



**F2 Labs**  
**16740 Peters Road**  
**Middlefield, Ohio 44062**  
**United States of America**  
**[www.f2labs.com](http://www.f2labs.com)**

## **CERTIFICATION TEST REPORT**

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**Manufacturing Address:** Zhen Jiangqiang Ling Electronic Co. Ltd.  
200 Xuefu Road  
Zhen Jiang  
Jiangsu 212016 CHINA

**Applicant Address:** Shanghai Qiangling Electronic Co., Ltd.  
139 Wang Dong RD S,  
SI Jing Song Jiang, Shanghai, 201601, CHINA

**Product Name:** TCP ColorSpree Limitless Color

**Product Description:** Bluetooth A19 Red Green Blue

**Model:** **A19RGB001**

**FCC ID:** **NIRA19RGB001**

**Testing Commenced:** **November 30, 2015**

**Testing Ended:** **Dec. 3, 2015**

**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 15.31(e) Voltage Variations**



Order Number: F2LQ7271B

Client: Technical Consumer Products, Inc.

Model: A19RGB001

**Evaluation Conducted by:**

Joe Knepper, EMC Proj. Eng.

**Report Reviewed by:**

Ken Littell, EMC Tech. Mgr.

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## 1 ADMINISTRATIVE INFORMATION

### 1.1 Measurement Location:

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

### 1.2 Measurement Procedure:

All measurements were performed according to the 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 2.7GHz                  | ±3.62dB              | ±1.81                |
| Radiated Emissions 2.7 GHz to 18GHz                 | ±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 |
|-----------------|-------------|---------------|-------------|
| F2LQ7271B-01E   | First Issue | Dec. 18, 2015 | 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 2dBi Integral Antenna | CFR 47 Part 15.247(d) / Part 15.209 / KDB558074 | Complies |
| Peak Power Spectral Density                           | CFR 47 Part 15.247(e) / KDB558074               | Complies |
| Conducted Emissions                                   | CFR 47 Part 15.207(a)                           | Complies |
| Voltage Variation                                     | CFR 47 Part 15.31(e)                            | Complies |

| Modifications Made to the Equipment |
|-------------------------------------|
| None                                |

**3 TABLE OF MEASURED RESULTS**

| Test                                       | Low Channel<br>2.402 GHz | Mid Channel<br>2.442 GHz | High Channel<br>2.480 GHz |
|--------------------------------------------|--------------------------|--------------------------|---------------------------|
| Conducted<br>Output Power                  | 0.1094mW<br>(-9.61dBm)   | 0.0853mW<br>(-10.69dBm)  | 0.0369mW<br>(-14.32dBm)   |
| Conducted<br>Output Power at<br>100V       | 0.0516mW<br>(-12.87dBm)  | 0.0656mW<br>(-11.83dBm)  | 0.0779mW<br>(-11.08dBm)   |
| Conducted<br>Output Power at<br>140V       | 0.0429mW<br>(-13.67dBm)  | 0.0485mW<br>(-13.14dBm)  | 0.0910mW<br>(-10.41dBm)   |
| Conducted<br>Output Power<br>Limit         | 1 Watt<br>(30dBm)        | 1 Watt<br>(30dBm)        | 1 Watt<br>(30dBm)         |
| E.I.R.P. with<br>2 dBi Integral<br>antenna | 0.173mW<br>(-7.61dBm)    | 0.135mW<br>(-8.69dBm)    | 0.144mW<br>(-8.41dBm)     |
| E.I.R.P. Limit                             | 4 Watts<br>(36.02dBm)    | 4 Watts<br>(36.02dBm)    | 4 Watts<br>(36.02dBm)     |
| Peak Power<br>Spectral Density             | -20.52dBm                | -20.66dBm                | -24.01dBm                 |
| Peak Power<br>Spectral Density<br>Limit    | 8dBm                     | 8dBm                     | 8dBm                      |
| -6dB Occupied<br>Bandwidth                 | 0.7241 MHz               | 0.7317 MHz               | 0.7287 MHz                |
| -6dB Occupied<br>Bandwidth Limit           | ≥ 500KHz                 | ≥ 500KHz                 | ≥ 500KHz                  |



#### **4 ENGINEERING STATEMENT**

This report has been prepared on behalf of Shanghai Qiangling Electronic Co., Ltd. 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: TCP ColorSpree Limitless Color

Model: A19RGB001

Serial Nos.: 1262-18, 1262-19, 1262-20

FCC ID: NIRA19RGB001

### **5.2 Trade Name:**

TCP

### **5.3 Power Supply:**

120V, 60 Hz

### **5.4 Applicable Rules:**

CFR 47, Part 15.247, subpart C

### **5.5 Equipment Category:**

Radio Transmitter-DTS

### **5.6 Antenna:**

Internal 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 at 120V, 60 Hz. EUT transmitted at High (2.48 GHz), Mid (2.442 GHz) and Low (2.402 GHz) continuously.

**6 LIST OF MEASUREMENT INSTRUMENTATION**

| Equipment Type                  | Asset Number           | Manufacturer        | Model                            | Serial Number | Calibration Due Date |
|---------------------------------|------------------------|---------------------|----------------------------------|---------------|----------------------|
| Shielded Chamber                | CL166                  | AlbatrossProjects   | B83117-DF435-T261                | US140023      | Jan. 1, 2016         |
| Temp/Hum. Recorder              | CL137                  | Extech              | RH520                            | CH16992       | May 7, 2016          |
| Receiver                        | CL151                  | Rohde & Schwarz     | ESU40                            | 100319        | Nov. 25, 2016        |
| Horn Antenna                    | CL098                  | Emco                | 3115                             | 9809-5580     | Dec. 3, 2015         |
| Pre-Amplifier                   | CL045                  | Hewlett-Packard     | 8447D                            | 2944A08445    | Nov. 2, 2016         |
| Amplifier w/Monopole & 18" Loop | CL163                  | A.H. Systems, Inc.  | EHA-52B                          | 100           | Apr. 20, 2016        |
| Software:                       | Tile Version 1.0       |                     | Software Verified: Nov. 30, 2015 |               |                      |
| Software:                       | EMC 32, Version 5.20.2 |                     | Software Verified: Nov. 30, 2015 |               |                      |
| Antenna, Horn                   | CL114                  | A. H. Systems, Inc. | SAS-572                          | 237           | Oct. 16, 2016        |
| Spectrum Analyzer               | 0141                   | Hewlett Packard     | 8591E                            | 3520A04145    | Jan. 8, 2016         |
| Temp/Hum. Rec.                  | CL119                  | Extech              | RH520                            | H005869       | Feb. 9, 2016         |
| Transient Limiter               | 0202                   | Hewlett Packard     | 11947A                           | 3107A00729    | June 27, 2018        |
| 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:**

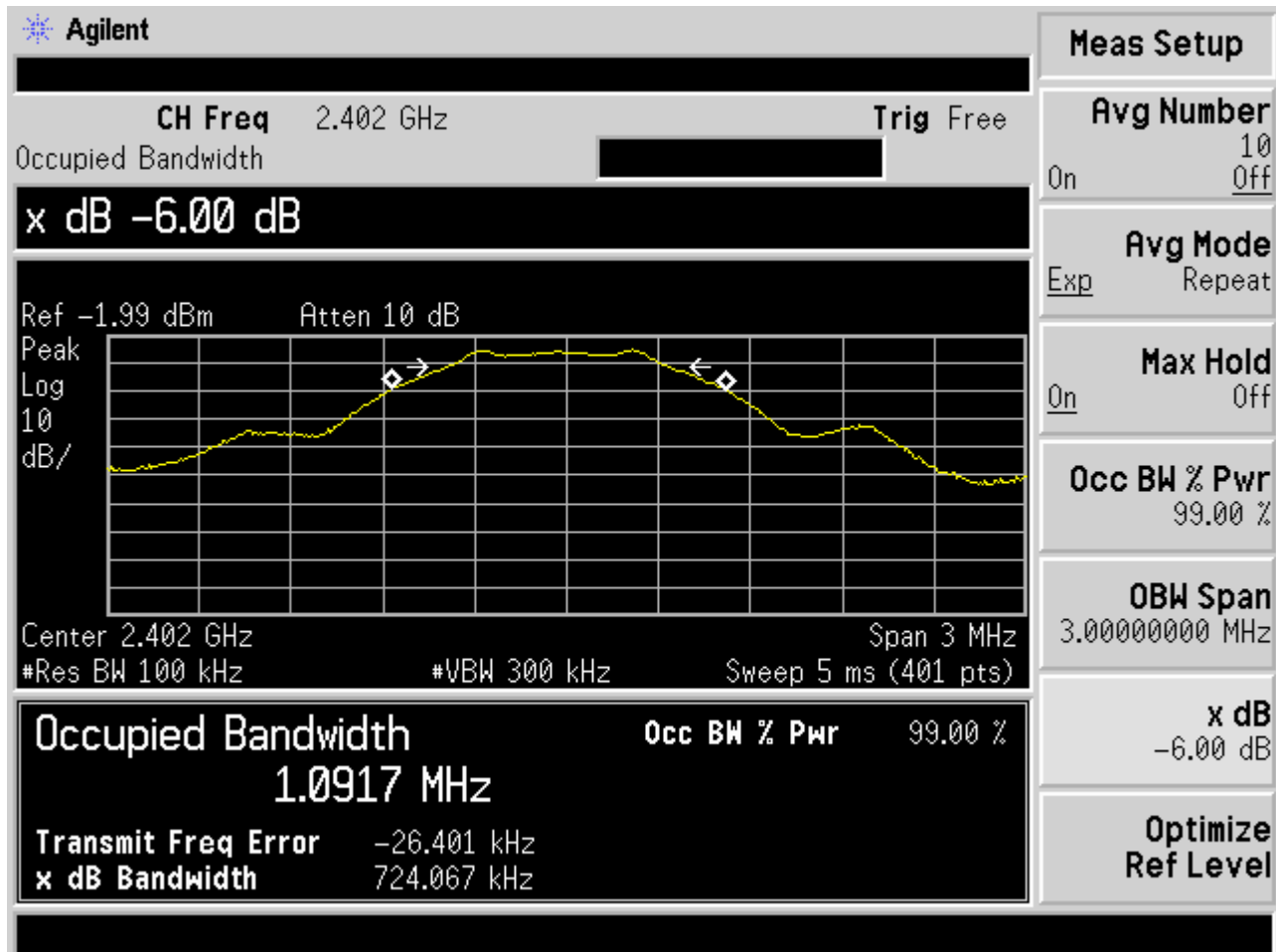
The 6dB bandwidth shall be greater than 500 kHz.

