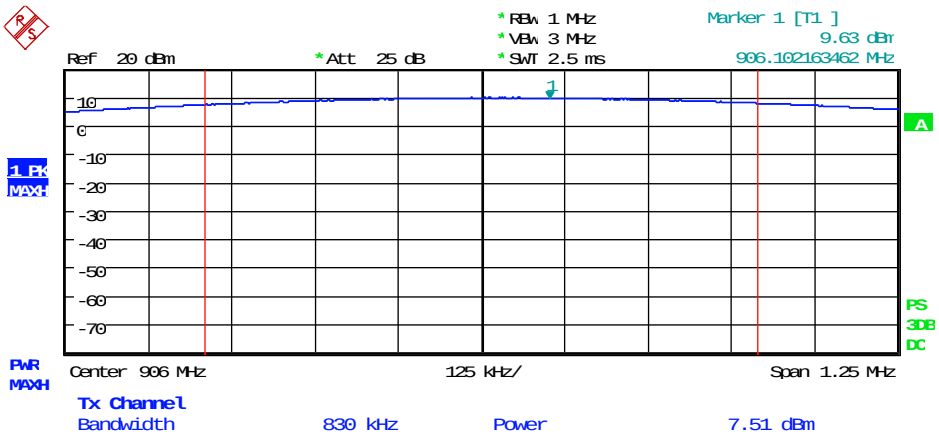
8.2 Requirements:

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.

8.3 Conducted Output Power Test Data

Test Date:	Nov. 23, 2013	**Test Engineer:**	K. Littell
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	**Air Temperature:**	20.3ºC
		Relative Humidity:	48%

Low Channel



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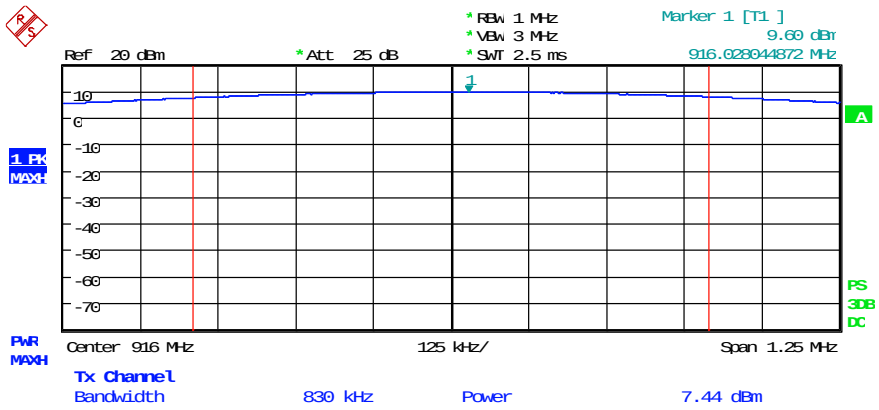

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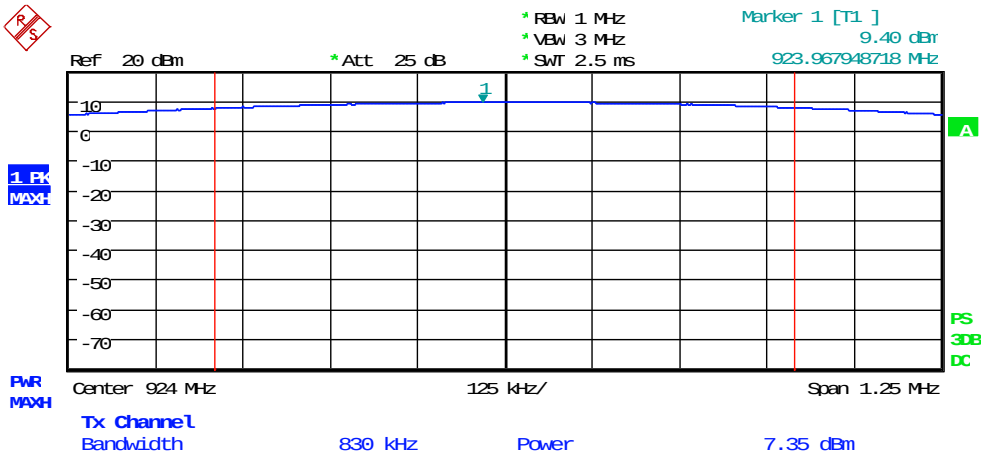
High Channel



Date: 13.MAR.2014 13:06:35

9 FCC Part 15.247(c) – CONDUCTED SPURIOUS EMISSIONS

9.1 Procedure:

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

9.2 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.

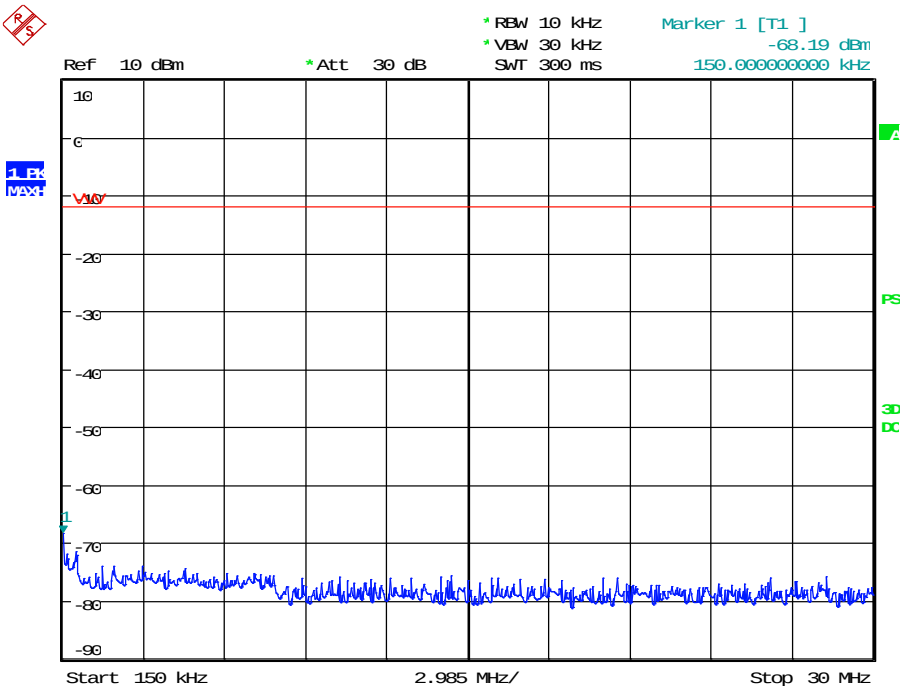
Spurious emissions measurements were made at the low, mid, and upper channels with the appropriate spectrum analyzer impulse bandwidth. Additionally, 20dB down points were measured for the low and high channels to verify band edge compliance.

9.3 Test Data – CONDUCTED SPURIOUS EMISSIONS

Test Date:	Nov. 23, 2013	**Test Engineer:**	K. Littell
Standards:	CFR 47 Part 15.247(d) / Part 15.209; KDB558074	**Air Temperature:**	21.7ºC
		Relative Humidity:	49%

Low Channel

.



Low Channel, cont'd

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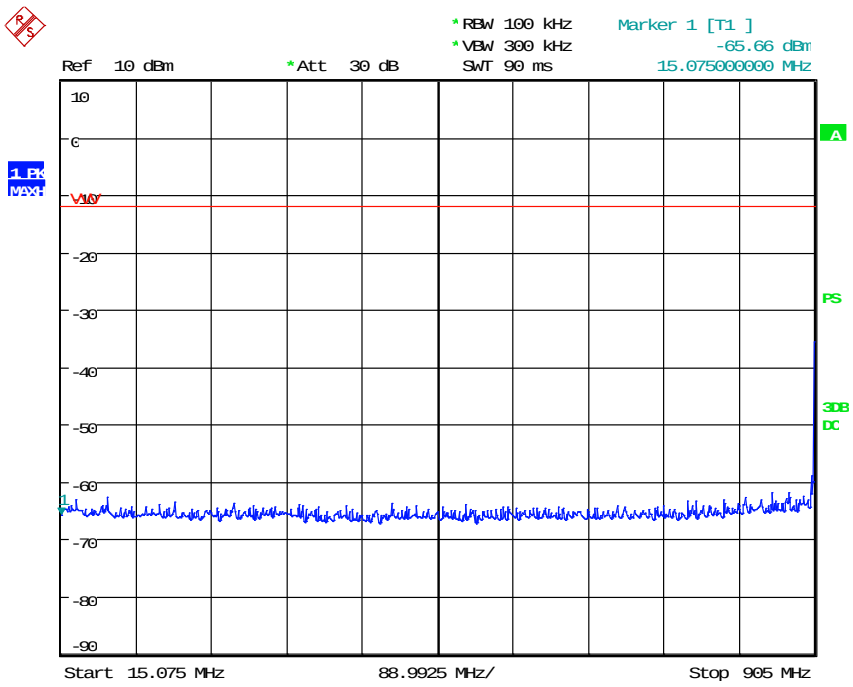

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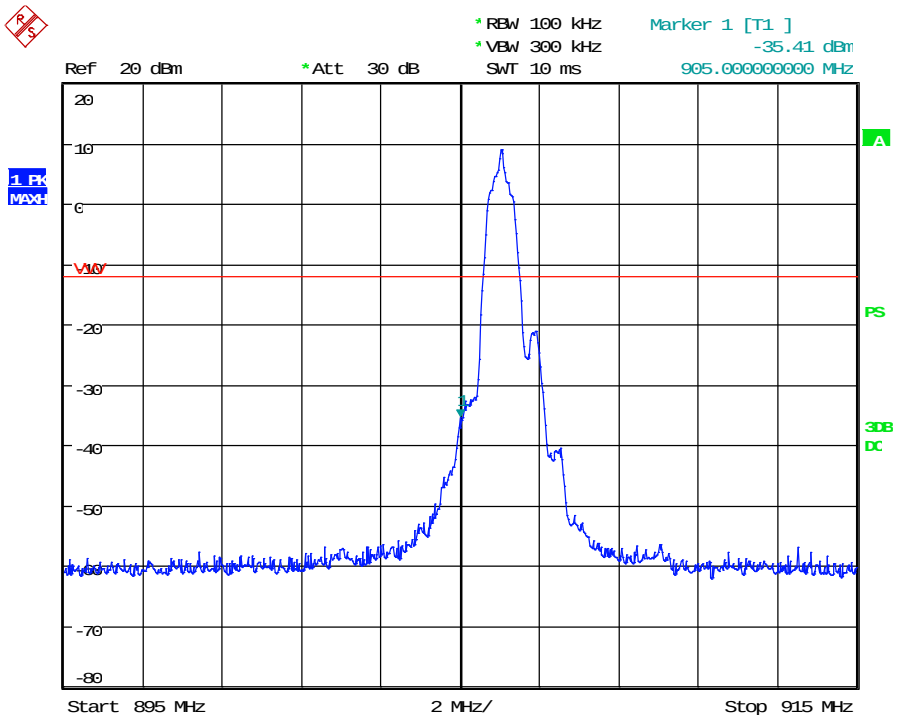

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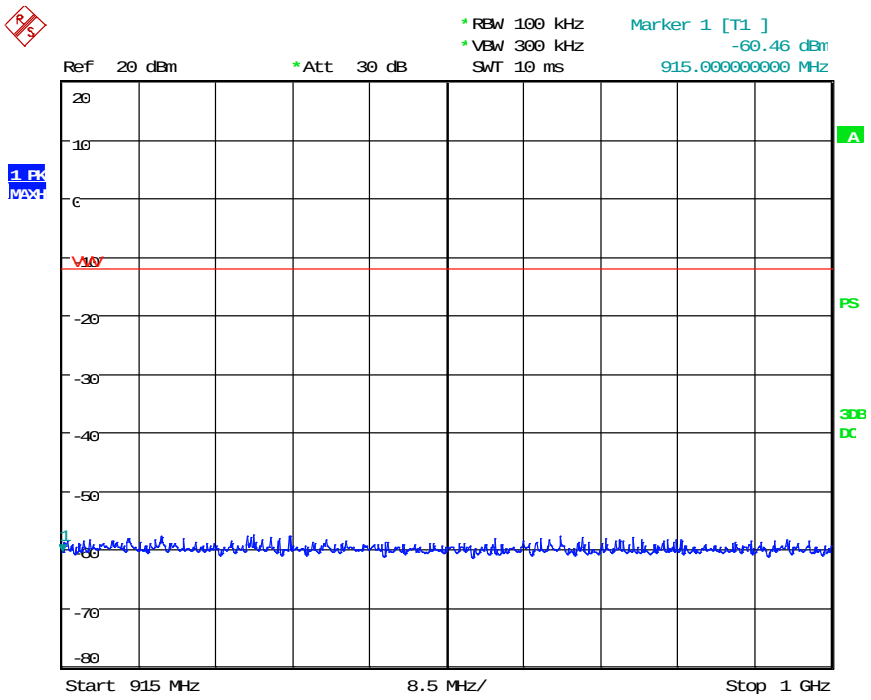

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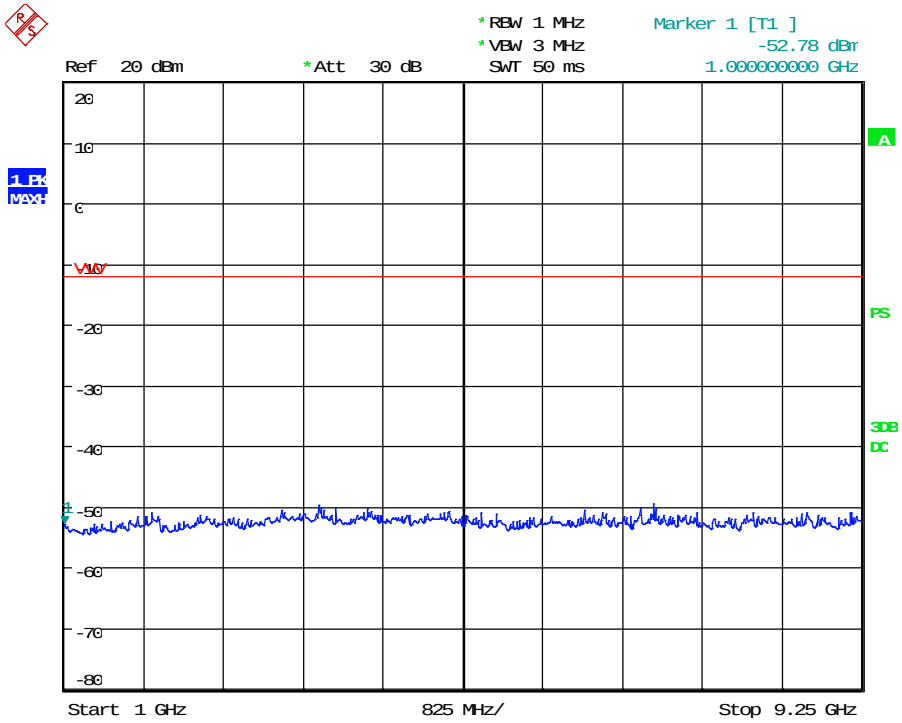

