



F2 Labs
16740 Peters Road
Middlefield, Ohio 44062
United States of America
www.f2labs.com

CERTIFICATION TEST REPORT

Manufacturer: CSE Corporation
800 Seco Road
Monroeville, Pennsylvania 15146
United States of America

Applicant: Same As Above

Product: Mine Safety Tag

Model: SR2000

FCC ID: 2ADSZ-12122014

Testing Commenced: Dec. 10, 2014

Testing Ended: Dec. 10, 2014

Summary of Test Results: Page 5

Standards:

- ❖ FCC Part 15 Subpart C, Section 15.249
- ❖ FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations
- ❖ FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards



Order Number: F2LQ6381

Client: CSE International

Model: SR2000

Evaluation Conducted by:

Joe Knepper, EMC Proj. Eng.

Report Reviewed by:

Ken Littell, EMC Tech. Mgr.

F2 Labs
26501 Ridge Road
Damascus, MD 20872
Ph 301.253.4500
Fax 301.253.5179

F2 Labs
16740 Peters Road
Middlefield, OH 44062
Ph 440.632.5541
Fax 440.632.5542

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TABLE OF CONTENTS

Section	Title	Page
1	ADMINISTRATIVE INFORMATION	4
2	SUMMARY OF TEST RESULTS/MODIFICATIONS	4
3	TABLE OF MEASURED RESULTS	5
4	ENGINEERING STATEMENT	6
5	LIST OF MEASUREMENT INSTRUMENTATION	7
6	EUT INFORMATION AND DATA	8
7	FCC Part 15.215(c) – 20dB OCCUPIED BANDWIDTH	10
8	FCC Part 15.249(a)(d) – FIELD STRENGTH OF EMISSIONS	14
9	PHOTOS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS	35



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 15.249. 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
F2LQ6381-01E	First Issue	Dec. 22, 2014	K. Littell
F2LQ6381-01E Rev. 1	Modification of Correction Factors	Apr. 20, 2015	K. Littell

**2 SUMMARY OF TEST RESULTS**

Test Name	Standard(s)	Results
-20dB Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
Field Strength of Emissions	CFR 47 Part 15.249(a)(d)	Complies

Modifications Made to the Equipment
None



3 TABLE OF MEASURED RESULTS

Test	High Channel 926 MHz	Mid Channel 914 MHz	Low Channel 904 MHz
Quasi-Peak Field Strength of Fundamental	92.5 dB μ V/m	90.5 dB μ V/m	91.5 dB μ V/m
Quasi-Peak Limit for Fundamental	(94dBuV/m)	(94dBuV/m)	(94dBuV/m)
-20dB Occupied Bandwidth	512.9	510.95	519.448

The 20 dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.



4 ENGINEERING STATEMENT

This report has been prepared on behalf of CSE International to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.249 of the FCC Rules using ANSI C63.4 2009 standard. The test results found in this test report relate only to the items tested.



5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: Safety Mine Tag

Model: SR2000

Serial No.: None Specified

FCC ID: 2ADSZ-12122014

5.2 Trade Name:

CSE International

5.3 Power Supply:

Battery-operated

5.4 Applicable Rules:

CFR 47, Part 15.249

5.5 Equipment Category:

Radio Transmitter-DTS

5.6 Antenna:

Integral 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 testing manner, powered by a new battery. EUT transmitted at high, mid and low frequencies.

**6 LIST OF MEASUREMENT INSTRUMENTATION**

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	May 5, 2015
OATS-3m	CL017	Compliance Labs	N/A	001	Dec. 13, 2014
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Nov. 17, 2015
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Nov. 12, 2015
Antenna 1-Chamber	0142	ETS/EMCO	3142B	9811-1330	Verified
Antenna 2-OATS	0105	Sunol Sciences	JB1	A101101	May 7, 2015
Pre-Amplifier	CL045	Hewlett-Packard	8447D	2944A08445	Nov. 15, 2015
Horn Antenna	CL098	Emco	3115	9809-5580	Dec. 3, 2015
Pre-Amplifier	CL045	Hewlett-Packard	8447D	2944A08445	Nov. 15, 2015
Pre-Amplifier	CL153	Agilent	83006-69007	MY39500900	Jan. 9, 2015
Amp. w/Monopole & 18" Loop	CL163	A.H. Systems, Inc.	EHA-52B	100	Apr. 24, 2015
Software:	Tile Version 1.0		Software Verified: Dec. 10, 2014		
Software:	EMC 32, Version 5.20.2		Software Verified: Dec. 10, 2014		



7 FCC PART 15.215(e) – OCCUPIED BANDWIDTH

7.1 Requirements:

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

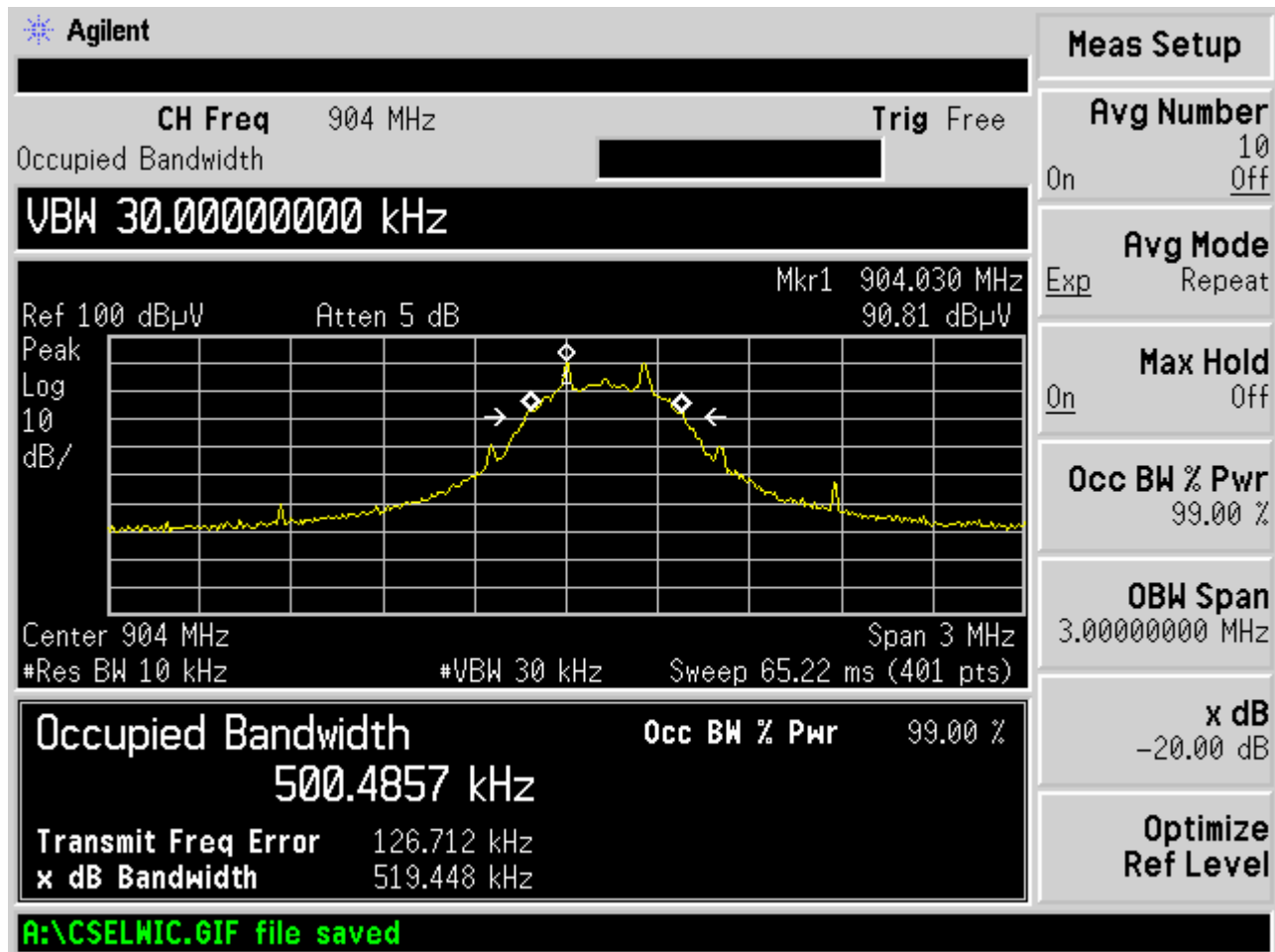
Bandwidth measurements were made at the low (904 MHz), mid (914 MHz) and upper (926 MHz) frequencies. The bandwidth was measured using the analyzer's marker function.



