



**F2 Labs**  
**16740 Peters Road**  
**Middlefield, Ohio 44062**  
**United States of America**  
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## **CERTIFICATION TEST REPORT**

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**Manufacturer:** Vapor Communications  
1 Broadway, 14<sup>th</sup> Floor  
Cambridge, Massachusetts 02142 USA

**Applicant:** Same As Above

**Product Name:** Cyrano

**Product Description:** The Cyrano is a step forward in Air Control devices. It allows consumers to control the air they breathe with a smart phone or tablet. The device is portable and battery-operated. It can be recharged via a supplied USB cable. It contains three scent chips and each chip can hold up to 4 individual scents for a total of 12 for the device. Consumers connect to the device via Bluetooth from an iPhone or iPad using our oNotes app. Users simply tap on a scent image to play an individual scent like "Suntan" or Coconut." Consumers can also create a track of scents to play one after the other.

**Model:** CYR161

**FCC ID:** 2AHYTCYR161

**Testing Commenced:** Apr. 4, 2016

**Testing Ended:** Apr. 12, 2016

**Summary of Test Results:** In Compliance

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

### **Standards:**

- **FCC Part 15 Subpart C, Section 15.247**
- **FCC15.207 - Conducted Limits**
- **ANSI C63.10:2013**
- **FCC Part 15.31(e)**



Order Number: F2LQ8323

Manufacturer: Vapor Communications

Model: CYR161

**Evaluation Conducted by:**

Joe Knepper, EMC Proj. Eng.

**Report Reviewed by:**

Ken Littell, Director of EMC & Wireless Operations

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1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

1.2 Measurement Procedure:

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement 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:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data, and are expressed with a 95% confidence factor. Note: Only measurements listed below which relate to tests included in this Test Report are applicable to it.

Measurement Range	Expanded Uncertainty	Combined Uncertainty
Radiated Emissions <1 GHz @ 3m	±5.07dB	±2.54
Radiated Emissions <1 GHz @10m	±5.09dB	±2.55
Radiated Emissions 1 GHz to 2.7 GHz	±3.62dB	±1.81
Radiated Emissions 2.7 GHz to 18 GHz	±3.10dB	±1.55
AC Power Line Conducted Emissions, 150kHz to 30 MHz	±2.76dB	±1.38

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
F2LQ8323-01E	First Issue	Apr. 13, 2016	K. Littell



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 15.207 / KDB558074	Complies
Radiated Spurious Emission with 4.5dBi Integral Antenna	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Voltage Variations	CFR 47 Part 15.31(e)	Complies
Peak Power Spectral Density	CFR 47 Part 15.247(e) / KDB558074	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

Modifications Made to the Equipment
None

**3 TABLE OF MEASURED RESULTS**

Test		Low Channel 2.402 GHz	Mid Channel 2.44 GHz	High Channel 2.48 GHz
-6dB Occupied Bandwidth		0.6827 MHz	0.6859 MHz	0.6923 MHz
-6dB Occupied Bandwidth Limit		≥ 500KHz	≥ 500KHz	≥ 500KHz
Conducted Output* Power at 120V		-8.06dBm 0.156mW	-8.70dBm 0.135mW	-8.57dBm 0.139mW
Output power at Extreme Voltages	-15% (100V)	-7.32dBm 0.185mW	-7.86dBm 0.164mW	-8.78dBm 0.132mW
	+15% (140)	-7.31dBm 0.186mW	-7.56dBm 0.175mW	-8.10dBm 0.154mW
Conducted Output Power Limit		1 Watt 30dBm	1 Watt 30dBm	1 Watt 30dBm
E.I.R.P. with 4.5dBi Integral Antenna		0.524mW (-2.81dBm)	0.494mW (-3.06dBm)	0.437mW (-3.60dBm)
E.I.R.P. Limit		4 Watts, (36.02dBm)	4 Watts, (36.02dBm)	4 Watts, (36.02dBm)
Peak Power Spectral Density		-20.66 dBm	-19.75 dBm	-21.25 dBm
Peak Power Spectral Density Limit		8 dBm	8 dBm	8 dBm

*\*To meet the requirements of 15.31 the nominal voltage was varied by ±15% and all tests below reflect the worst case output power. The +15% (140V) was the worst case.*



**Order Number: F2LQ8323**

**Manufacturer: Vapor Communications**

**Model: CYR161**

#### **4 ENGINEERING STATEMENT**

This report has been prepared on behalf of Vapor Communications 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 C63.10 2013 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: Cyrano

Model: CYR161

Serial No.: None Spec.\*

FCC ID: 2AHYTCYR161

\*Two samples were provided - S01 was used for Conducted Emissions tests; S02 was used for Radiated Emissions tests.

### 5.2 Trade Name:

Vapor Communications

### 5.3 Power Supply:

USB AC/DC Supply – Samsung ETA-U90JWE, s/n RT4DA15PS/B-E

### 5.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

### 5.5 Equipment Category:

Radio Transmitter-DTS

### 5.6 Antenna:

Single Line PCB (Inverted F 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, transmitting continuous at Low (2402 GHz), Mid (2.44 GHz) and High (2.48 GHz) channels.



**6 LIST OF MEASUREMENT INSTRUMENTATION**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166	AlbatrossProjects	B83117-DF435-T261	US140023	Apr. 30, 2016
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	May 7, 2016
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Nov. 13, 2016
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Nov. 25, 2016
Loop Antenna	CL163L	A.H. Systems, Inc.	EHA-52B	100	Apr. 20, 2016
Horn Antenna	CL098	Emco	3115	9809-5580	Dec. 10, 2016
Combination Antenna	CL175	Sunol Sciences	JB3	A030315	Apr. 1, 2017
Software:	Tile Version 1.0		Software Verified: Apr. 4, 2016		
Software:	EMC 32, Version 5.20.2		Software Verified: Apr. 4, 2016		
Antenna, Horn	CL114	A. H. Systems, Inc.	SAS-572	237	Oct. 16, 2016
Temp./Hum. Rec.	CL119	Extech	RH520	H005869	Jan. 29, 2017
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	Feb. 1, 2017
Spectrum Analyzer	CL147	Agilent	E7402A	MY45101241	Dec. 3, 2016
LISN	CL184	Com-Power	LI-125A	191213	June 9, 2016
LISN	CL185	Com-Power	LI-125A	191214	June 9, 2016



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

### 7.1 Requirements:

The 6dB bandwidth shall be greater than 500 kHz.

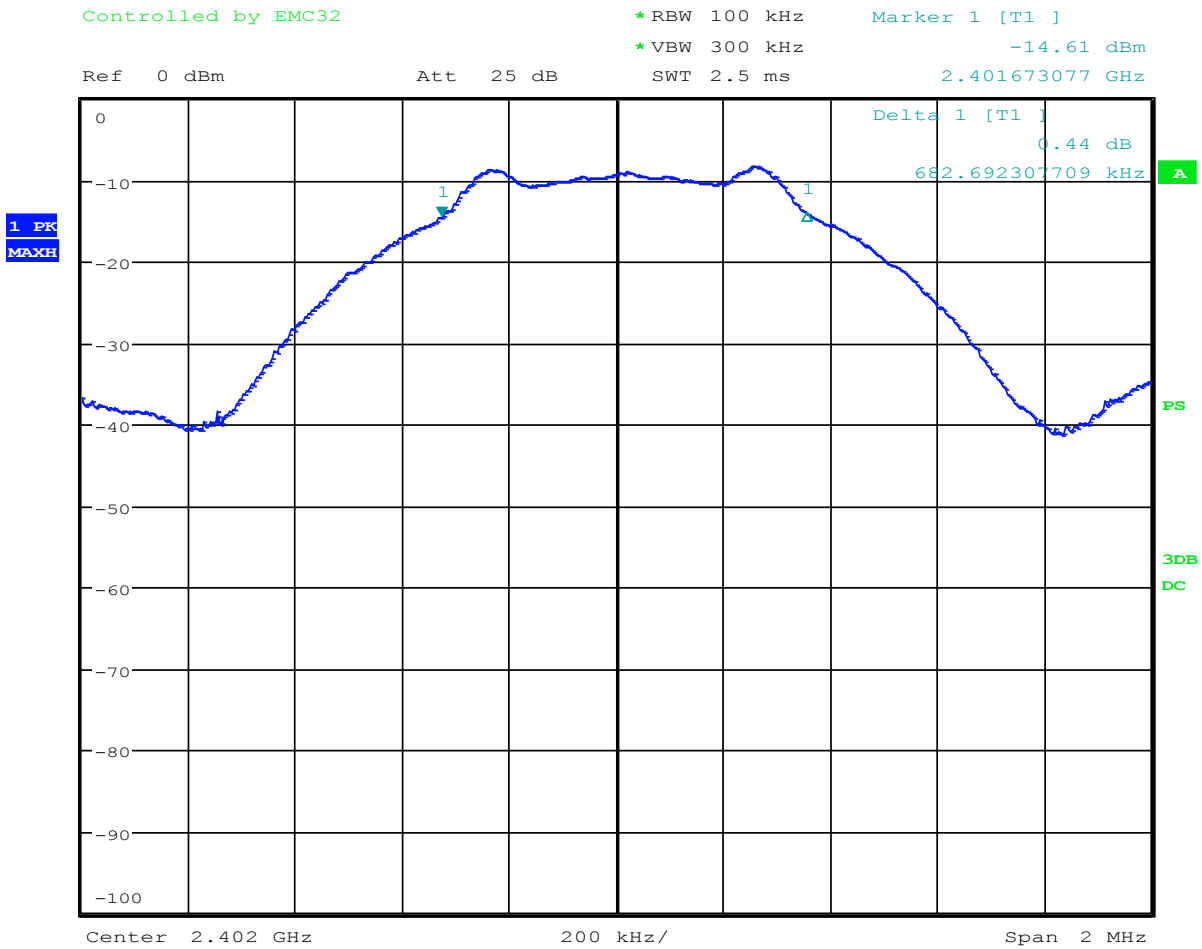
Bandwidth measurements were made at the Low (2.4052GHz), Mid (2.44 GHz) and High (2.48 GHz) frequencies. The bandwidth was measured using the analyzer's marker function.



### 7.2 Occupied Bandwidth Test Data

<b>Test Date(s):</b>	Apr. 4-7, 2015	<b>Test Engineer:</b>	J. Knepper
<b>Standards:</b>	CFR 47 Part 15.247(a)(2); KDB558074	<b>Air Temperature:</b>	19.4°C
		<b>Relative Humidity:</b>	45%

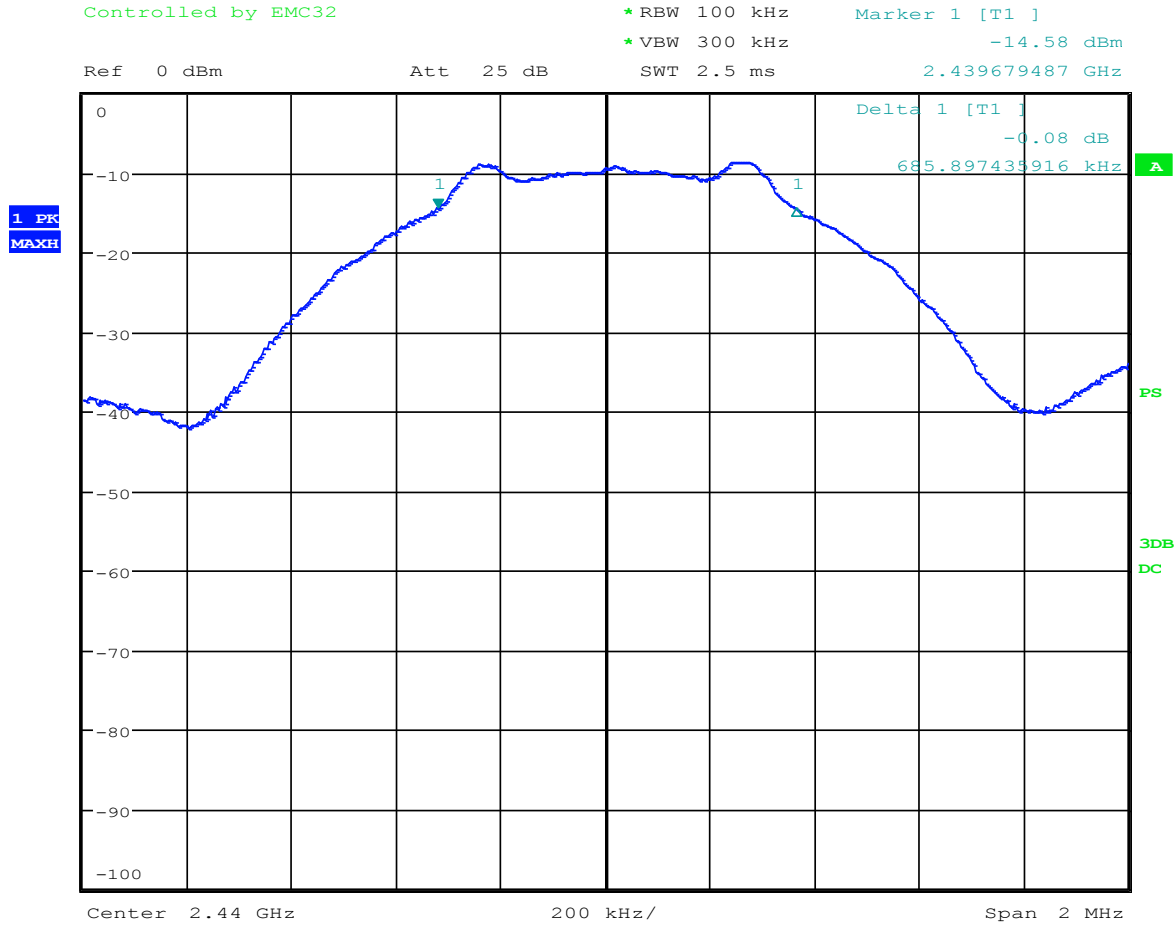
### Low Channel



Date: 7.APR.2016 13:47:22



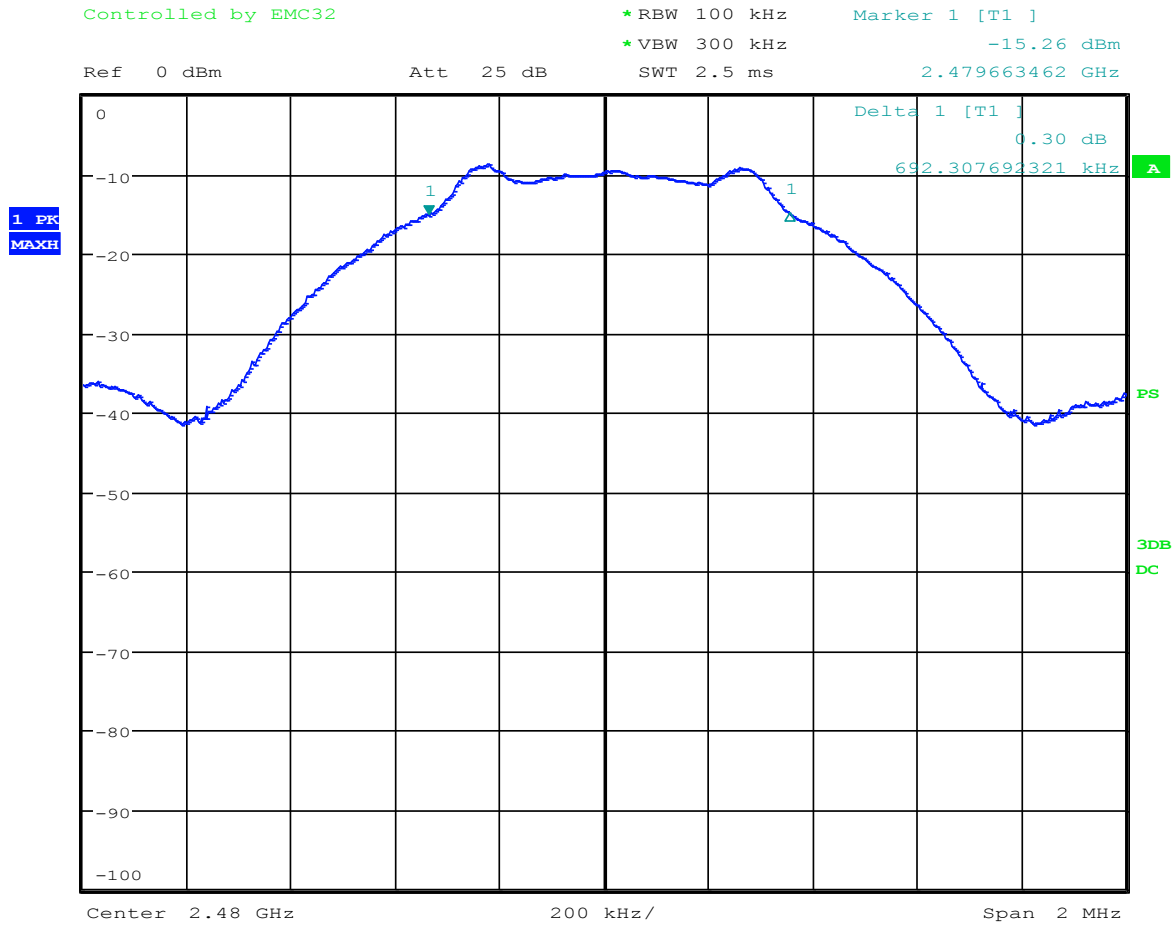
### Mid Channel



Date: 7.APR.2016 13:48:35



### High Channel



Date: 7.APR.2016 13:42:26



## 8 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.

### 8.1 Requirements:

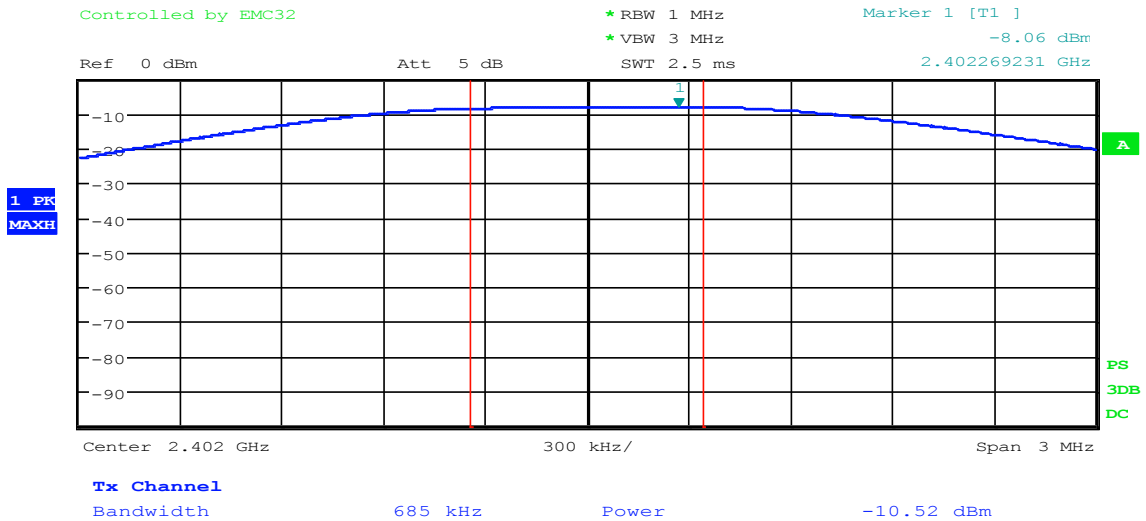
The peak power output shall be 1 watt (30 dBm) or less when using an antenna with a gain of less than 6dBi. For antennas having a gain of more than 6dBi, the limit is reduced by 1dB for every dB the antenna gain is over 6dBi.