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Low Channel, cont'd

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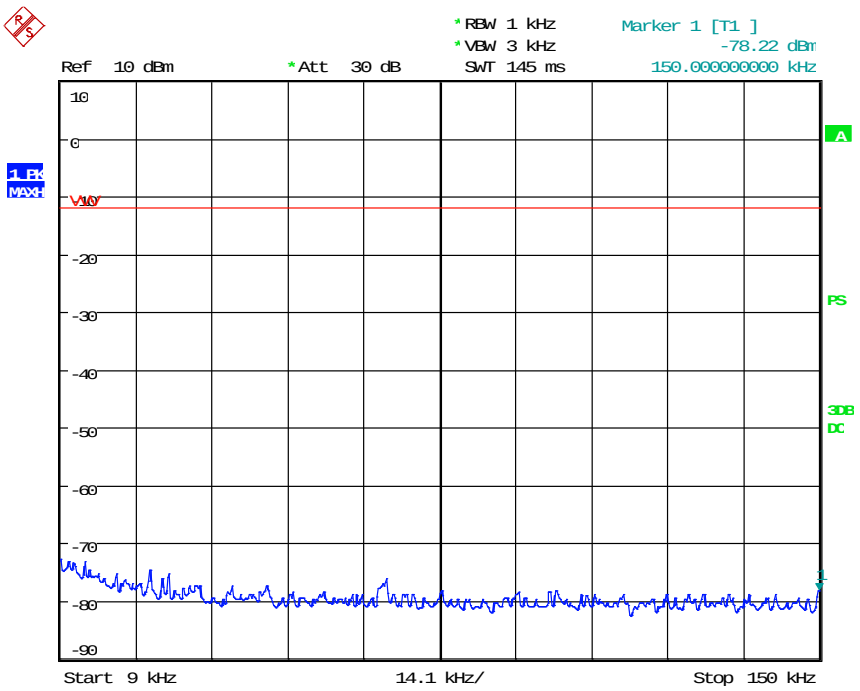

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Mid-Channel

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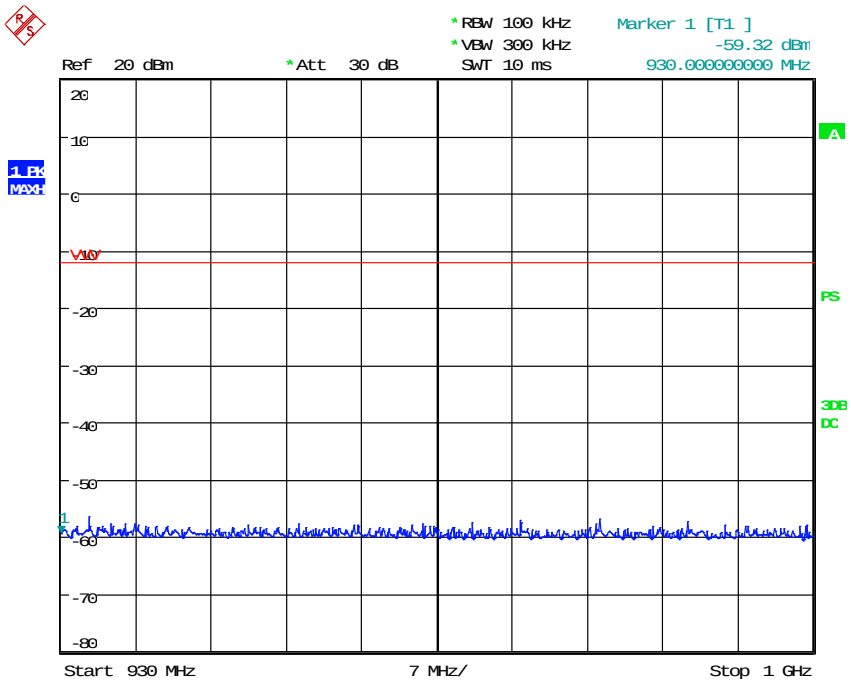

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Mid-Channel, cont'd

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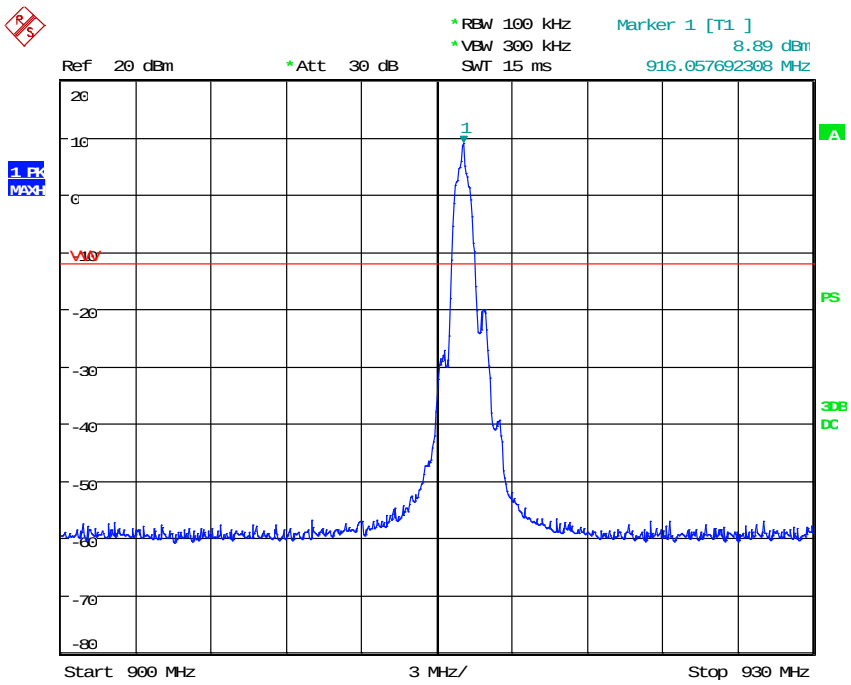

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Mid-Channel, cont'd

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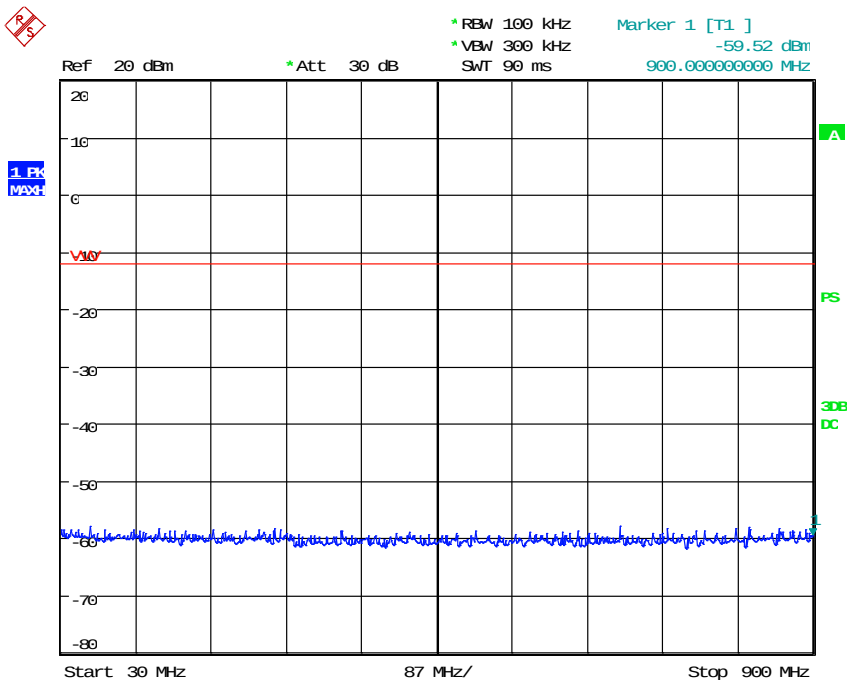

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Mid-Channel, cont'd

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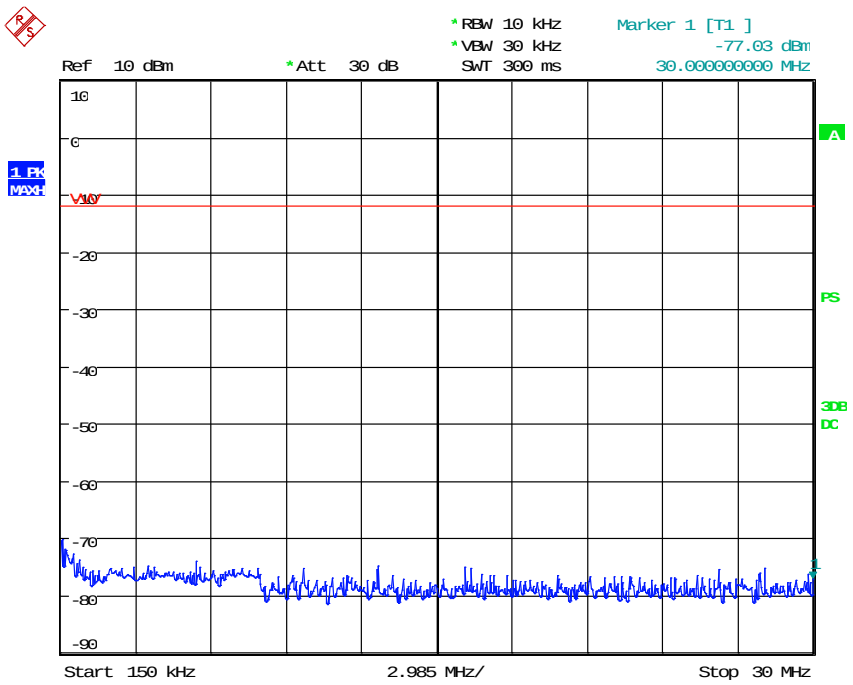

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Mid-Channel, cont'd

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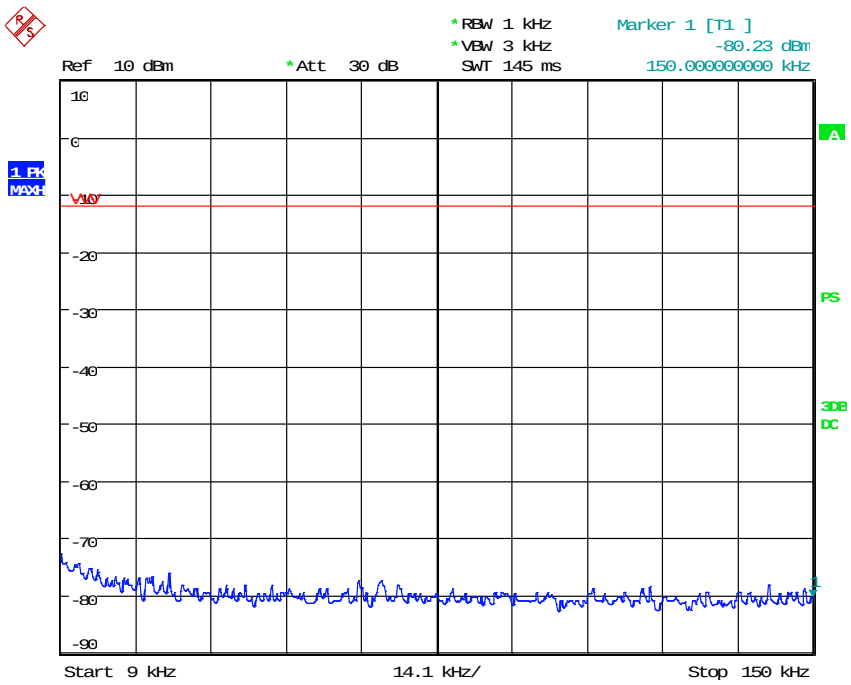

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Mid-Channel, cont'd

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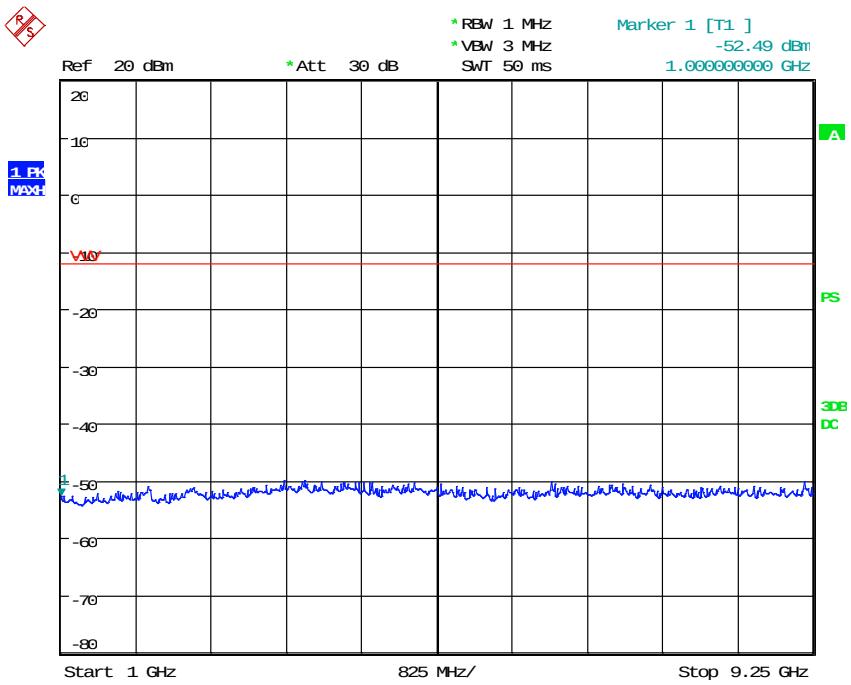