7.2 Occupied Bandwidth Test Data

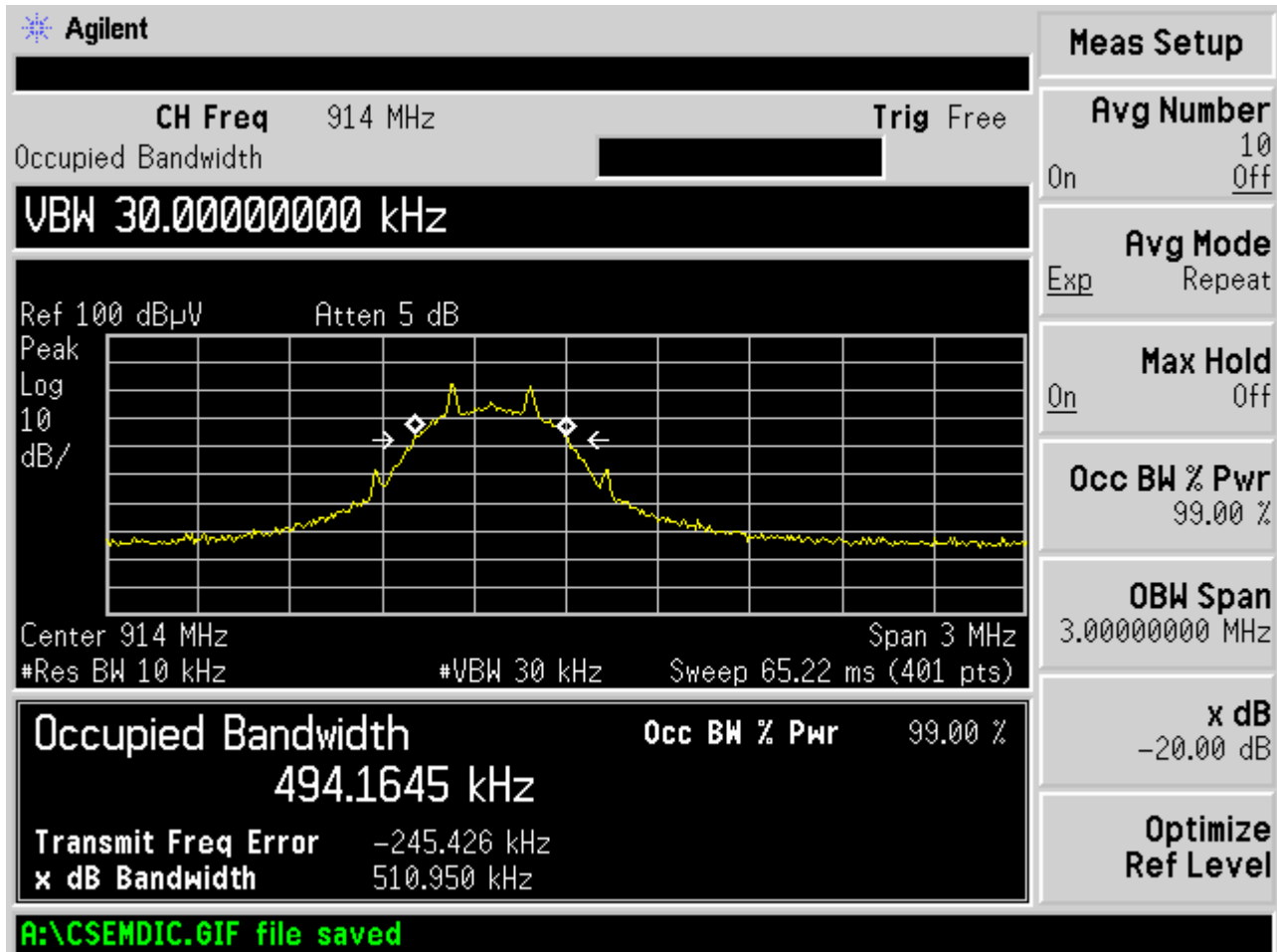
Test Date:	Dec. 10, 2014	Test Engineer(s):	J. Knepper
Standards:	CFR 47 Part 15.215(c)	Air Temperature:	20.8°C
		Relative Humidity:	43%

Low Channel



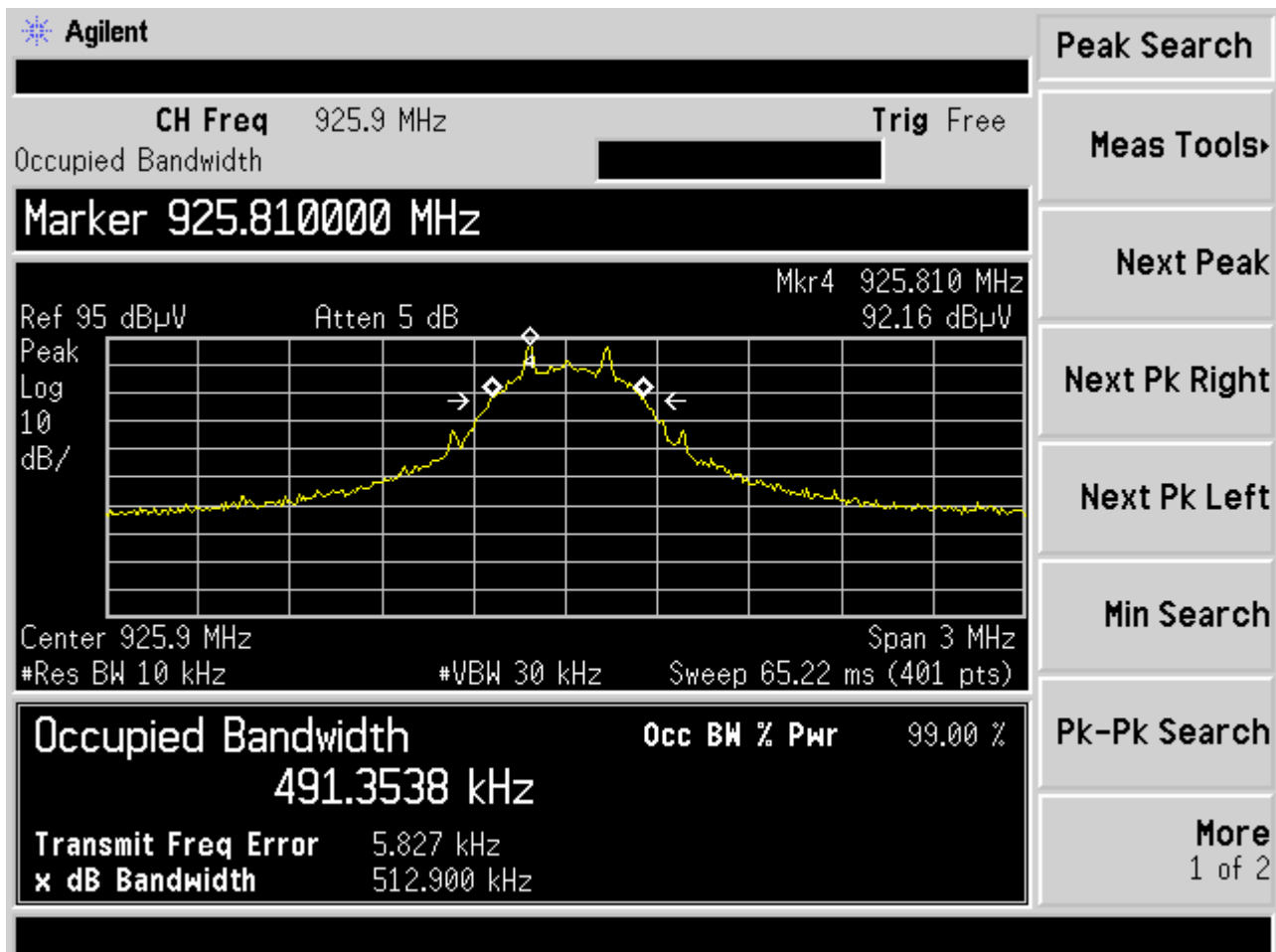


Mid Channel





High Channel



**8 FCC PART 15.249(a)(d) – FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS**

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

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

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

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

**8.1 Test Data - Field Strength of Emissions from Intentional Radiators**

Test Date:	Dec. 10, 2014	Test Engineer(s):	J. Knepper
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	10.7°C
		Relative Humidity:	43%

Low Channel

Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dB μ V/m)	QuasiPeak (dB μ V/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
904.000000	V	28.40	81.1	94	-12.9	120.000
904.290000	H	28.40	91.5	94	-2.5	120.000

Mid Channel

Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dB μ V/m)	QuasiPeak (dB μ V/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
913.880000	V	28.2	80.8	94	-13.2	120.000
913.880000	H	28.2	90.5	94	-3.5	120.000

High Channel

Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dB μ V/m)	QuasiPeak (dB μ V/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
925.810000	V	28.2	80	94	-14.0	120.000
925.810000	H	28.2	92.6	94	-1.4	120.000



8.2 Test Data – Spurious Emissions

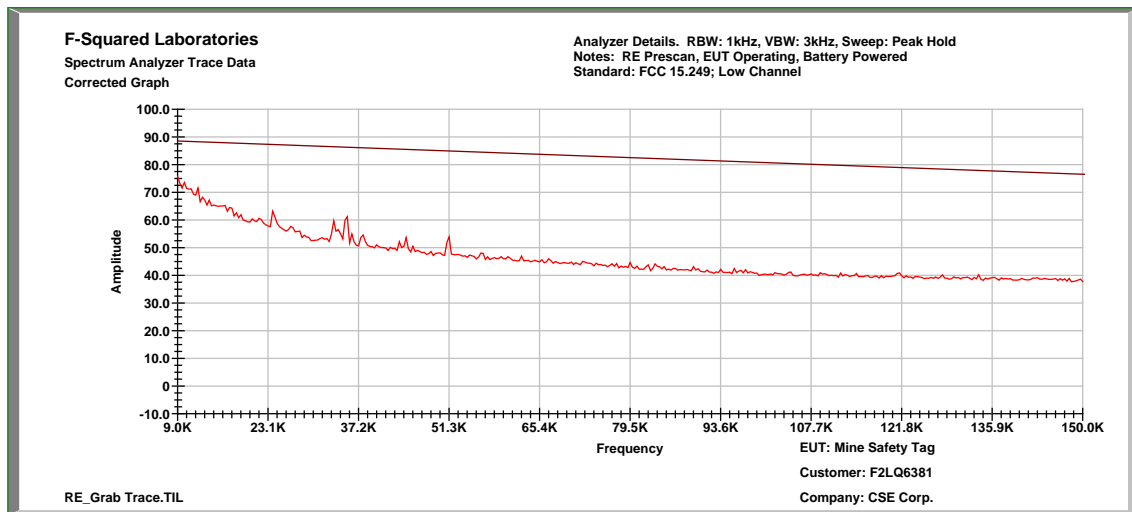
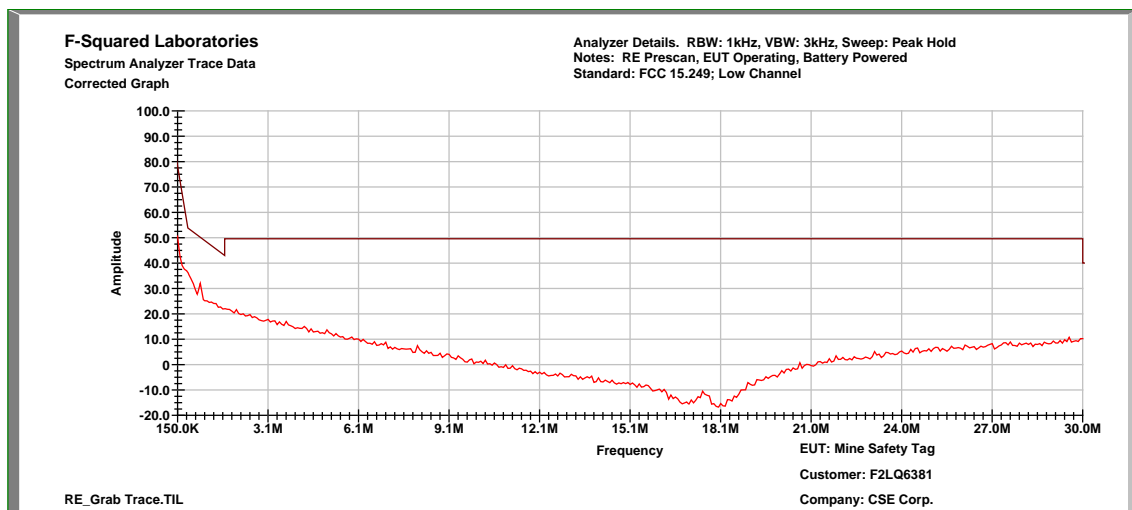
Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

At least 6 of the highest frequencies were measured per ANSI 63.4 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.