### 8.2 Conducted Output Power Test Data

<b>Test Date(s):</b>	Apr. 7, 2016	<b>Test Engineer:</b>	J. Knepper
<b>Standards:</b>	CFR 47 Part 15.247(b)(3); KDB558074	<b>Air Temperature:</b>	21.2°C
		<b>Relative Humidity:</b>	44%

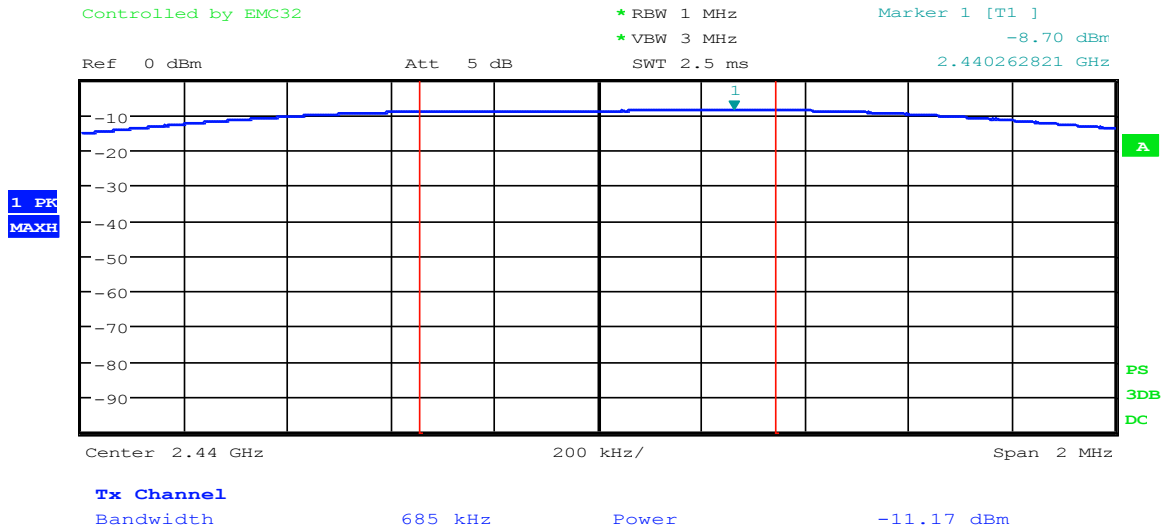
#### Low Channel



Date: 7.APR.2016 13:54:16



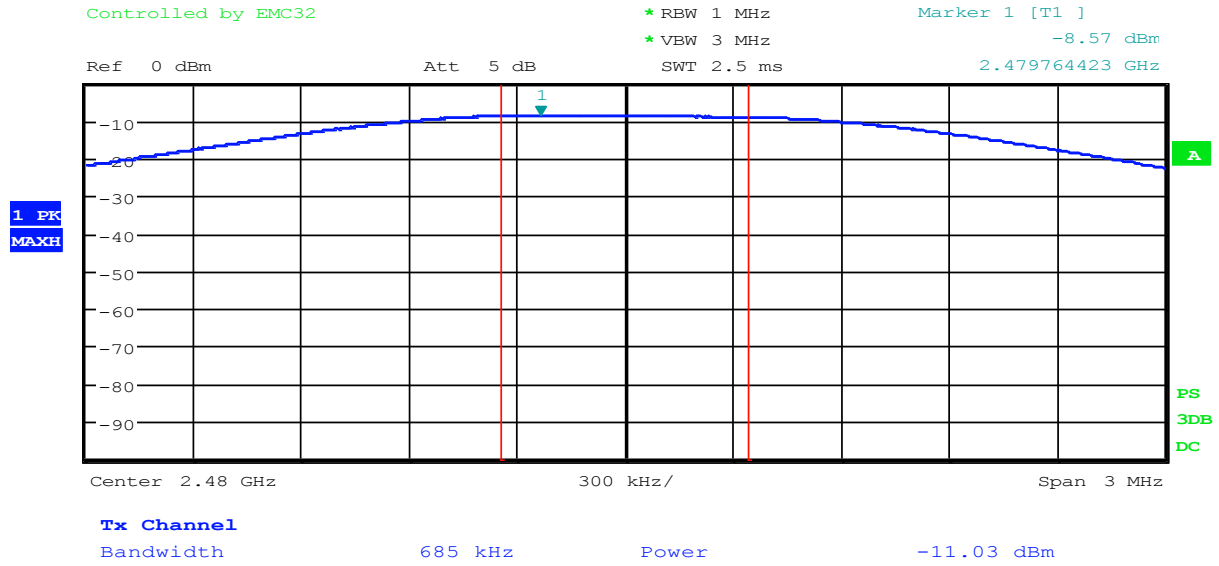
### Mid Channel



Date: 7.APR.2016 13:50:39



### High Channel



Date: 7.APR.2016 13:52:48



## 9 FCC PART 15.31(e) – EXTREME VOLTAGES

### 9.1 Requirements

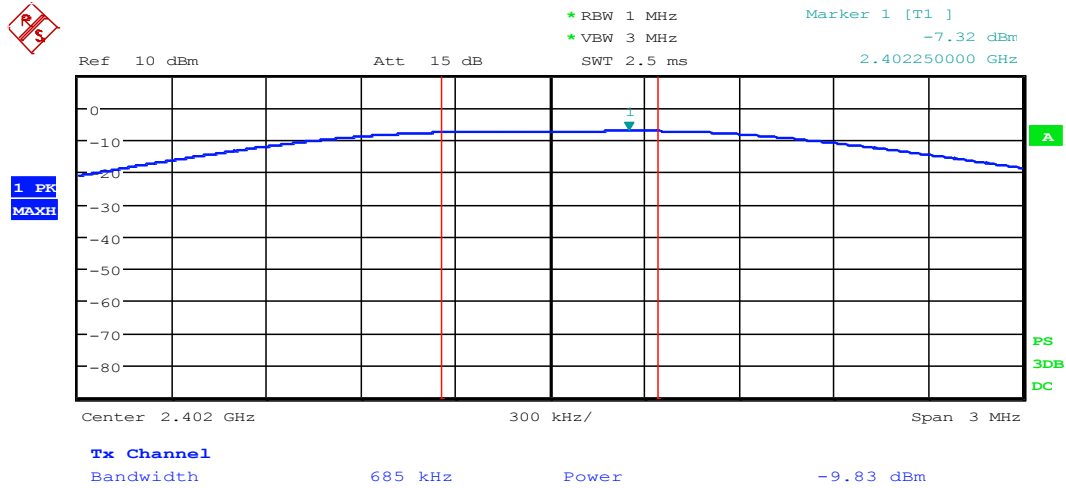
For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.



### 9.2 Extreme Voltages Test Data

<b>Test Date(s):</b>	Apr. 8, 2016	<b>Test Engineer:</b>	J. Knepper
<b>Rule:</b>	15.31(e)	<b>Air Temperature:</b>	21.3° C
<b>Test Results:</b>	Complies	<b>Relative Humidity:</b>	40%

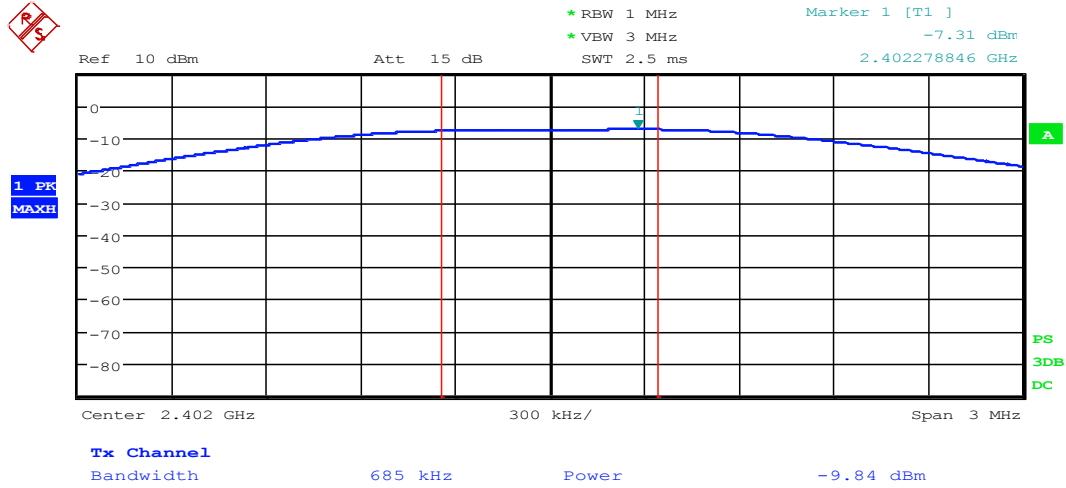
### Low Channel, 100V



Date: 8.APR.2016 12:12:58



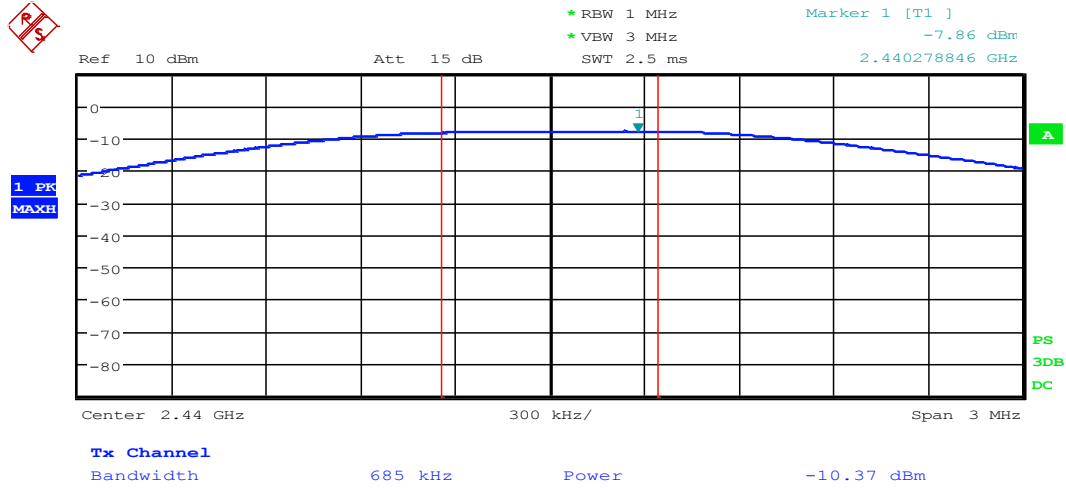
### Low Channel, 140V



Date: 8.APR.2016 12:14:07



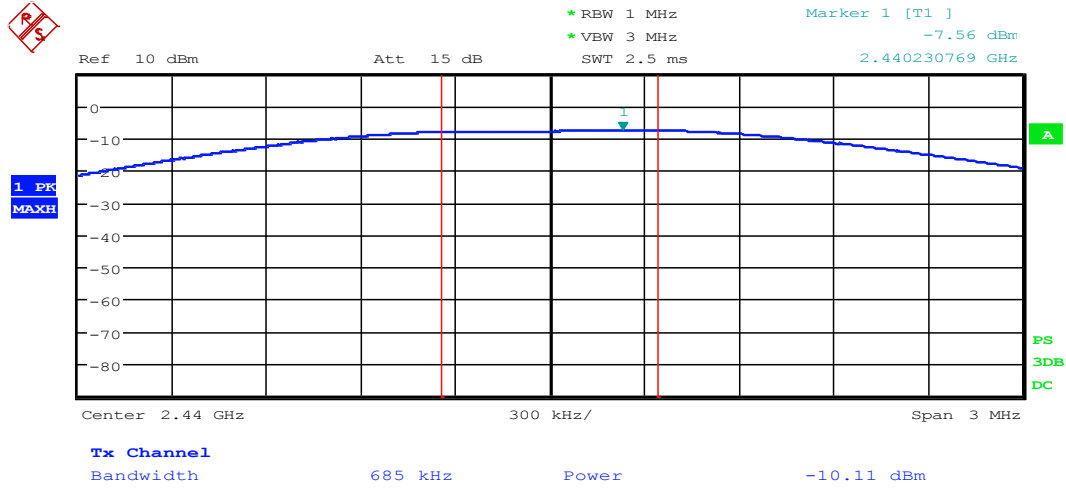
### Mid Channel, 100V



Date: 8.APR.2016 12:15:33



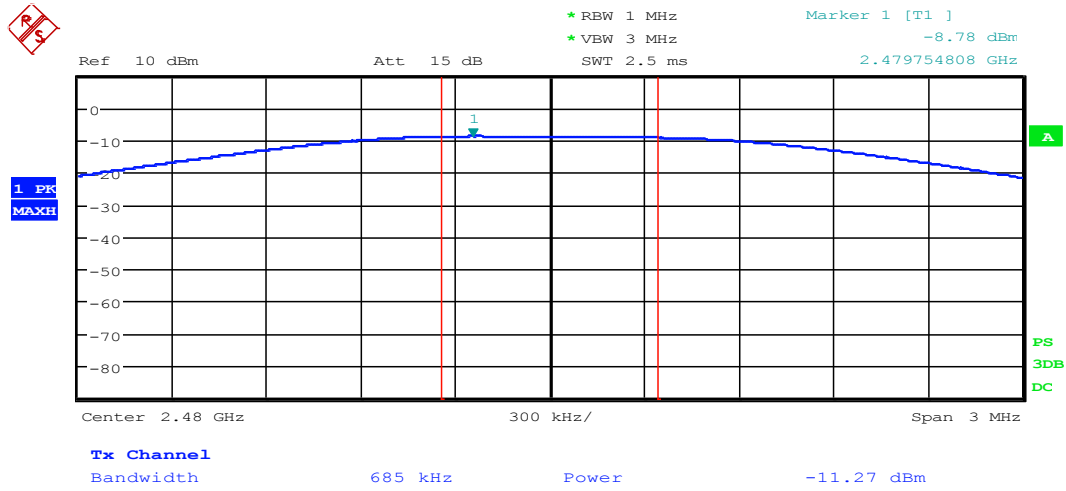
### Mid Channel, 140V



Date: 8.APR.2016 12:14:46



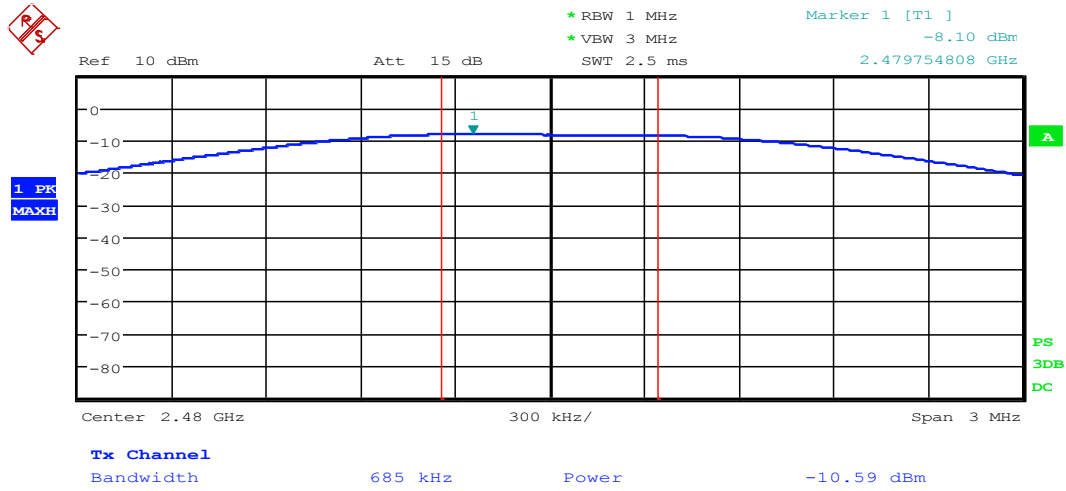
### High Channel, 100V



Date: 8.APR.2016 12:16:49



### High Channel, 140V



Date: 8.APR.2016 12:18:00



## 10 FCC Part 15.247(d) – CONDUCTED SPURIOUS EMISSIONS

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

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.

### 10.1 Requirements:

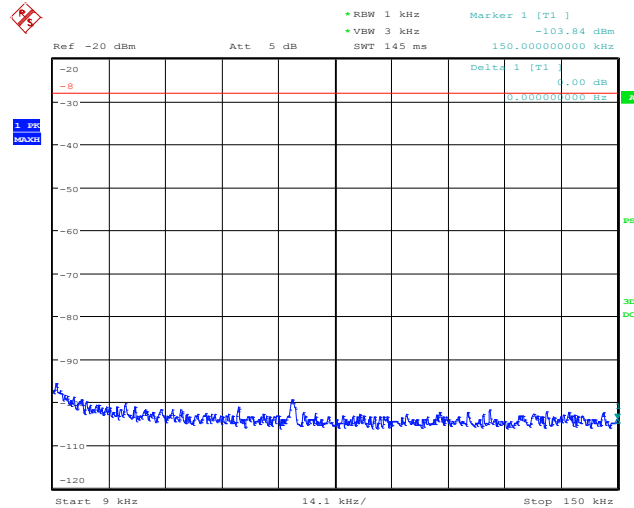
All Spurious Emissions must be at least 20dB down from the highest emission level measured within the authorized band up through the tenth harmonic.



### 10.2 Test Data – Conducted Spurious Emissions

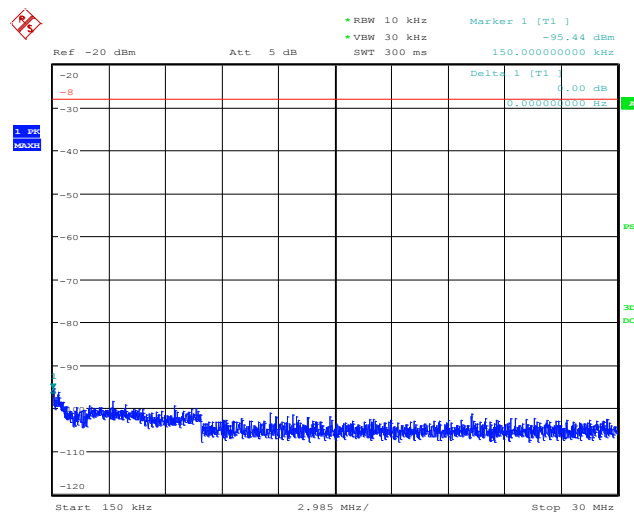
<b>Test Date(s):</b>	Apr. 8, 2016	<b>Test Engineer:</b>	J. Knepper
<b>Standards:</b>	CFR 47 Part 15.247(d) / Part 15.207 KDB558074	<b>Air Temperature:</b>	21.2°C
		<b>Relative Humidity:</b>	40%