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High Channel

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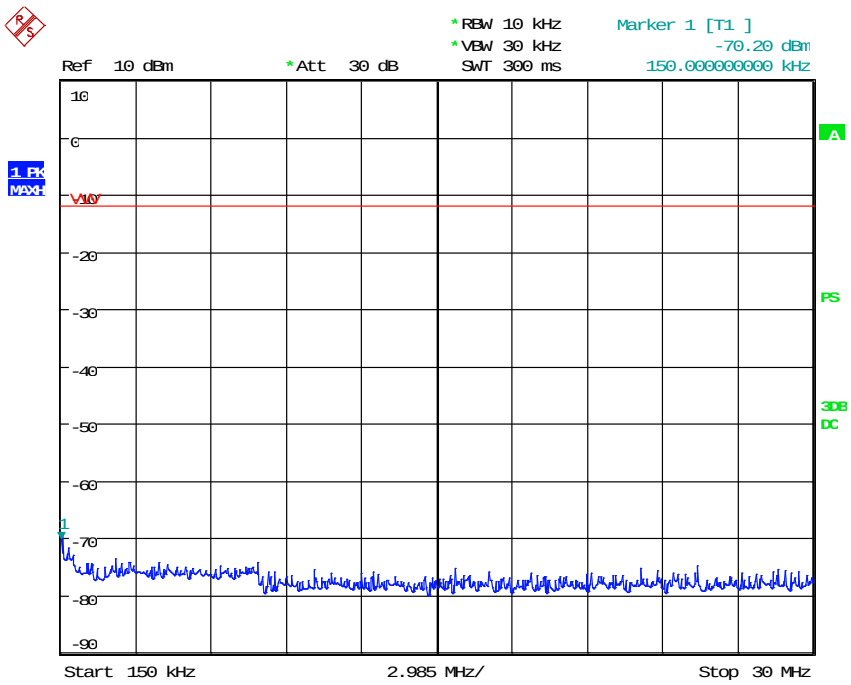

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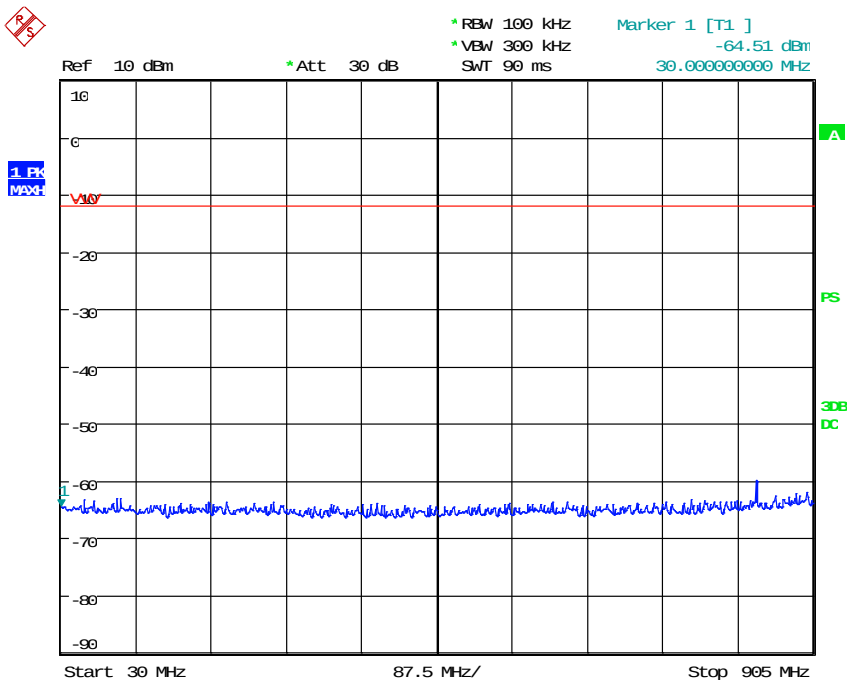

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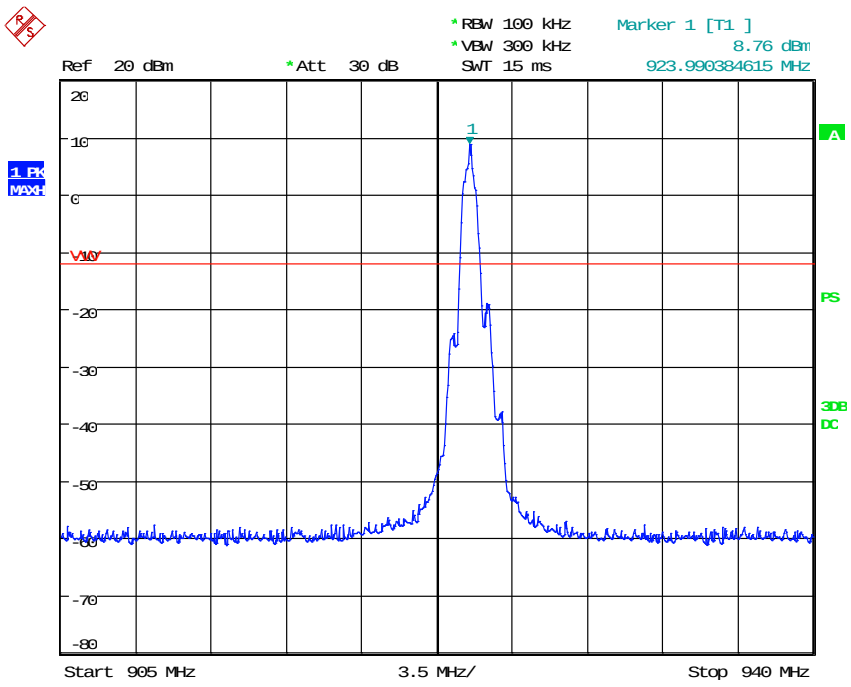

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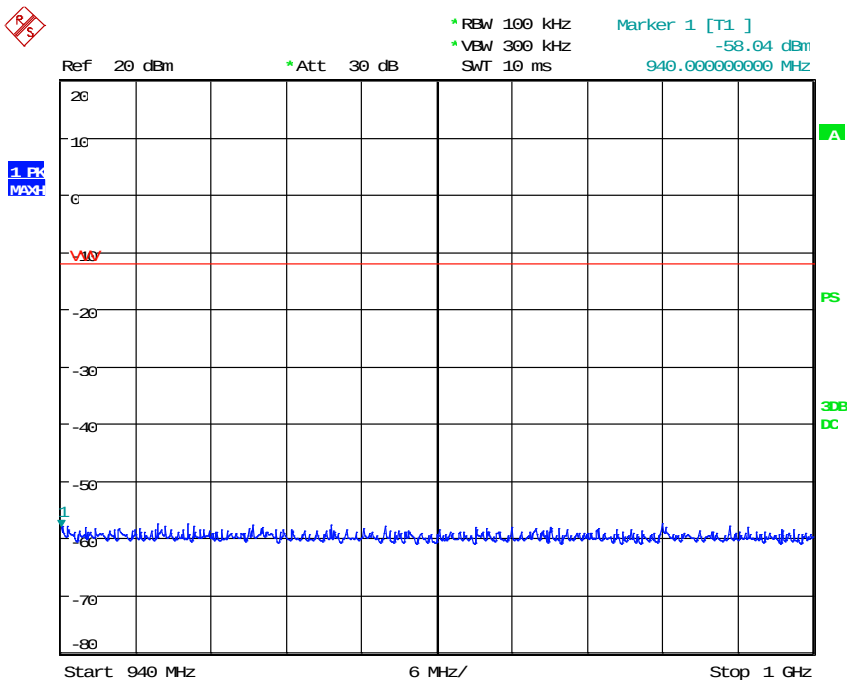

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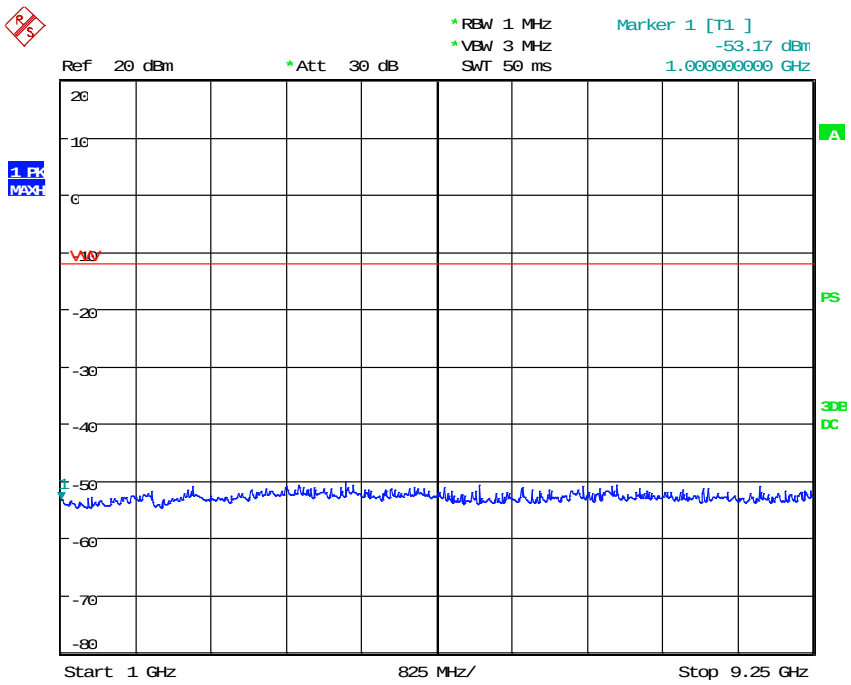

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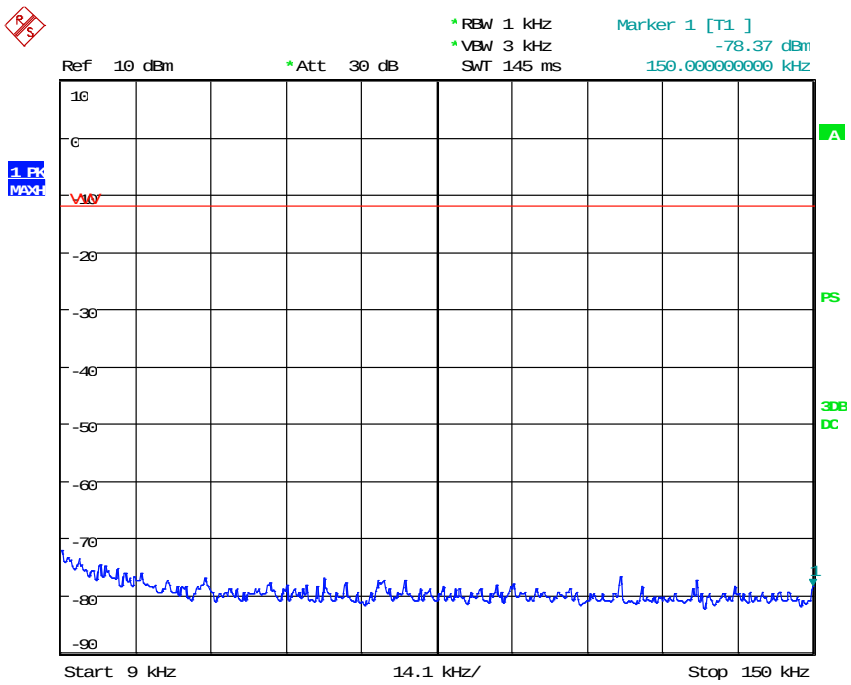


Date: 23.NOV.2013 18:02:23

10 RADIATED SPURIOUS EMISSION

10.1 Procedure:

The EUT antenna port was fitted with its integral/internal chip antenna. 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.

10.2 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).

10.3 Radiated Spurious Emission Test Data

Test Dates:	Nov. 25-Dec. 23, 2013	**Test Engineer:**	K. Littell
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	21.0ºC
		Relative Humidity:	44%

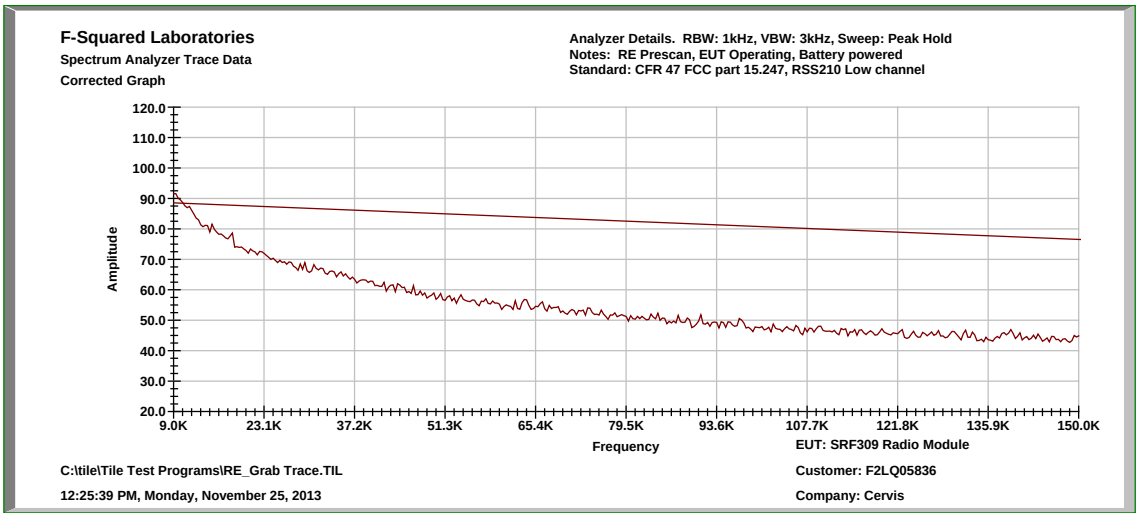
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. No emissions 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. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions, but these were ambient frequencies which did not change with the EUT on. The test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the limit.