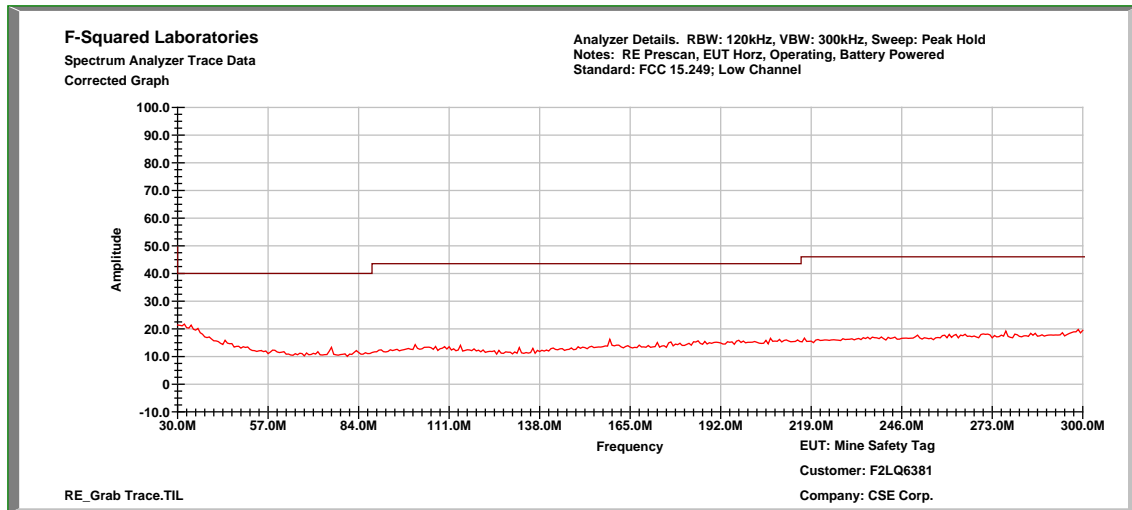


Test Date:	Dec. 10, 2014	Test Engineer(s):	J. Knepper
Standards:	CFR 47 Part 15.249(d) / Part 15.209	Air Temperature:	10.7°C
		Relative Humidity:	43%

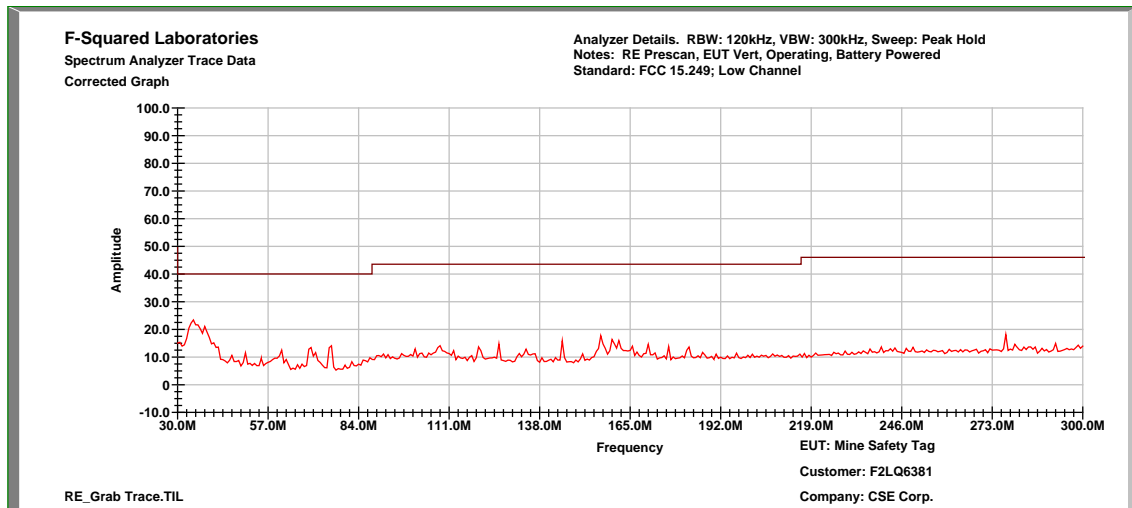
Low Channel, .009 to 0.15 MHz**Low Channel, 0.15 MHz to 30 MHz**