#### Low Channel, 9kHz to 150kHz



Date: 8.APR.2016 10:41:25

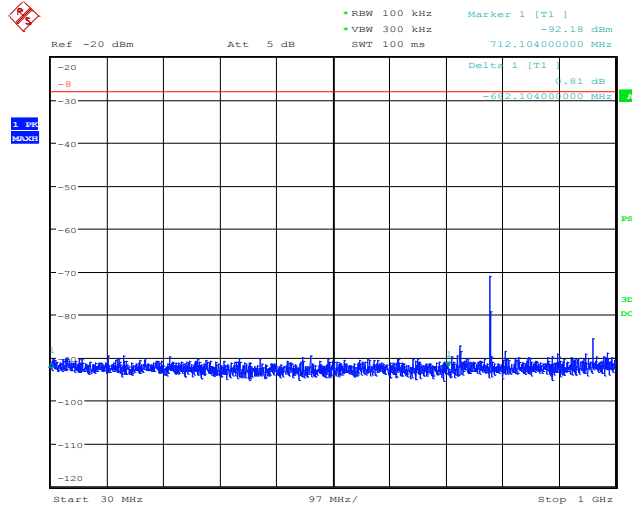
#### Low Channel, 150kHz to 30 MHz



Date: 8.APR.2016 10:42:11

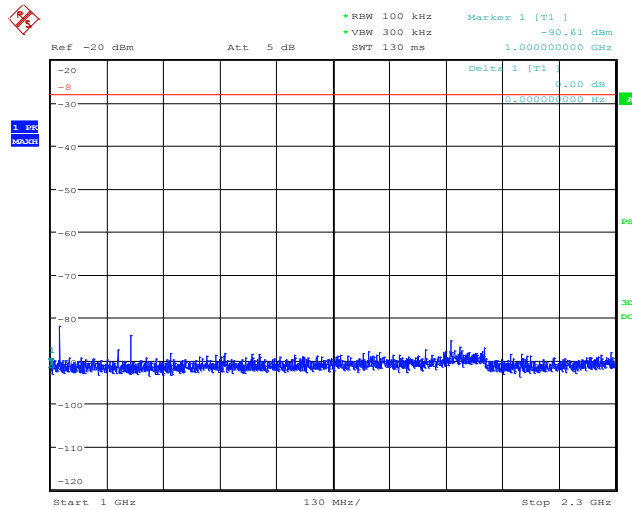


### Low Channel, 30 MHz to 1 GHz



Date: 8.APR.2016 10:46:32

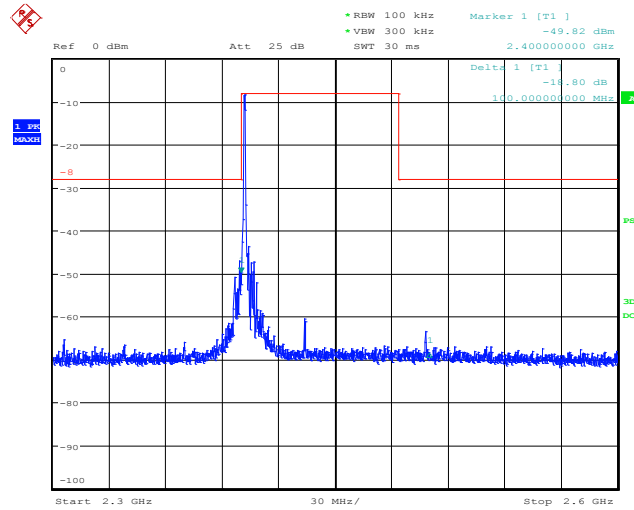
### Low Channel, 1 GHz to 2.3 GHz



Date: 8.APR.2016 10:46:51

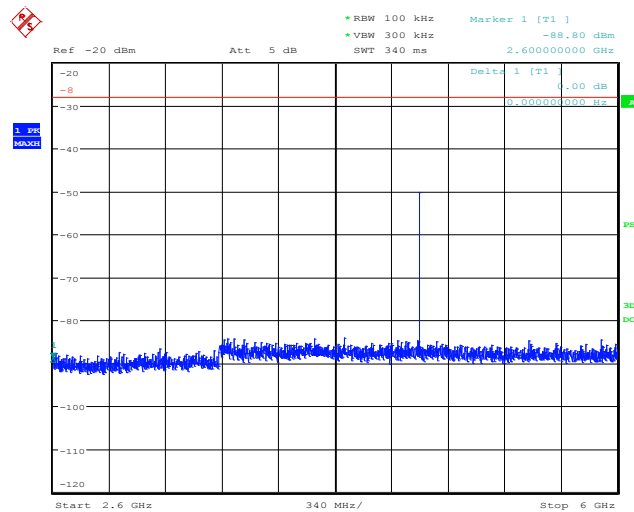


### Low Channel, 2.3 GHz to 2.6 GHz



Date: 8.APR.2016 10:49:04

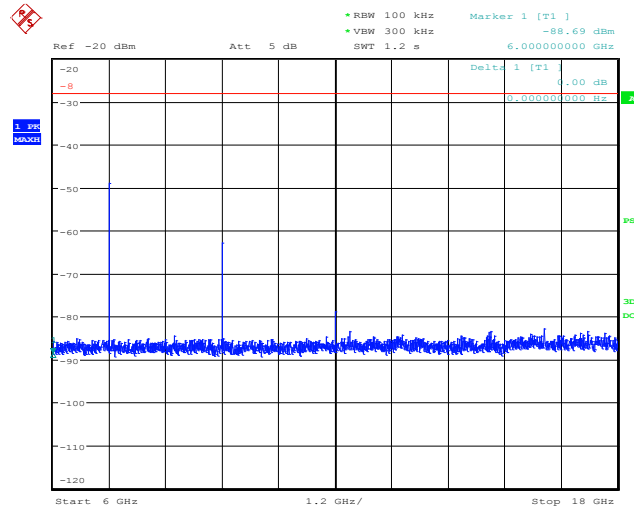
### Low Channel, 2.6 GHz to 6 GHz



Date: 8.APR.2016 10:47:27

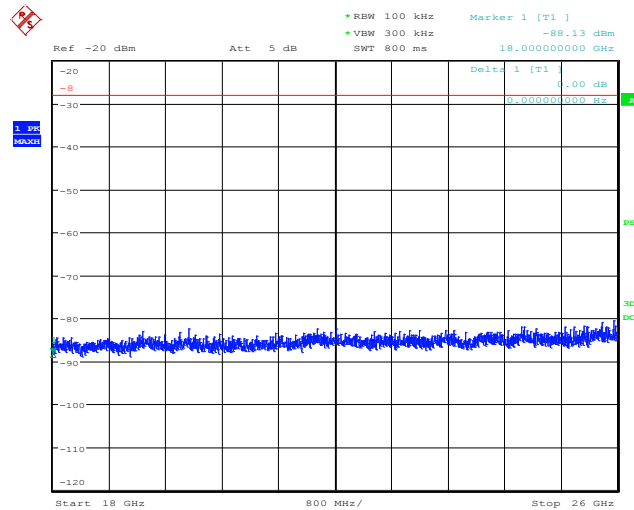


### Low Channel, 6 GHz to 18 GHz



Date: 8.APR.2016 10:47:39

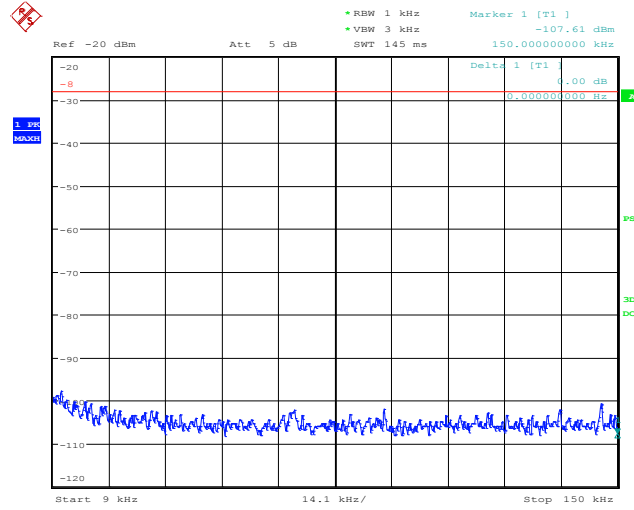
### Low Channel, 18 GHz to 26 GHz



Date: 8.APR.2016 10:47:53

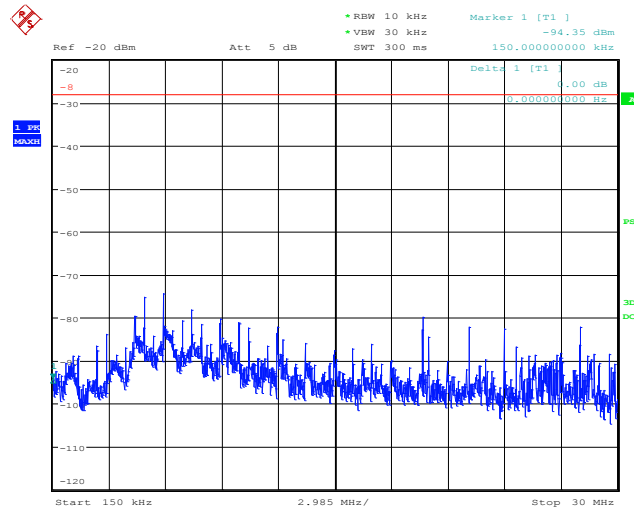


### Mid Channel, 9kHz to 150kHz



Date: 8.APR.2016 10:49:39

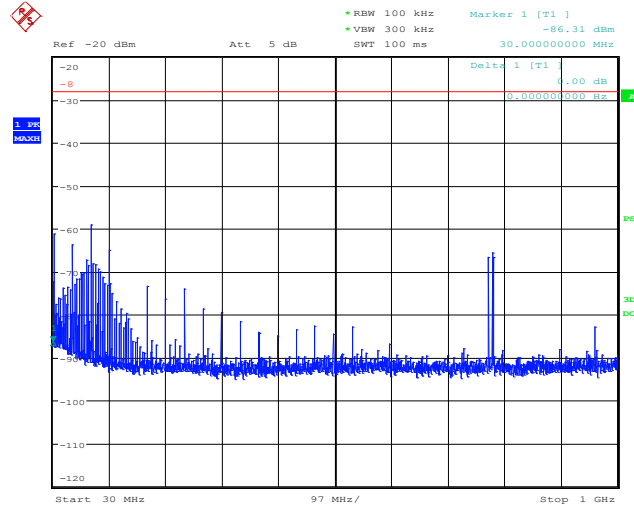
### Mid Channel, 150kHz to 30 MHz



Date: 8.APR.2016 10:50:02

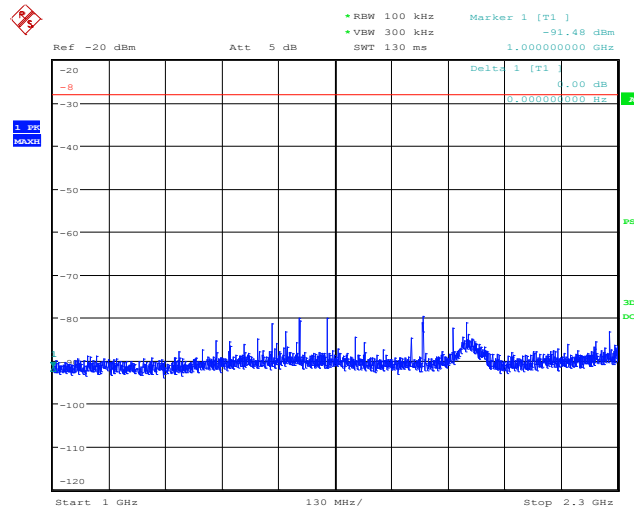


### Mid Channel, 30 MHz to 1 GHz



Date: 8.APR.2016 10:50:21

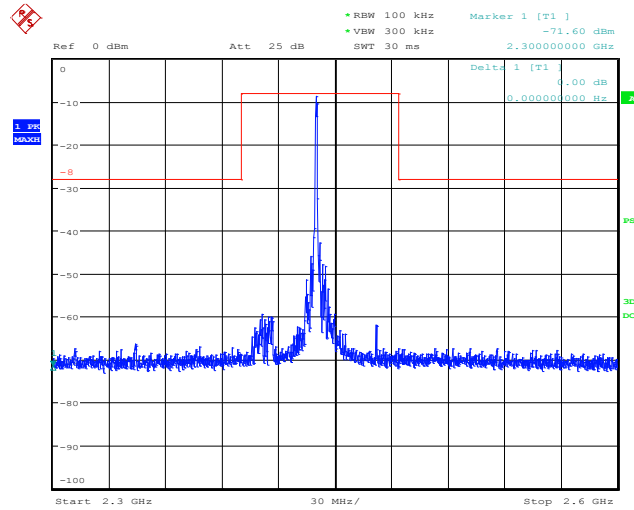
### Mid Channel, 1 GHz to 2.3 GHz



Date: 8.APR.2016 10:50:34

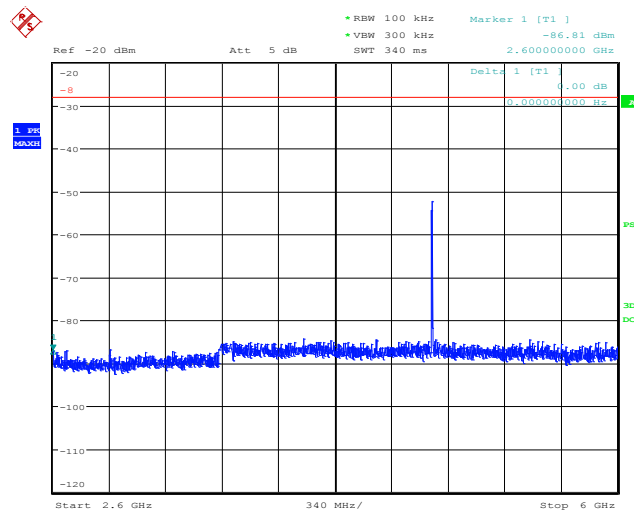


### Mid Channel, 2.3 GHz to 2.6 GHz



Date: 8.APR.2016 10:50:54

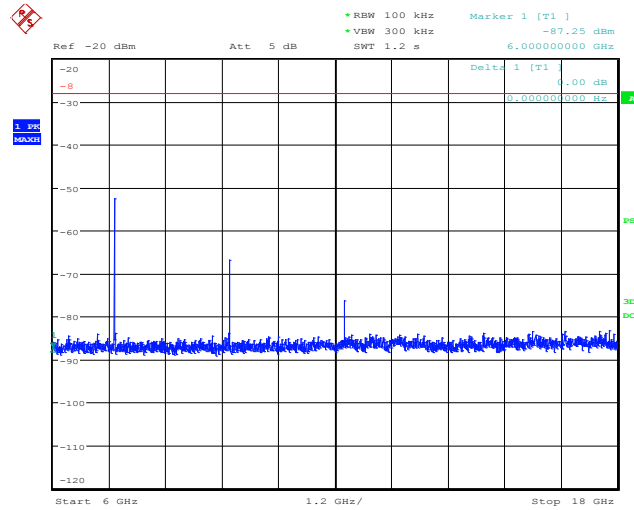
### Mid Channel, 2.6 GHz to 6 GHz



Date: 8.APR.2016 10:51:12

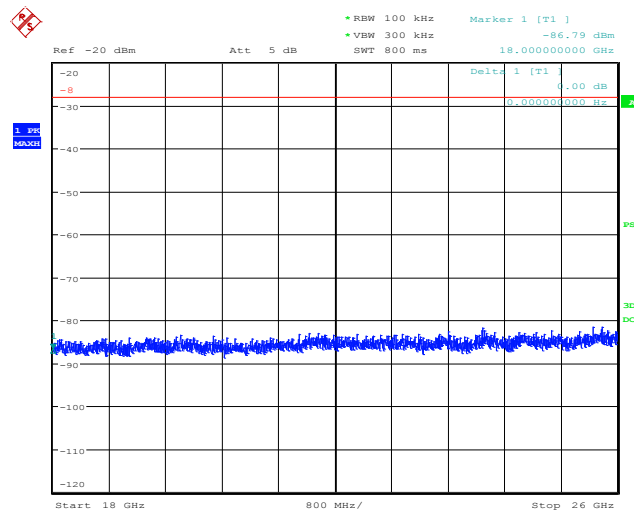


### Mid Channel, 6 GHz to 18 GHz



Date: 8.APR.2016 10:51:25

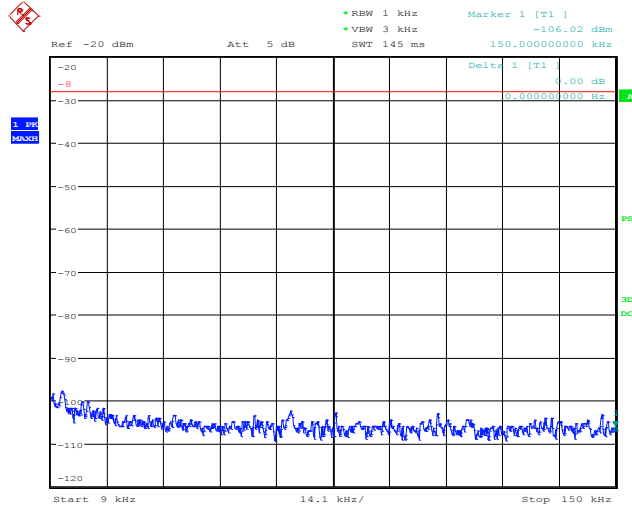
### Mid Channel, 18 GHz to 26 GHz



Date: 8.APR.2016 10:51:39

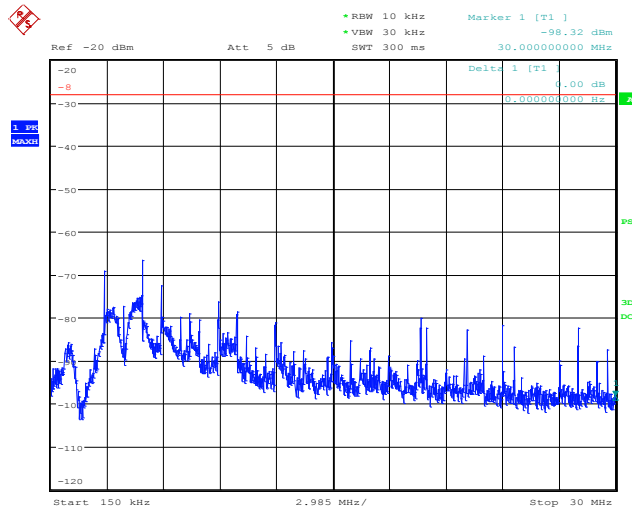


### High Channel, 9kHz to 150kHz



Date: 8.APR.2016 10:52:27

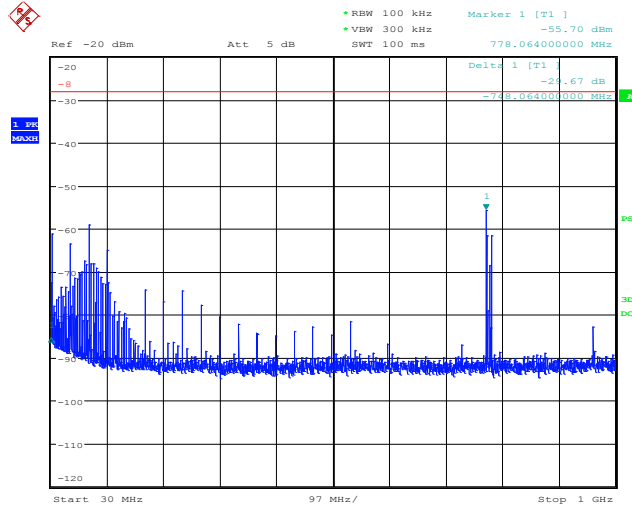
### High Channel, 150kHz to 30 MHz



Date: 8.APR.2016 10:53:41

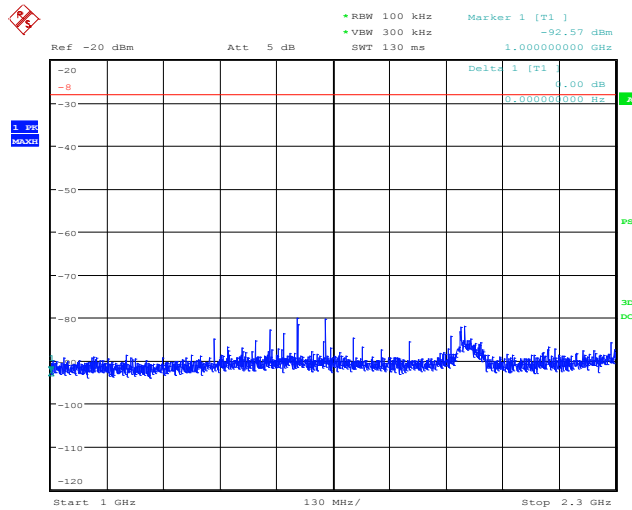


### High Channel, 30 MHz to 1 GHz



Date: 8.APR.2016 10:54:40

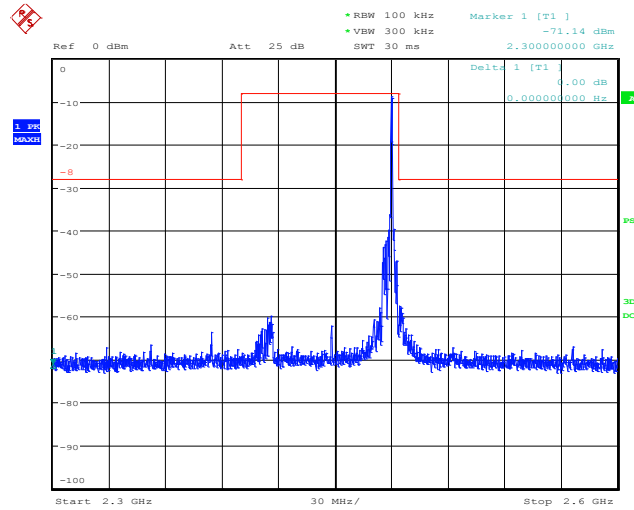
### High Channel, 1 GHz to 2.3 GHz



Date: 8.APR.2016 10:54:49

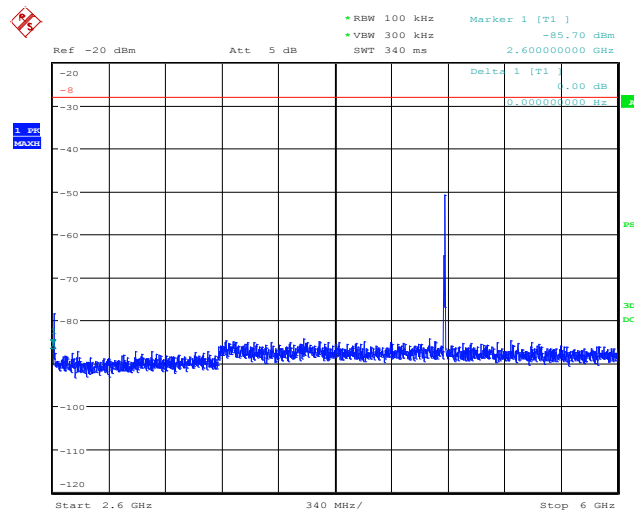


### High Channel, 2.3 GHz to 2.6 GHz



Date: 8.APR.2016 10:55:03

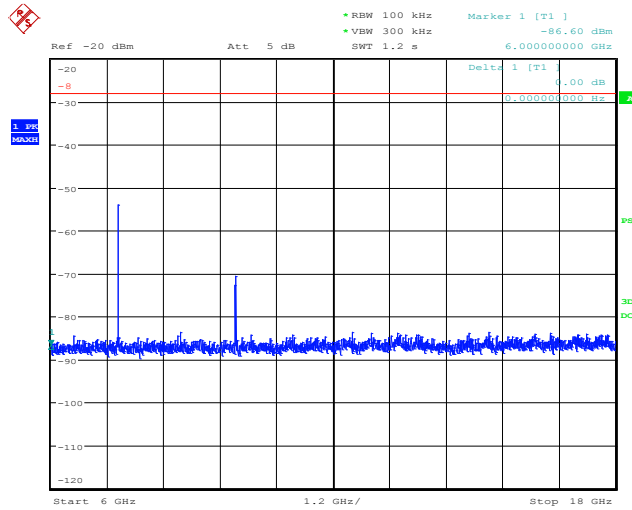
### High Channel, 2.6 GHz to 6 GHz



Date: 8.APR.2016 10:55:18

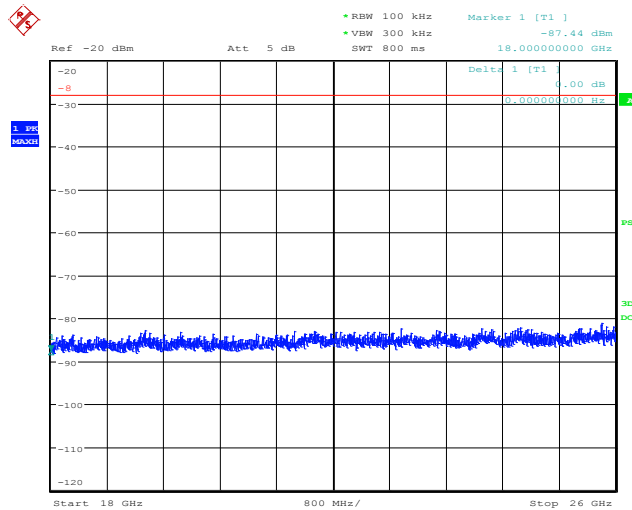


### High Channel, 6 GHz to 18 GHz



Date: 8.APR.2016 10:55:31

### High Channel, 18 GHz to 26 GHz



Date: 8.APR.2016 10:55:45



## 11 FCC Part 15.247(d) – RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its integral/internal chip antenna. Radiated emissions were measured in a Semi-Anechoic Chamber. All emissions generated that fall in the restricted bands per FCC Part 15.205 were examined.

### 11.1 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).



### 11.2 Radiated Spurious Emission Test Data

<b>Test Date(s):</b>	Apr. 11-12, 2016	<b>Test Engineer:</b>	J. Knepper
<b>Standards:</b>	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	<b>Air Temperature:</b>	21.4°C
		<b>Relative Humidity:</b>	41%

**Notes:**

Emissions were checked with the final metal enclosure and the emissions went down. Emissions were run without the enclosure as worst case operation.

Plots are peak, max hold prescan data included only to determine what frequencies to investigate and measure. The EUT was initially placed in a semi-anechoic chamber, and rotated in all three orthogonal positions to maximize the emissions. Characterization measurements were then performed to determine at which frequencies significant emissions occurred. These graphs are shown below.