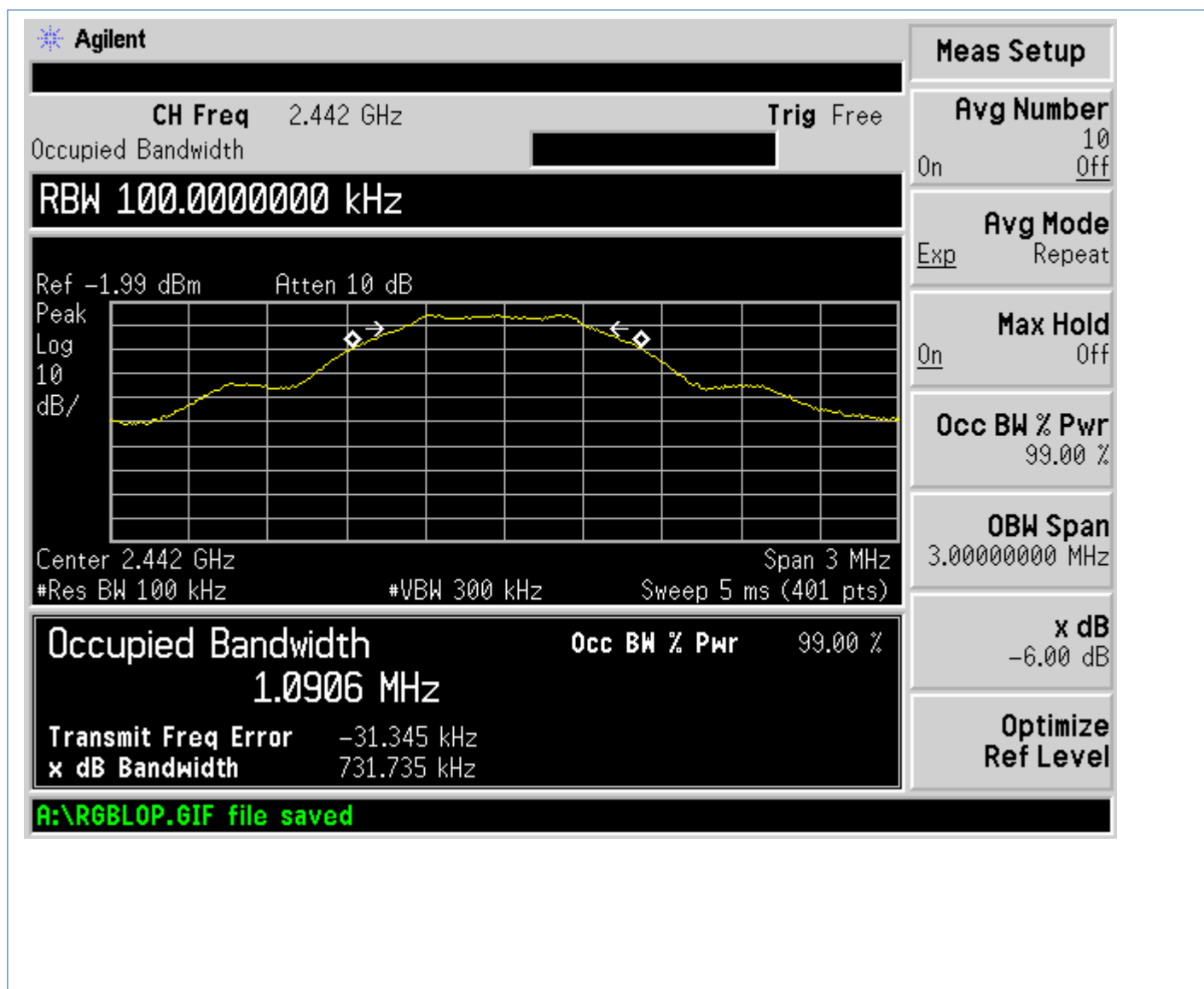
Bandwidth measurements were made at the low (2.402 GHz), mid (2.442 GHz) and upper (2.480 GHz) frequencies. The bandwidth was measured using the analyzer's occupied bandwidth function.

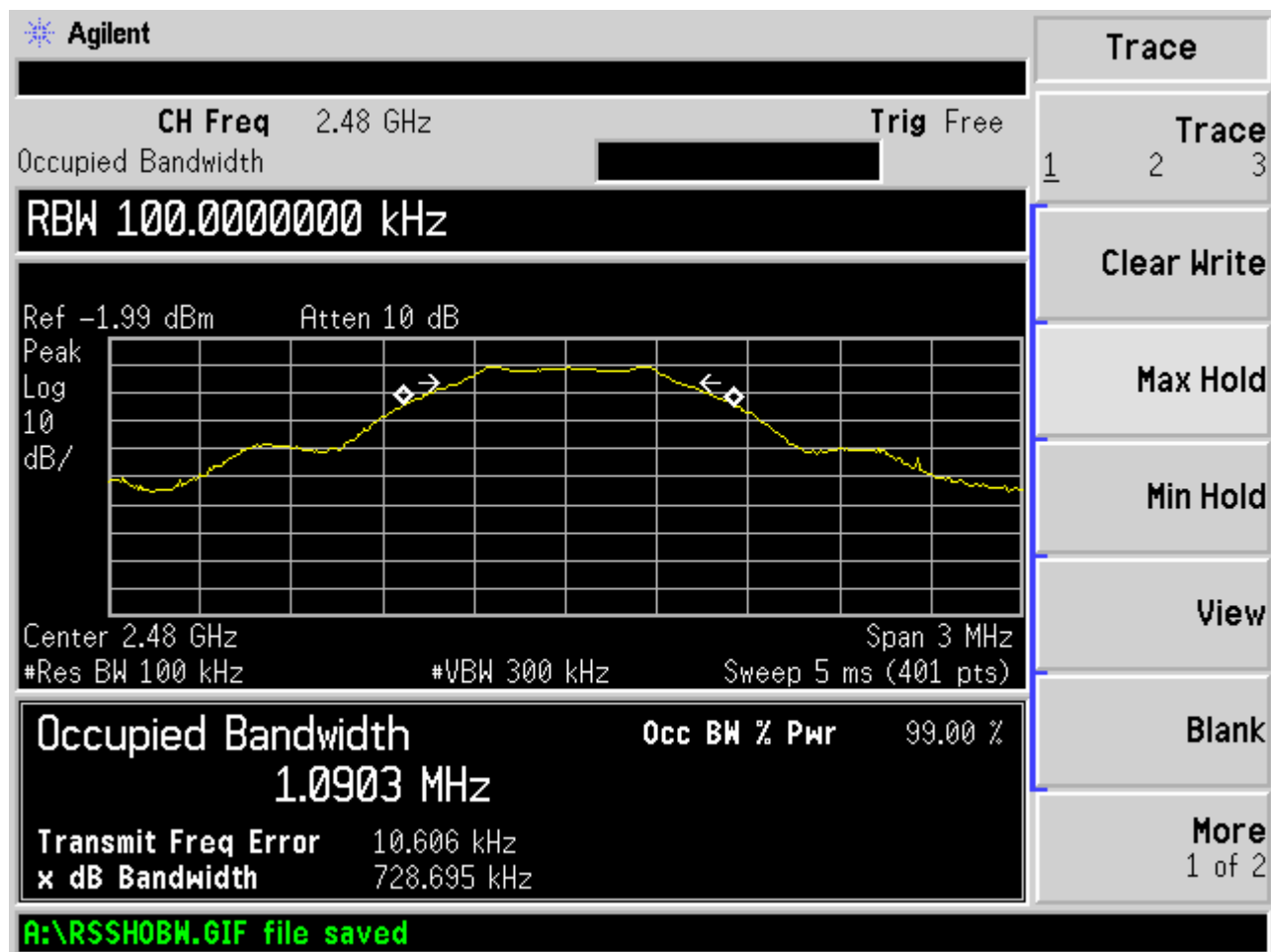


## 7.2 Occupied Bandwidth Test Data

|            |                                        |                    |            |
|------------|----------------------------------------|--------------------|------------|
| Test Date: | Nov. 30, 2015                          | Test Engineer:     | J. Knepper |
| Standards: | CFR 47 Part 15.247(a)(2);<br>KDB558074 | Air Temperature:   | 19.3°C     |
|            |                                        | Relative Humidity: | 46%        |