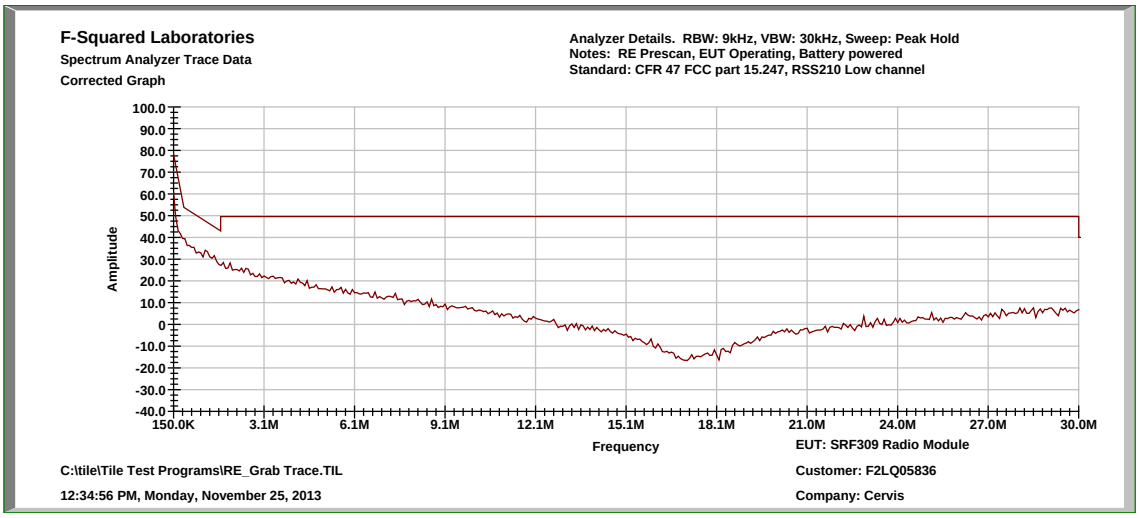
The equipment was fully exercised with all cabling attached to the EUT and was positioned for maximum emissions. The EUT antenna was positioned flat against the plastic tabletop and it was verified, by placing a foam support between the table and the antenna, that the table had no effect on the emissions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