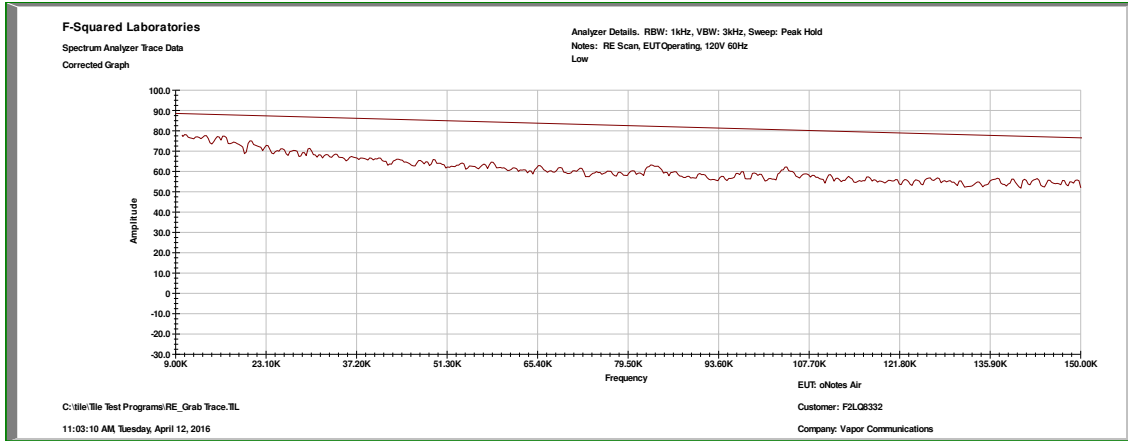
The equipment was fully exercised with all cabling attached to the EUT and was positioned on the OATS for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength. The tables of measured results can be found below.

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.

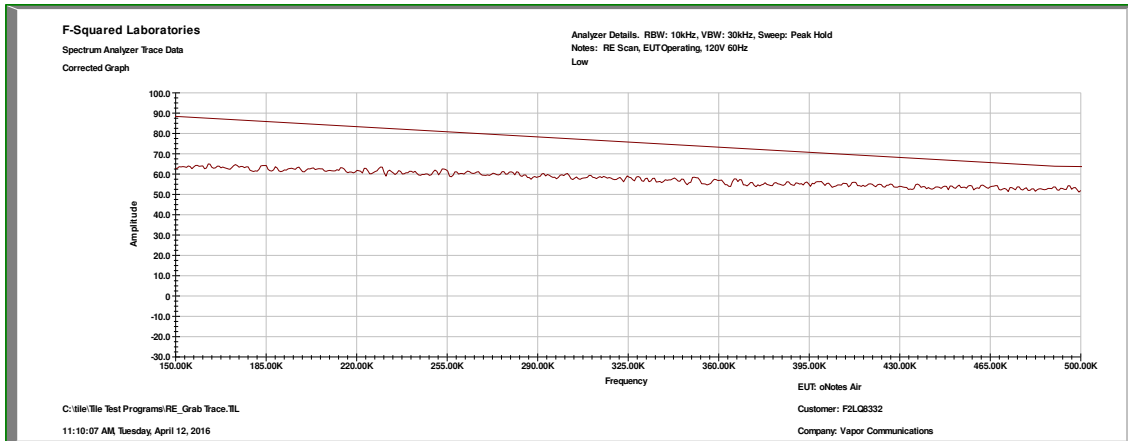
In the following plots, the black line indicates ambient noise and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables. The plots are for reference only and the limit lines are not actual limit lines but merely a guide.