Low Channel, 30 MHz to 300 MHz, Horizontal

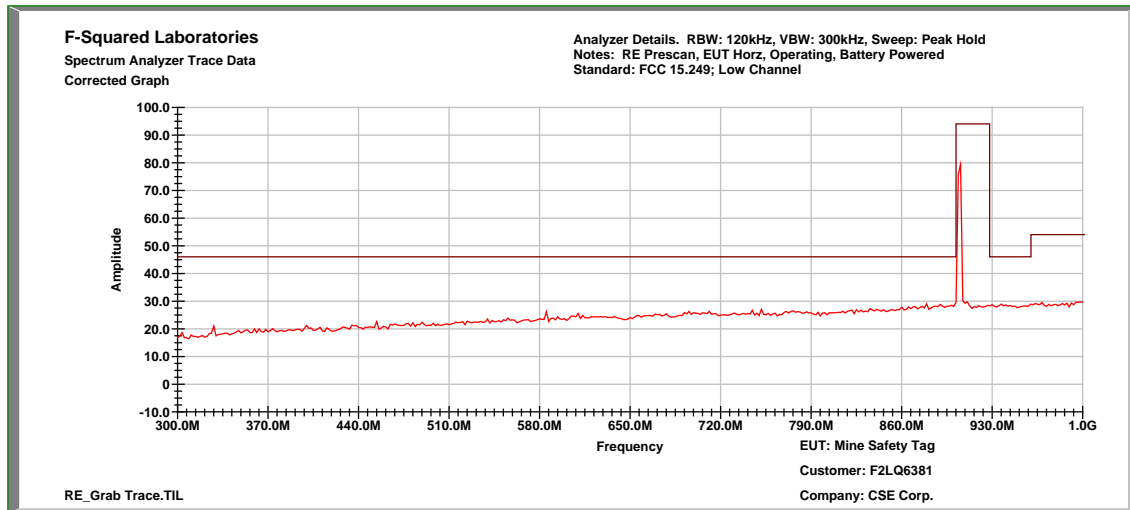


Low Channel, 30 MHz to 300 MHz, Vertical

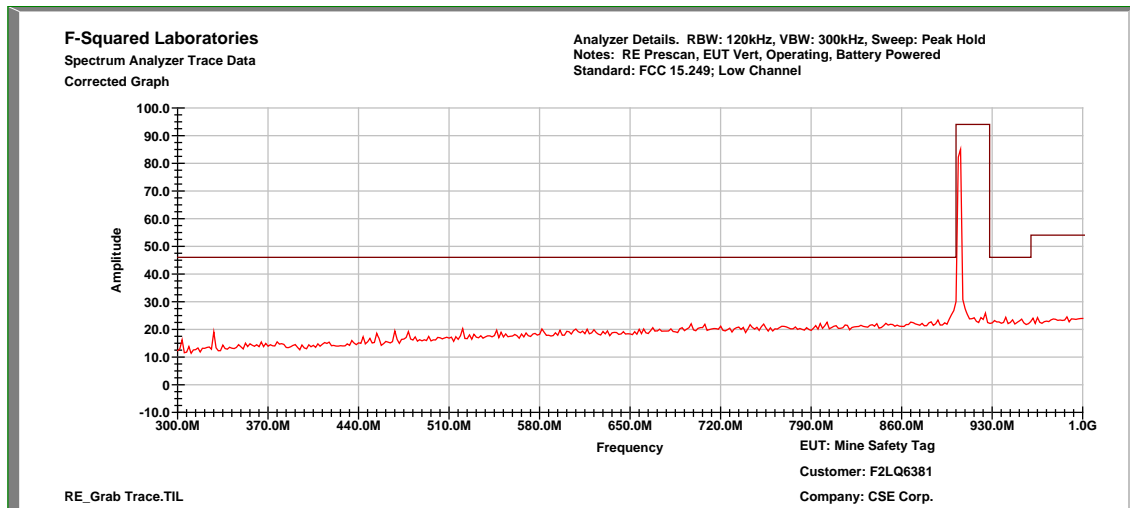




Low Channel, 300 MHz to 1 GHz, Horizontal

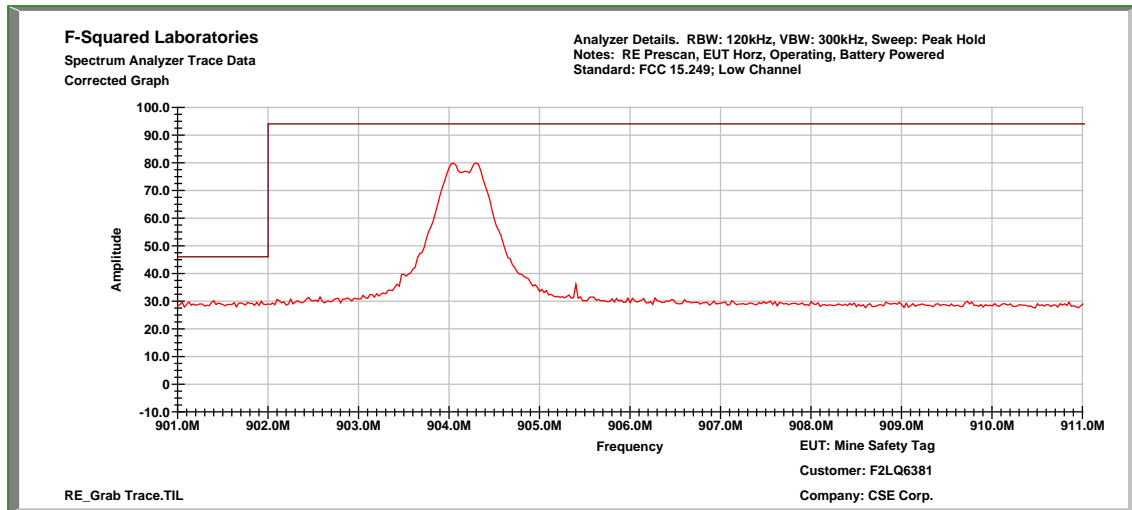


Low Channel, 300 MHz to 1 GHz, Vertical

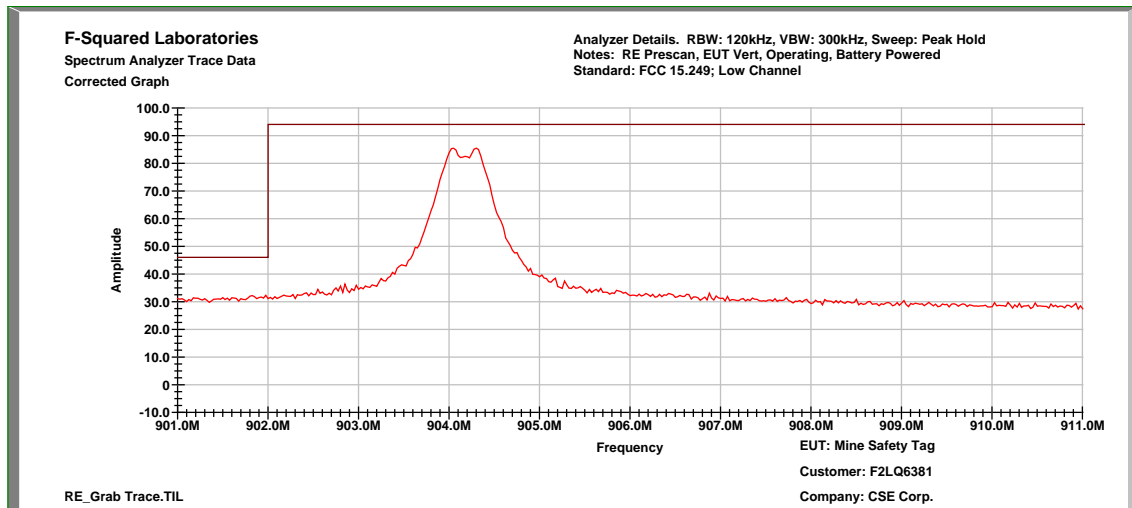




Low Channel, Fundamental, Horizontal

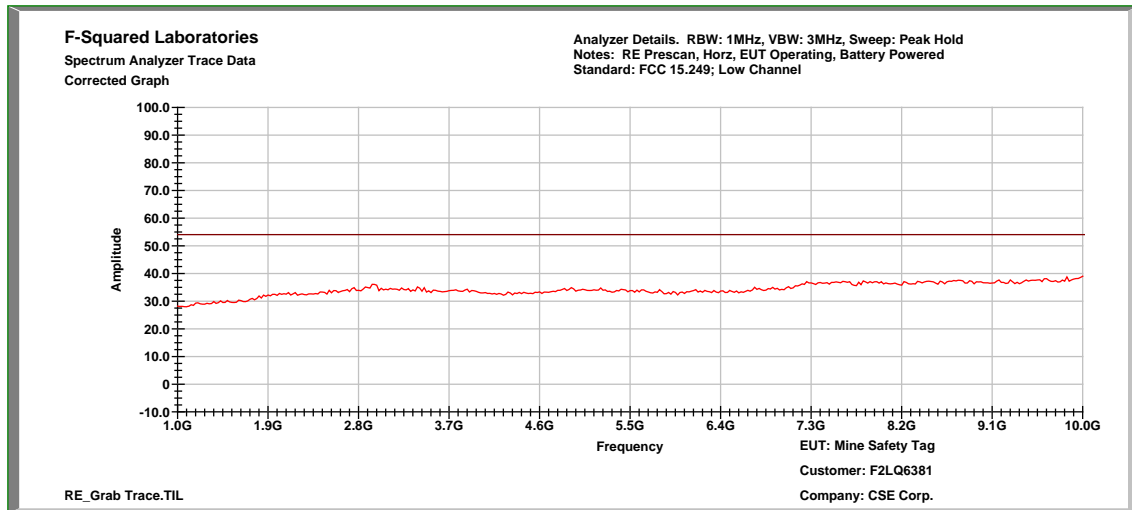


Low Channel, Fundamental, Vertical

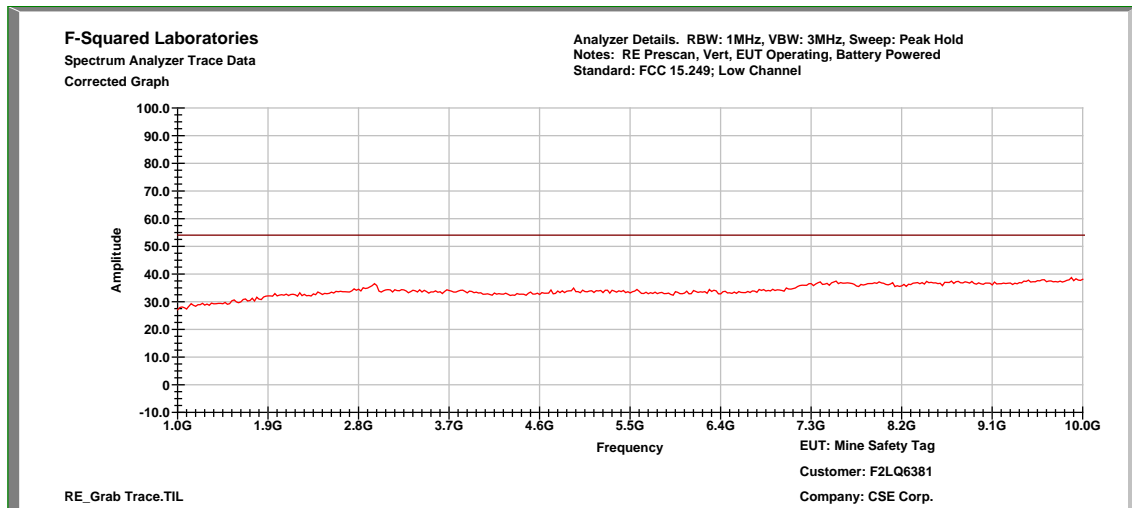




Low Channel, 1 GHz to 10 GHz, Horizontal

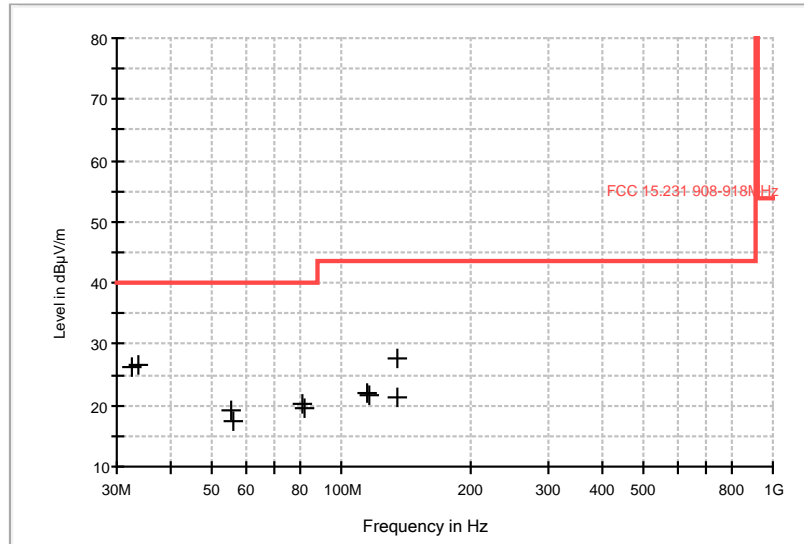


Low Channel, 1 GHz to 10 GHz, Vertical





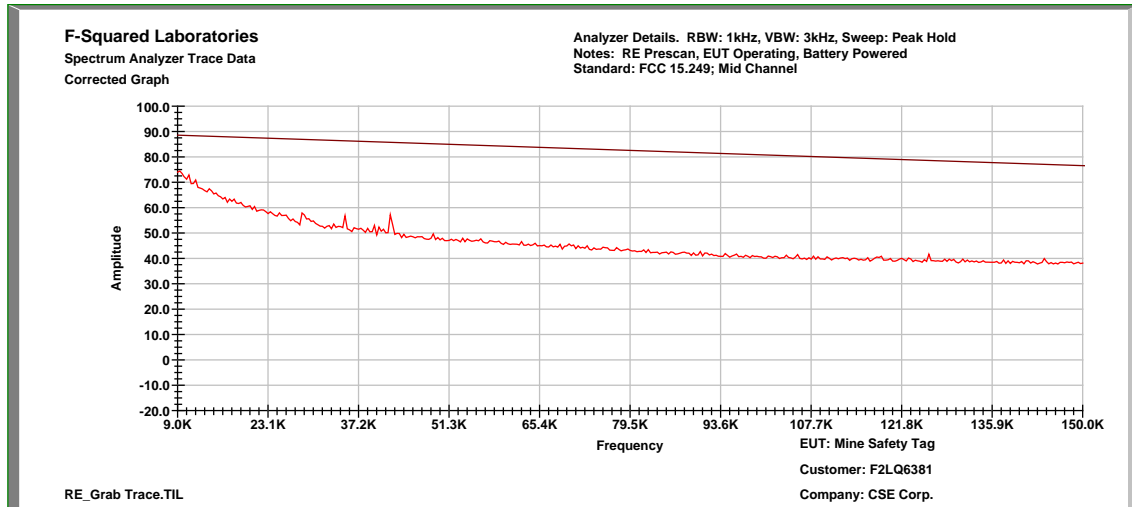
Low Channel



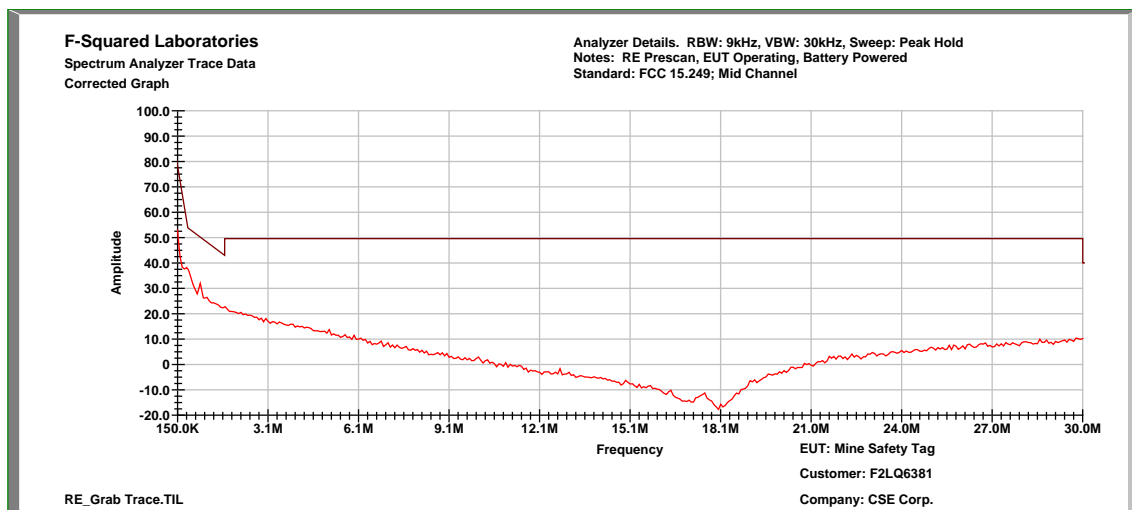
Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
32.590000	H	120.000	8.4	18.0	26.4	40.0	-13.6
33.740000	V	120.000	8.7	18.0	26.7	40.0	-13.3
55.150000	V	120.000	10.3	8.9	19.2	40.0	-20.8
56.090000	H	120.000	8.5	8.9	17.4	40.0	-22.6
81.280000	V	120.000	11.1	9.1	20.2	40.0	-19.8
81.440000	H	120.000	10.6	9.1	19.7	40.0	-20.3
114.770000	V	120.000	6.7	15.4	22.1	43.5	-21.4
115.320000	H	120.000	6.3	15.4	21.7	43.5	-21.8
134.450000	V	120.000	12.2	15.4	27.6	43.5	-15.9
134.720000	H	120.000	6.1	15.4	21.5	43.5	-22.0