## **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.

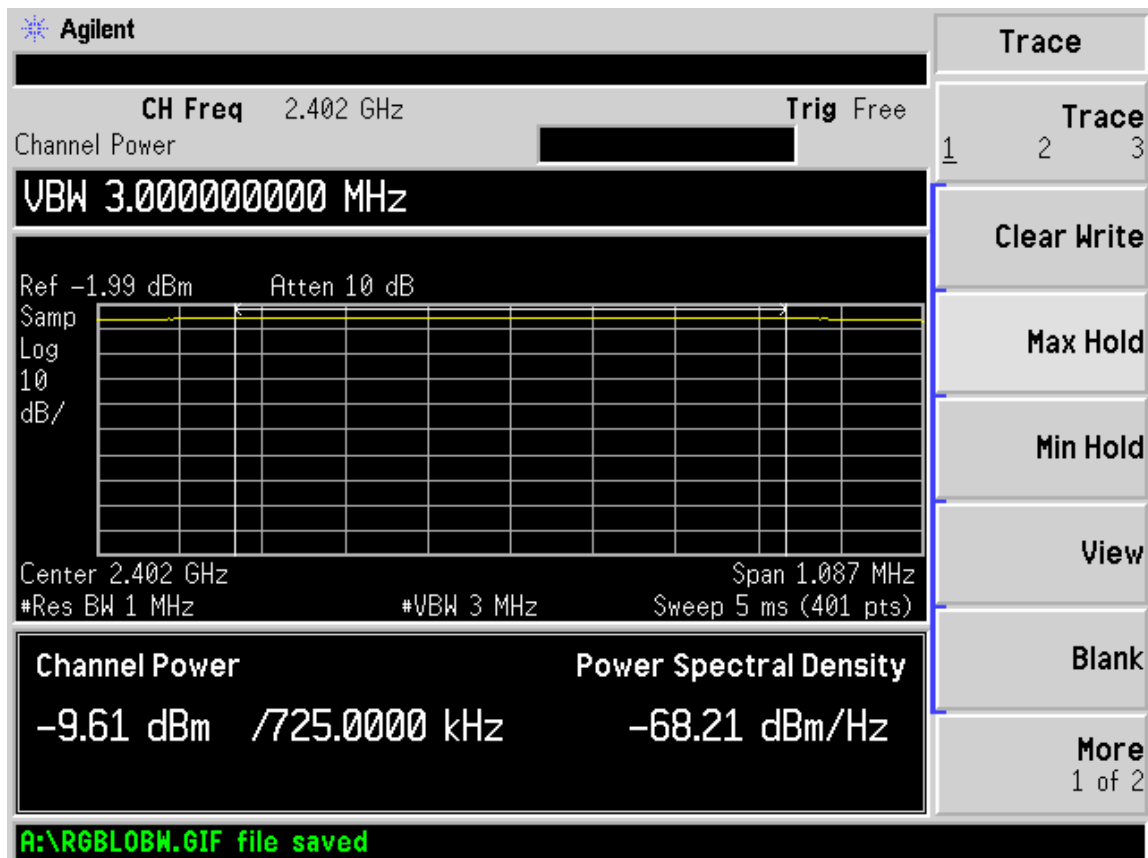
### **8.1 Requirements:**

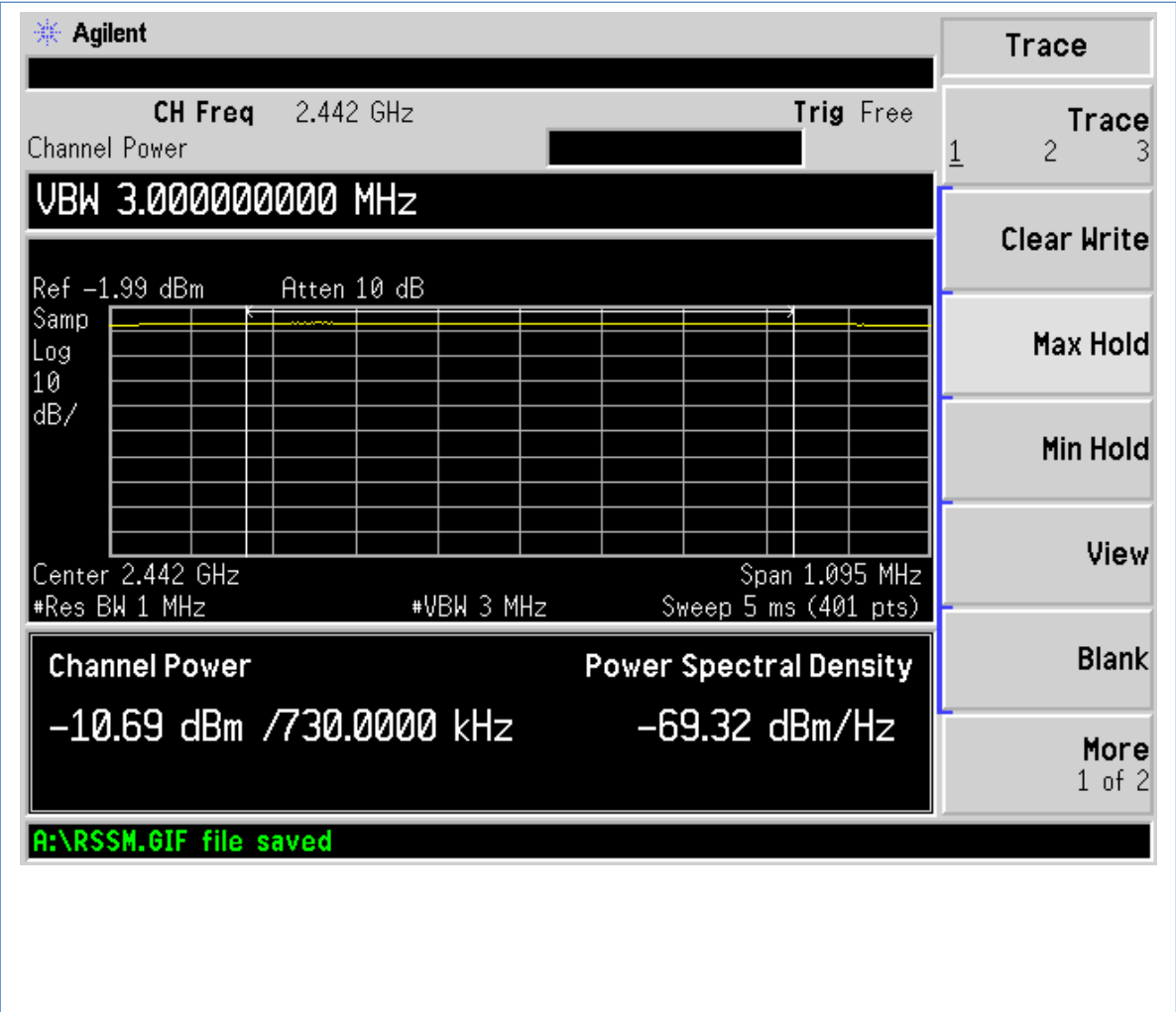
The peak power output shall be 1 watt (30 dBm) or less when using an antenna with a gain of less than 6dBi. For antennas having a gain of more than 6dBi, the limit is reduced by 1dB for every dB the antenna gain is over 6dBi.

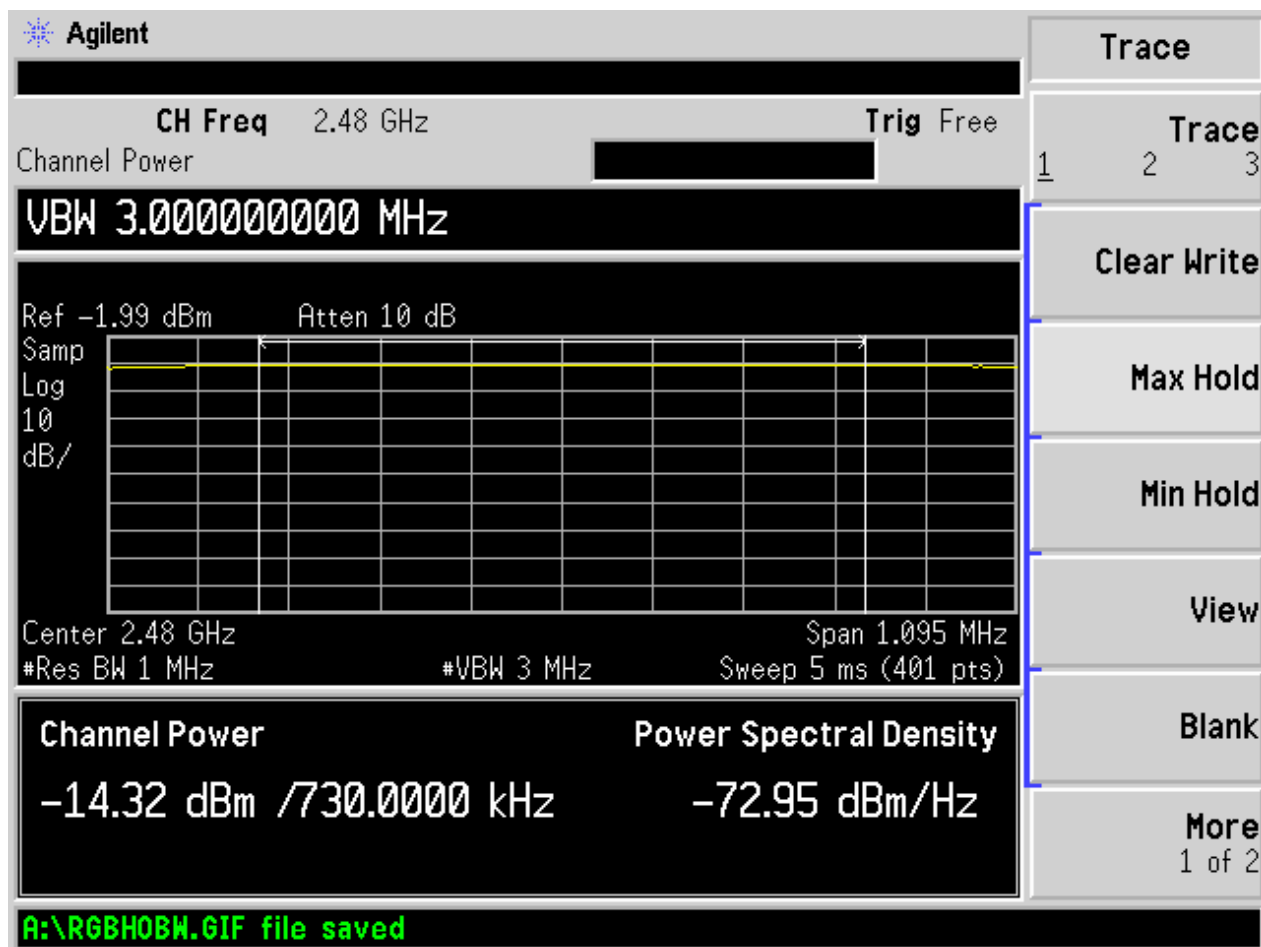


## 8.2 Conducted Output Power Test Data

|                   |                                        |                           |            |
|-------------------|----------------------------------------|---------------------------|------------|
| <b>Test Date:</b> | Nov. 30, 2015                          | <b>Test Engineer:</b>     | J. Knepper |
| <b>Standards:</b> | CFR 47 Part 15.247(b)(3);<br>KDB558074 | <b>Air Temperature:</b>   | 19.3°C     |
|                   |                                        | <b>Relative Humidity:</b> | 46%        |









## 9 **FCC Part 15.247(d) – CONDUCTED SPURIOUS EMISSIONS**

The following tests were performed to demonstrate compliance.