Radiated Spurious Emission with 1.49dBi Chip Antenna: Low Channel

9kHz to 150kHz

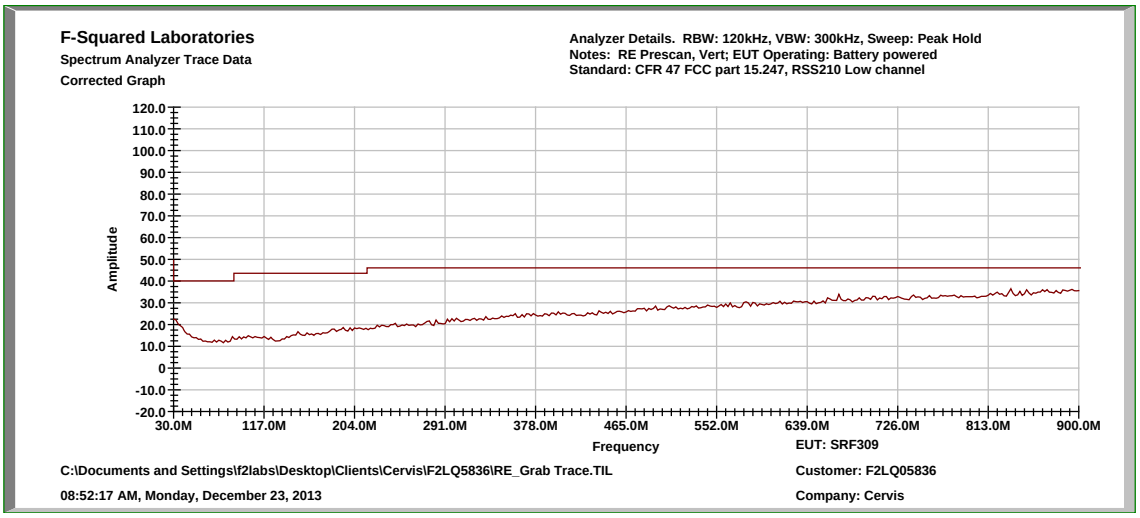


150kHz to 30 MHz

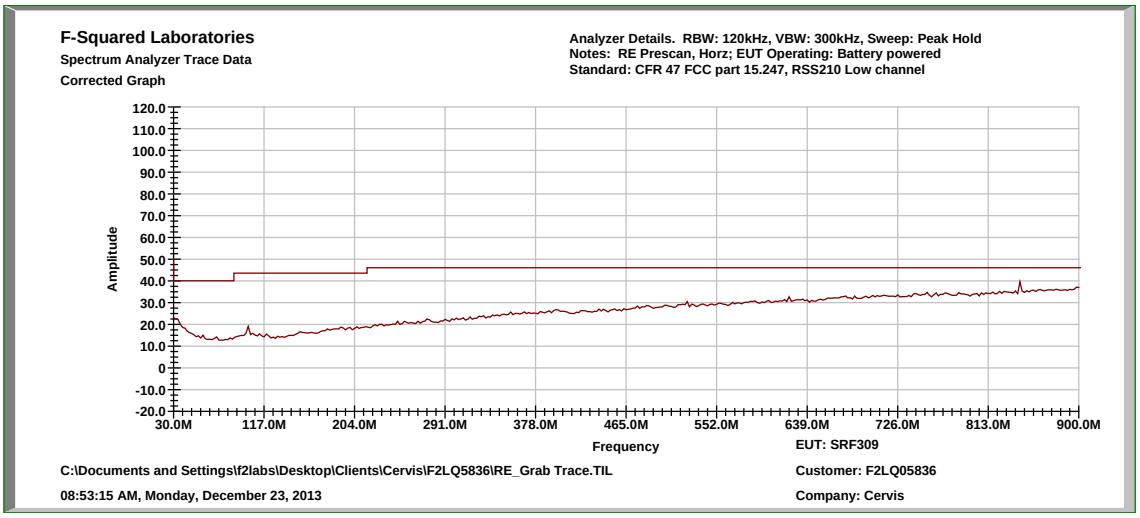


Radiated Spurious Emission with 1.49dBi Chip Antenna: Low Channel, cont'd

30 MHz to 900 MHz Vertical

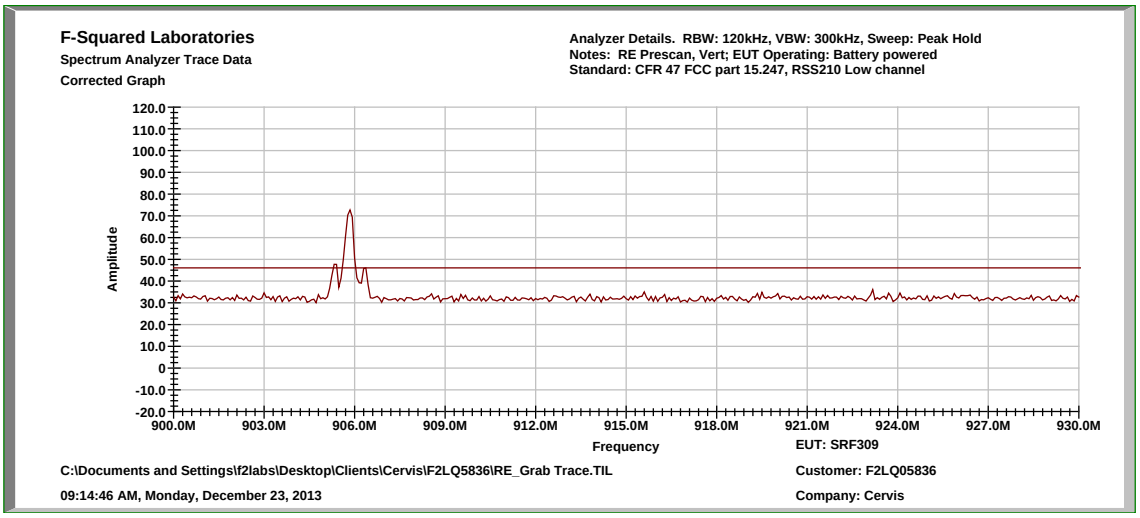


30 MHz to 900 MHz Horizontal

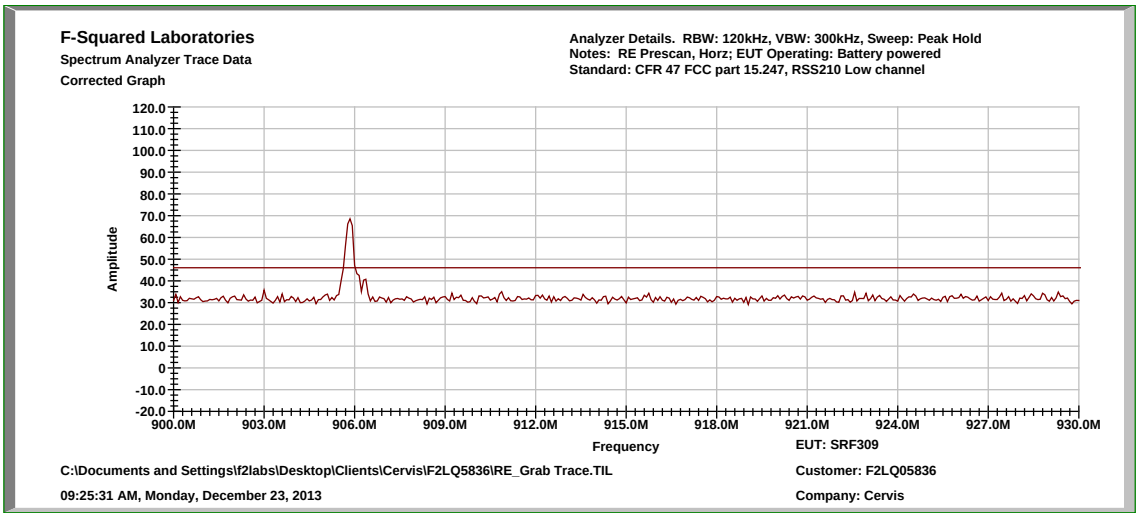


Radiated Spurious Emission with 1.49dBi Chip Antenna: Low Channel, cont'd

900 MHz to 930 MHz Vertical

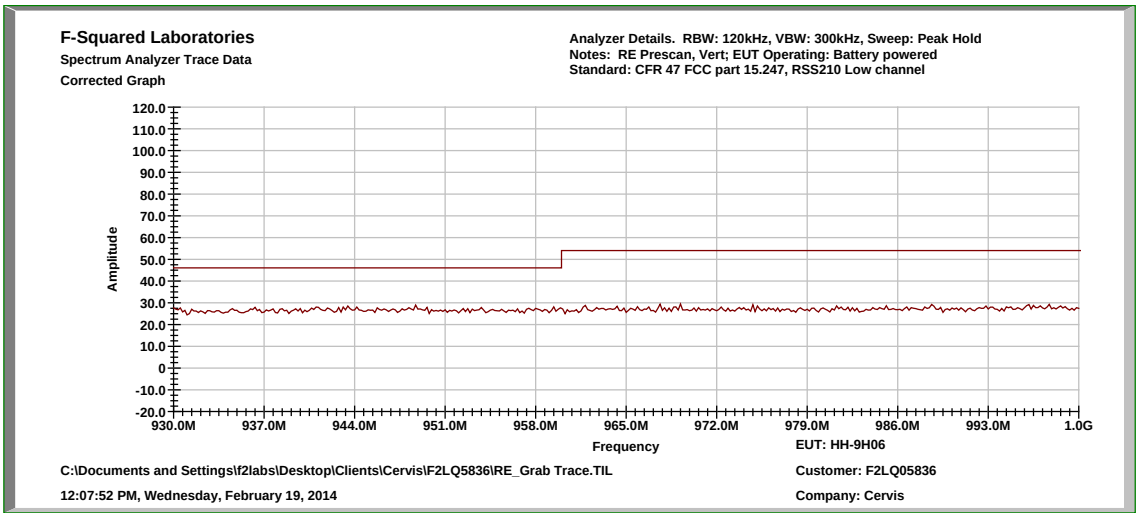


900 MHz to 930 MHz Horizontal

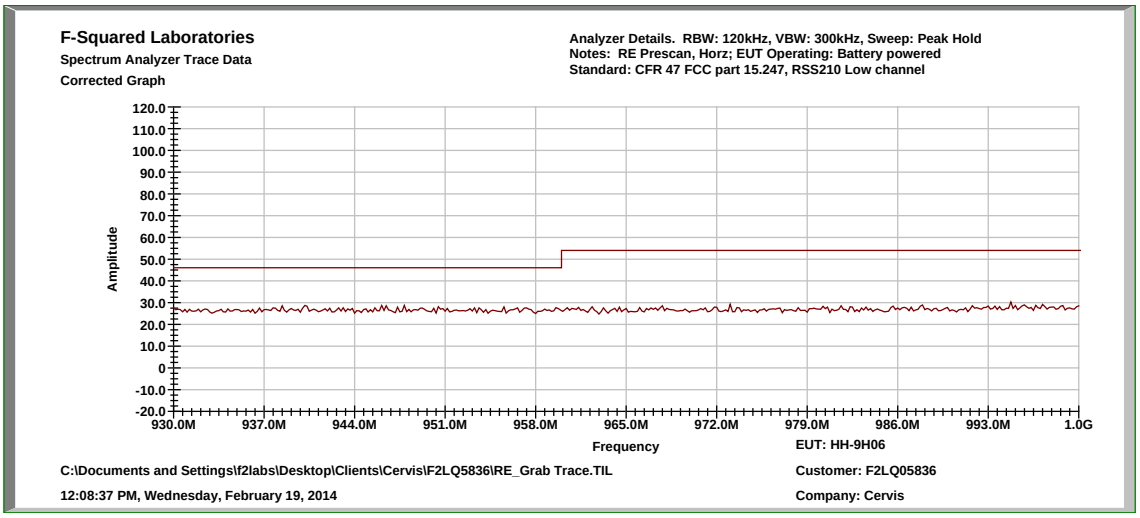


Radiated Spurious Emission with 1.49dBi Chip Antenna: Low Channel, cont'd

930 MHz to 1 GHz Vertical

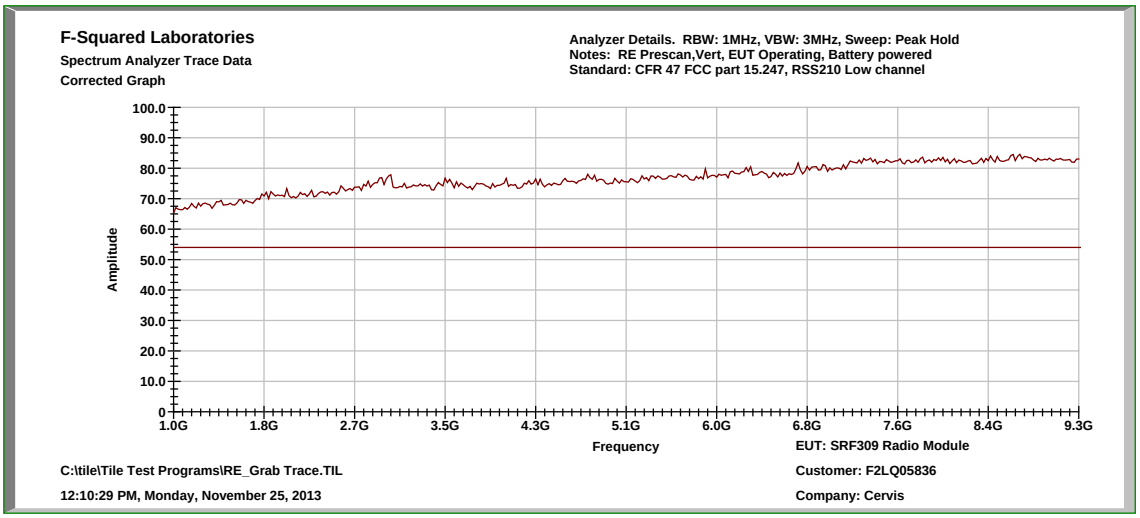


930 MHz to 1 GHz Horizontal

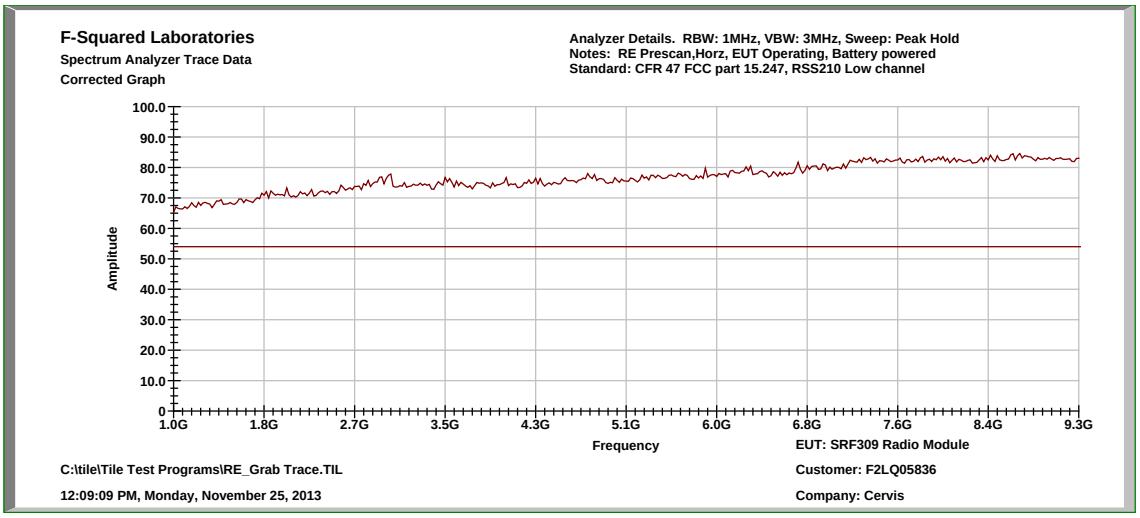


Radiated Spurious Emission with 1.49dBi Chip Antenna: Low Channel, cont'd

1 GHz to 9.25 GHz Vertical

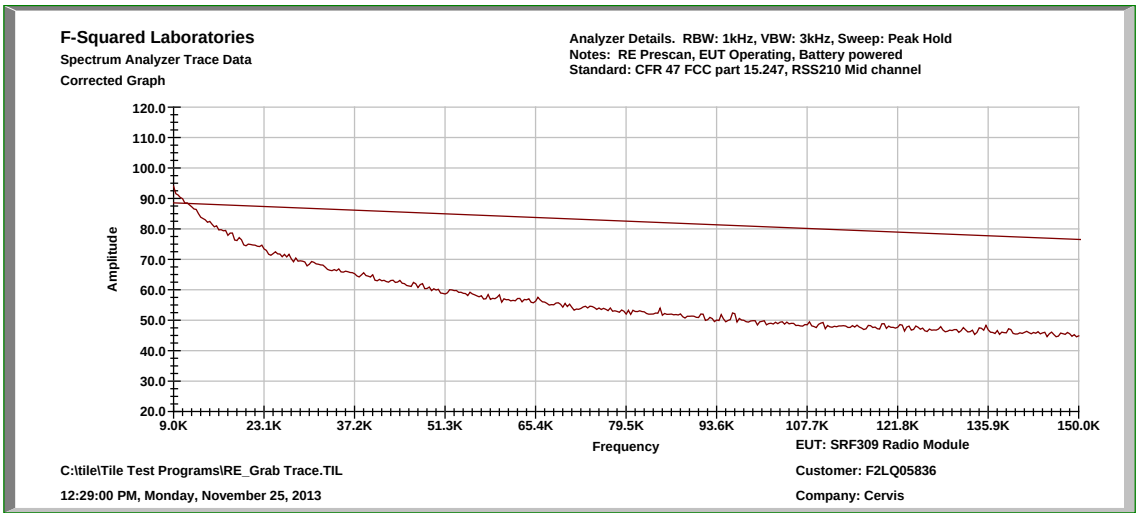


1 GHz to 9.25 GHz Horizontal

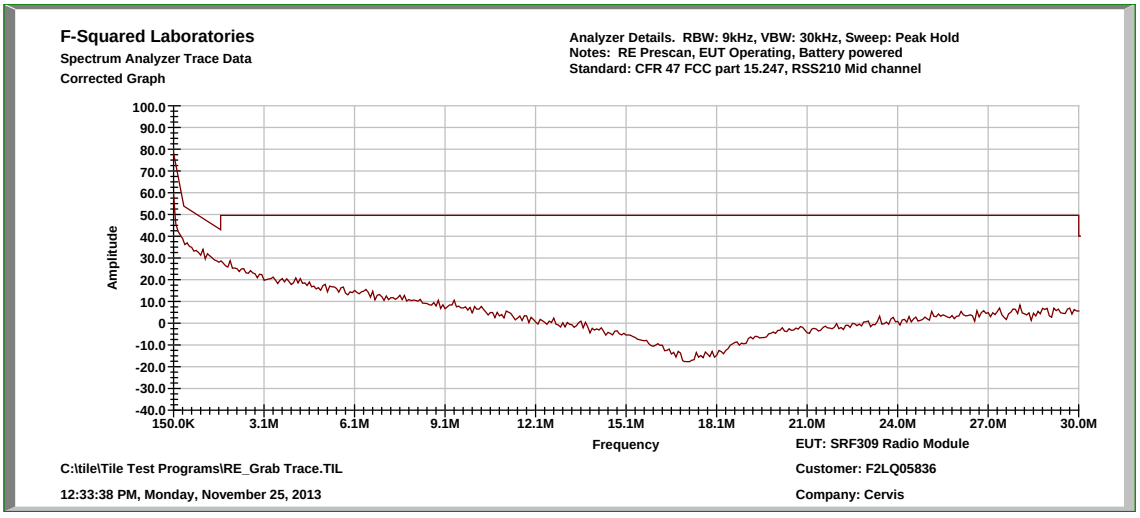


Radiated Spurious Emission with 1.49dBi Chip Antenna: Mid Channel

9kHz to 150kHz