Mid Channel, .009 to 0.15 MHz

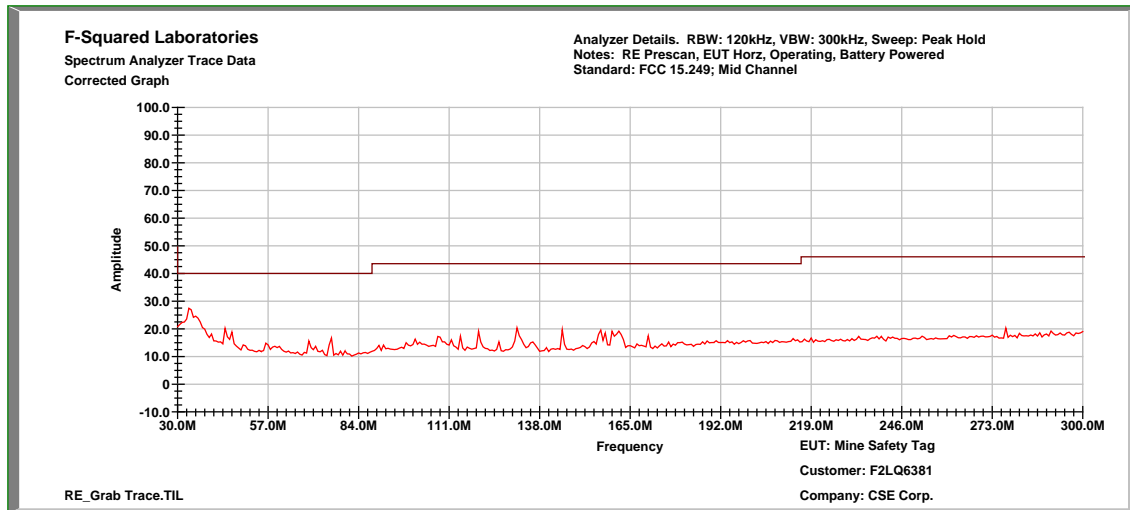


Mid Channel, 0.15 MHz to 30 MHz

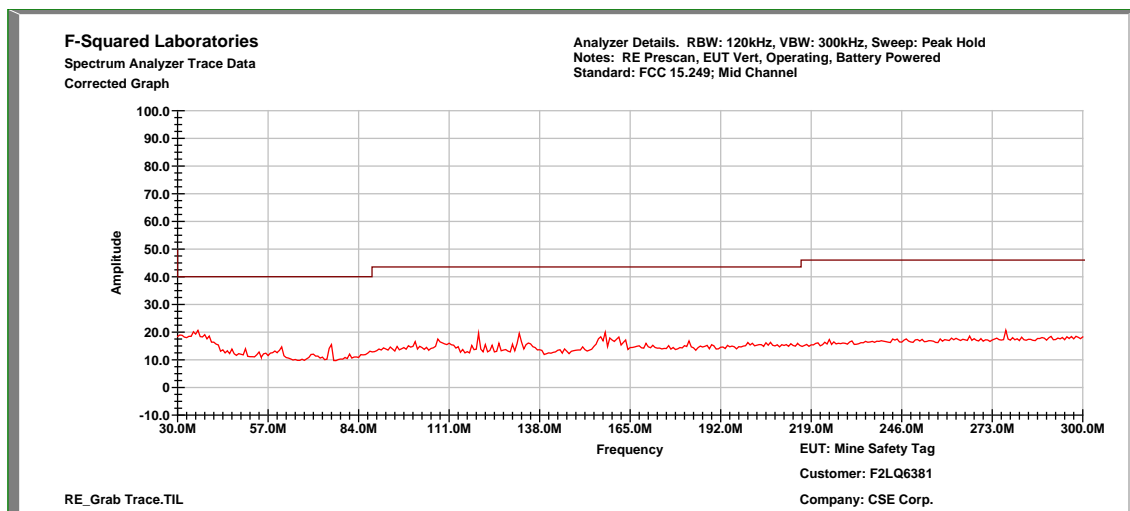




Mid Channel, 30 MHz to 300 MHz, Horizontal

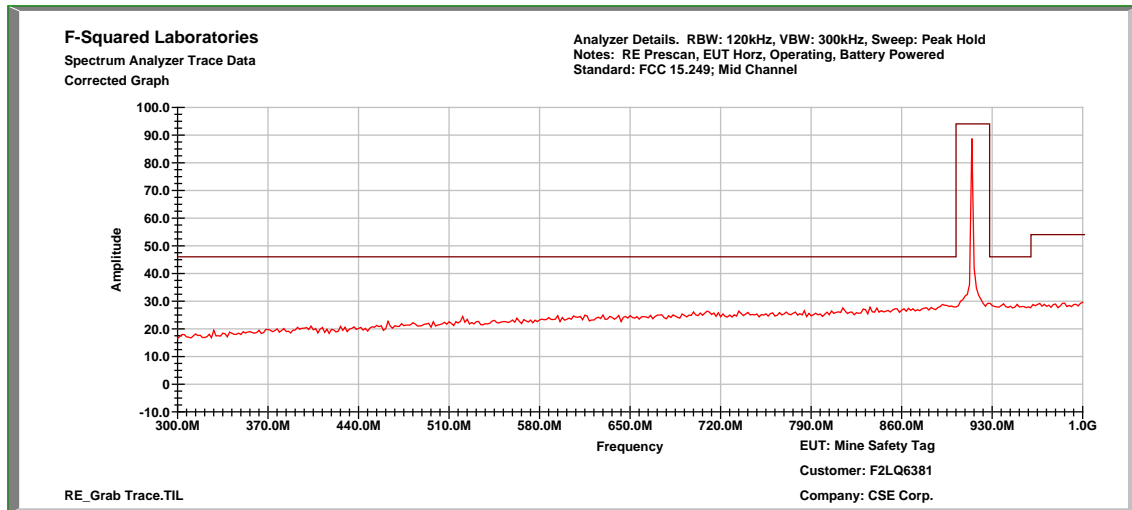


Mid Channel, 30 MHz to 300 MHz, Vertical

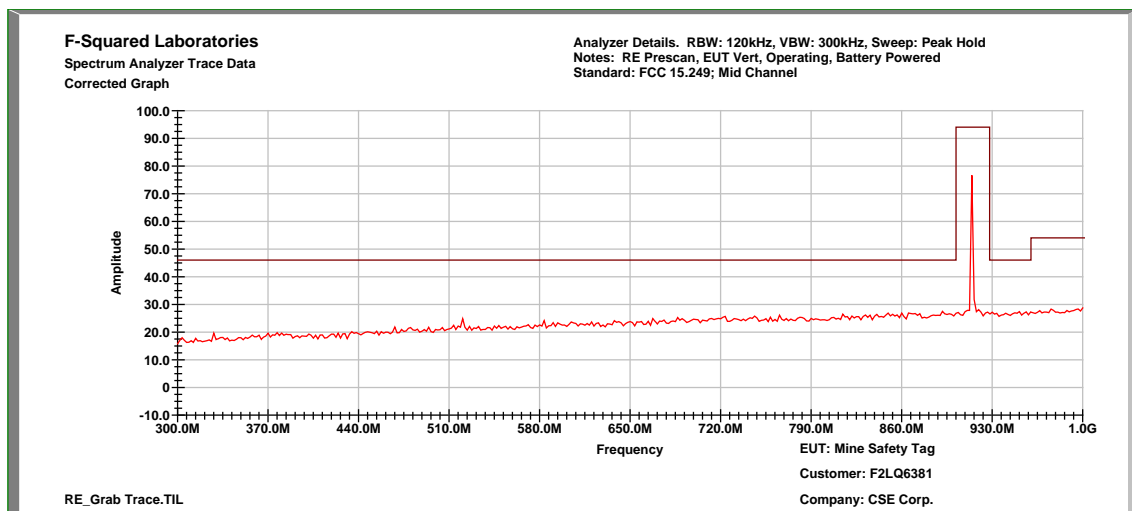




Mid Channel, 300 MHz to 1 GHz, Horizontal

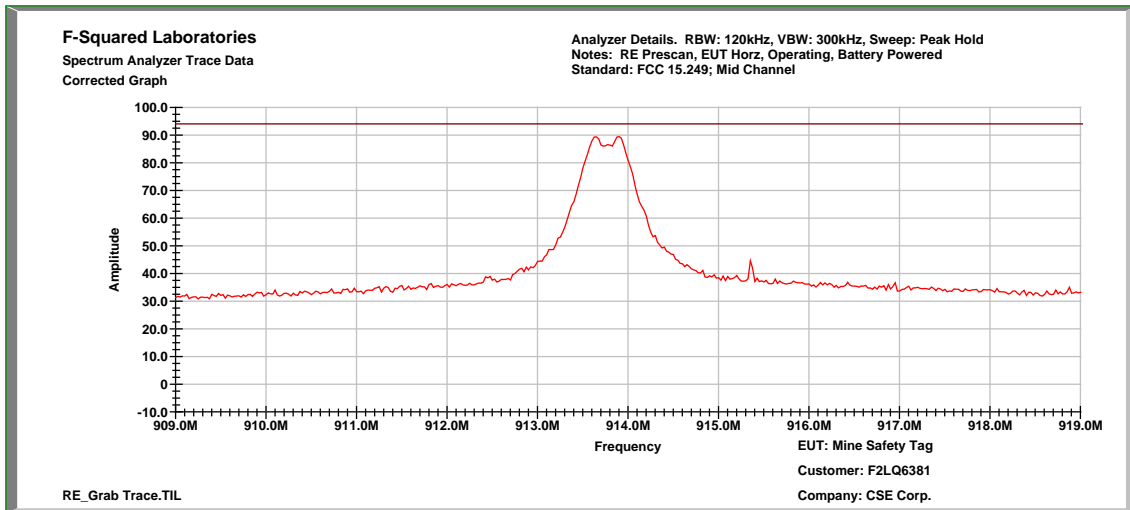


Mid Channel, 300 MHz to 1 GHz, Vertical

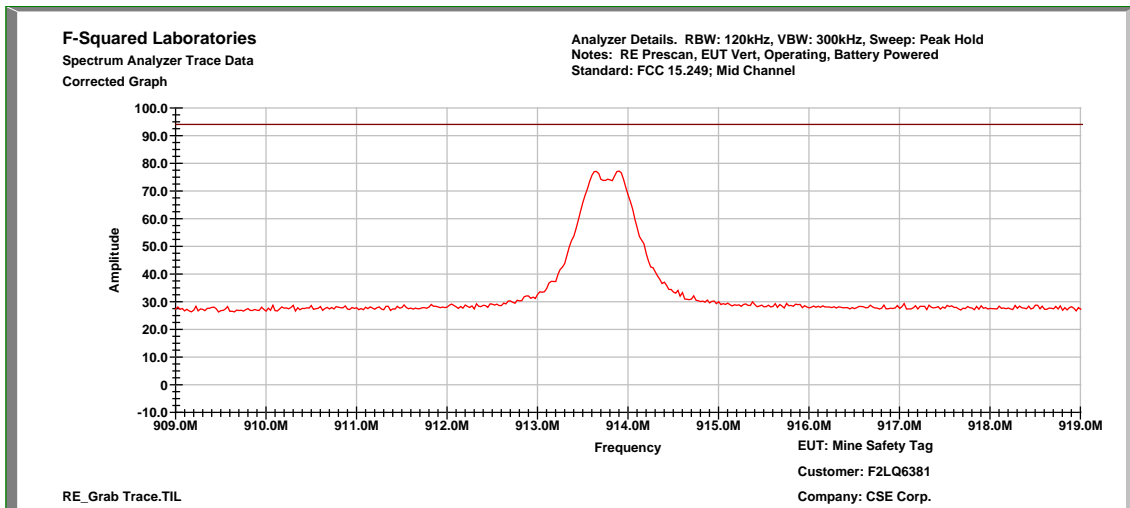




Mid Channel, Fundamental, Horizontal

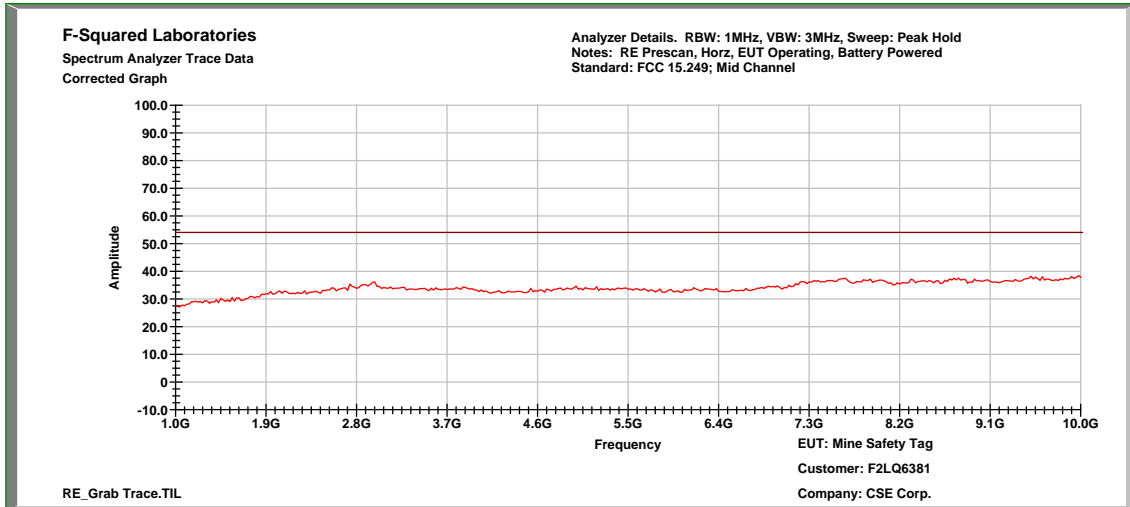


Mid Channel, Fundamental, Vertical

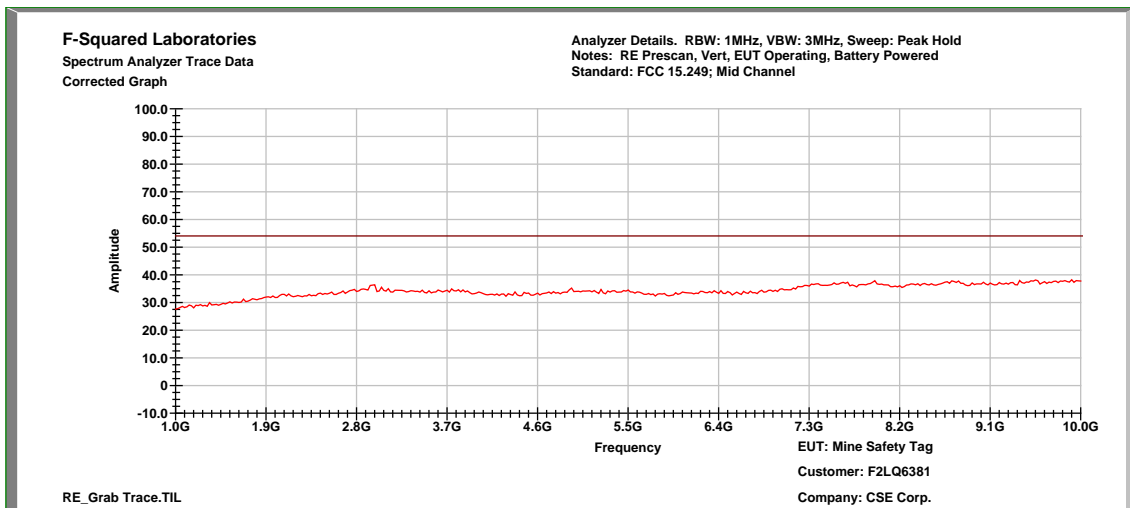




Mid Channel, 1 GHz to 10 GHz, Horizontal