### **RF Antenna Conducted Test**

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

#### **9.1 Requirements:**

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

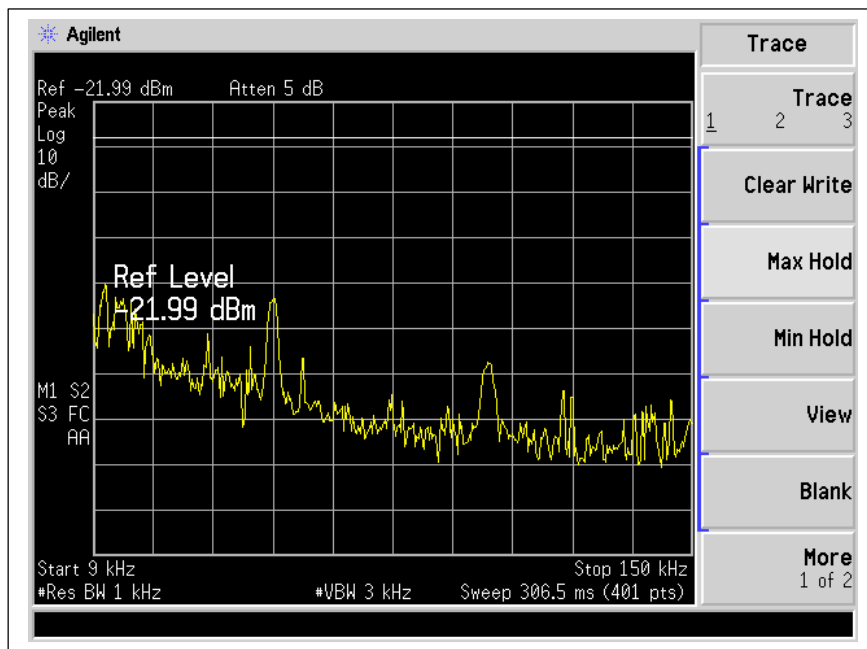
Spurious emissions measurements were made at the low, mid, and upper channels with the appropriate spectrum analyzer impulse bandwidth. Additionally, 6dB down points were measured for the low and high channels to verify band edge compliance.



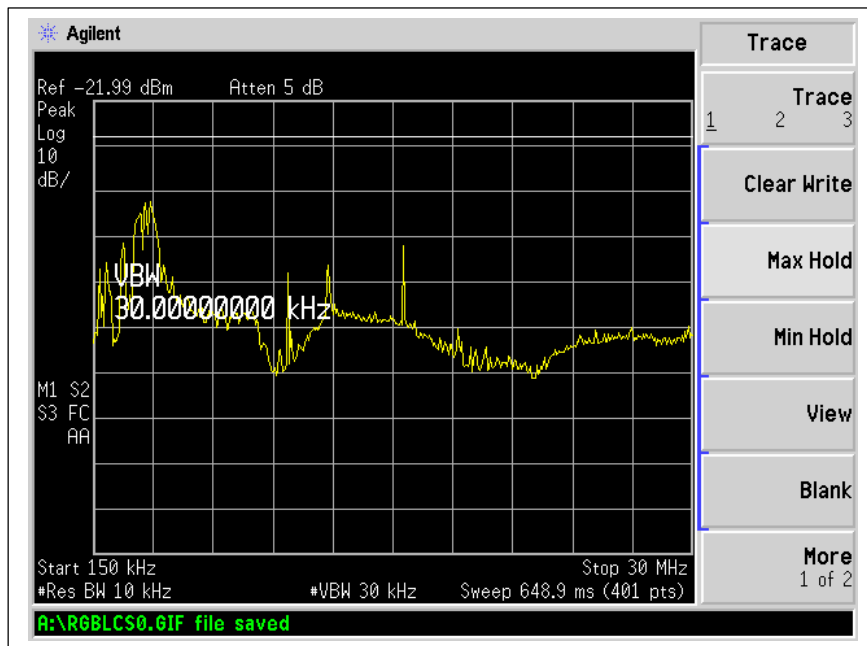
## 9.2 Test Data – Conducted Spurious Emissions

|            |                                                   |                    |            |
|------------|---------------------------------------------------|--------------------|------------|
| Test Date: | Nov. 30, 2015                                     | Test Engineer:     | J. Knepper |
| Standards: | CFR 47 Part 15.247(d) / Part 15.209;<br>KDB558074 | Air Temperature:   | 19.5°C     |
|            |                                                   | Relative Humidity: | 46%        |