### Low Channel, 9kHz to 150kHz

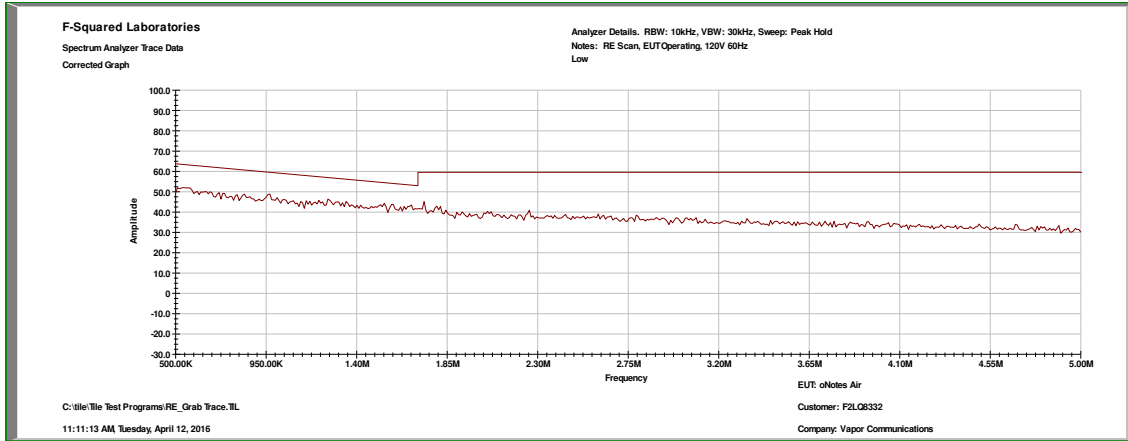


### Low Channel, 150kHz to 0.5 MHz

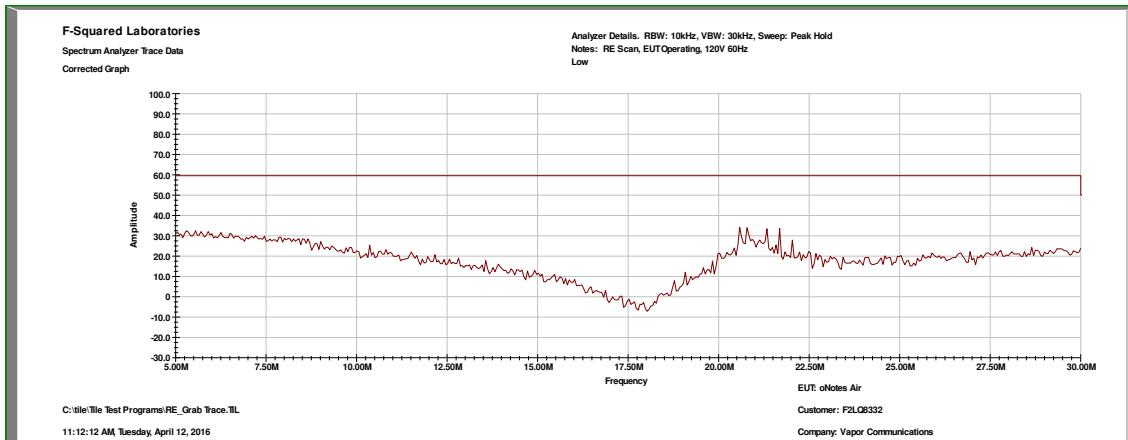




### Low Channel, 0.5 MHz to 5 MHz

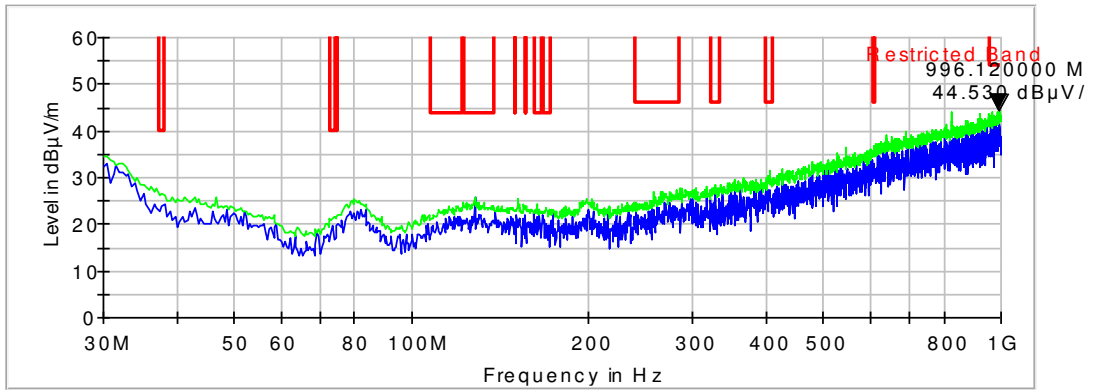


### Low Channel, 5 MHz to 30 MHz

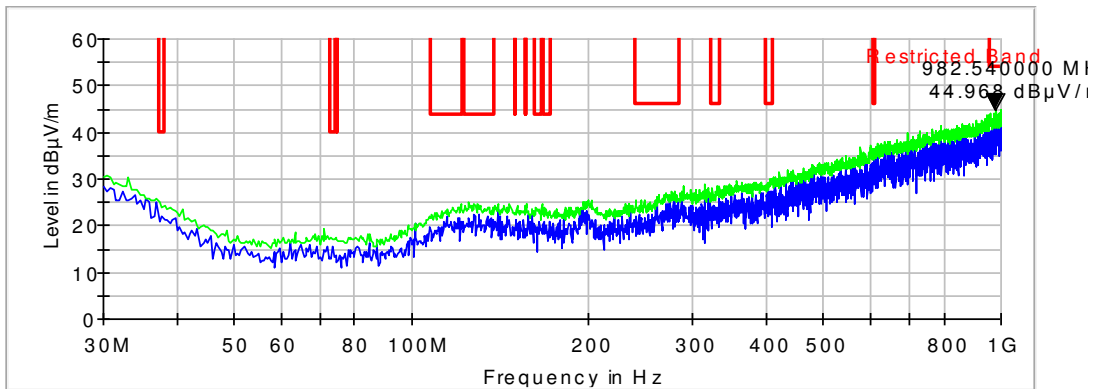




### Low Channel, 30 MHz to 1 GHz, Vertical

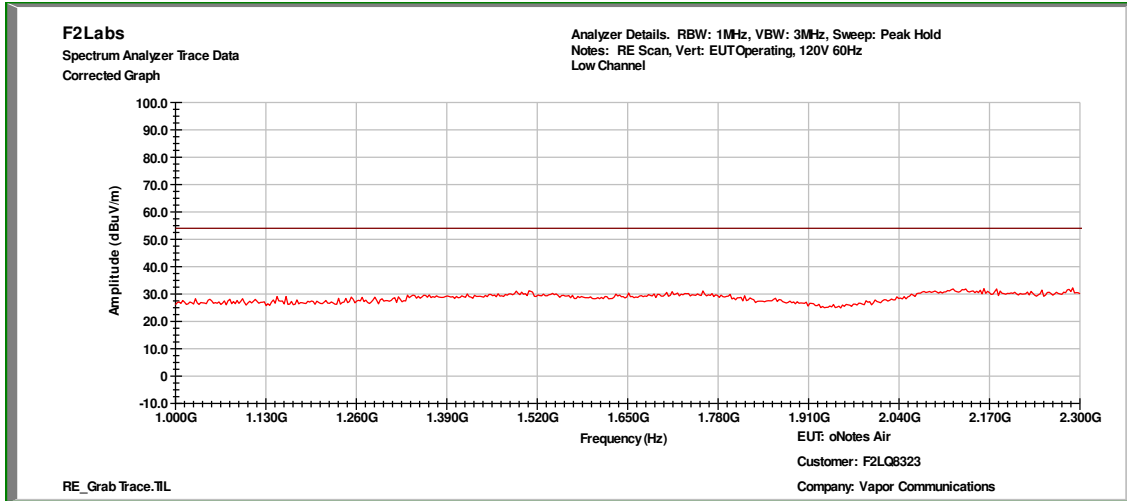


### Low Channel, 30 MHz to 1 GHz, Horizontal

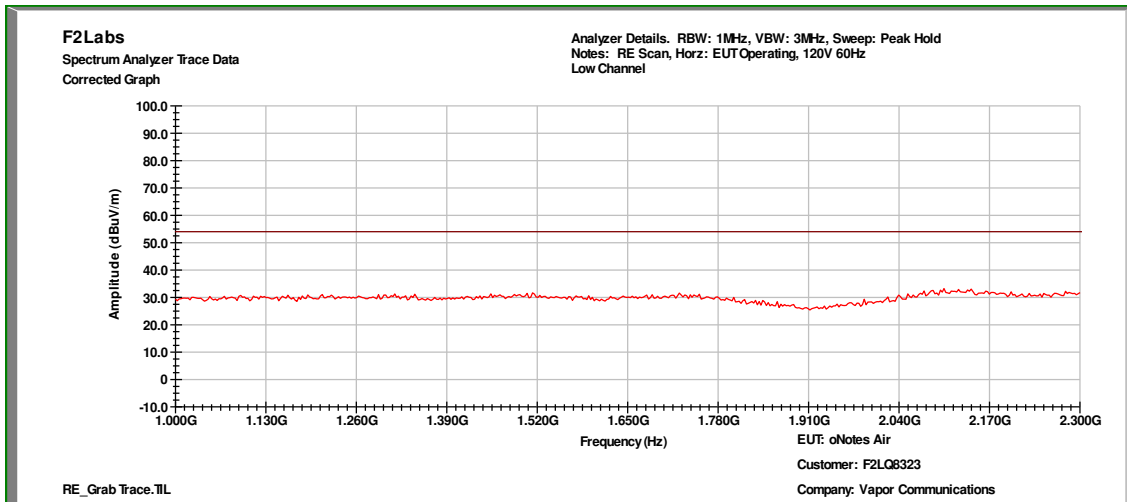




### Low Channel, 1 GHz to 2.3 GHz, Vertical

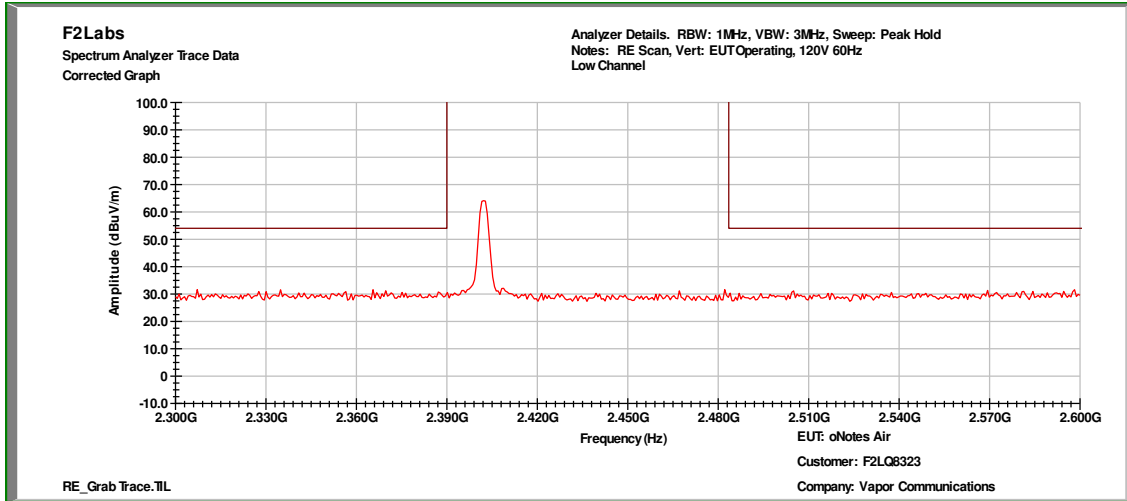


### Low Channel, 1 GHz to 2.3 GHz, Horizontal

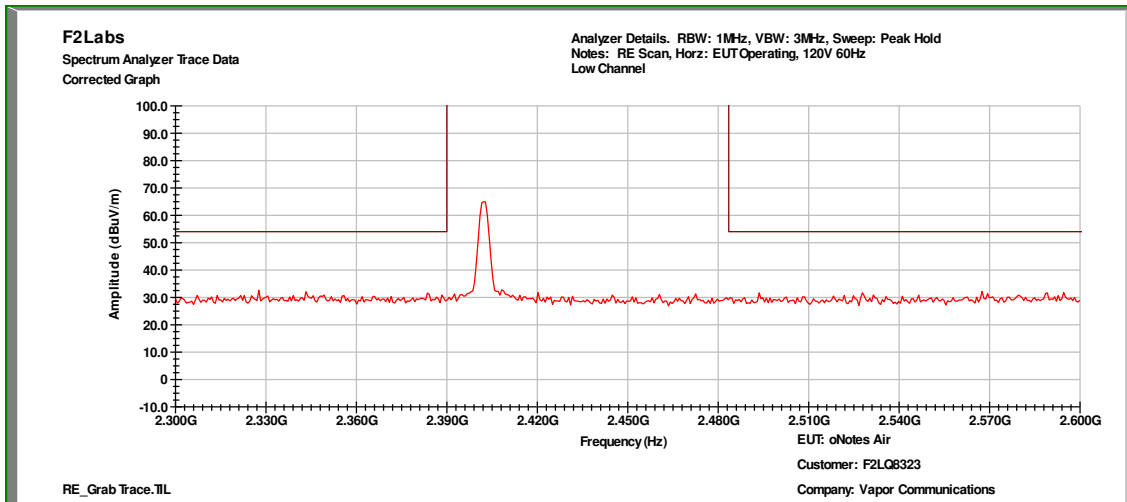




### Low Channel, 2.3 GHz to 2.6 GHz, Vertical

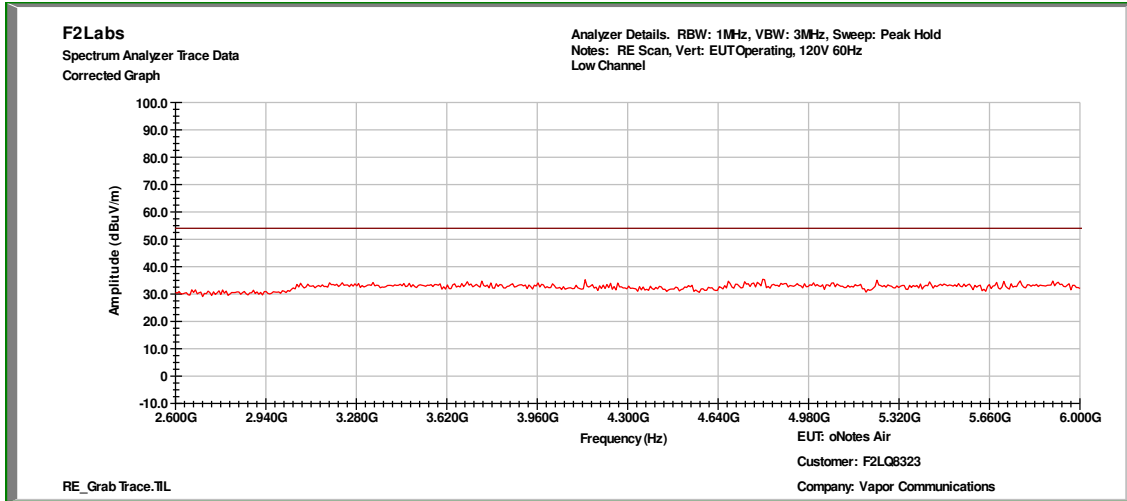


### Low Channel, 2.3 GHz to 2.6 GHz, Horizontal

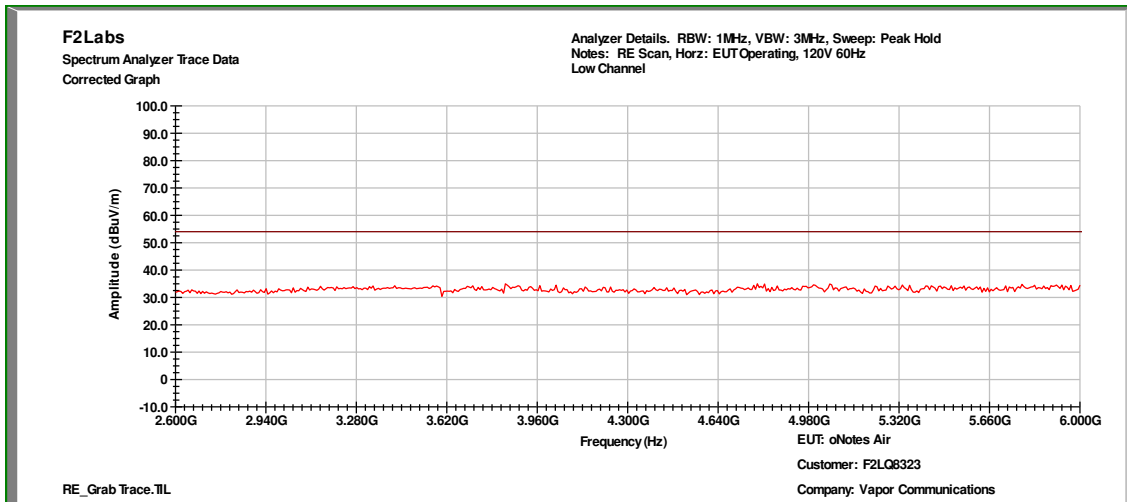




### Low Channel, 2.6 GHz to 6 GHz, Vertical

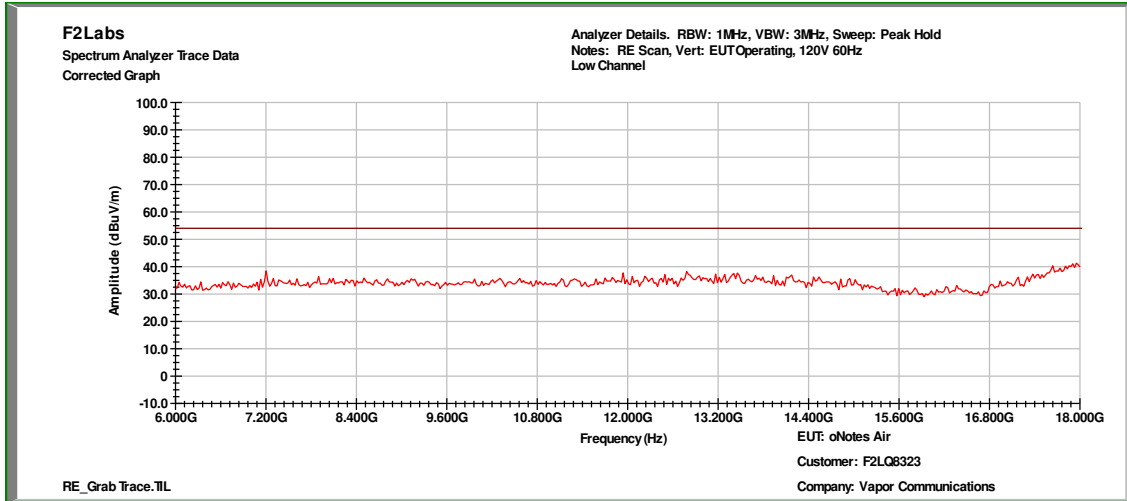


### Low Channel, 2.6 GHz to 6 GHz, Horizontal

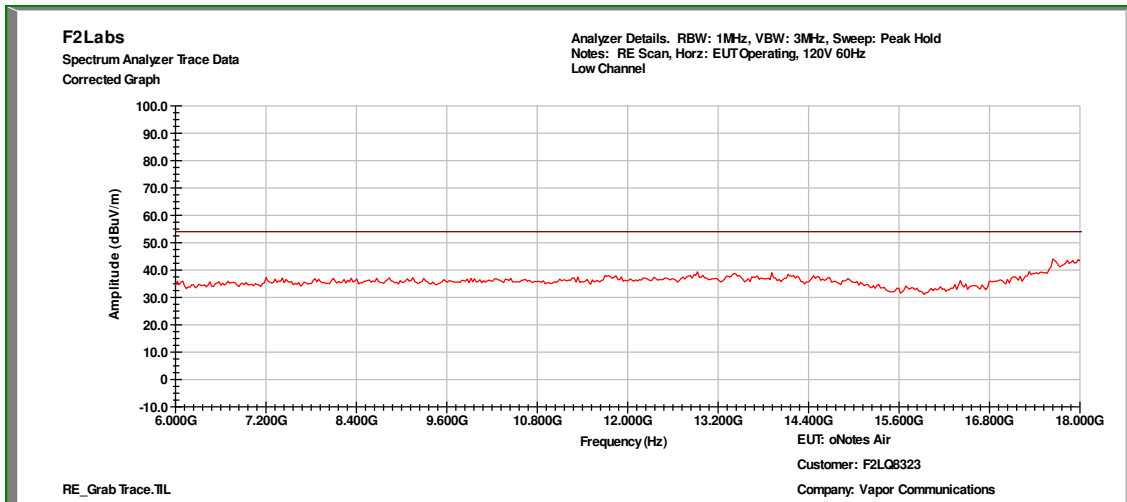




### Low Channel, 6 GHz to 18 GHz, Vertical

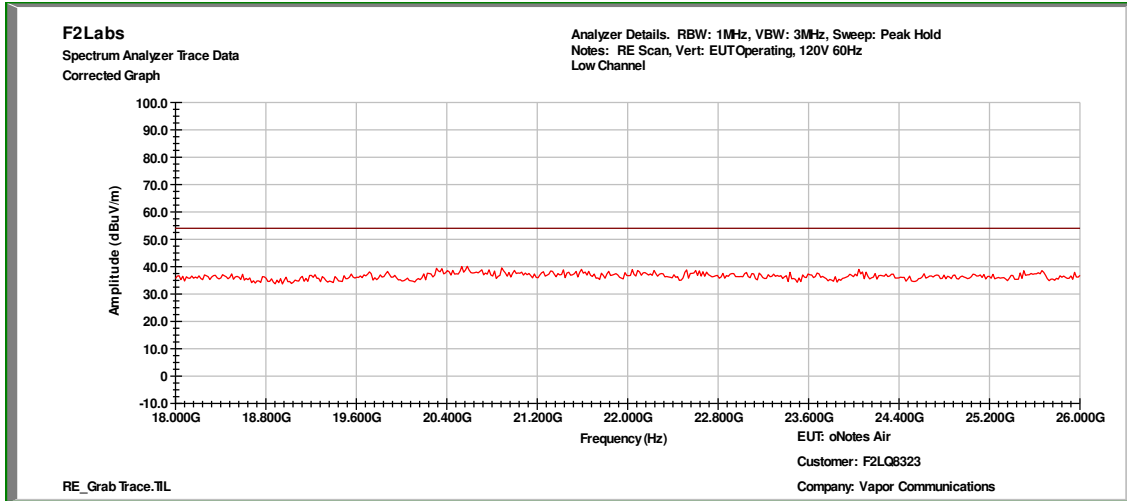


### Low Channel, 6 GHz to 18 GHz, Horizontal

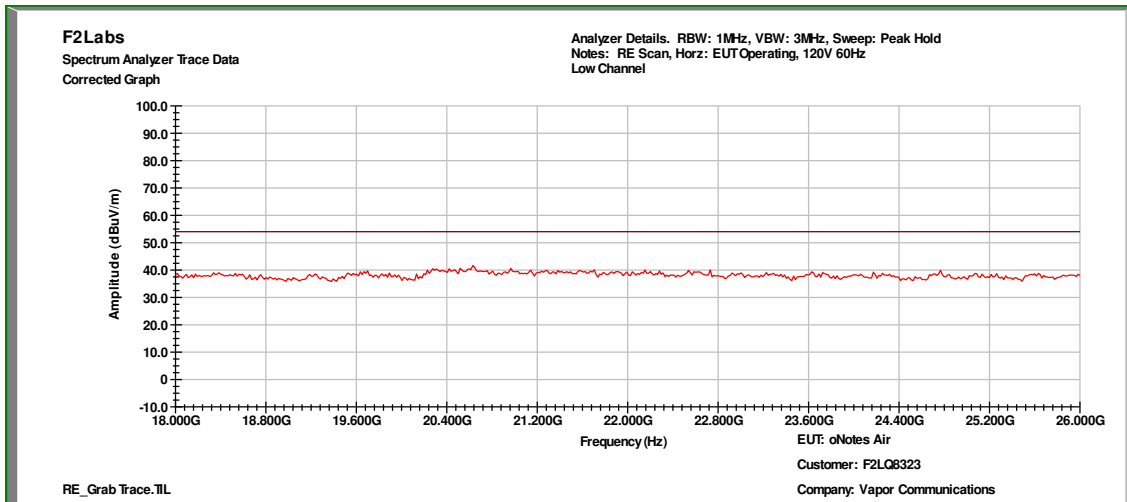




### Low Channel, 18 GHz to 26 GHz, Vertical

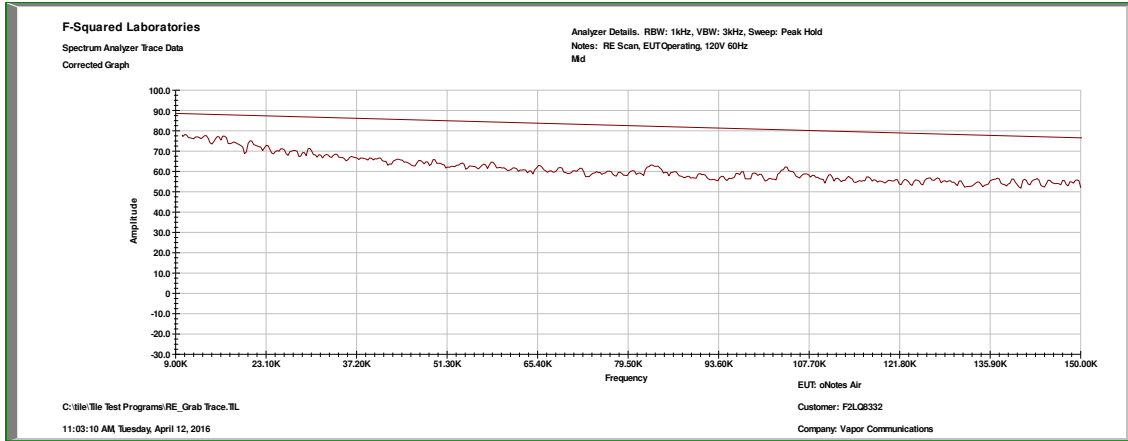


### Low Channel, 18 GHz to 26 GHz, Horizontal

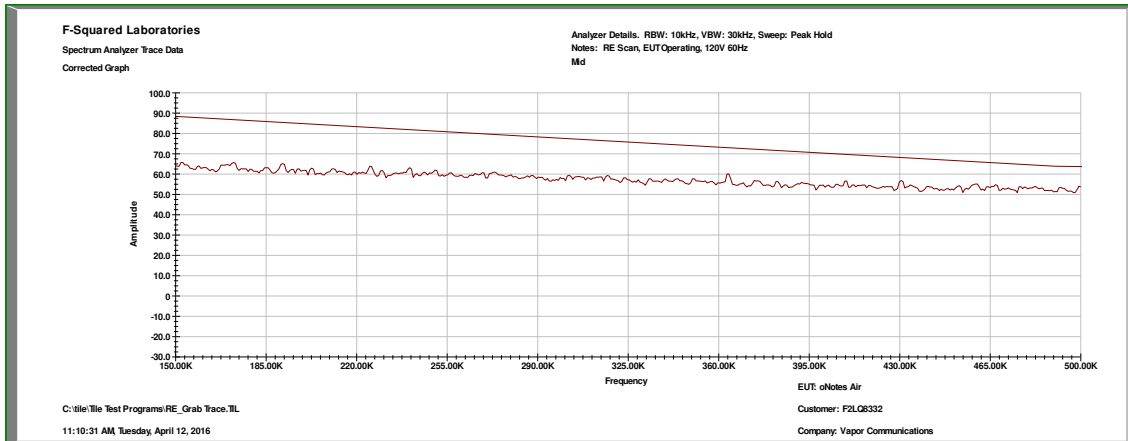




### Mid Channel, 9kHz to 150kHz

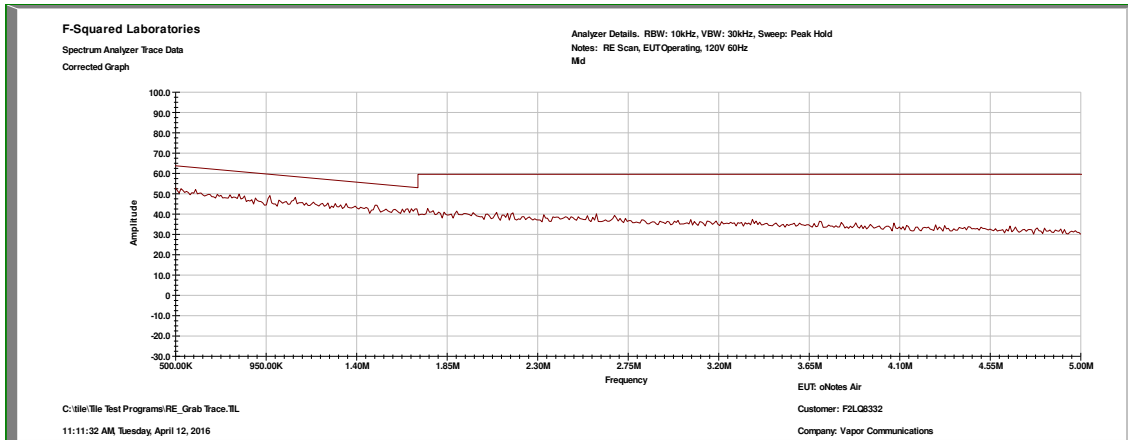


### Mid Channel, 150kHz to 0.5 MHz

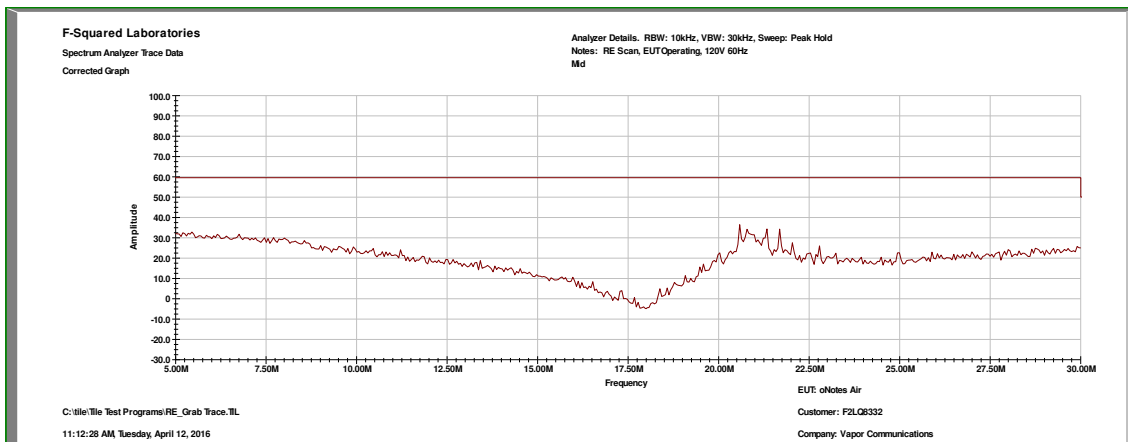




### Mid Channel, 0.5 MHz to 5 MHz

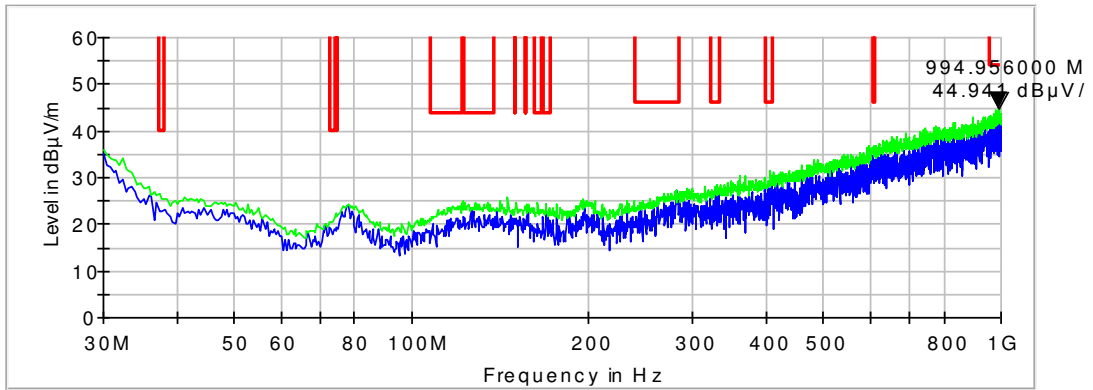


### Mid Channel, 5 MHz to 30 MHz

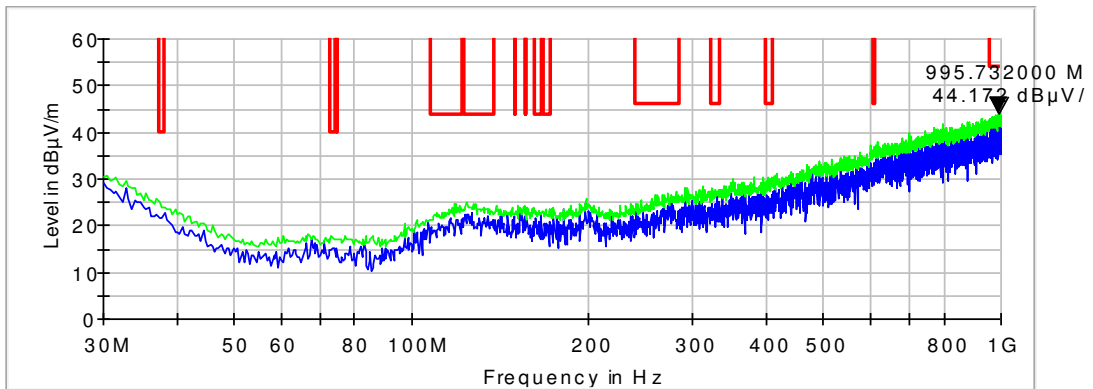




### Mid Channel, 30 MHz to 1 GHz, Vertical

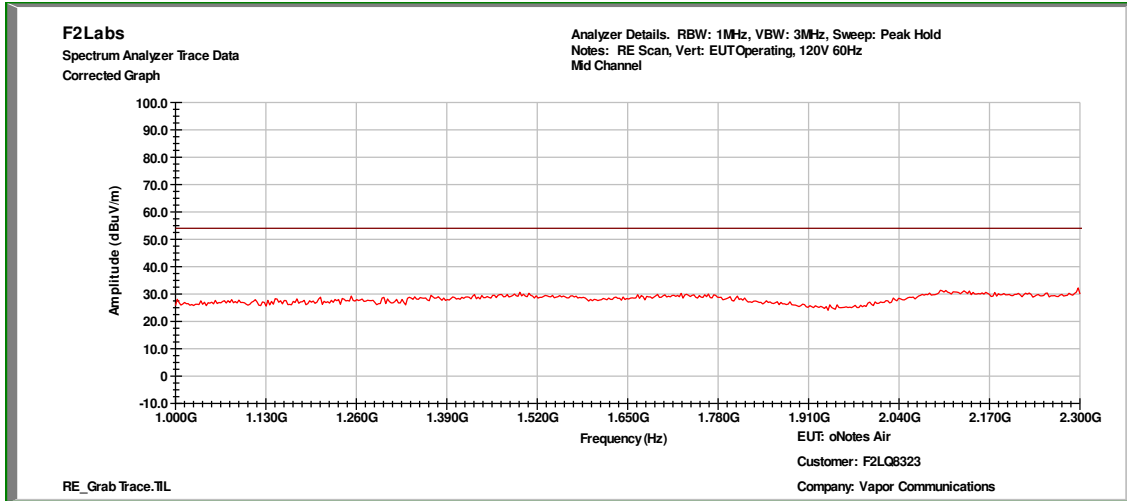


### Mid Channel, 30 MHz to 1 GHz, Horizontal

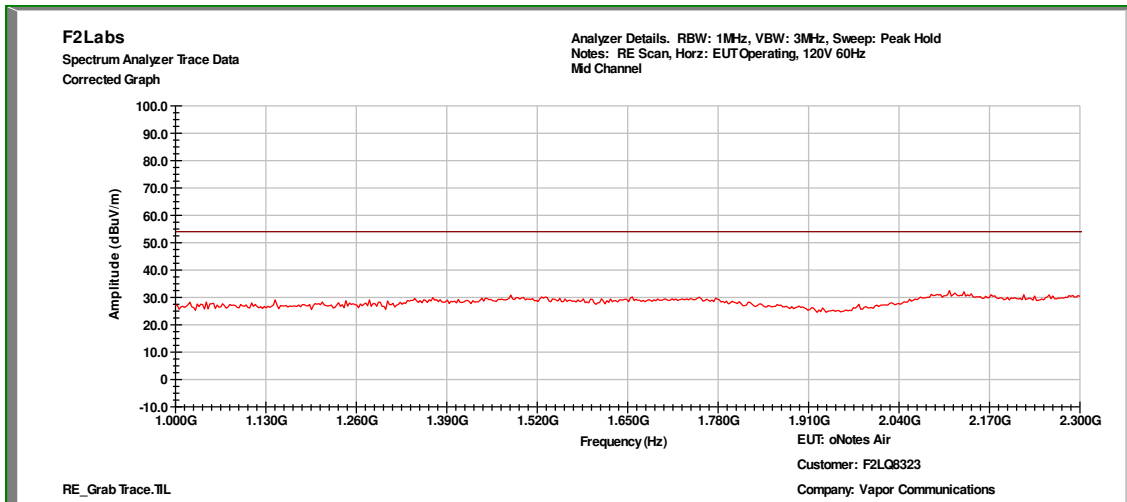




### Mid Channel, 1 GHz to 2.3 GHz, Vertical

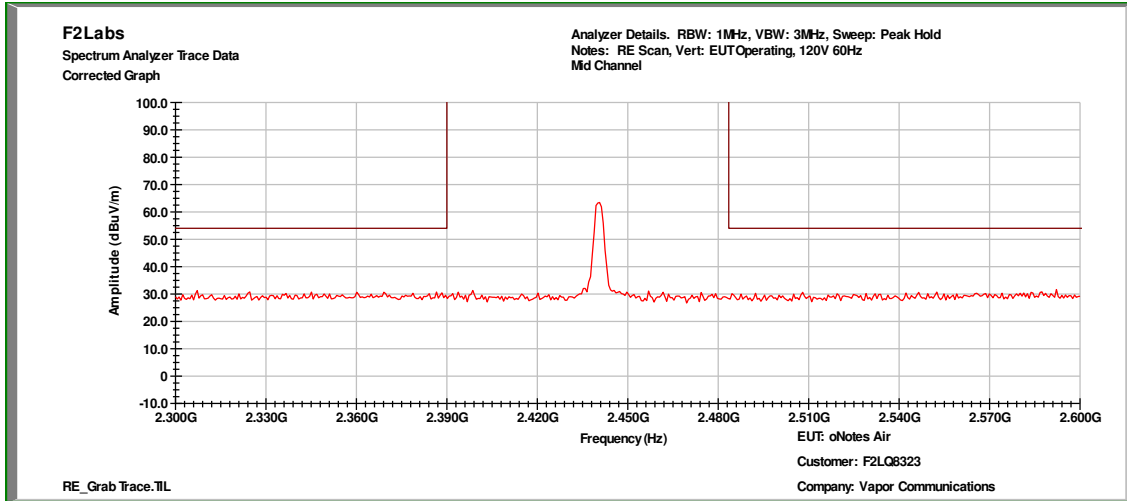


### Mid Channel, 1 GHz to 2.3 GHz, Horizontal

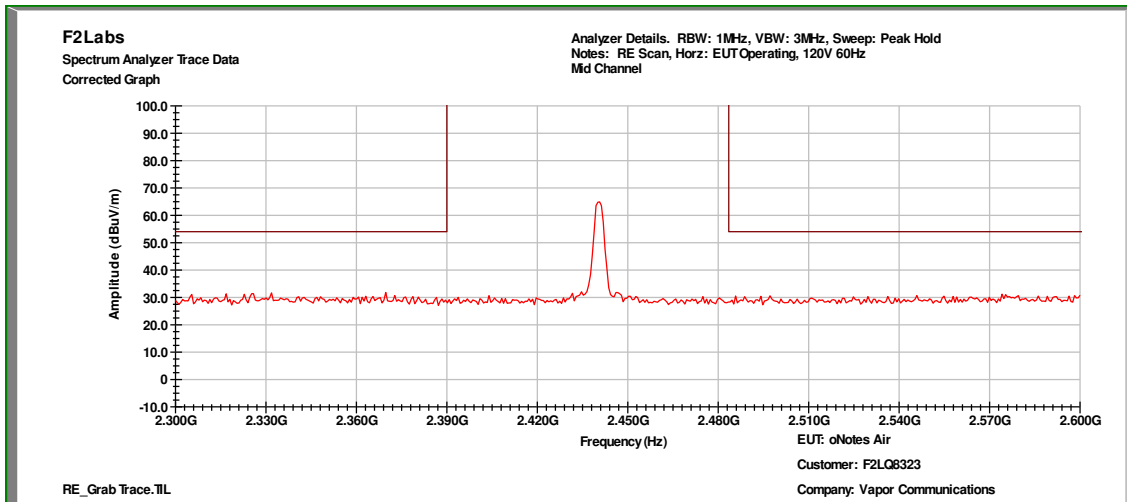




### Mid Channel, 2.3 GHz to 2.6 GHz, Vertical

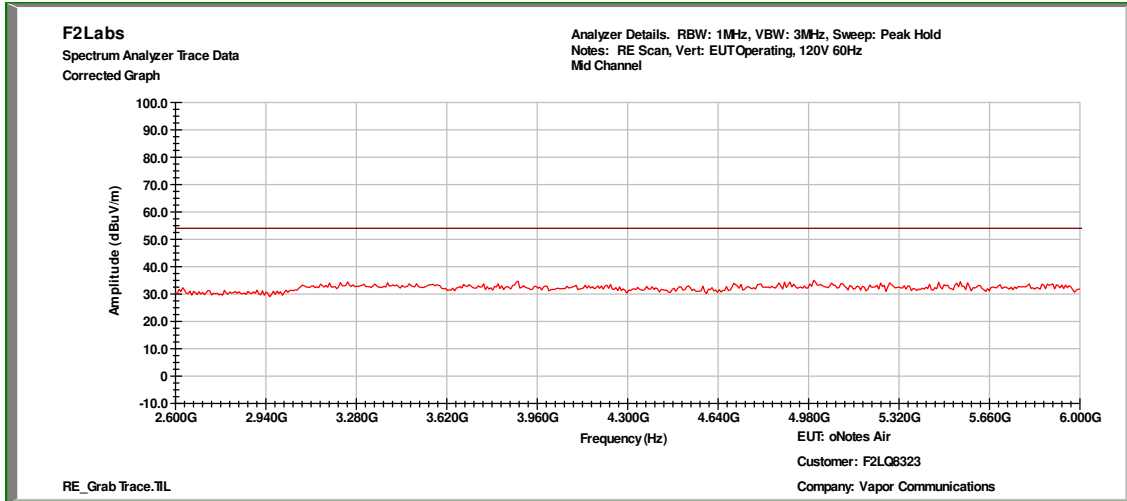


### Mid Channel, 2.3 GHz to 2.6 GHz, Horizontal

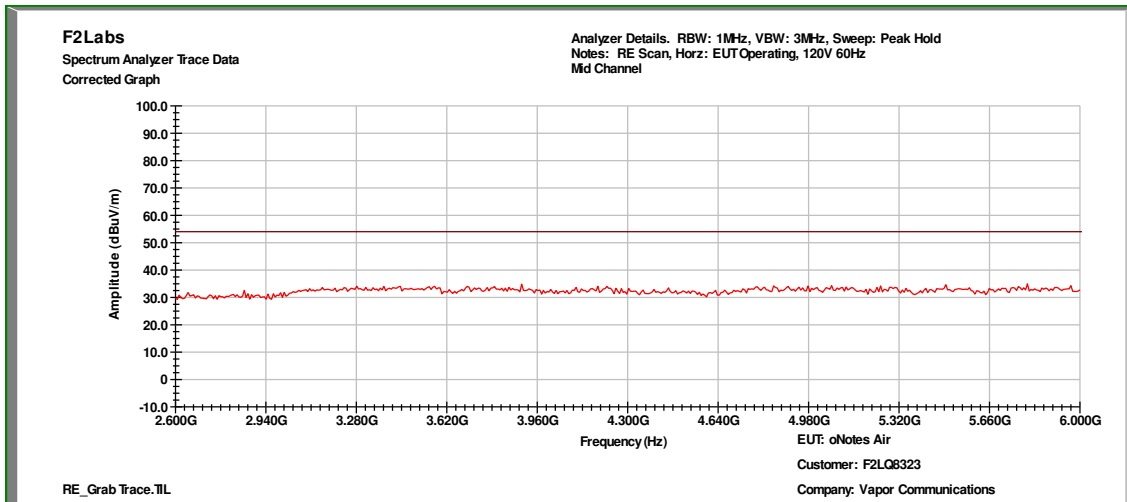




### Mid Channel, 2.6 GHz to 6 GHz, Vertical

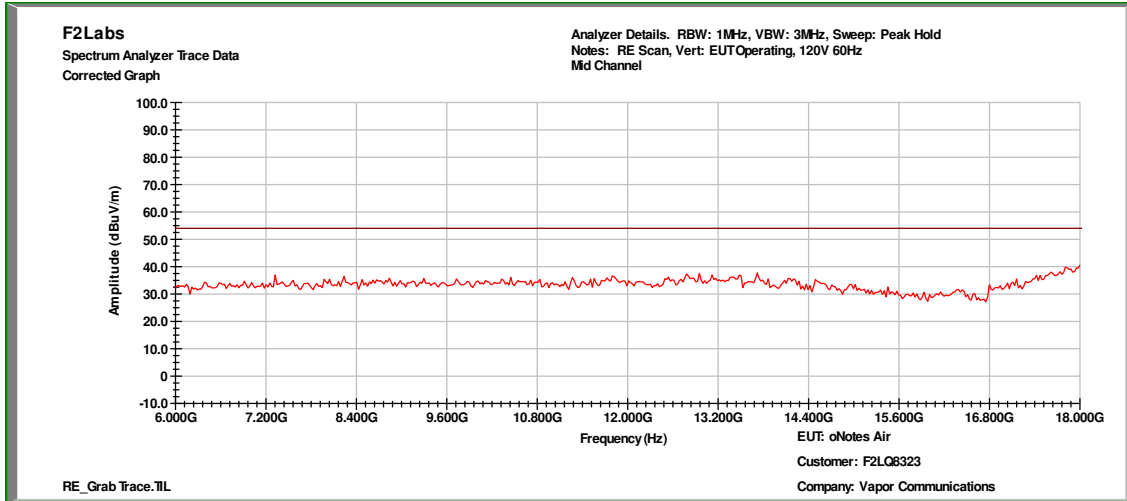


### Mid Channel, 2.6 GHz to 6 GHz, Horizontal

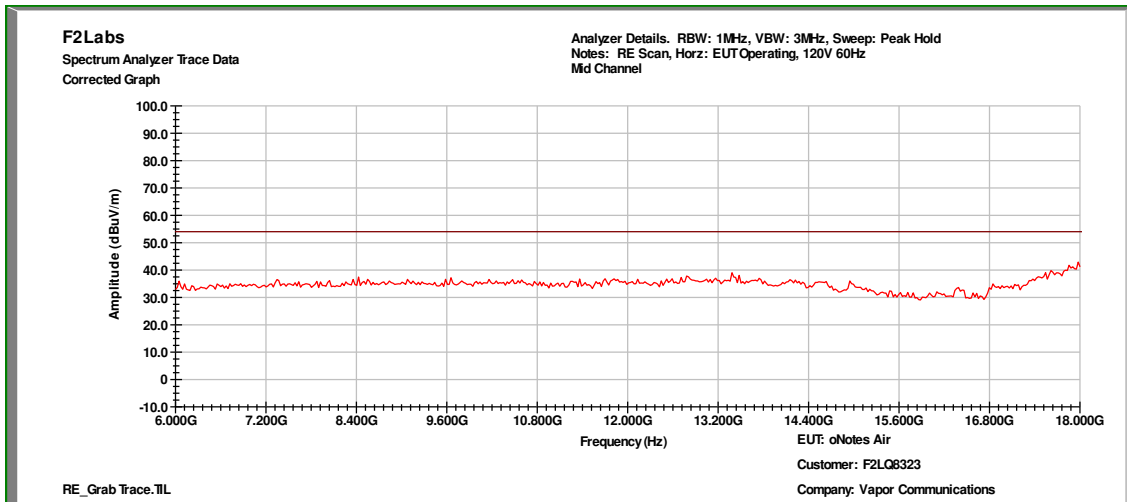




### Mid Channel, 6 GHz to 18 GHz, Vertical

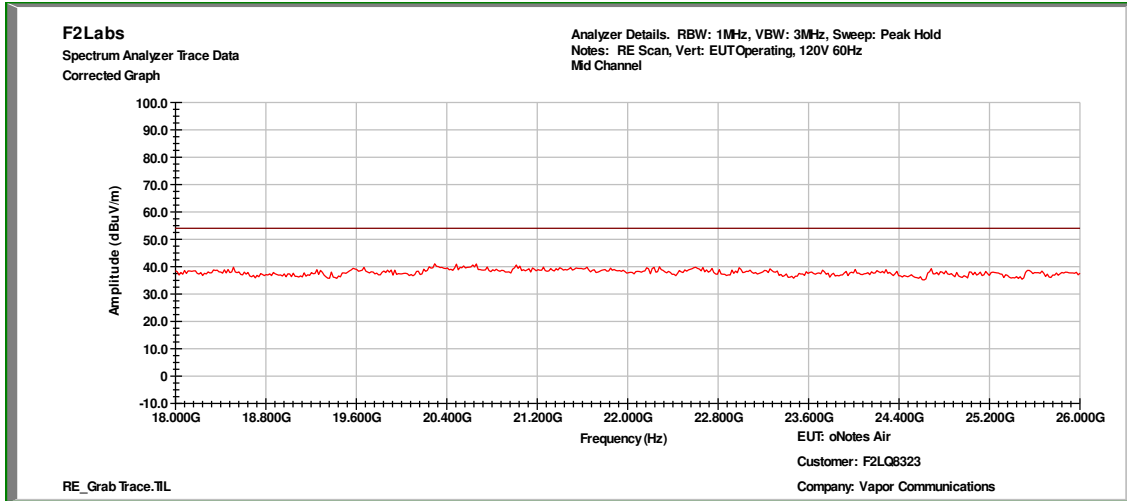


### Mid Channel, 6 GHz to 18 GHz, Horizontal

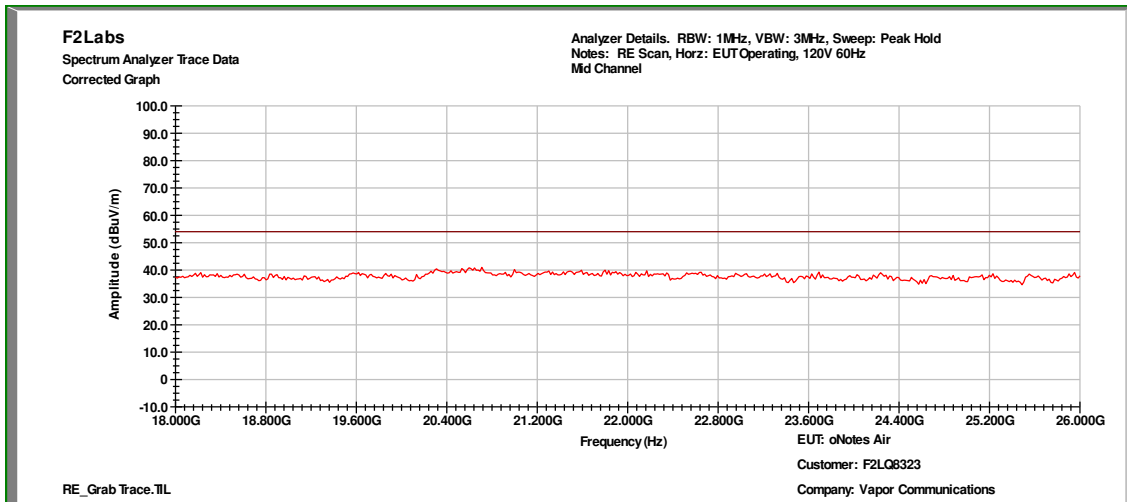