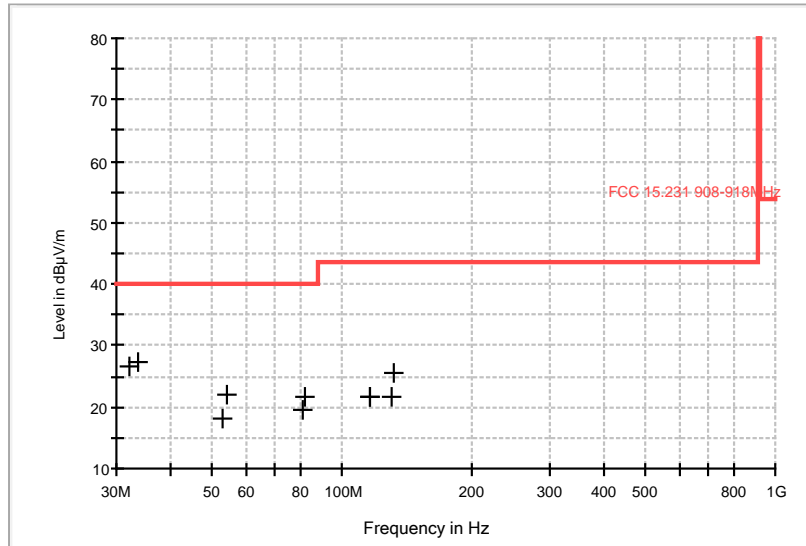


Mid Channel, 1 GHz to 10 GHz, Vertical





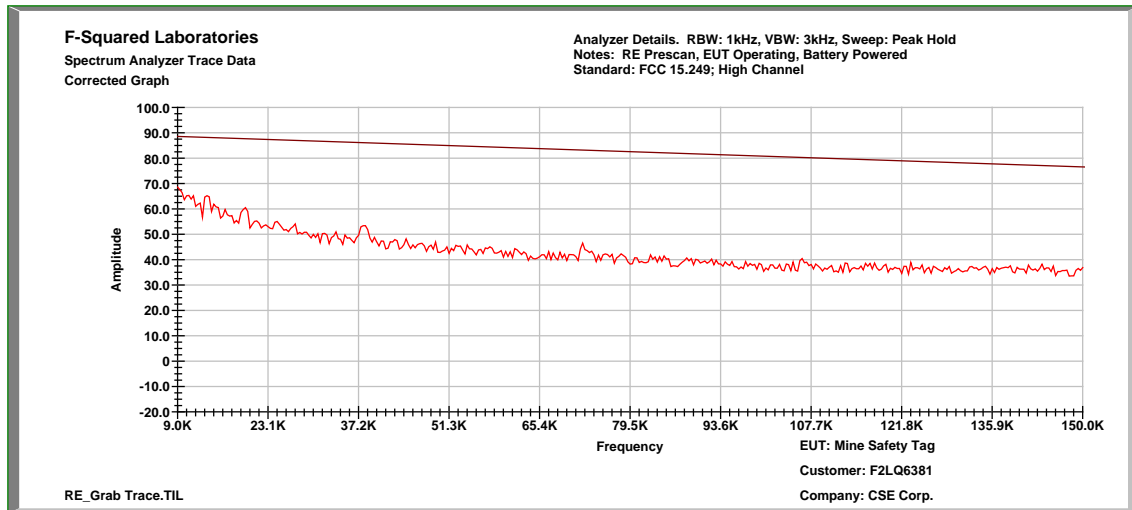
Mid Channel



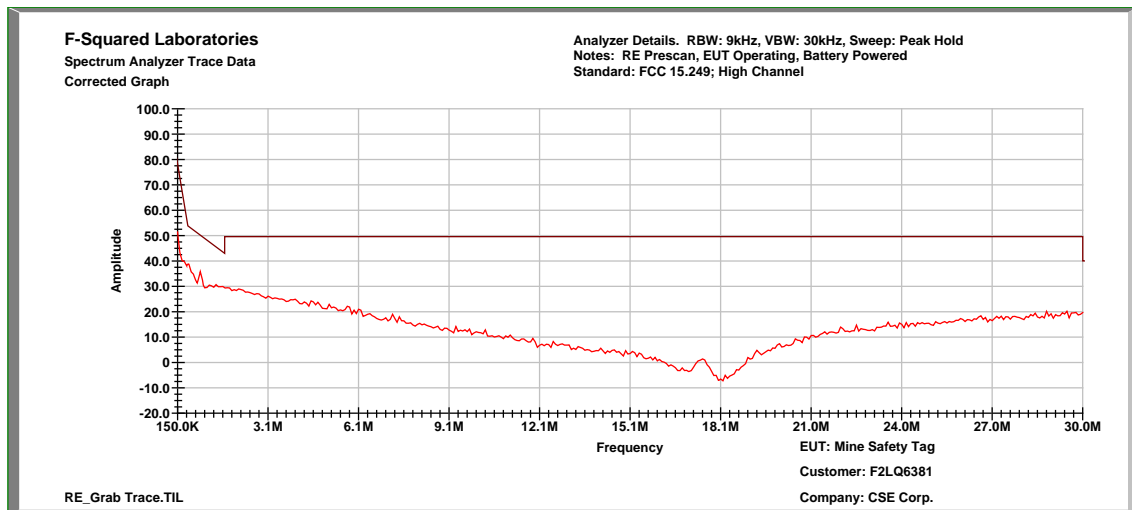
Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
32.070000	H	120.000	6.2	20.3	26.5	40.0	-13.5
33.590000	V	120.000	7.1	20.3	27.4	40.0	-12.6
52.620000	H	120.000	9.5	8.7	18.2	40.0	-21.8
53.900000	V	120.000	13.3	8.7	22.0	40.0	-18.0
80.590000	H	120.000	10.4	9.1	19.5	40.0	-20.5
81.470000	V	120.000	12.6	9.1	21.7	40.0	-18.3
115.150000	V	120.000	6.2	15.4	21.6	43.5	-21.9
115.160000	H	120.000	6.4	15.4	21.8	43.5	-21.7
130.250000	H	120.000	6.1	15.6	21.7	43.5	-21.8
130.680000	V	120.000	9.9	15.6	25.5	43.5	-18.0