### Low Channel: 0.009 MHz to 0.15 MHz

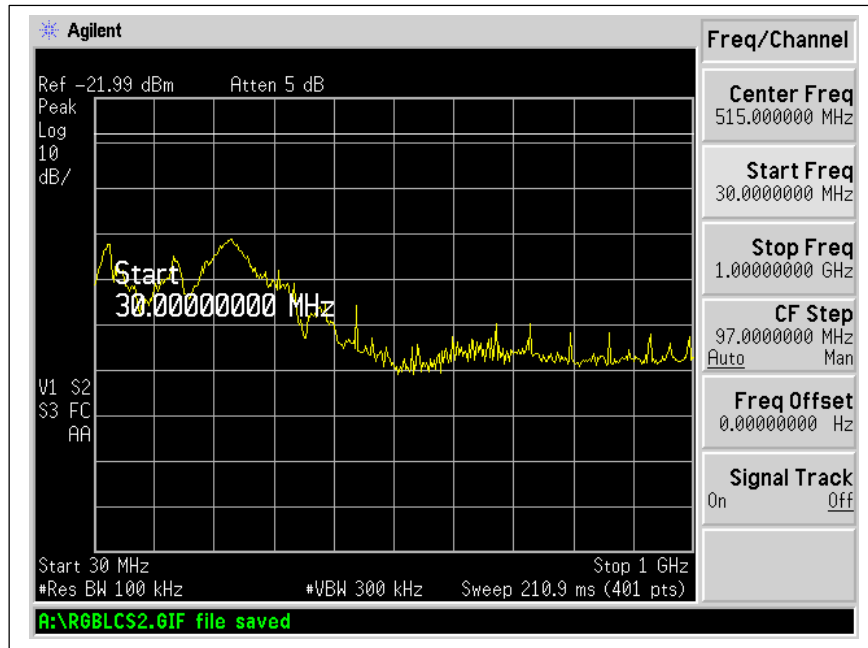


### Low Channel: 0.15 MHz to 30 MHz

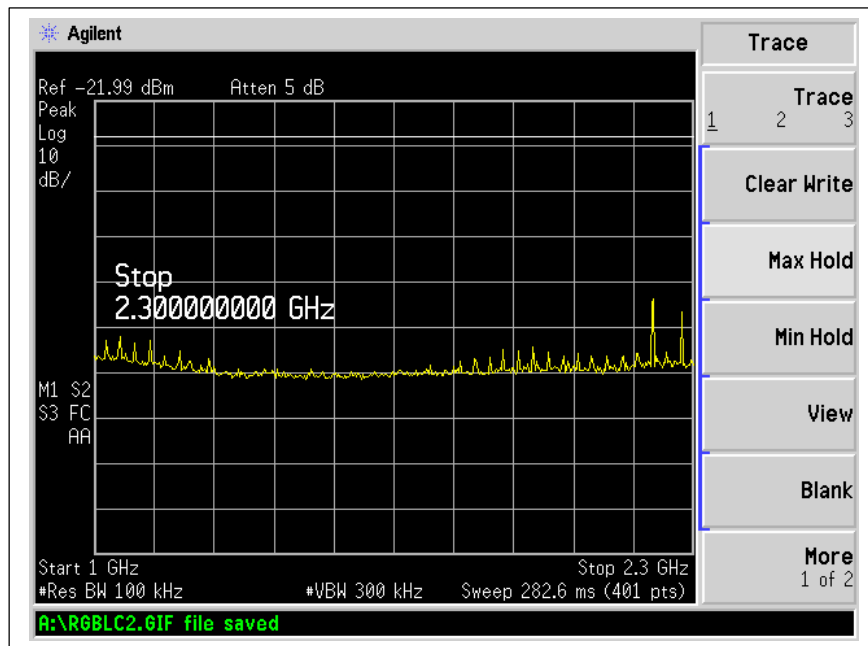




Low Channel: 30 MHz to 1 GHz

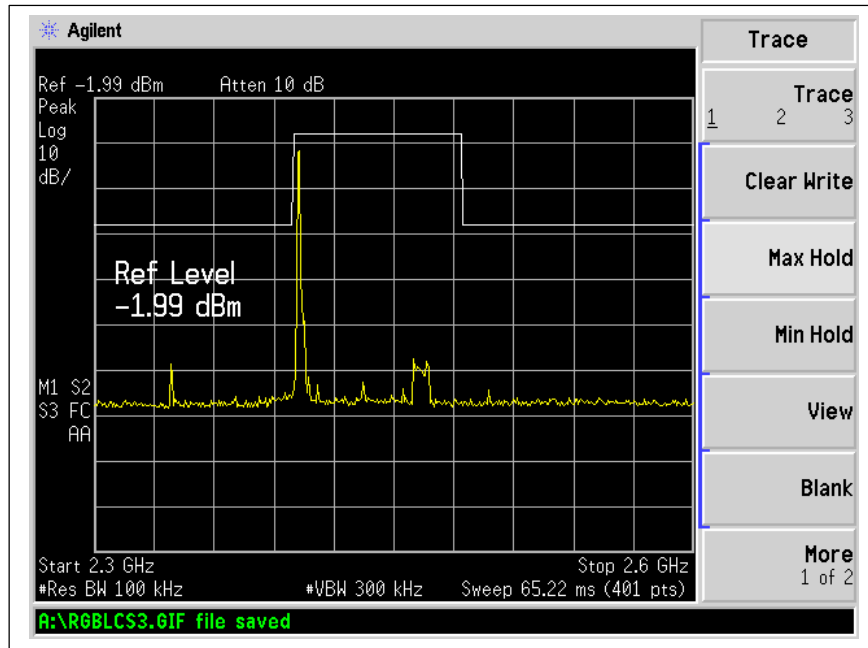


Low Channel: 1 GHz to 2.3 GHz

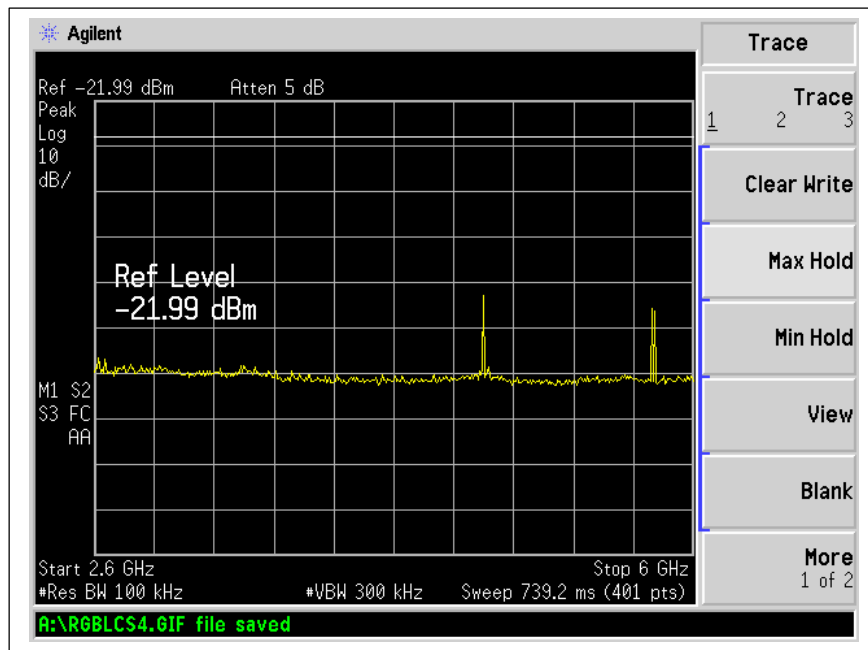




### Low Channel: 2.3 GHz to 2.6 GHz

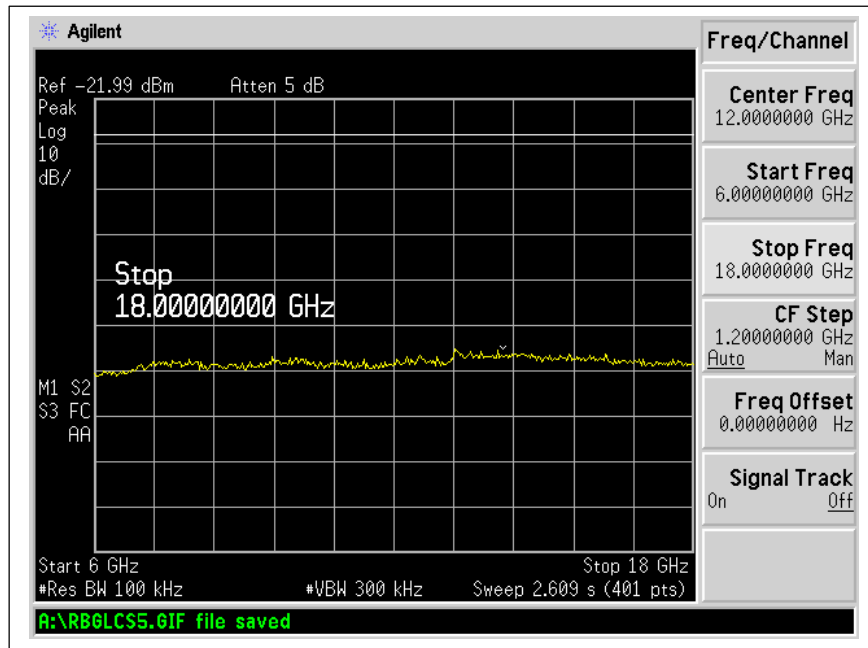


### Low Channel: 2.6 GHz to 6 GHz

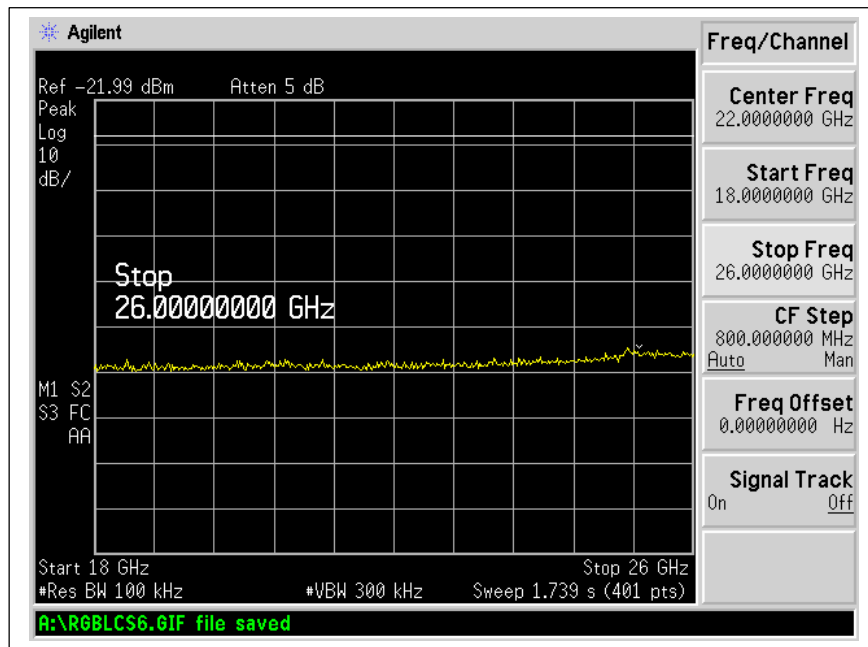




## Low Channel: 6 GHz to 18 GHz

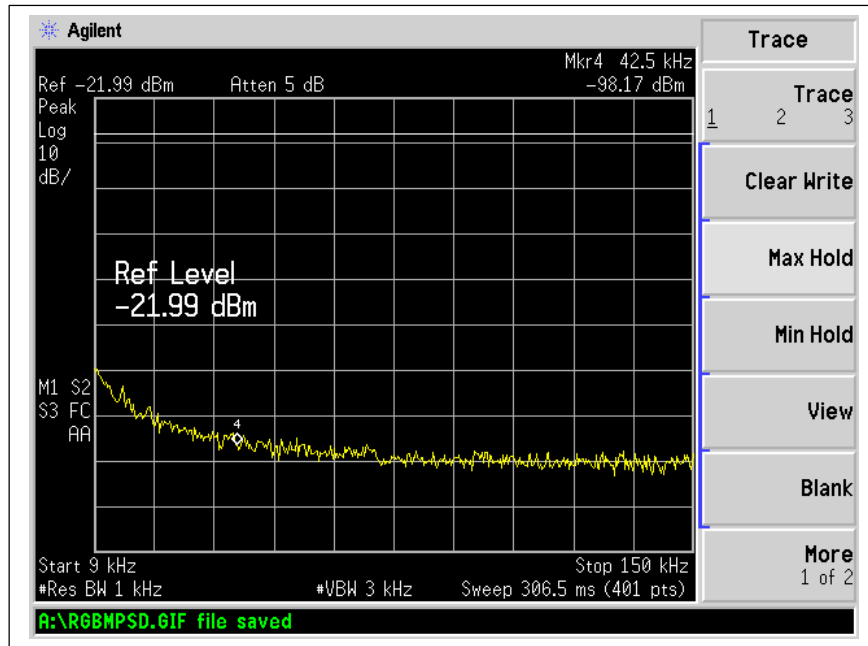


## Low Channel: 18 GHz to 26 GHz

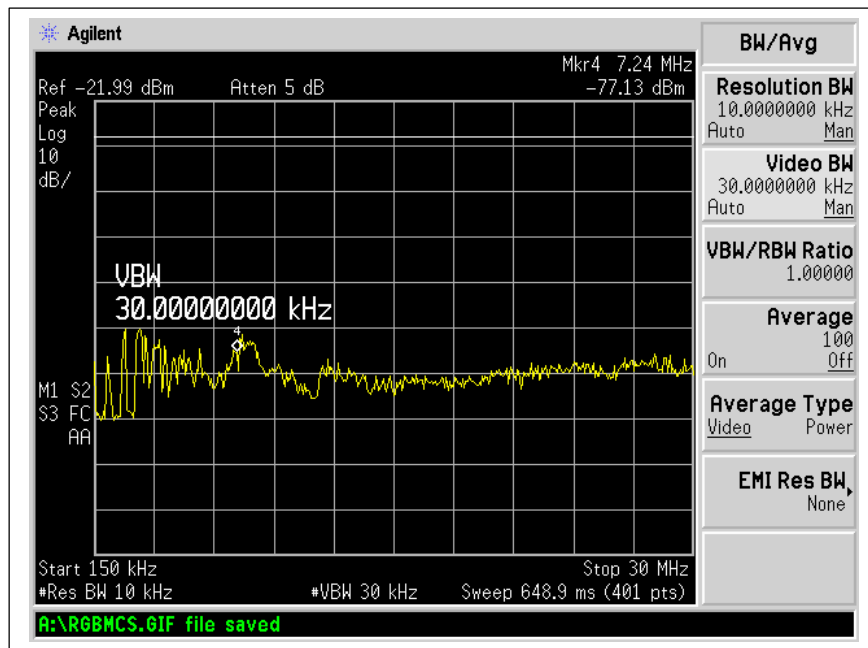




## Mid Channel: 0.009 MHz to 0.15 MHz

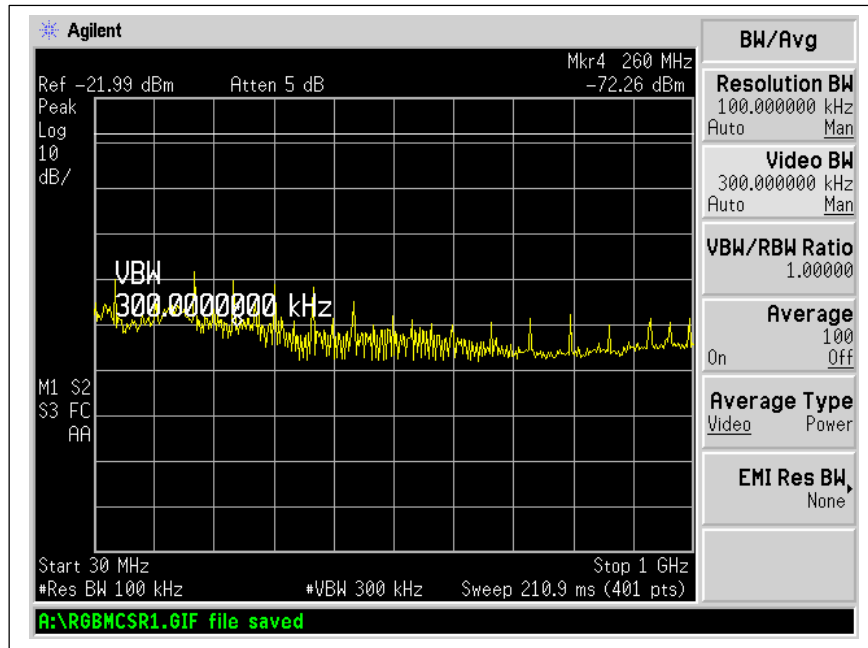


## Mid Channel: 0.15 MHz to 30 MHz

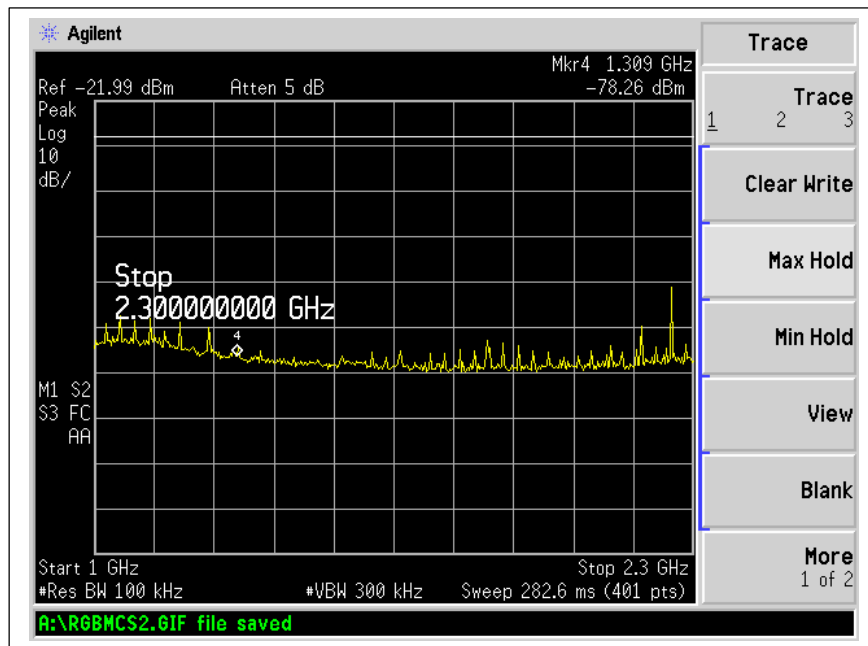