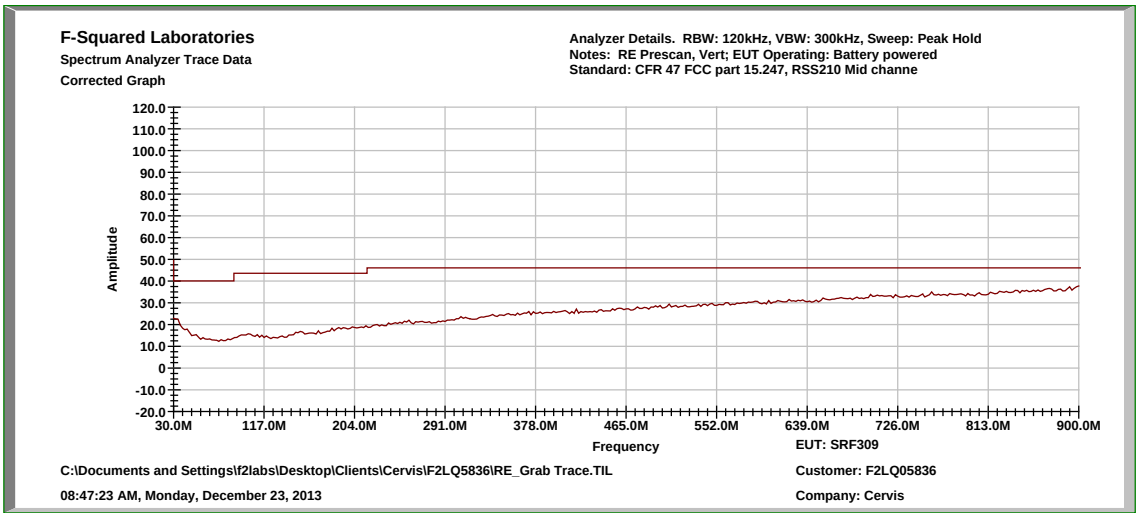


150kHz to 30 MHz

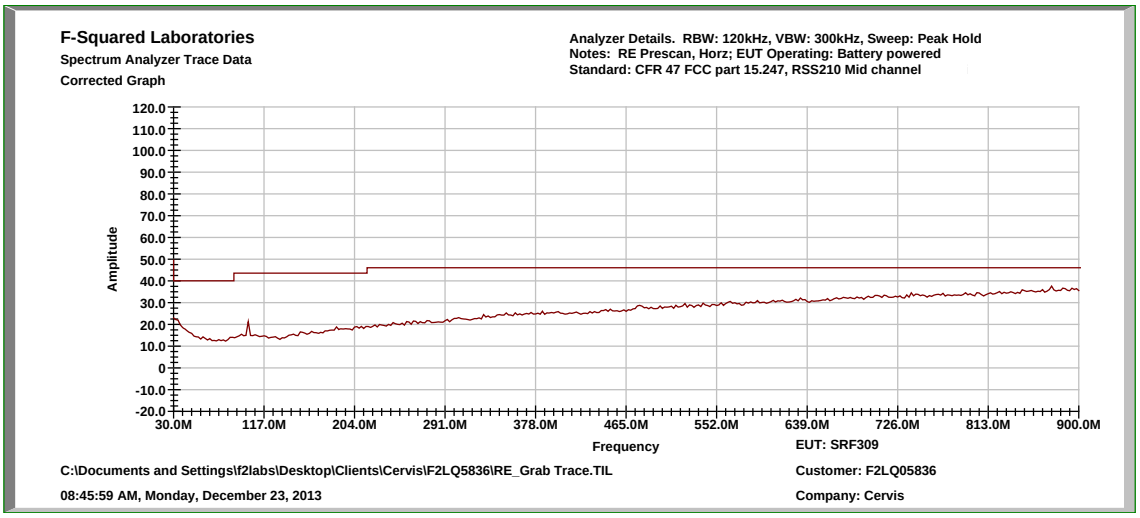


Radiated Spurious Emission with 1.49dBi Chip Antenna: Mid Channel, cont'd

30 MHz to 900 MHz Vertical

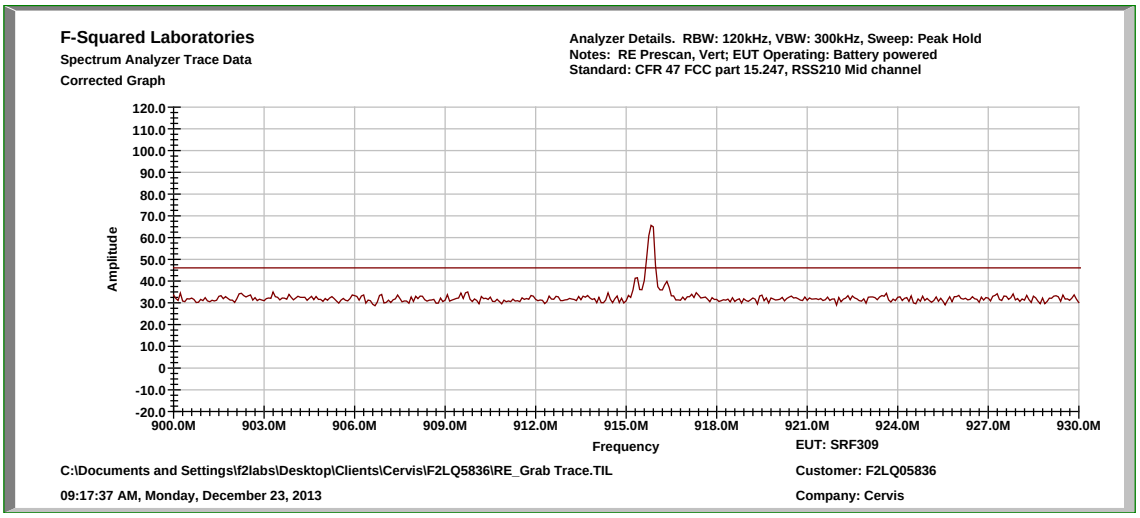


30 MHz to 900 MHz Horizontal

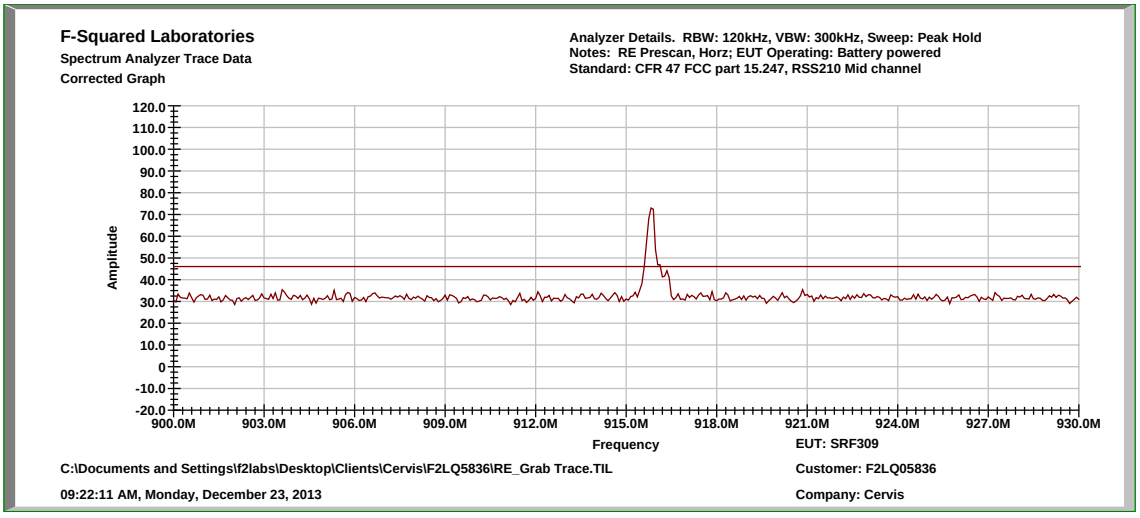


Radiated Spurious Emission with 1.49dBi Chip Antenna: Mid Channel, cont'd

900 MHz to 930 MHz Vertical

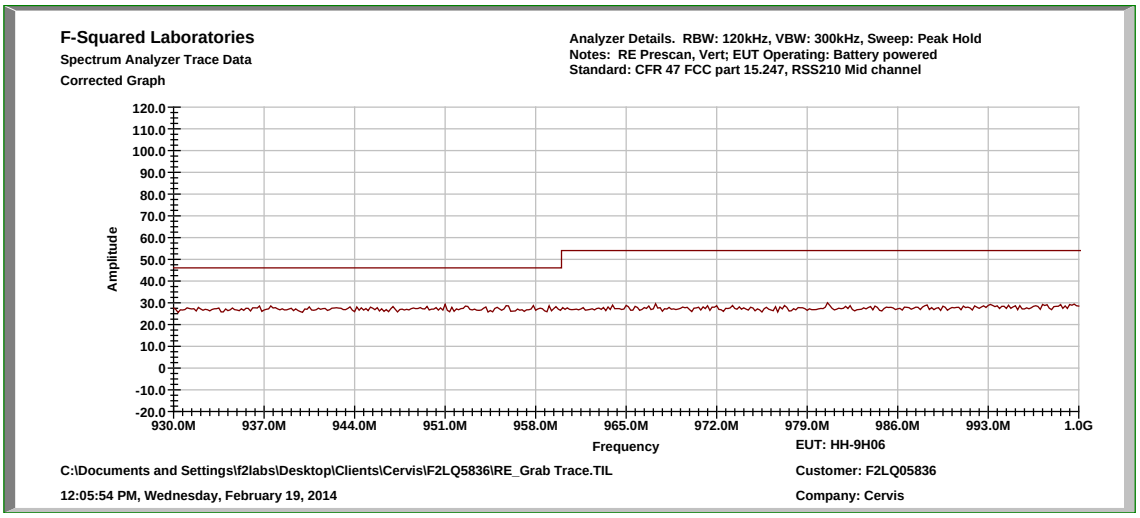


900 MHz to 930 MHz Horizontal

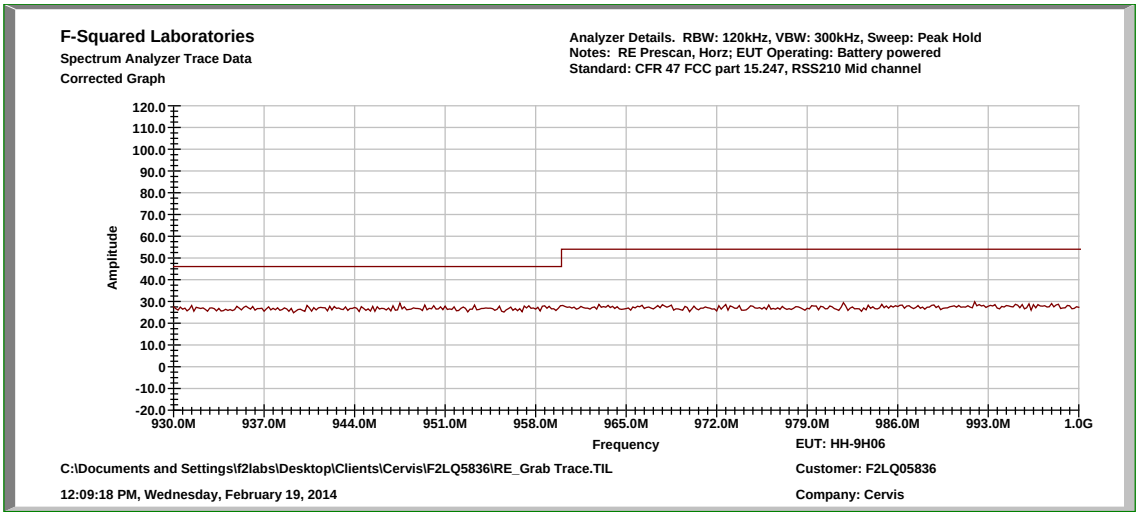


Radiated Spurious Emission with 1.49dBi Chip Antenna: Mid Channel, cont'd

930 MHz to 1 GHz Vertical

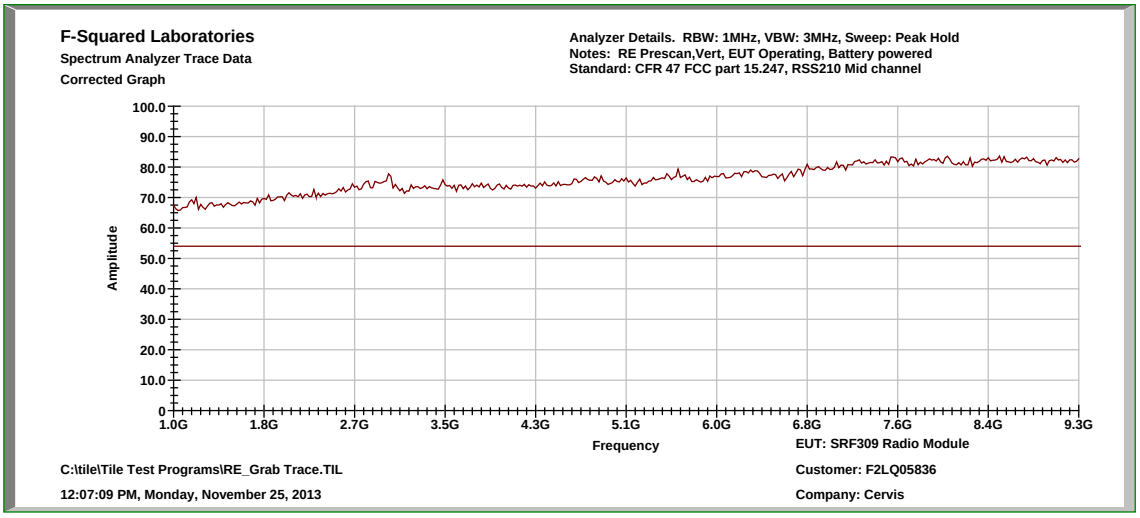


930 MHz to 1 GHz Horizontal

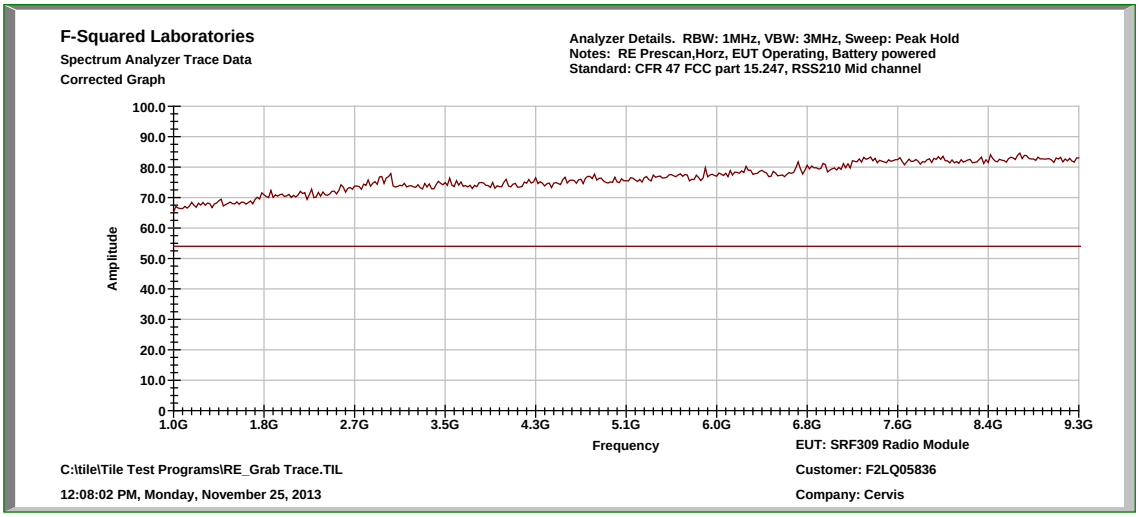


Radiated Spurious Emission with 1.49dBi Chip Antenna: Mid Channel, cont'd

1 GHz to 9.25 GHz Vertical

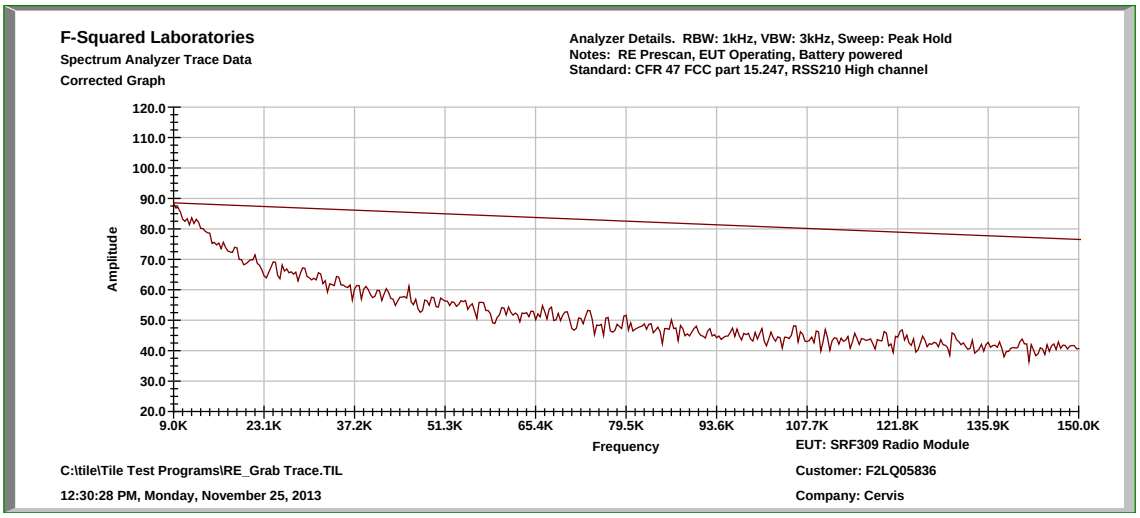


1 GHz to 9.25 GHz Horizontal

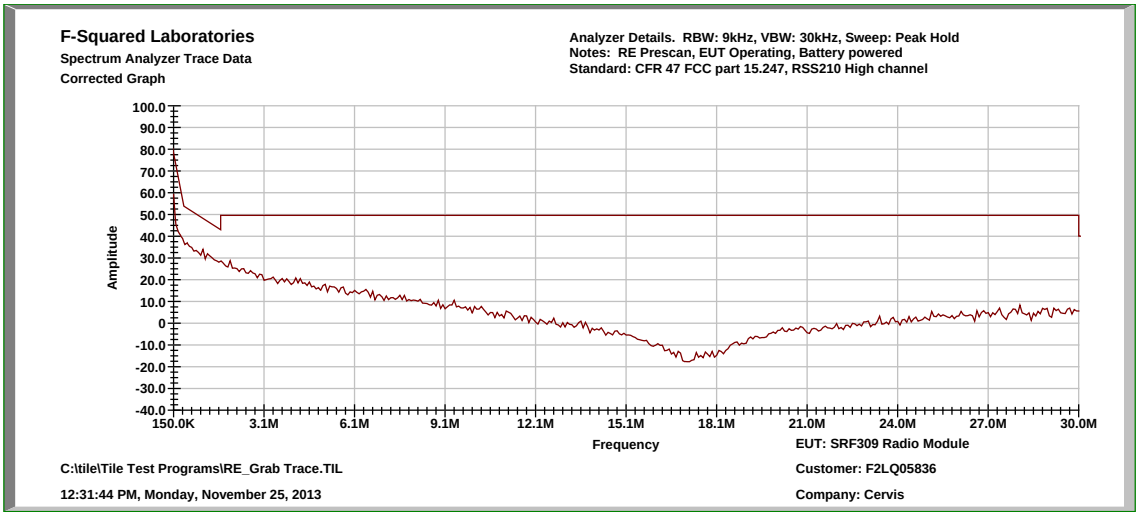


Radiated Spurious Emission with 1.49dBi Chip Antenna: High Channel

9kHz to 150kHz

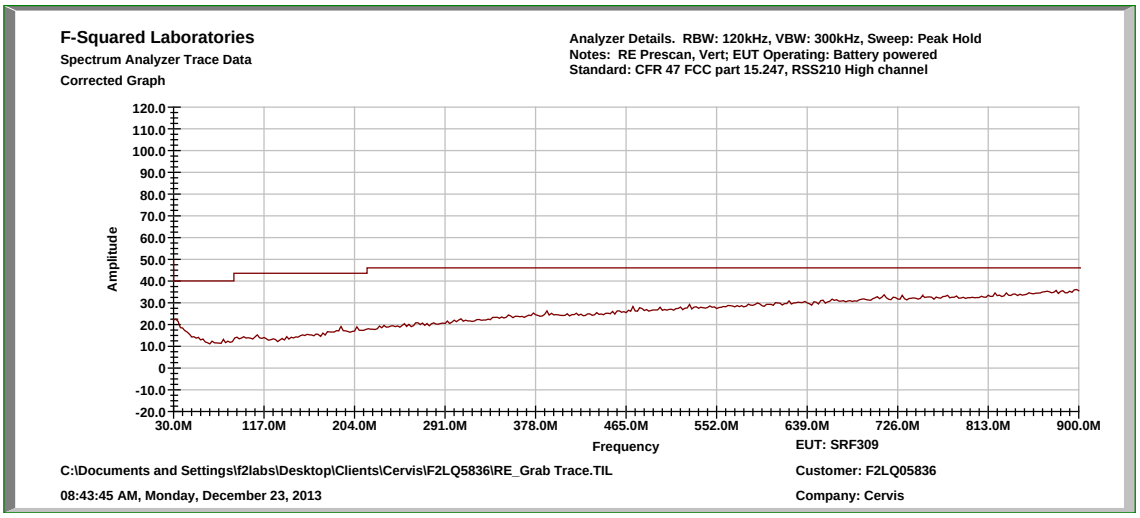


150kHz to 30 MHz

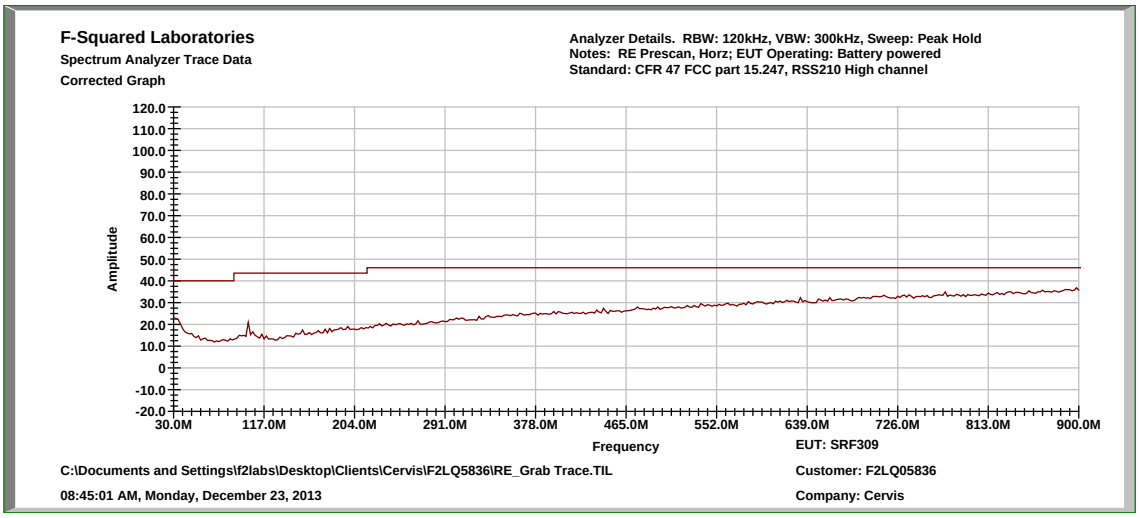