### Mid Channel, 18 GHz to 26 GHz, Vertical

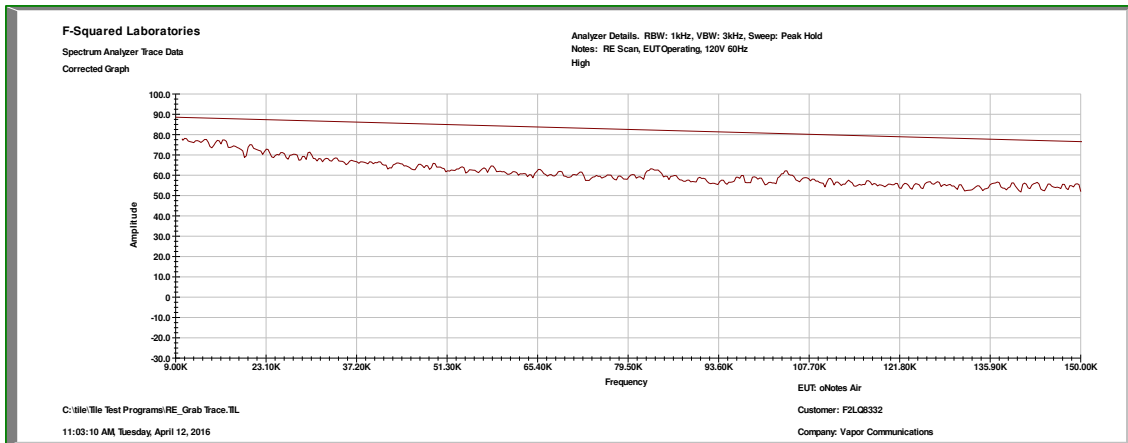


### Mid Channel, 18 GHz to 26 GHz, Horizontal

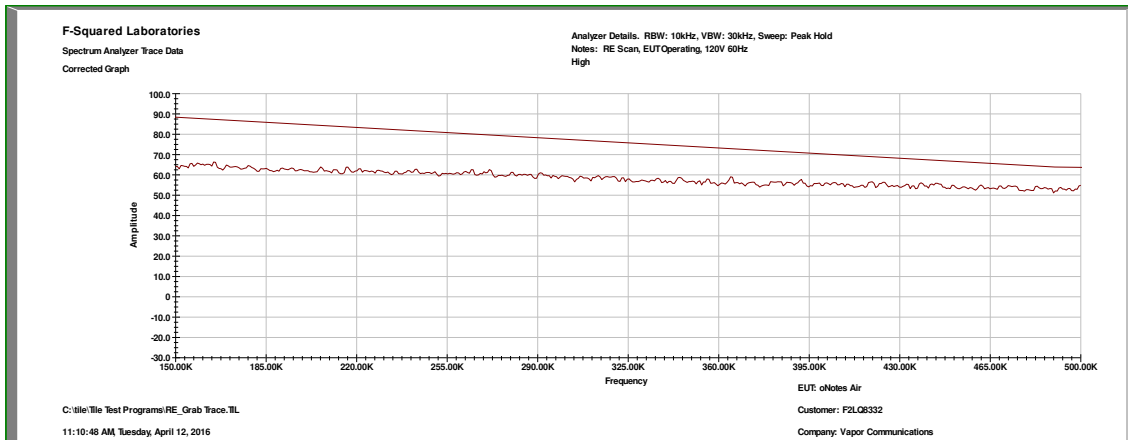




### High Channel, 9kHz to 150kHz

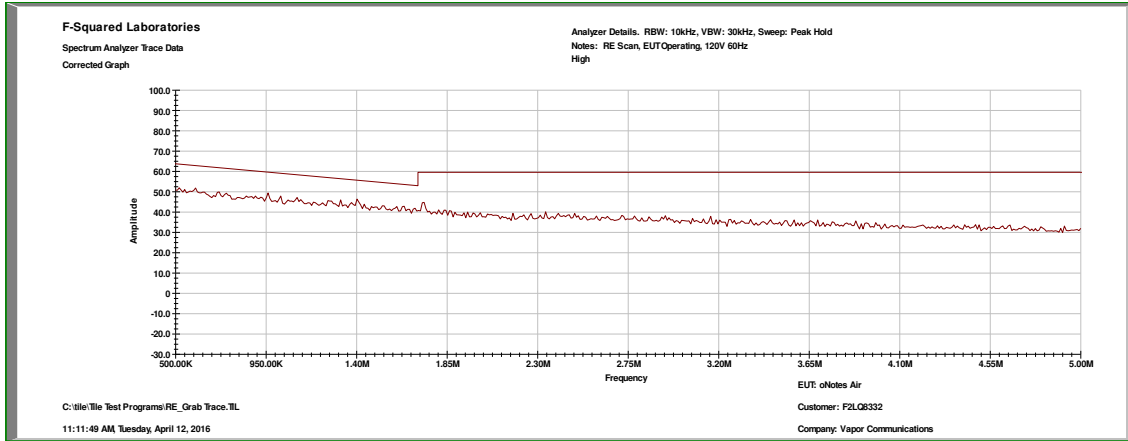


### High Channel, 150kHz to 0.5 MHz

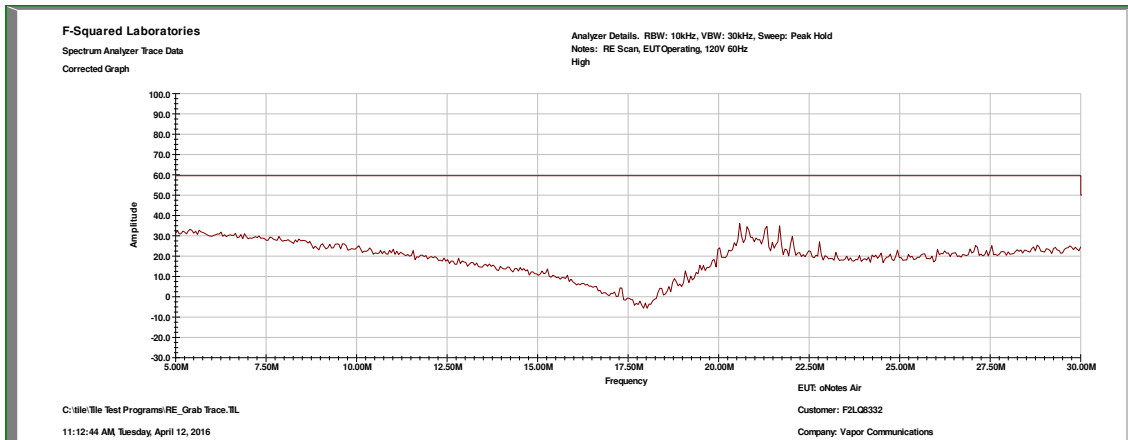




### High Channel, 0.5 MHz to 5 MHz

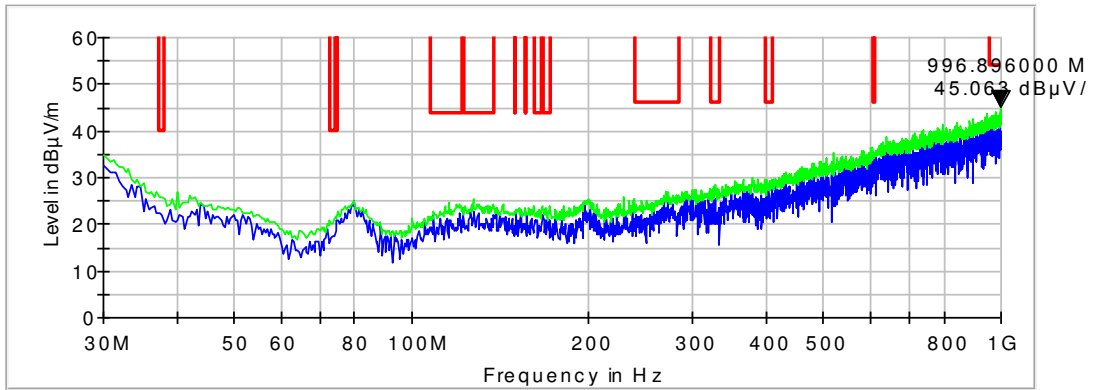


### High Channel, 5 MHz to 30 MHz

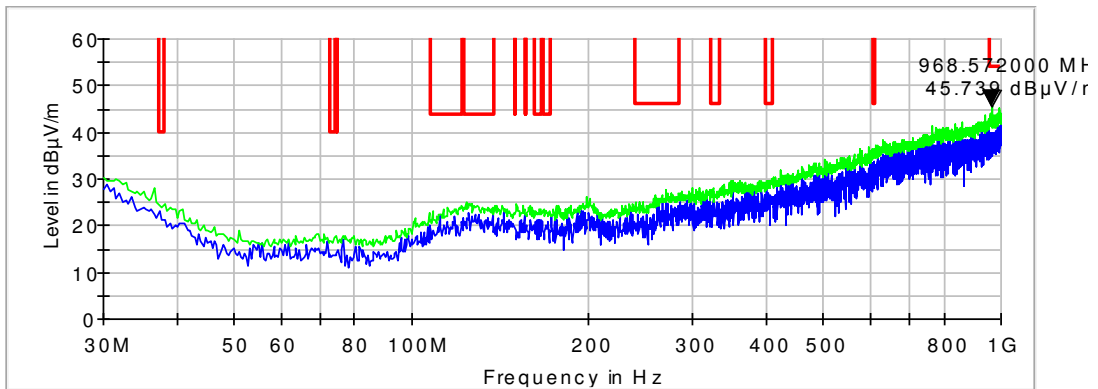




### High Channel, 30 MHz to 1 GHz, Vertical

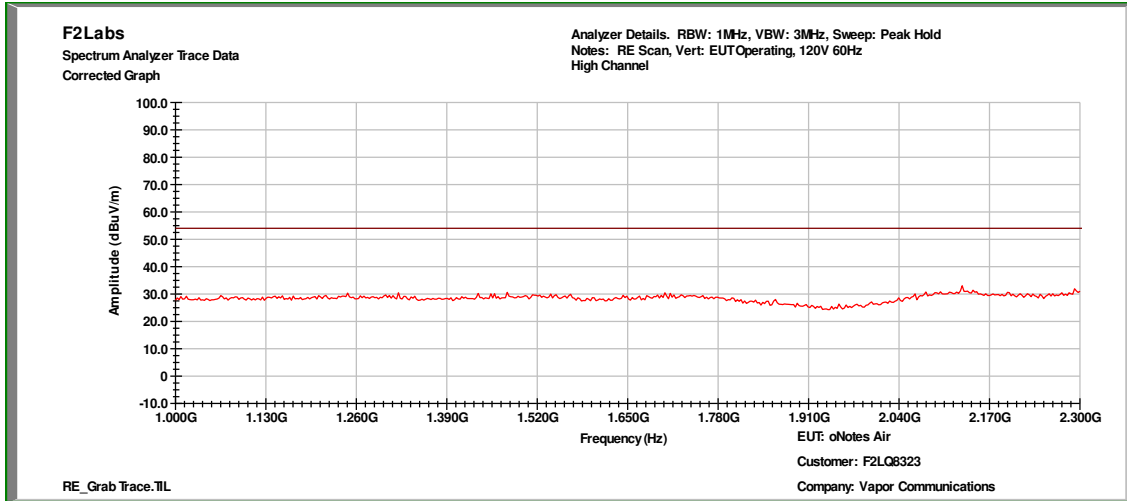


### High Channel, 30 MHz to 1 GHz, Horizontal

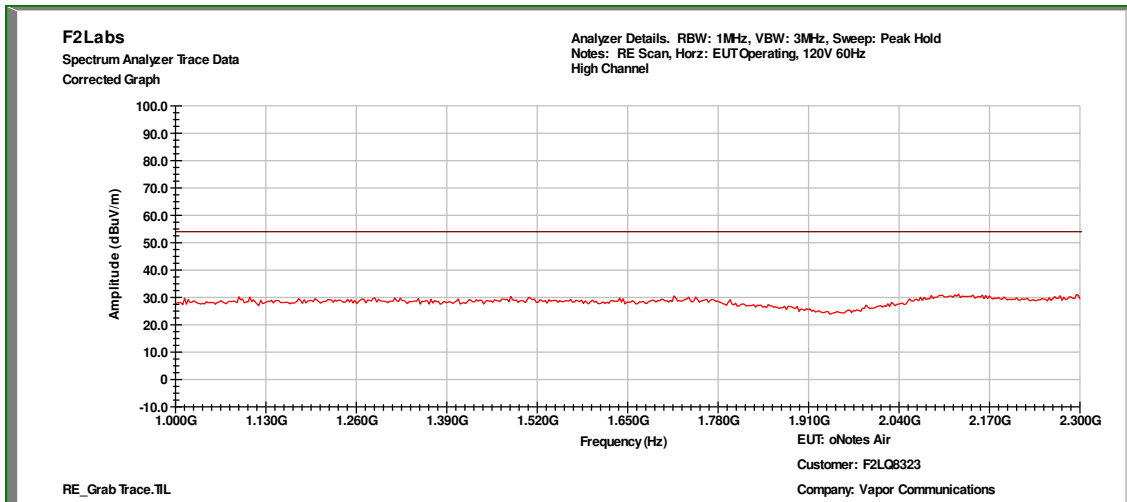




### High Channel, 1 GHz to 2.3 GHz, Vertical

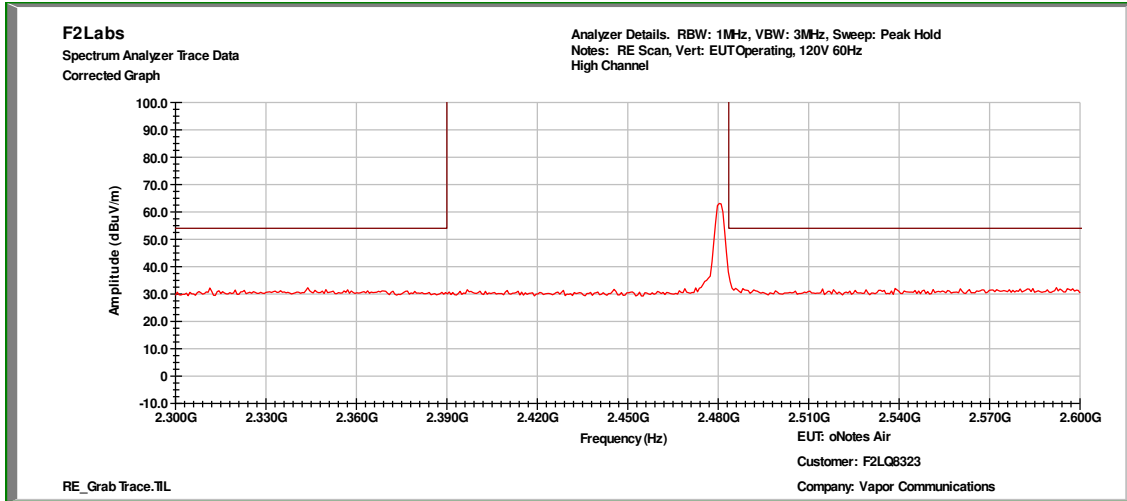


### High Channel, 1 GHz to 2.3 GHz, Horizontal

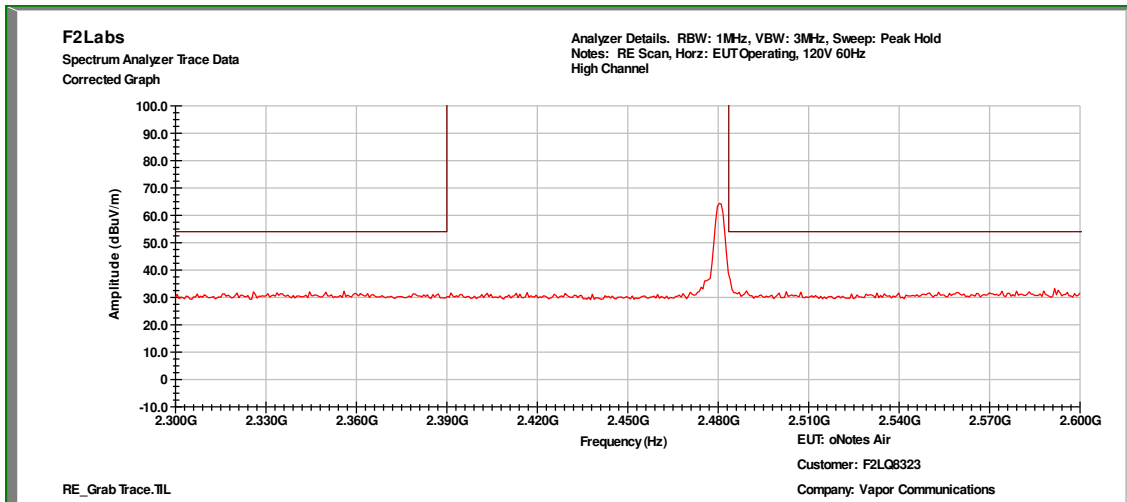




### High Channel, 2.3 GHz to 2.6 GHz, Vertical

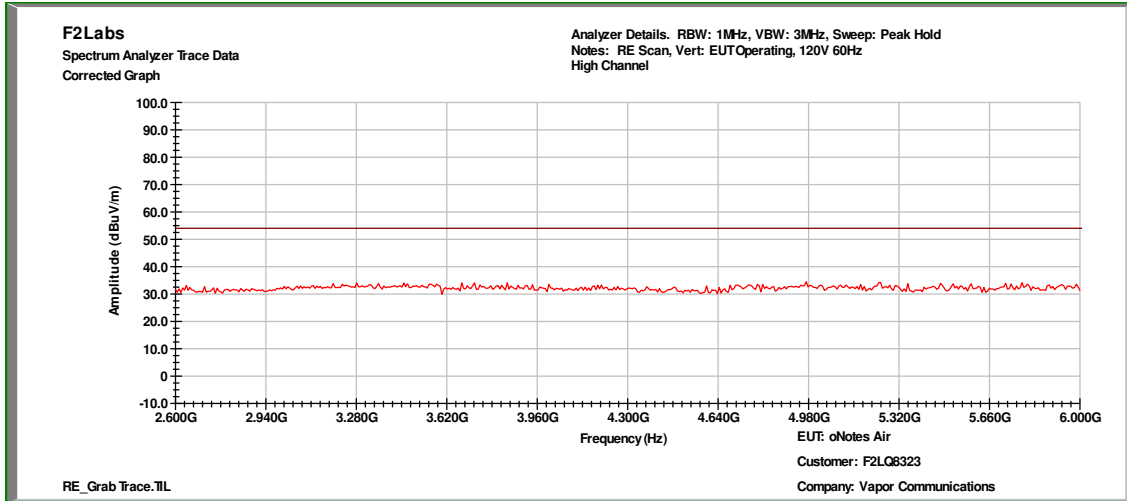


### High Channel, 2.3 GHz to 2.6 GHz, Horizontal

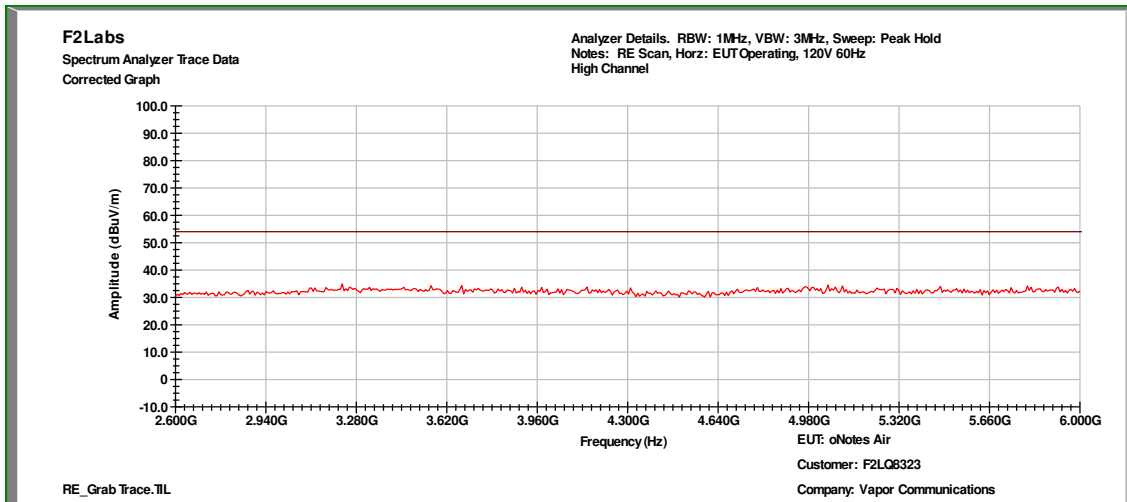




### High Channel, 2.6 GHz to 6 GHz, Vertical

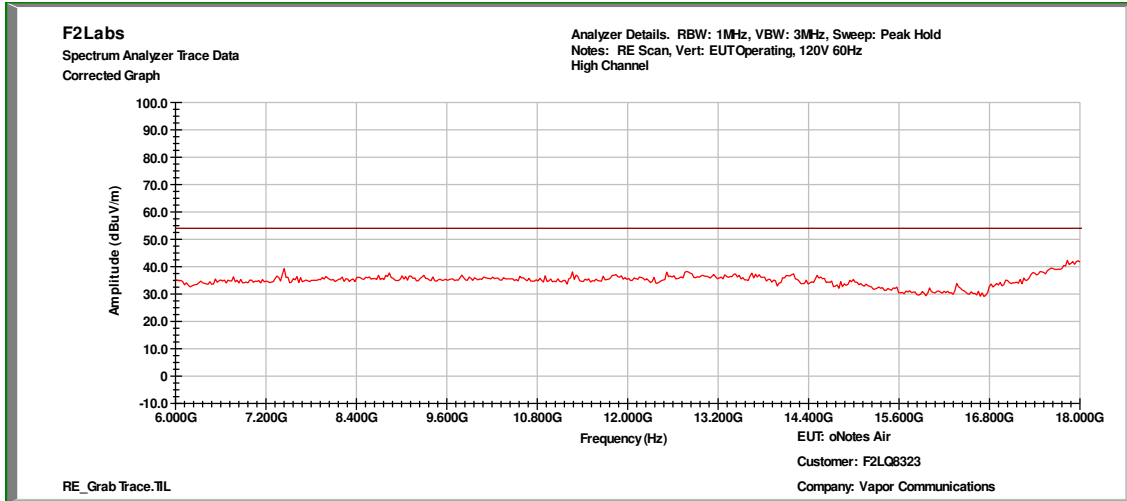


### High Channel, 2.6 GHz to 6 GHz, Horizontal

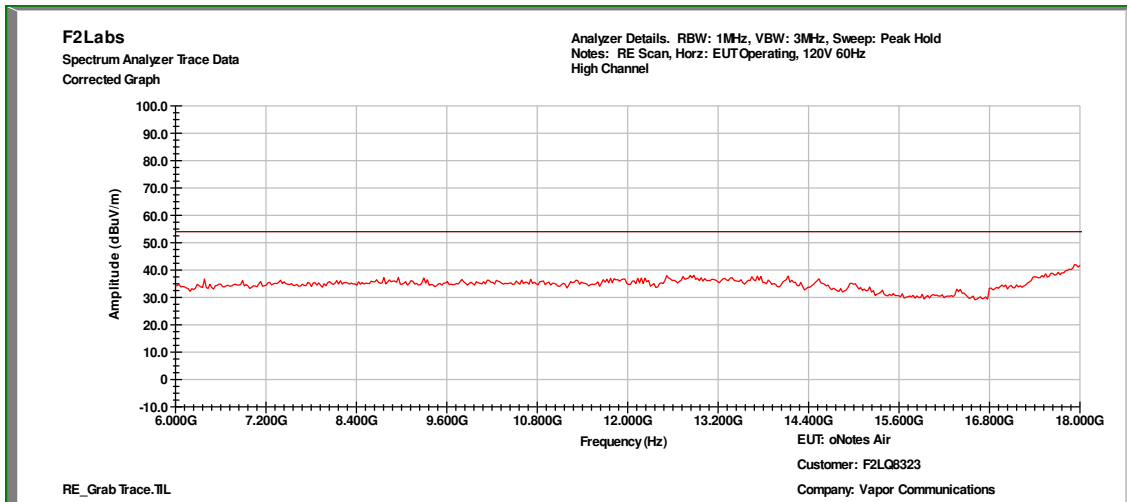




### High Channel, 6 GHz to 18 GHz, Vertical

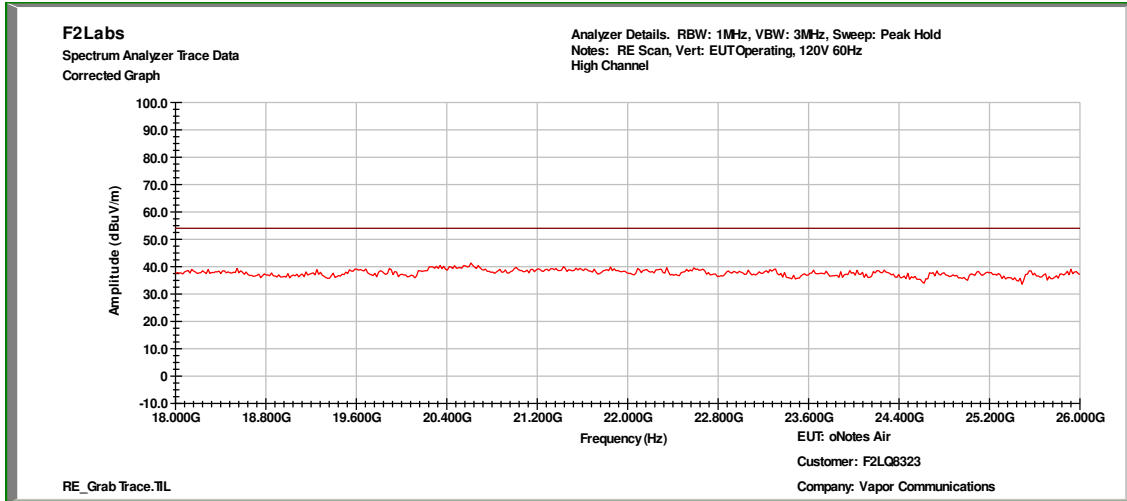


### High Channel, 6 GHz to 18 GHz, Horizontal

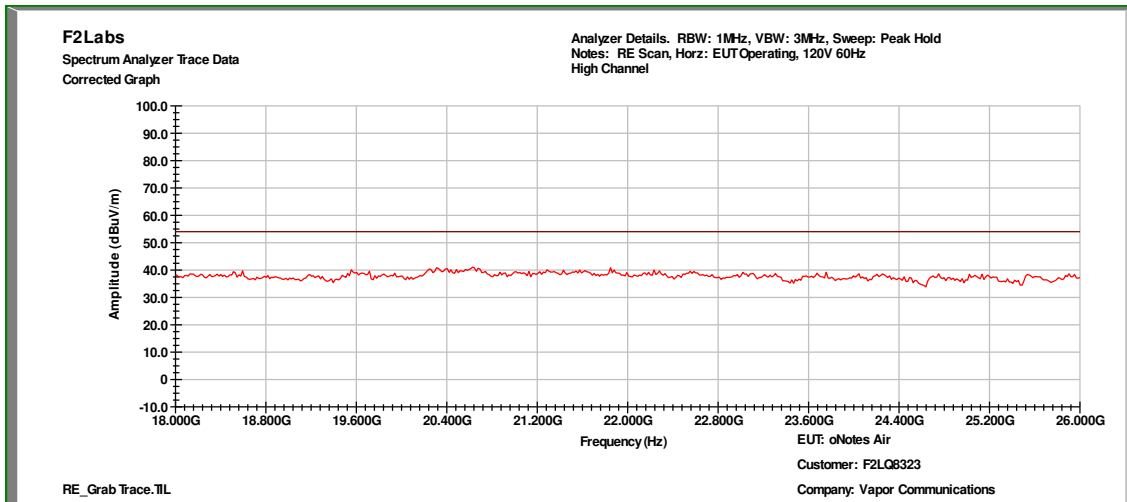




### High Channel, 18 GHz to 26 GHz, Vertical



### High Channel, 18 GHz to 26 GHz, Horizontal





**Measurements**

**Low Channel - MaxPeak**

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	H	30.5	15.7	46.20	74.0	-27.8
2390.000000	V	30.3	15.7	46.00	74.0	-28.0
2483.500000	H	31.1	15.9	47.00	74.0	-27.0
2483.500000	V	31.4	15.9	47.30	74.0	-26.7

**Low Channel - Average**

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	H	17.3	15.7	33.00	54.0	-21.0
2390.000000	V	17.3	15.7	33.00	54.0	-21.0
2483.500000	H	17.6	15.9	33.50	54.0	-20.5
2483.500000	V	17.6	15.9	33.50	54.0	-20.5

**Low Channel - QuasiPeak**

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
37.500000	V	6.6	18.2	24.80	40.0	-15.2
38.250000	H	6.1	17.6	23.70	40.0	-16.3
73.000000	H	6.1	10.8	16.90	40.0	-23.1
76.948000	V	9.9	10.8	20.70	40.0	-19.3
115.360000	V	6.1	16.6	22.70	43.52	-20.8
121.940000	H	6.1	17.2	23.30	43.52	-20.2
132.432000	V	6.1	17.3	23.40	43.52	-20.1
167.720000	H	6.4	16.0	22.40	43.52	-21.1
285.000000	H	6.3	19.0	25.30	46.0	-20.7
285.304000	V	6.4	19.0	25.40	46.0	-20.6
399.900000	H	6.6	22.1	28.70	46.0	-17.3
608.000000	V	7.5	26.7	34.20	46.0	-11.8
614.000000	H	7.5	26.9	34.40	46.0	-11.6