## Mid Channel: 30 MHz to 1 GHz

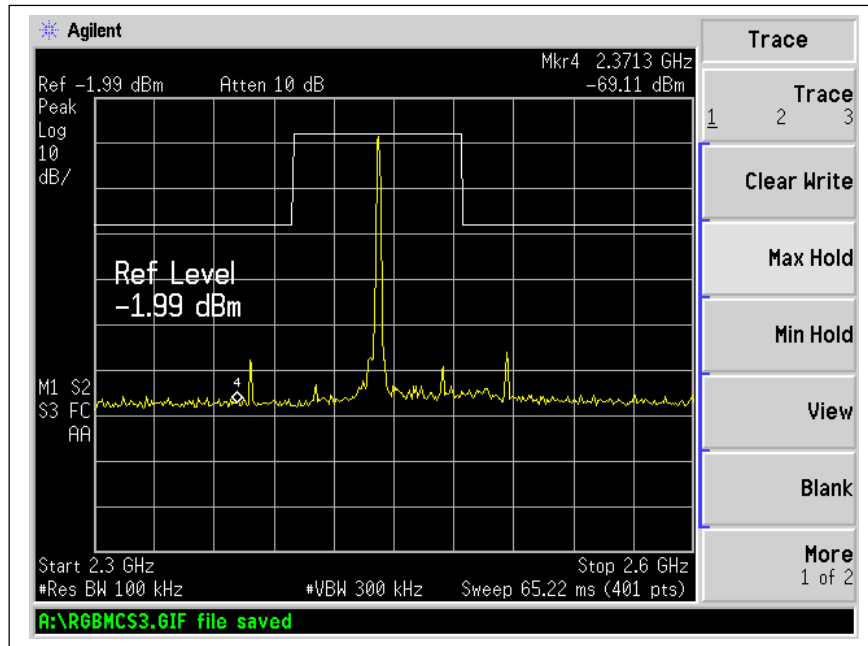


## Mid Channel: 1 GHz to 2.3 GHz

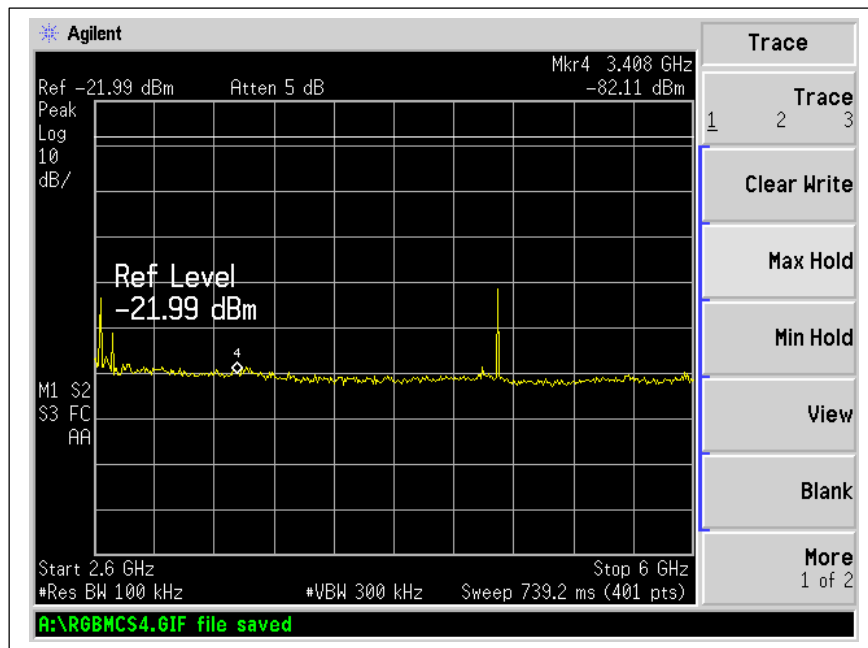




### Mid Channel: 2.3 GHz to 2.6 GHz

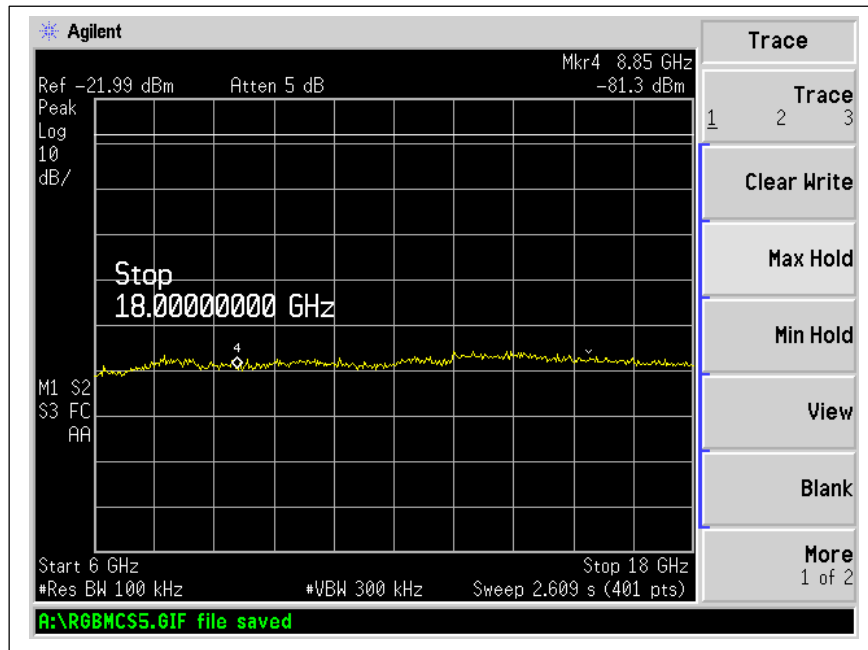


### Mid Channel: 2.6 GHz to 6 GHz

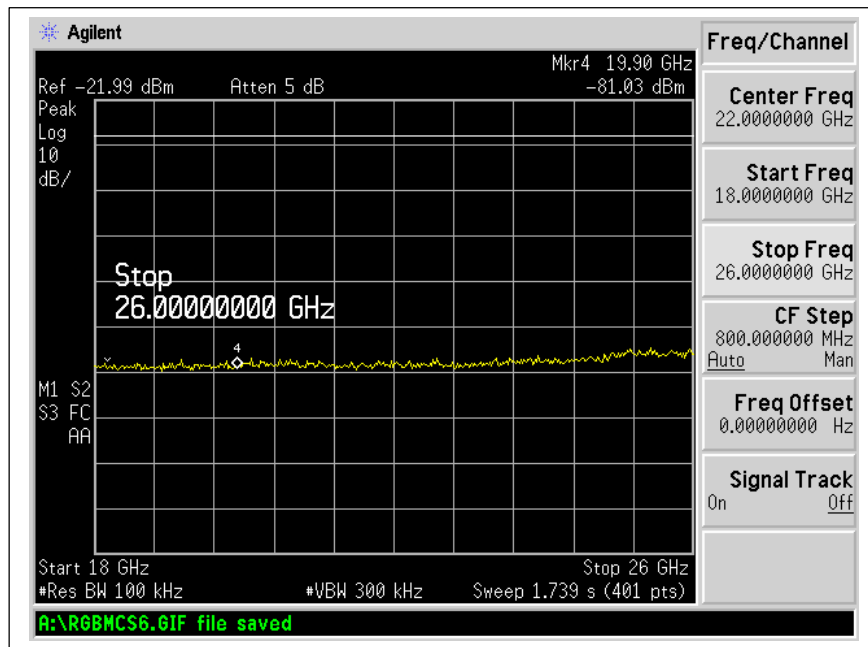




## Mid Channel: 6 GHz to 18 GHz

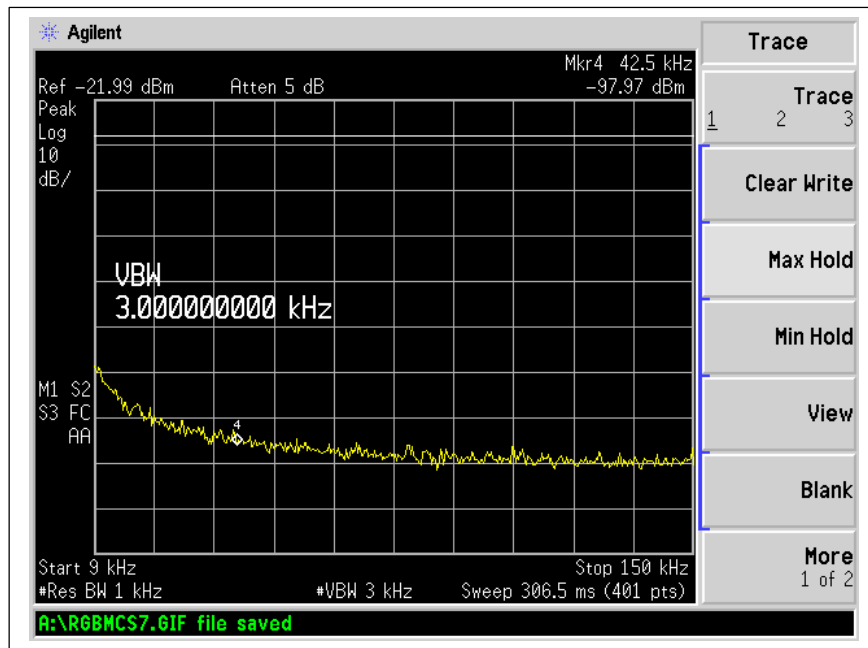


## Mid Channel: 18 GHz to 26 GHz

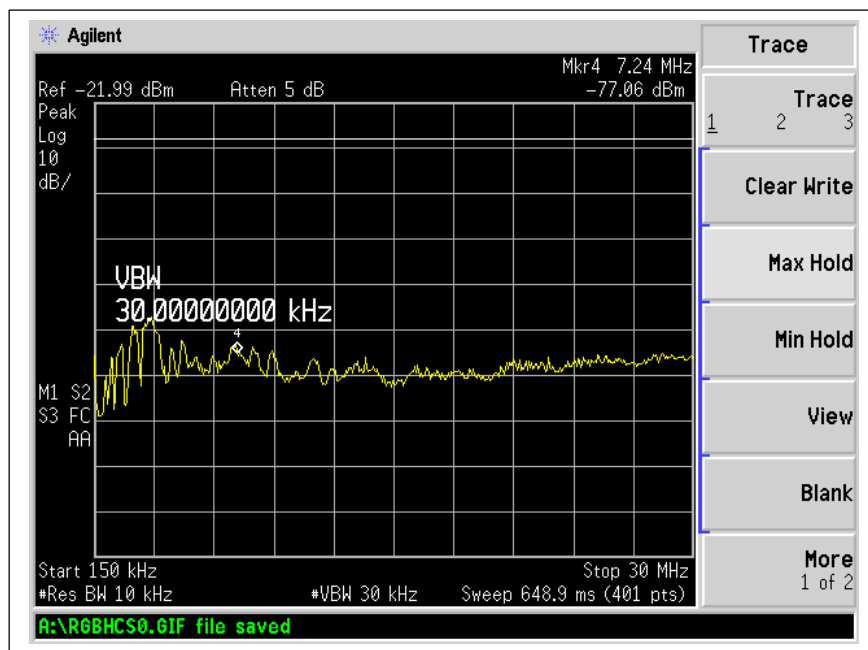




### High Channel: 0.009 MHz to 0.15 MHz

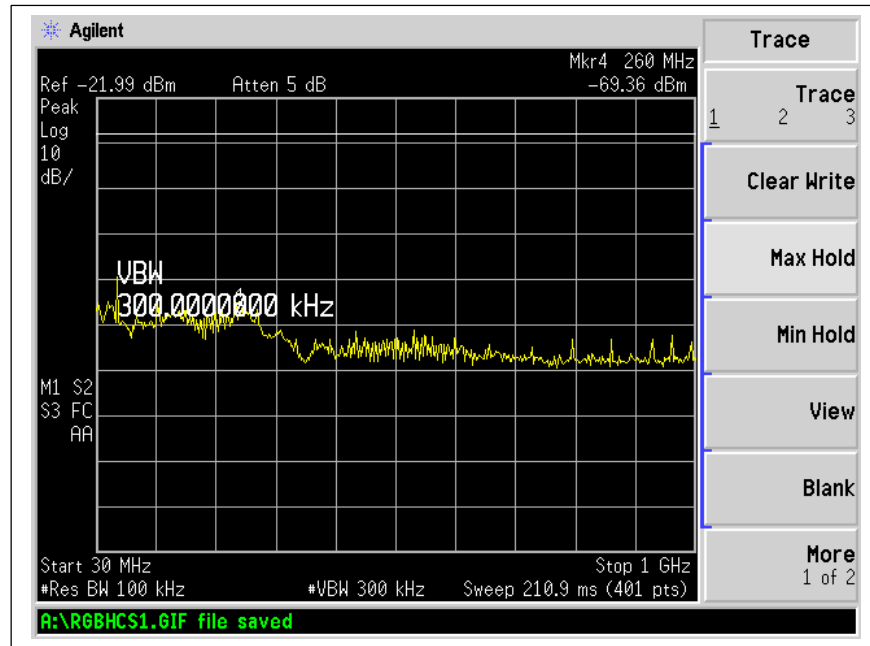


### High Channel: 0.15 MHz to 30 MHz

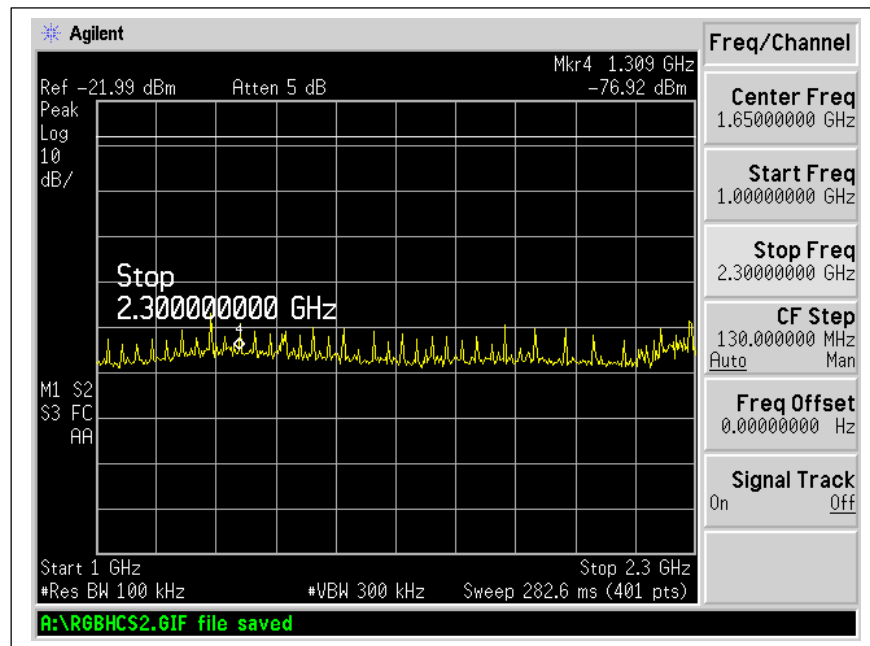




## High Channel: 30 MHz to 1 GHz

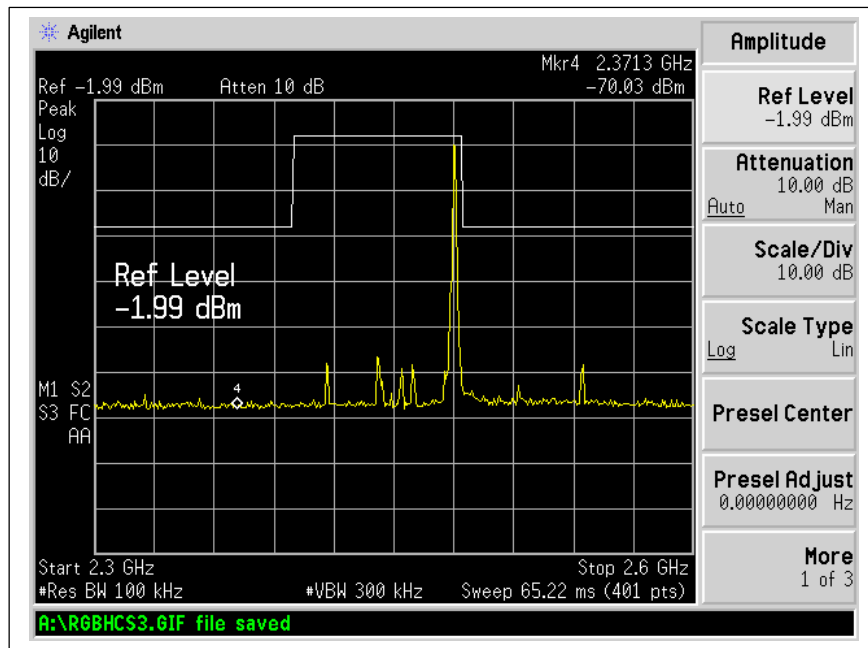


## High Channel: 1 GHz to 2.3 GHz

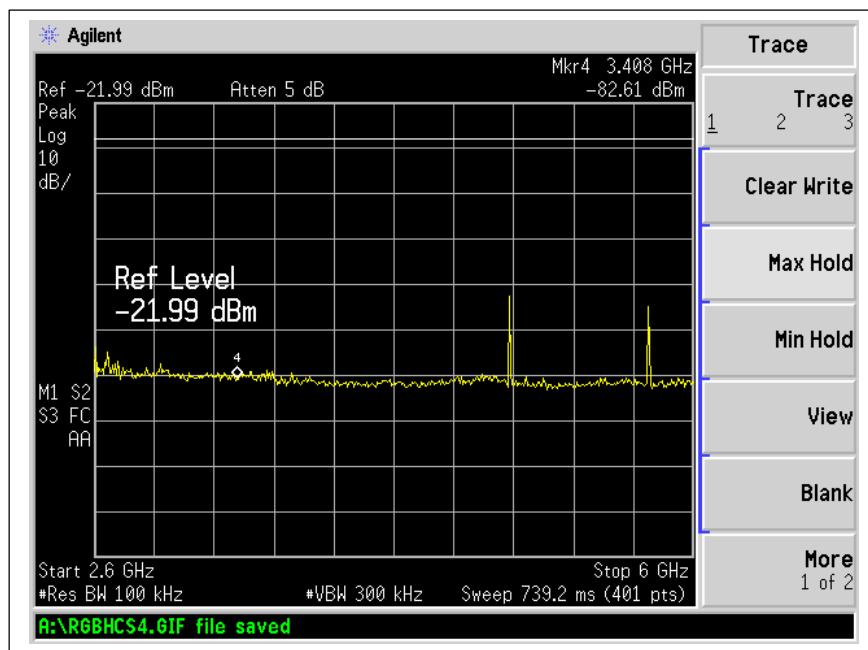