Radiated Spurious Emission with 1.49dBi Chip Antenna: High Channel, cont'd

30 MHz to 900 MHz Vertical

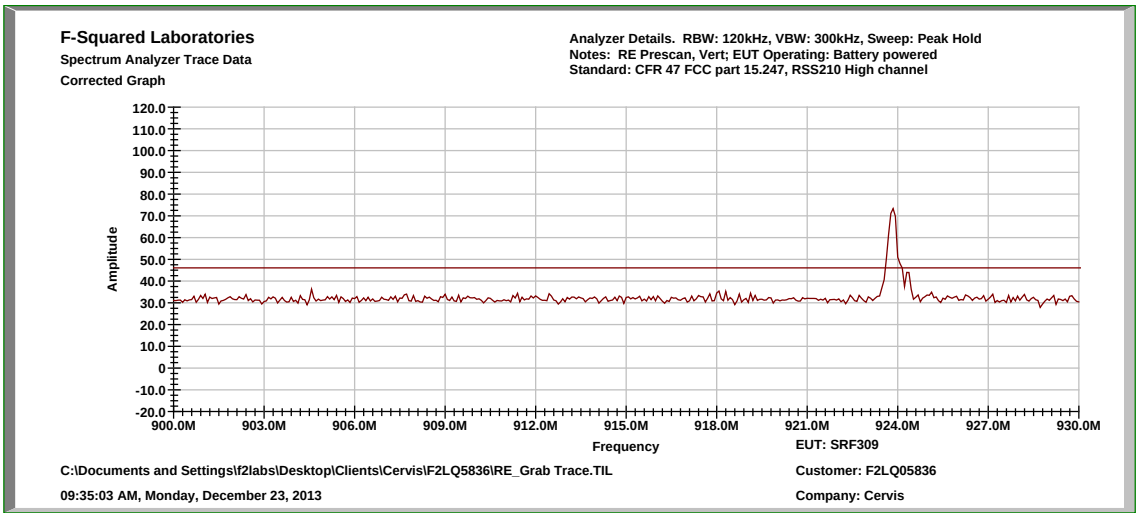


30 MHz to 900 MHz Horizontal

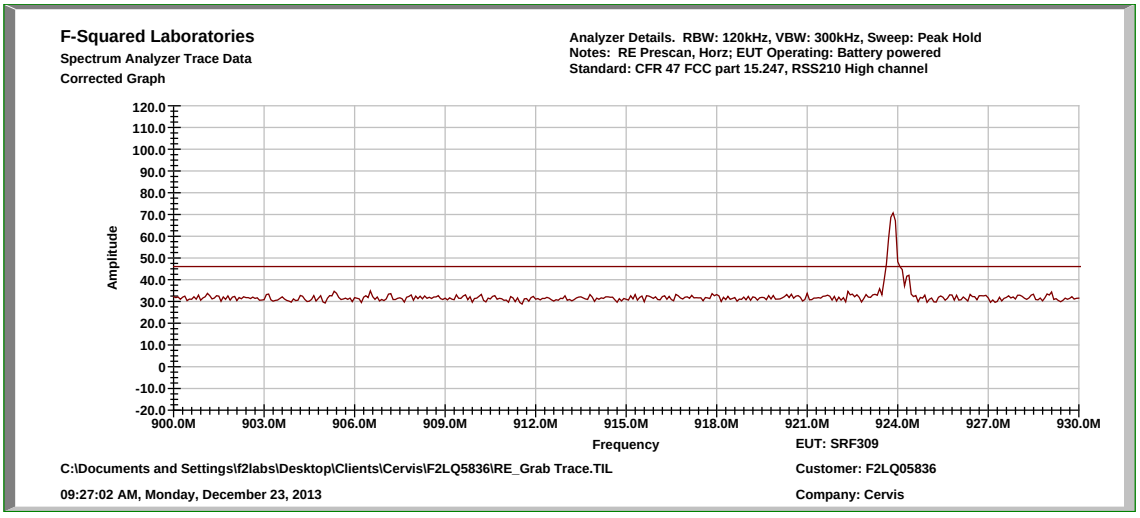


Radiated Spurious Emission with 1.49dBi Chip Antenna: High Channel, cont'd

900 MHz to 930 MHz Vertical

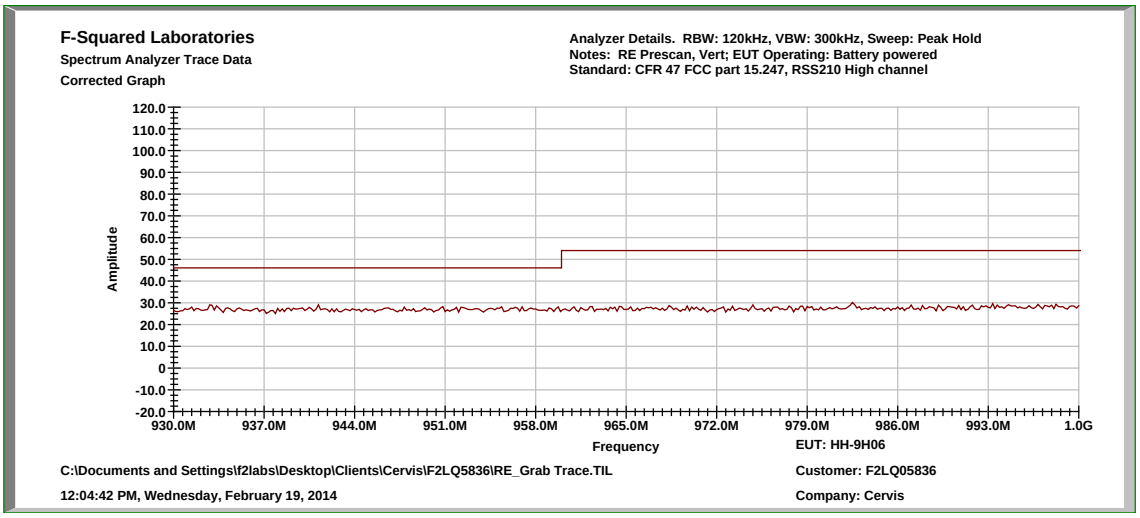


900 MHz to 930 MHz Horizontal

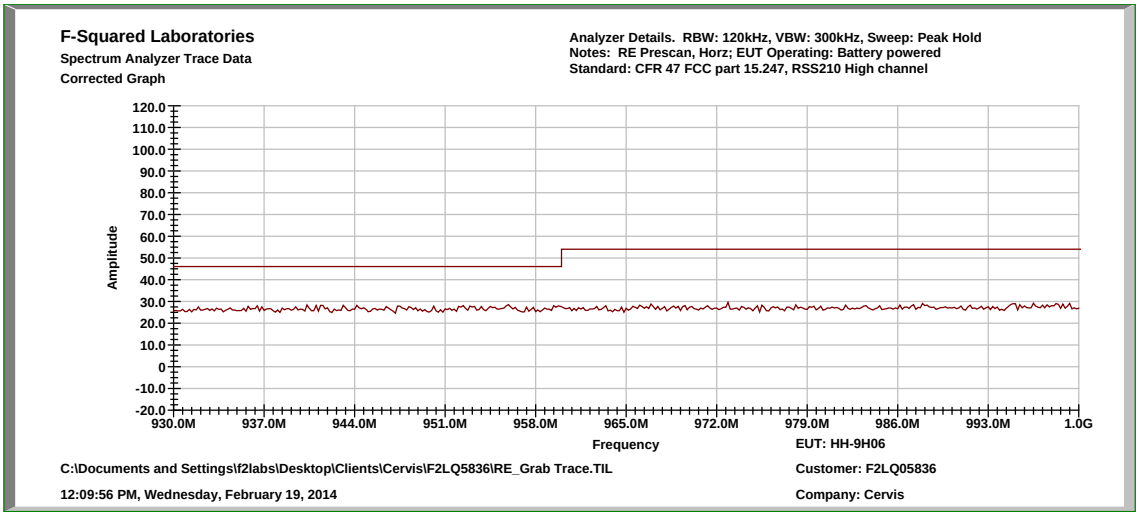


Radiated Spurious Emission with 1.49dBi Chip Antenna: High Channel, cont'd

930 MHz to 1 GHz Vertical

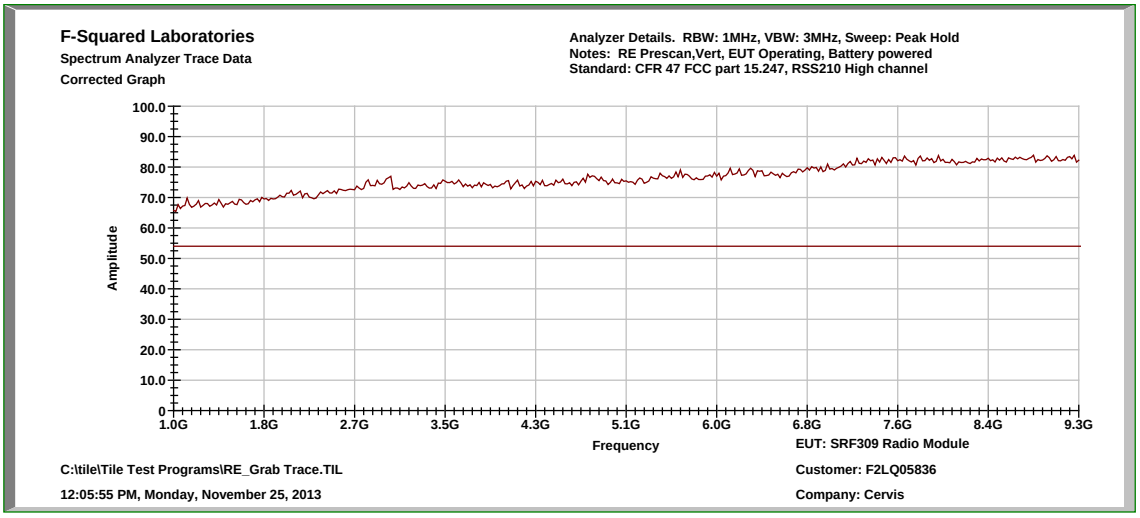


930 MHz to 1GHz Horizontal

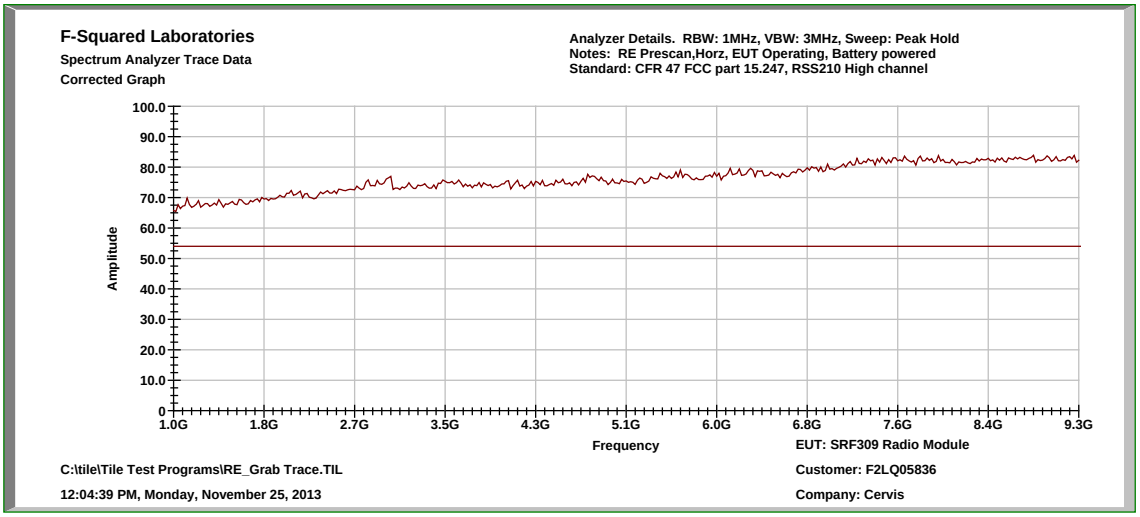


Radiated Spurious Emission with 1.49dBi Chip Antenna: High Channel, cont'd

1 GHz to 9.25 GHz Vertical



1 GHz to 9.25 GHz Horizontal



Measurements

Low Channel - Vertical

Frequency MHz	QP dBµV/m	Limit dBµV/m	BW kHz	Pol.	Corr. dB
901.930000	38.7	46.0	120.000	V	30.6
902.600000	38.8	46.0	120.000	V	30.6
909.960000	39.2	46.0	120.000	V	30.8
914.000000	39.0	46.0	120.000	V	30.7
915.010000	39.2	46.0	120.000	V	30.8
920.010000	39.3	46.0	120.000	V	30.9
925.090000	39.2	46.0	120.000	V	30.9
927.920000	39.5	46.0	120.000	V	31.1