958.872000	V	8.4	32.9	41.30	46.0	-4.7
995.344000	H	8.6	33.3	41.90	54.0	-12.1



**Mid Channel - MaxPeak**

Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2390.000000	V	30.8	15.7	46.50	74.0	-27.5
2390.000000	H	31.0	15.7	46.70	74.0	-27.3
2483.500000	V	30.8	15.9	46.70	74.0	-27.3
2483.500000	H	30.7	15.9	46.60	74.0	-27.4

**Mid Channel - Average**

Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2390.000000	V	17.3	15.7	33.00	54.0	-21.0
2390.000000	H	17.3	15.7	33.00	54.0	-21.0
2483.500000	V	17.6	15.9	33.50	54.0	-20.5
2483.500000	H	17.6	15.9	33.50	54.0	-20.5

**Mid Channel - QuasiPeak**

Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
37.500000	H	6.1	18.2	24.30	40.0	-15.7
38.250000	V	6.3	17.6	23.90	40.0	-16.1
74.600000	H	6.0	10.9	16.90	40.0	-23.1
74.800000	V	9.0	10.9	19.90	40.0	-20.1
121.940000	V	6.1	17.2	23.30	43.52	-20.2
121.940000	H	6.1	17.2	23.30	43.52	-20.2
138.000000	H	6.1	16.9	23.00	43.52	-20.5
138.000000	V	6.1	16.9	23.00	43.52	-20.5
167.720000	H	6.4	16.0	22.40	43.52	-21.1
173.200000	V	6.3	15.7	22.00	43.52	-21.5
285.000000	H	6.3	19.0	25.30	46.0	-20.7
399.900000	V	6.6	22.1	28.70	46.0	-17.3
399.900000	H	6.6	22.1	28.70	46.0	-17.3
608.000000	H	7.5	26.7	34.20	46.0	-11.8
960.000000	H	8.4	33.0	41.40	46.0	-4.6



High Channel - MaxPeak

Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2390.000000	H	30.7	15.7	46.40	74.0	-27.6
2390.000000	H	31.1	15.7	46.80	74.0	-27.2
2483.500000	H	31.4	15.9	47.30	74.0	-26.7
2483.500000	H	30.9	15.9	46.80	74.0	-27.2

High Channel - Average

Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2390.000000	H	17.3	15.7	33.00	54.0	-21.0
2390.000000	H	17.3	15.7	33.00	54.0	-21.0
2483.500000	H	17.6	15.9	33.50	54.0	-20.5
2483.500000	H	17.6	15.9	33.50	54.0	-20.5

High Channel - QuasiPeak

Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Cable Loss & Antenna Factor (dB)	Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
36.596000	H	6.3	18.9	25.20	40.0	-14.8
37.500000	V	6.6	18.2	24.80	40.0	-15.2
74.232000	H	6.1	10.9	17.00	40.0	-23.0
74.800000	V	8.5	10.9	19.40	40.0	-20.6
113.808000	V	6.1	16.3	22.40	43.52	-21.1
114.972000	H	6.1	16.5	22.60	43.52	-20.9
127.388000	V	6.2	17.4	23.60	43.52	-19.9
128.940000	H	6.1	17.4	23.50	43.52	-20.0
173.200000	V	6.3	15.7	22.00	43.52	-21.5
173.200000	V	6.3	15.7	22.00	43.52	-21.5
173.200000	H	6.3	15.7	22.00	43.52	-21.5
258.532000	H	6.6	17.6	24.20	46.0	-21.8
285.000000	V	6.3	19.0	25.30	46.0	-20.7
410.000000	H	6.6	22.6	29.20	46.0	-16.8
614.000000	V	7.4	26.9	34.30	46.0	-11.7



## 12 FCC PART 15.247(e) – PEAK POWER SPECTRAL DENSITY (PSD)

Peak power spectral density measurements were performed.