### High Channel: 2.3 GHz to 2.6 GHz

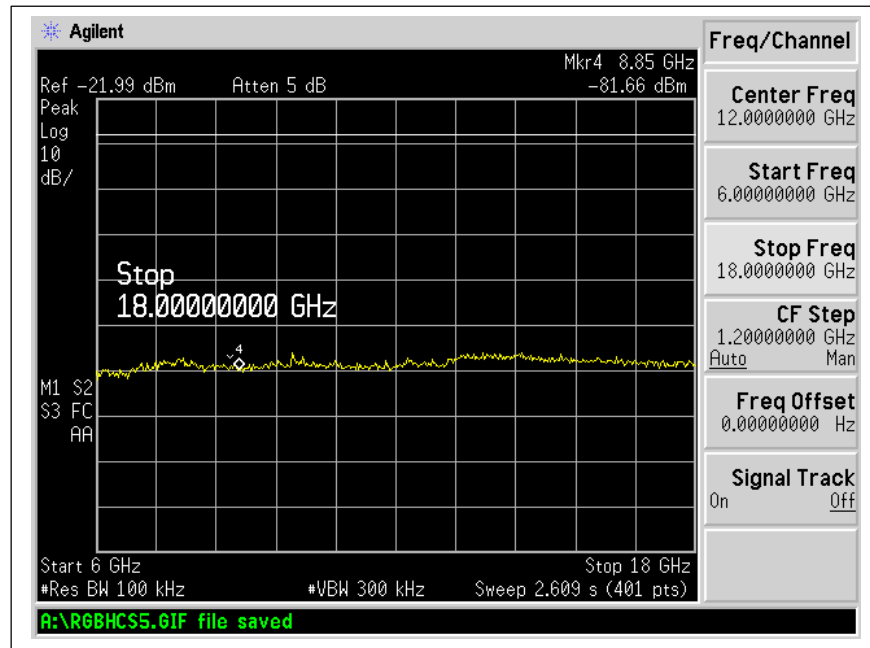


### High Channel: 2.6 GHz to 6 GHz

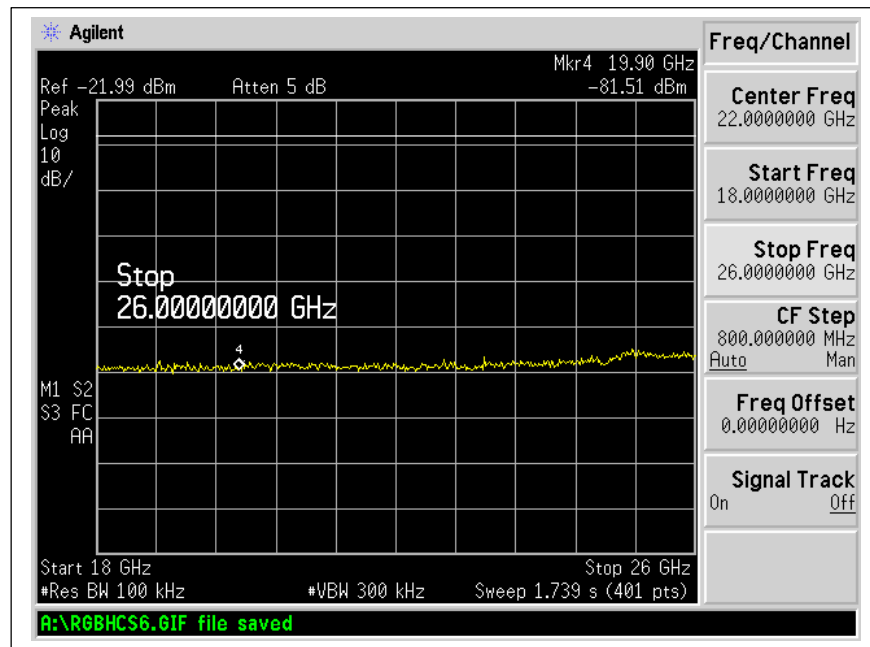




## High Channel: 6 GHz to 18 GHz



## High Channel: 18 GHz to 26 GHz





## 10 RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its internal 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.

### 10.1 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).



## 10.2 Radiated Spurious Emission Test Data

|                      |                                                   |                           |            |
|----------------------|---------------------------------------------------|---------------------------|------------|
| <b>Test Date(s):</b> | Dec. 1-2, 2015                                    | <b>Test Engineer:</b>     | J. Knepper |