Low Channel - Horizontal

Frequency MHz	QP dBµV/m	Limit dBµV/m	BW kHz	Pol.	Corr. dB
86.030000	20.2	40.0	120.00	H	9.2
150.470000	21.2	43.5	120.00	H	13.9
900.320000	39.1	46.0	120.00	H	31.0
902.120000	39.2	46.0	120.00	H	31.0
903.390000	39.3	46.0	120.00	H	31.1
904.880000	40.8	46.0	120.00	H	31.1
910.060000	39.6	46.0	120.00	H	31.3
919.920000	39.6	46.0	120.00	H	31.4
925.000000	39.7	46.0	120.00	H	31.4
928.000000	39.9	46.0	120.00	H	31.5

Mid Channel

Frequency MHz	QP dBµV/m	Limit dBµV/m	BW kHz	Pol.	Corr. dB
901.100000	39.1	46.0	120.000	H	31.0
901.740000	39.2	46.0	120.000	V	31.0
902.150000	39.3	46.0	120.000	H	31.0
902.500000	39.2	46.0	120.000	V	31.0
904.720000	39.2	46.0	120.000	V	31.1
907.630000	39.4	46.0	120.000	H	31.2
910.120000	39.6	46.0	120.000	V	31.3
912.170000	39.6	46.0	120.000	H	31.2
912.450000	39.8	46.0	120.000	V	31.2
917.520000	39.7	46.0	120.000	V	31.4
919.990000	39.6	46.0	120.000	H	31.4
925.000000	39.6	46.0	120.000	V	31.4
925.100000	39.7	46.0	120.000	H	31.4
927.470000	40.0	46.0	120.000	V	31.5
927.990000	40.0	46.0	120.000	H	31.5
928.100000	40.0	46.0	120.000	H	31.5
928.520000	39.9	46.0	120.000	V	31.5

High Channel

Frequency MHz	QP dBµV/m	Limit dBµV/m	BW kHz	Pol.	Corr. dB
901.370000	39.2	46.0	120.000	H	31.0
901.370000	39.1	46.0	120.000	H	31.0
901.810000	39.1	46.0	120.000	V	31.0
904.840000	39.2	46.0	120.000	V	31.1
904.950000	39.3	46.0	120.000	H	31.1
910.020000	39.6	46.0	120.000	H	31.3
910.040000	39.5	46.0	120.000	V	31.3
914.860000	39.1	46.0	120.000	V	30.8
915.140000	39.8	46.0	120.000	H	31.4
915.140000	39.7	46.0	120.000	H	31.4
919.900000	39.2	46.0	120.000	V	30.9
919.920000	39.7	46.0	120.000	H	31.4
926.010000	39.9	46.0	120.000	V	31.0
927.500000	39.5	46.0	120.000	V	31.0
927.520000	40.0	46.0	120.000	H	31.5
928.100000	39.5	46.0	120.000	V	31.1
928.250000	39.9	46.0	120.000	H	31.5

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

Peak power spectral density measurements were performed.

10.1 Requirements:

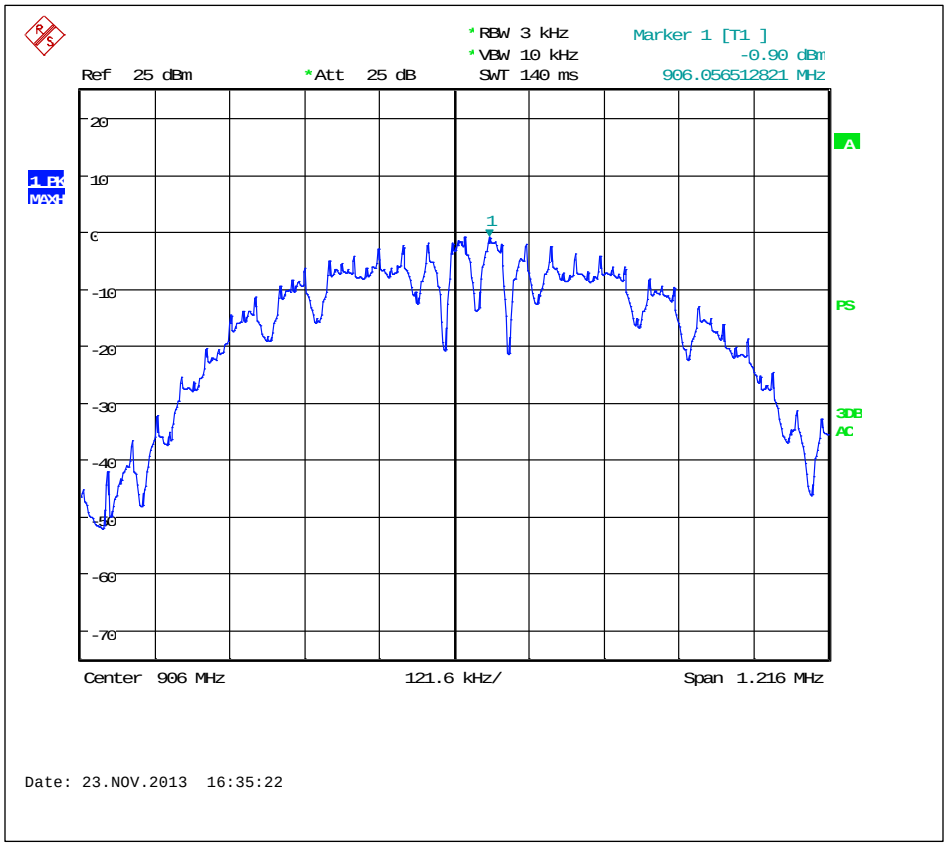
The peak power spectral density shall not exceed +8dBm in any 3 kHz band during any time interval of continuous transmission.

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.

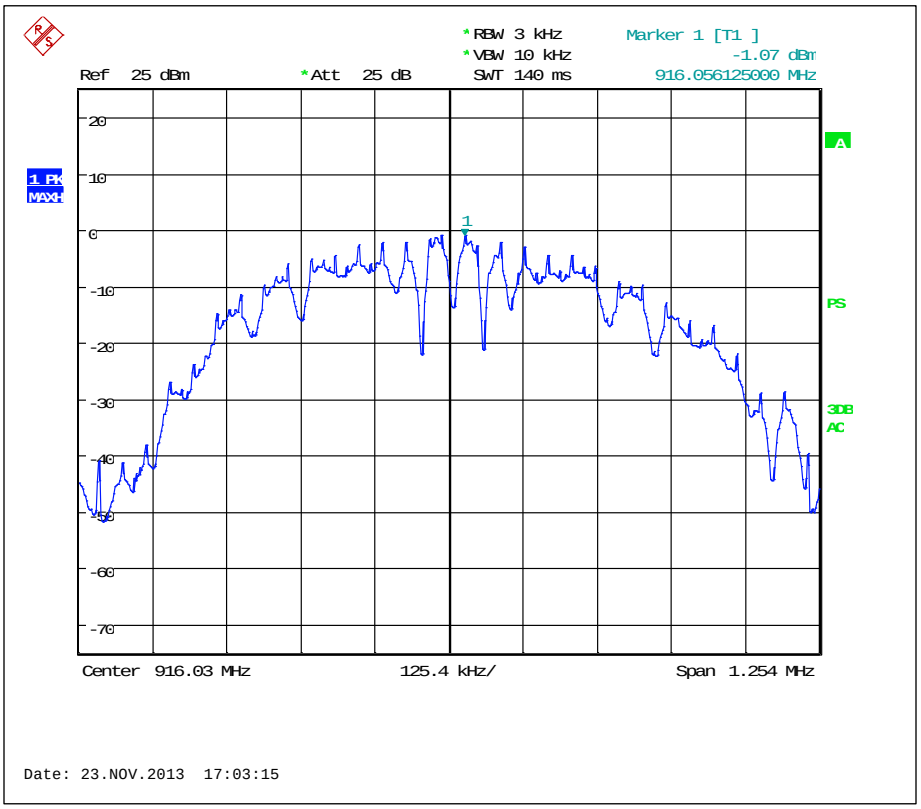
10.2 Peak Power Spectral Density Test Data

Test Date:	Nov. 23, 2013	Test Engineer:	K. Littell
Standards:	CFR 47 Part 15.247; KDB558074	Air Temperature:	20.2ºC
		Relative Humidity:	48%

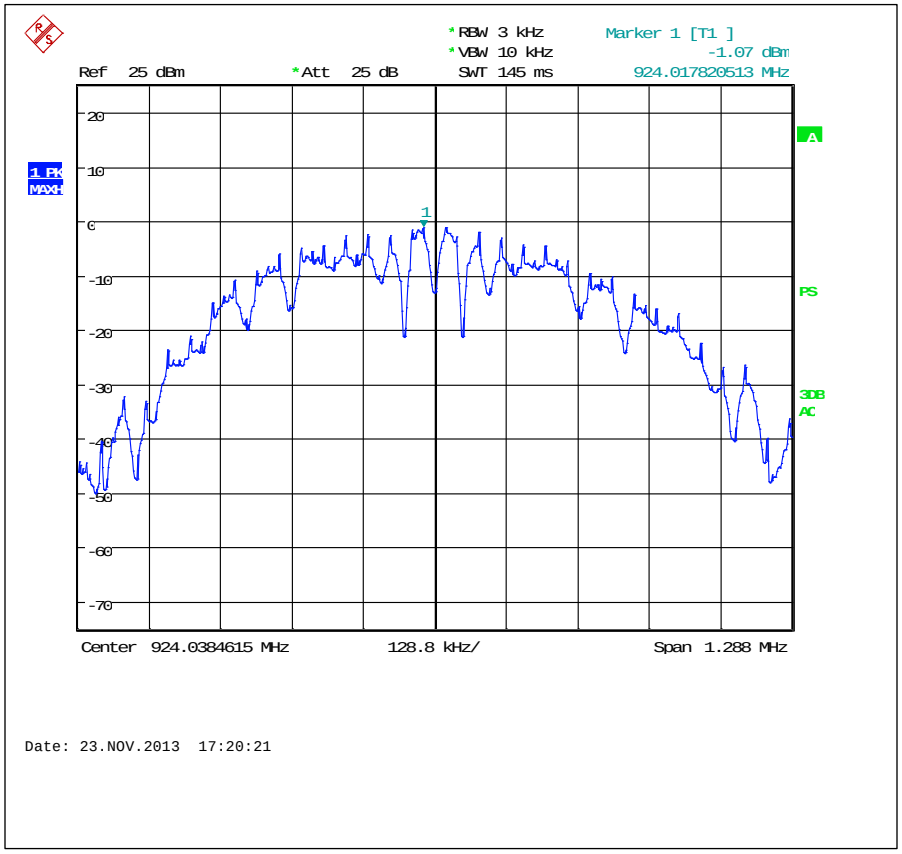
Low Channel



Mid Channel

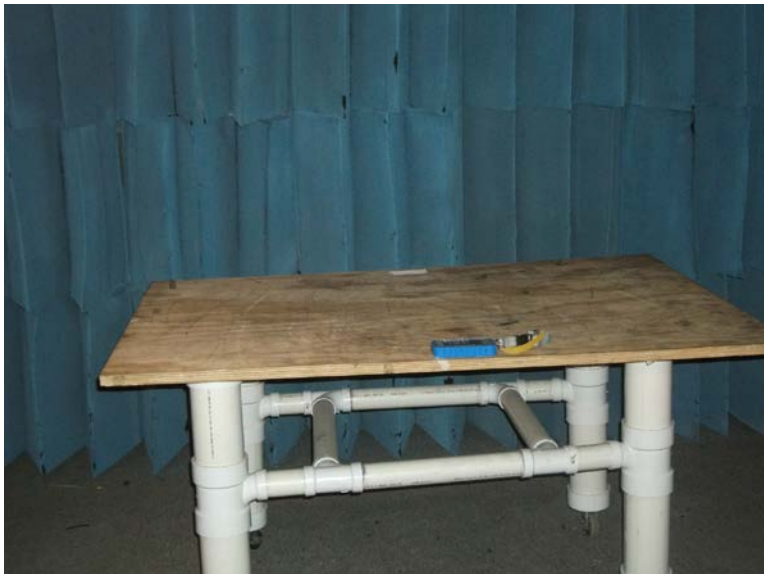
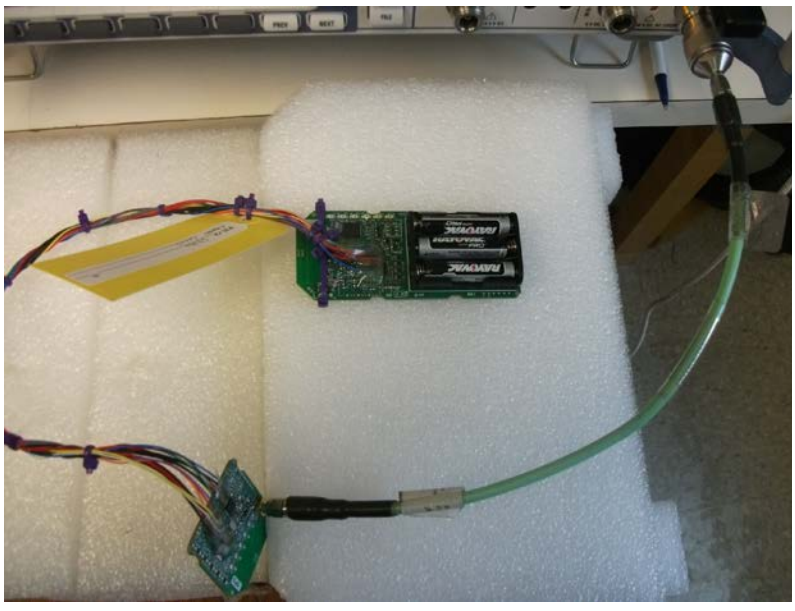

*RBW 3 kHz
*VBW 10 kHz
SWT 140 ms
Marker 1 [T1]
-1.07 dBm
916.056125000 MHz
Ref 25 dBm
*Att 25 dB
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 916.03 MHz
125.4 kHz/
Span 1.254 MHz
Date: 23.NOV.2013 17:03:15

High Channel



11 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Radiated Spurious Emission with 1.49dBi Chip Antenna



Conducted Output Power, Peak Power Spectral Density, -6dB Occupied Bandwidth, and Conducted Spurious Emissions