### 12.1 Requirements:

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

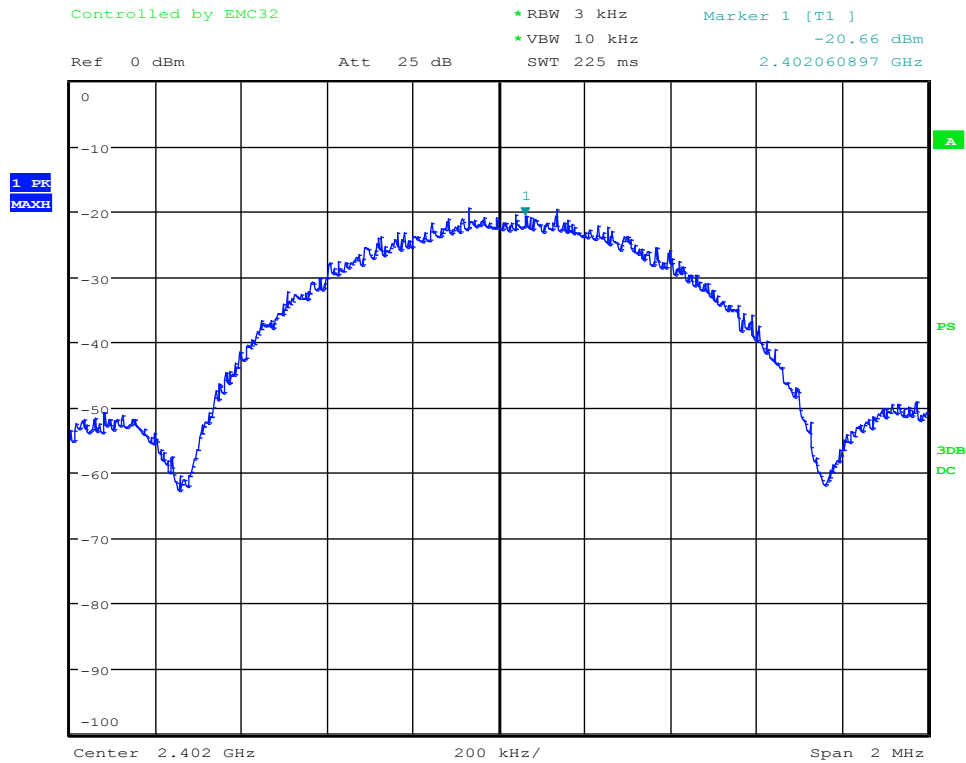
Power spectral density measurements were performed at a resolution bandwidth of 3 kHz (video bandwidth set at 10 KHz). The peak spectral densities were measured at the low, mid, and upper channels.



### 12.2 Peak Power Spectral Density Test Data

<b>Test Date(s):</b>	Apr. 7, 2016	<b>Test Engineer:</b>	J. Knepper
<b>Standards:</b>	CFR 47 Part 15.247(e); KDB558074	<b>Air Temperature:</b>	21.2°C
		<b>Relative Humidity:</b>	44%

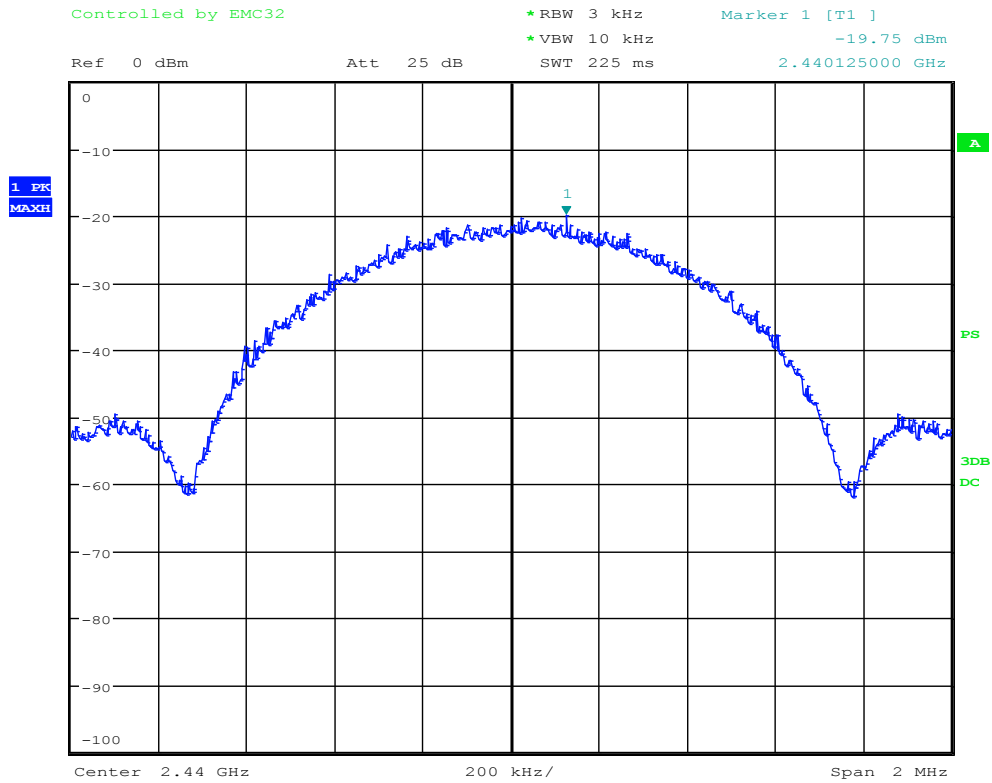
### Low Channel



Date: 7.APR.2016 13:55:14



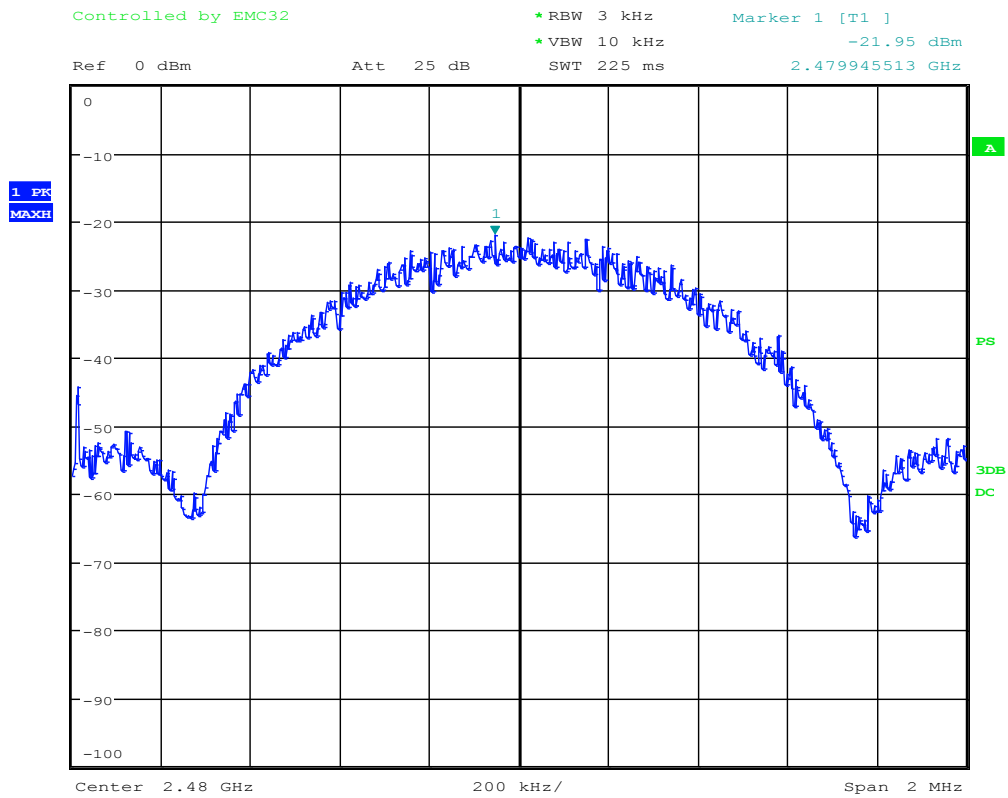
### Mid Channel



Date: 7.APR.2016 13:56:19



### High Channel



Date: 7.APR.2016 13:57:12



### 13 CONDUCTED EMISSIONS

#### 13.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), "Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

\*Decreases with the logarithm of the frequency.

#### 13.2 Procedure

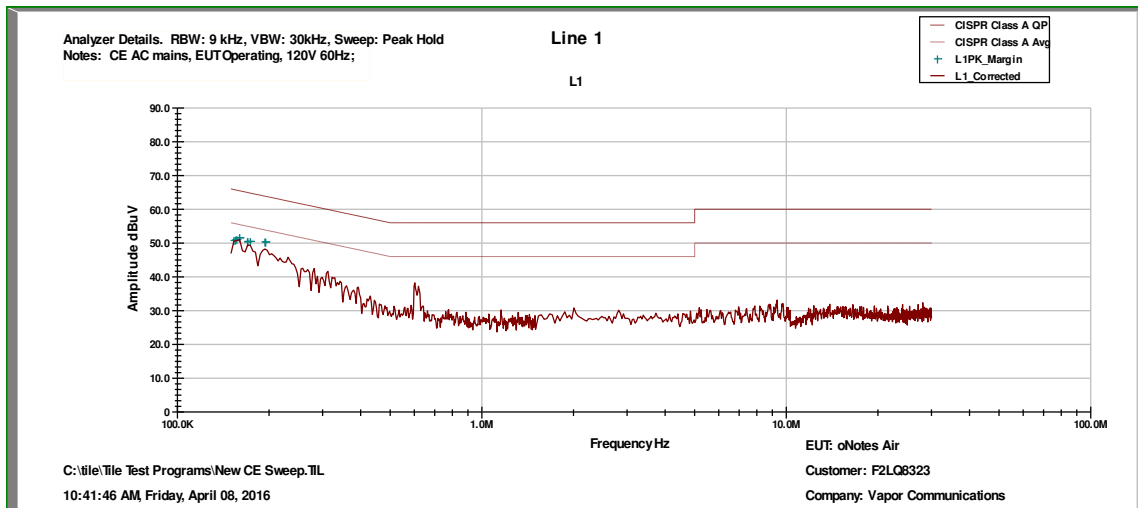
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power 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.



### 13.3 Conducted Emissions Test Data

<b>Test Date:</b>	Apr. 8, 2016	<b>Test Engineer:</b>	J. Knepper
<b>Rule:</b>	15.207	<b>Air Temperature:</b>	21.3° C
<b>Test Results:</b>	Complies	<b>Relative Humidity:</b>	40%

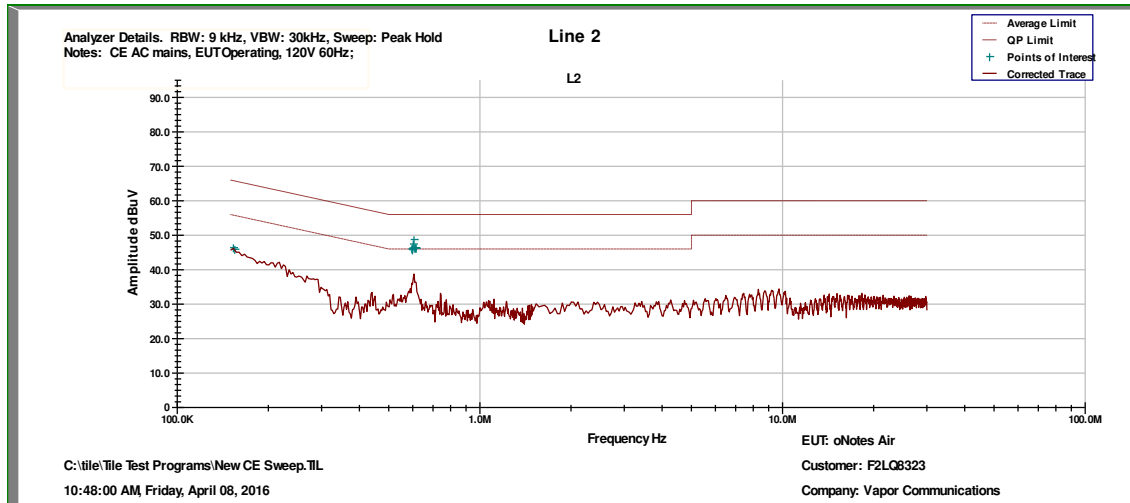
#### Conducted Test – Line 1: 0.15 MHz to 30.0 MHz



Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBµV)	Adjustment (dB)	Results (dBµV)	Limit (dBµV)	Margin (dB)
1	Line 1	0.153375	Quasi-Peak	37.208	11.546	48.754	65.816	-17.062
		0.153375	Average	15.082	11.546	26.628	55.816	-29.188
2	Line 1	0.155	Quasi-Peak	34.246	11.520	45.766	65.728	-19.962
		0.155	Average	16.413	11.520	27.933	55.728	-27.795
3	Line 1	0.15675	Quasi-Peak	36.373	11.492	47.865	65.6	-17.775
		0.15675	Average	20.689	11.492	32.181	55.6	-23.459
4	Line 1	0.16	Quasi-Peak	31.014	11.440	42.454	65.5	-23.010
		0.16	Average	16.443	11.440	27.883	55.464	-27.581
5	Line 1	0.160125	Quasi-Peak	30.223	11.439	41.662	65.230	-23.57
		0.160125	Average	15.938	11.439	27.377	55.2	-27.853
6	Line 1	0.17	Quasi-Peak	30.357	11.320	41.677	65.0	-23.284
		0.17	Average	16.458	11.320	27.778	54.961	-27.183
7	Line 1	0.17025	Quasi-Peak	30.834	11.317	42.151	64.949	-22.798
		0.17025	Average	15.590	11.317	26.907	54.949	-28.042
8	Line 1	0.173625	Quasi-Peak	30.773	11.273	42.046	64.786	-22.740
		0.173625	Average	15.417	11.273	26.690	54.786	-28.096
9	Line 1	0.193875	Quasi-Peak	28.550	11.085	39.635	63.87	-24.235
		0.193875	Average	13.271	11.085	24.356	53.87	-29.514
10	Line 1	0.195	Quasi-Peak	28.956	11.075	40.031	63.821	-23.790
		0.195	Average	12.060	11.075	23.135	53.821	-30.686



Conducted Test – Line 2: 0.15 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	0.153375	Quasi-Peak	30.331	11.546	41.877	65.816	-23.939
		0.153375	Average	15.814	11.546	27.360	55.816	-28.456
2	Line 2	0.155	Quasi-Peak	30.480	11.520	42.000	65.728	-23.728
		0.155	Average	15.381	11.520	26.901	55.728	-28.827
3	Line 2	0.5955	Quasi-Peak	23.371	10.381	33.752	56.0	-22.248
		0.5955	Average	18.016	10.381	28.397	46.0	-17.603
4	Line 2	0.598875	Quasi-Peak	23.888	10.380	34.268	56.0	-21.732
		0.598875	Average	17.896	10.380	28.276	46.0	-17.724
5	Line 2	0.6	Quasi-Peak	23.970	10.380	34.350	56.0	-21.65
		0.6	Average	18.300	10.380	28.680	46.0	-17.320
6	Line 2	0.60225	Quasi-Peak	23.965	10.379	34.344	56.0	-21.656
		0.60225	Average	18.394	10.379	28.773	46.0	-17.227
7	Line 2	0.605625	Quasi-Peak	23.734	10.377	34.111	56.0	-21.889
		0.605625	Average	17.745	10.377	28.122	46.0	-17.878
8	Line 2	0.609	Quasi-Peak	22.778	10.375	33.153	56.0	-22.847
		0.609	Average	16.654	10.375	27.029	46.0	-18.971
9	Line 2	0.612375	Quasi-Peak	21.674	10.374	32.048	56.0	-23.952
		0.612375	Average	15.616	10.374	25.990	46.0	-20.010
10	Line 2	0.61575	Quasi-Peak	20.263	10.372	30.635	56.0	-25.365
		0.61575	Average	14.328	10.372	24.700	46.0	-21.300

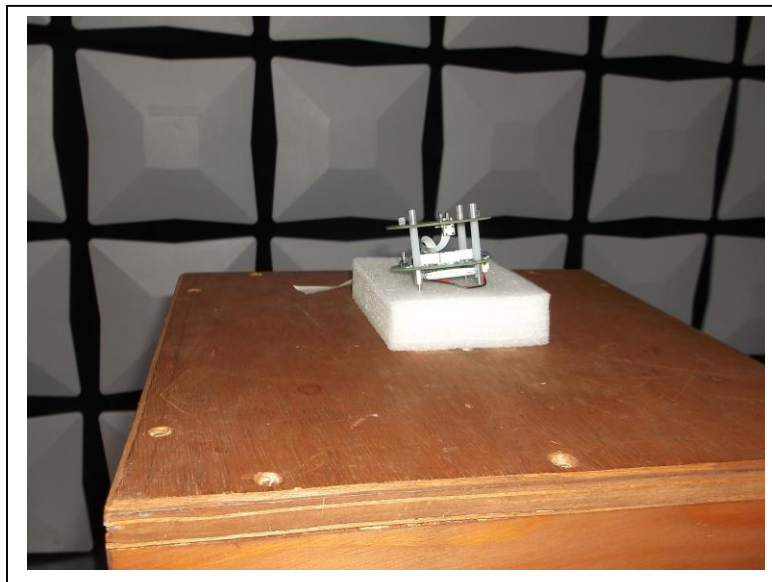


14 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

**Radiated Spurious Emission <1GHz**

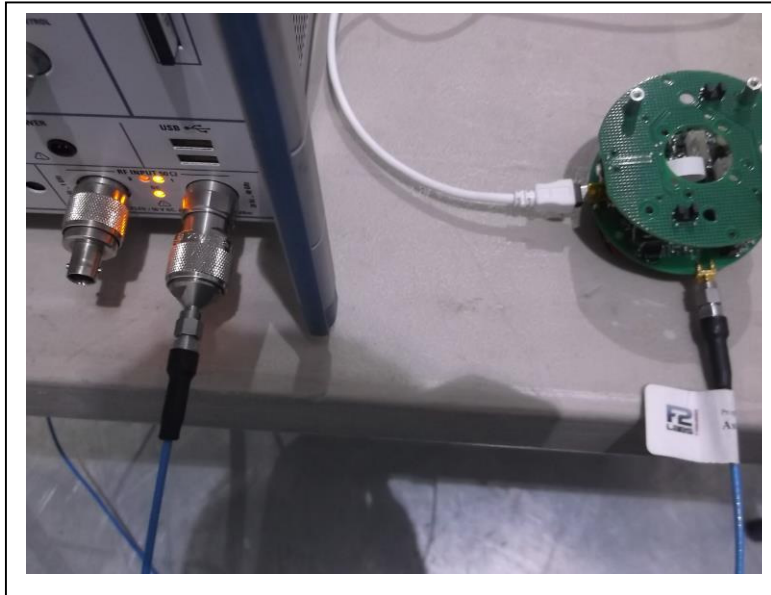


**Radiated Spurious Emission >1GHz**





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



**Conducted Emissions**