High Channel, .009 to 0.15 MHz

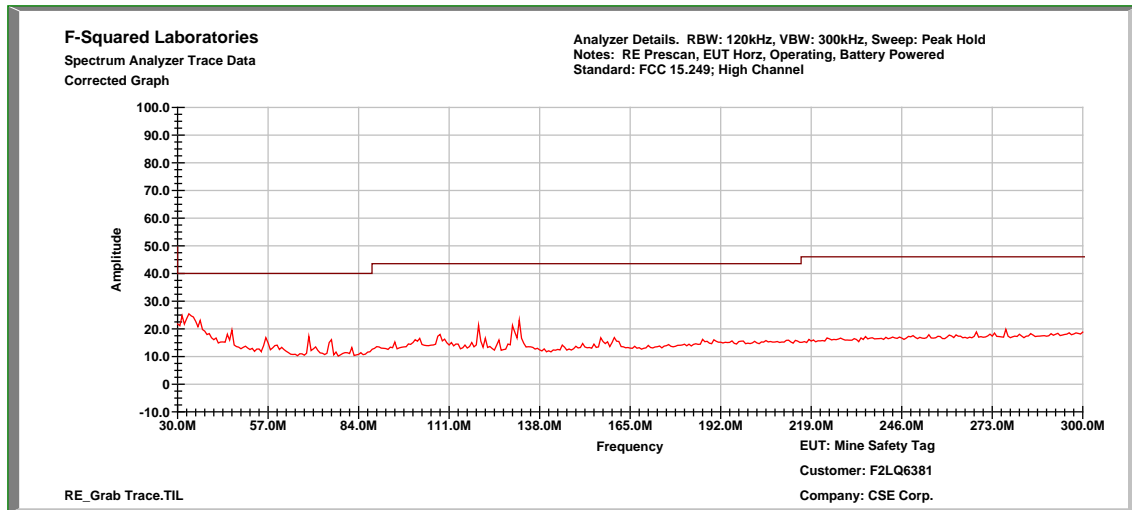


High Channel, 0.15 MHz to 30 MHz

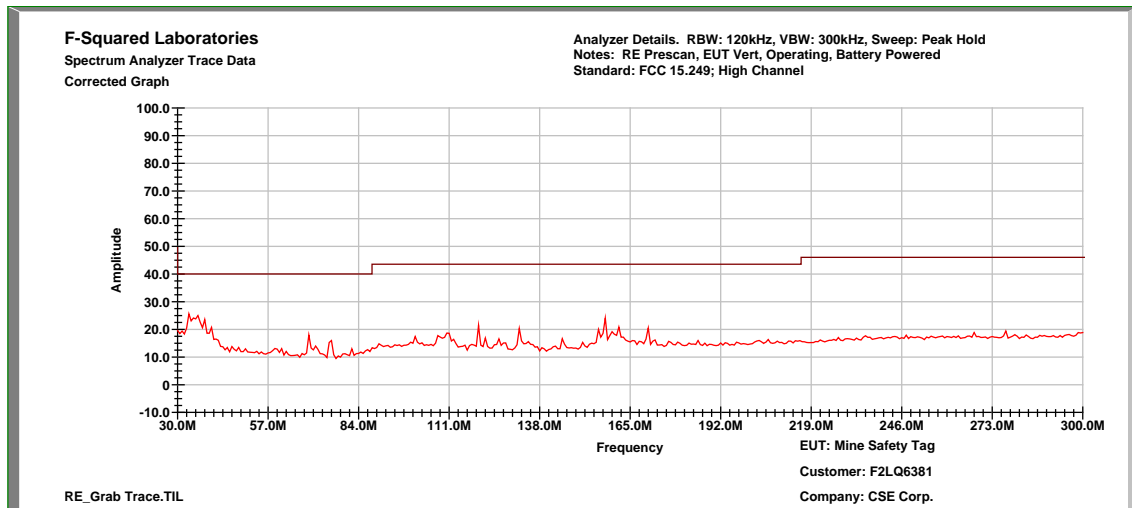




High Channel, 30 MHz to 300 MHz, Horizontal

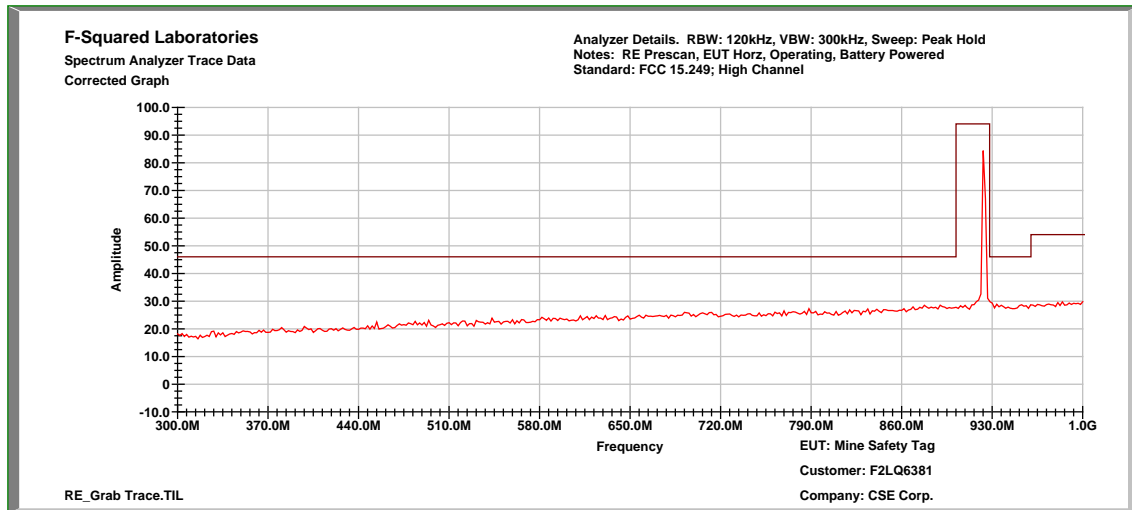


High Channel, 30 MHz to 300 MHz, Vertical

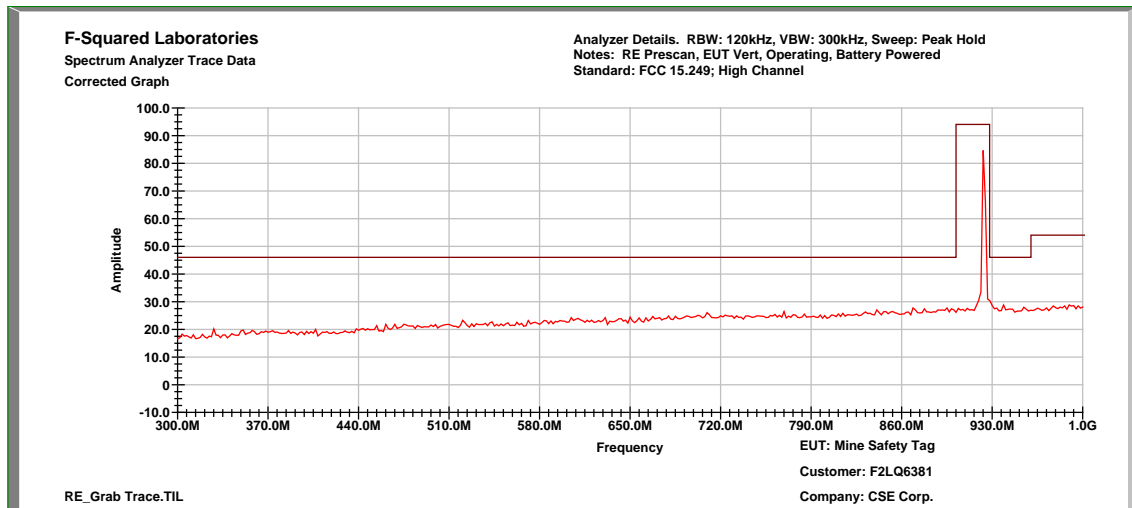




High Channel, 300 MHz to 1 GHz, Horizontal

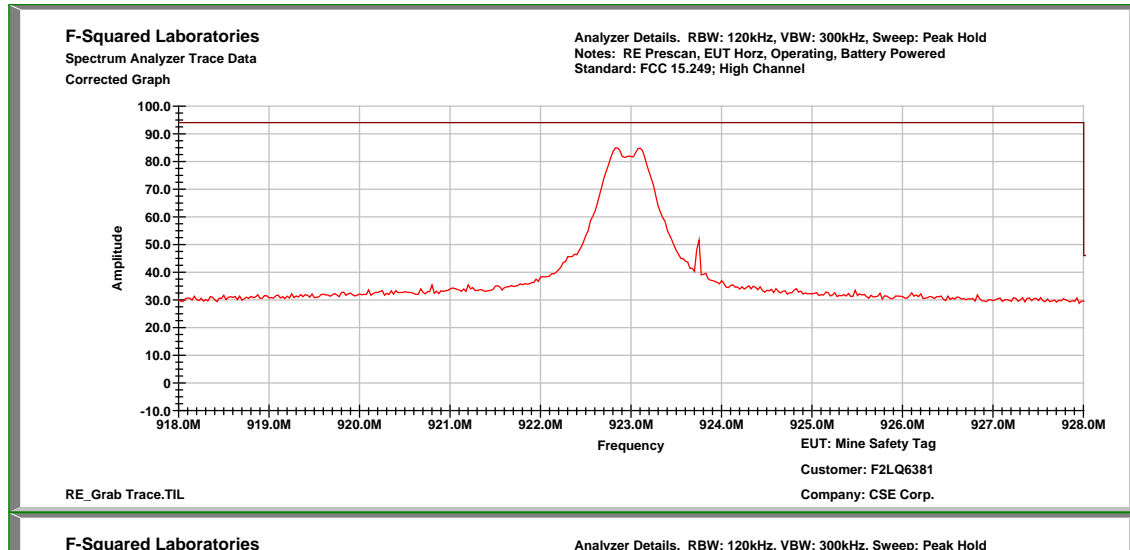


High Channel, 300 MHz to 1 GHz, Vertical

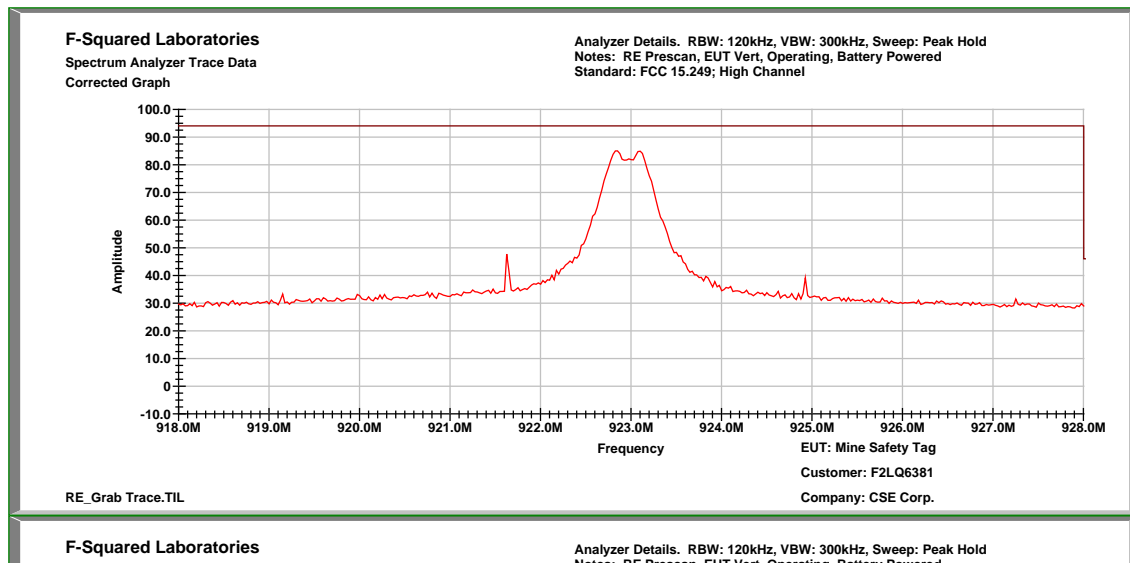




High Channel, Fundamental, Horizontal

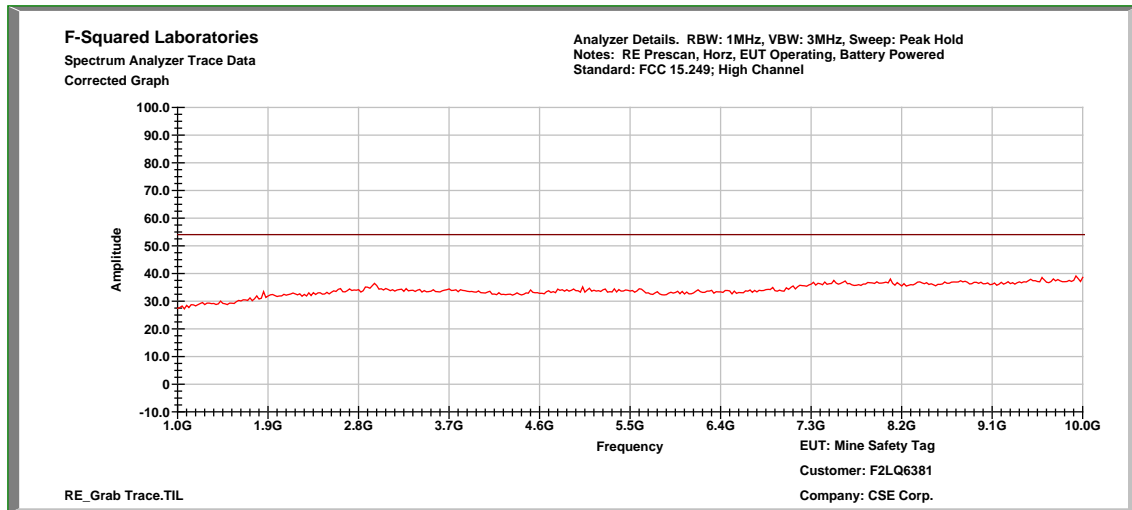


High Channel, Fundamental, Vertical

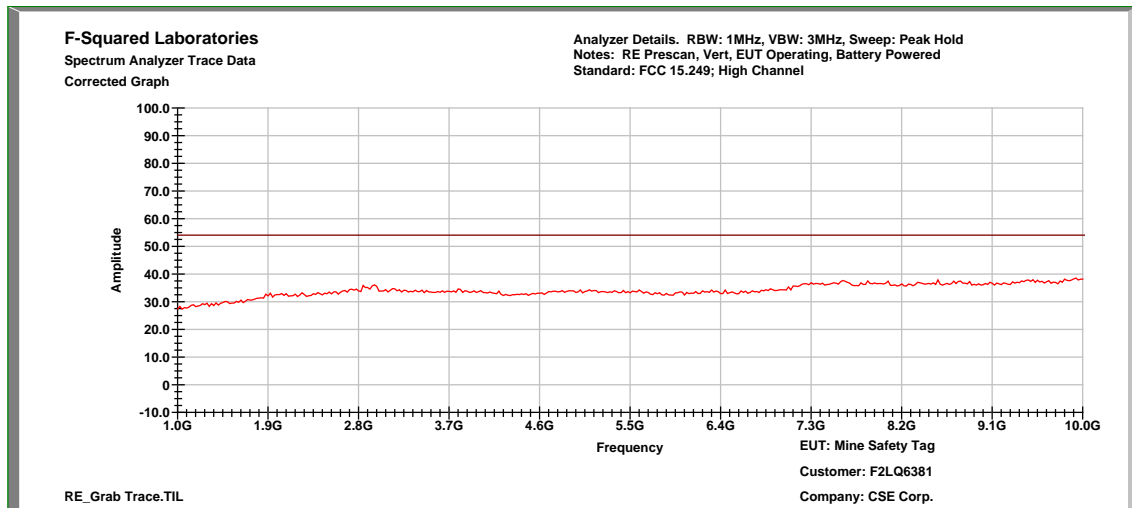




High Channel, 1 GHz to 10 GHz, Horizontal

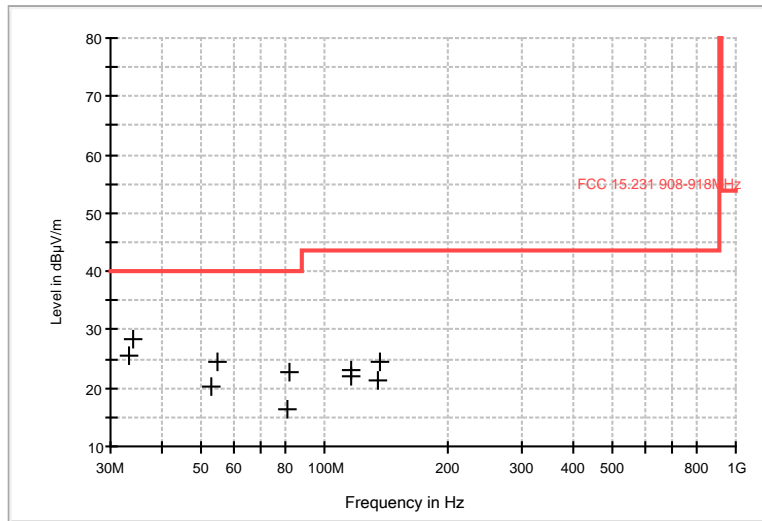


High Channel, 1 GHz to 10 GHz, Vertical





High Channel



Frequency (MHz)	Antenna Polarization	Bandwidth (kHz)	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
33.220000	H	120.000	6.3	19.4	25.7	40.0	-14.3
33.960000	V	120.000	9.1	19.4	28.5	40.0	-11.5
52.670000	H	120.000	11.6	8.7	20.3	40.0	-19.7
54.880000	V	120.000	15.7	8.7	24.4	40.0	-15.6
81.300000	H	120.000	7.1	9.1	16.2	40.0	-23.8
81.850000	V	120.000	13.6	9.1	22.7	40.0	-17.3
115.560000	V	120.000	7.6	15.5	23.1	43.5	-20.4
115.640000	H	120.000	6.5	15.5	22.0	43.5	-21.5
134.580000	H	120.000	6.1	15.4	21.5	43.5	-22.0
135.510000	V	120.000	9.2	15.4	24.6	43.5	-18.9

9 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Radiated Spurious Emissions, Occupied Bandwidth



Pre-scan