| <b>Standards:</b>    | CFR 47 Part 15.247(d);<br>Part 15.209 / KDB558074 | <b>Air Temperature:</b>   | 19.6°C     |
|                      |                                                   | <b>Relative Humidity:</b> | 47%        |

Notes: 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 in a semi-anechoic chamber 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.

The plots are for reference only and the limit lines are not actual limit lines but merely a guide.

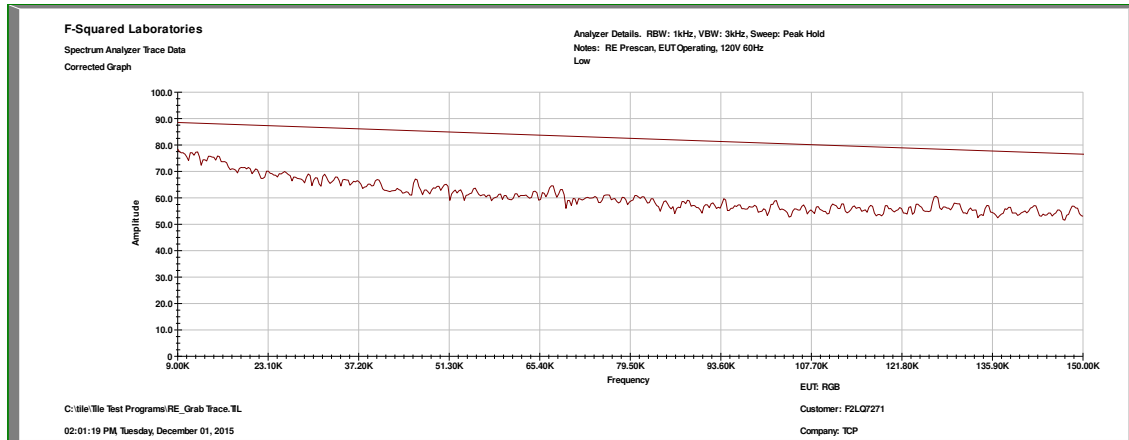


Order Number: F2LQ7271B

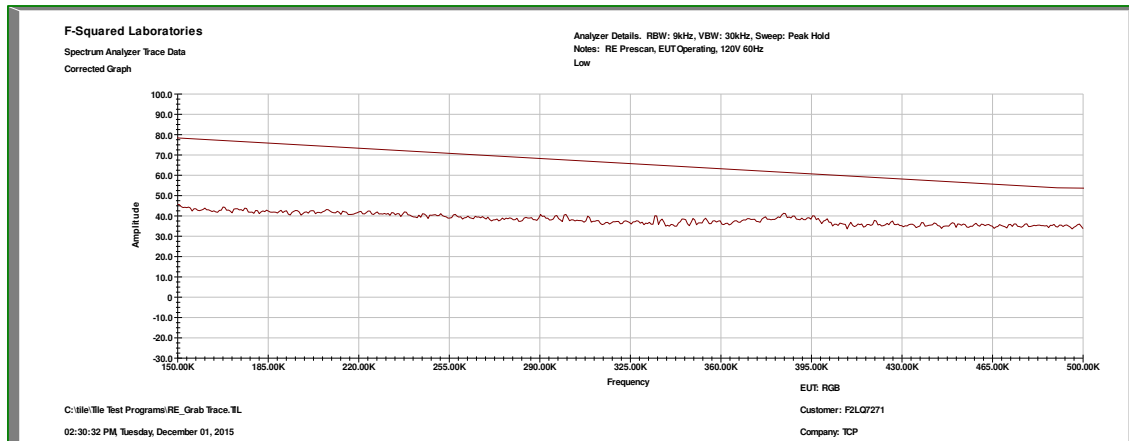
Client: Technical Consumer Products, Inc.

Model: A19RGB001

### Low Channel: 0.009 MHz to 0.15 MHz



### Low Channel: 0.15 MHz to 0.5 MHz



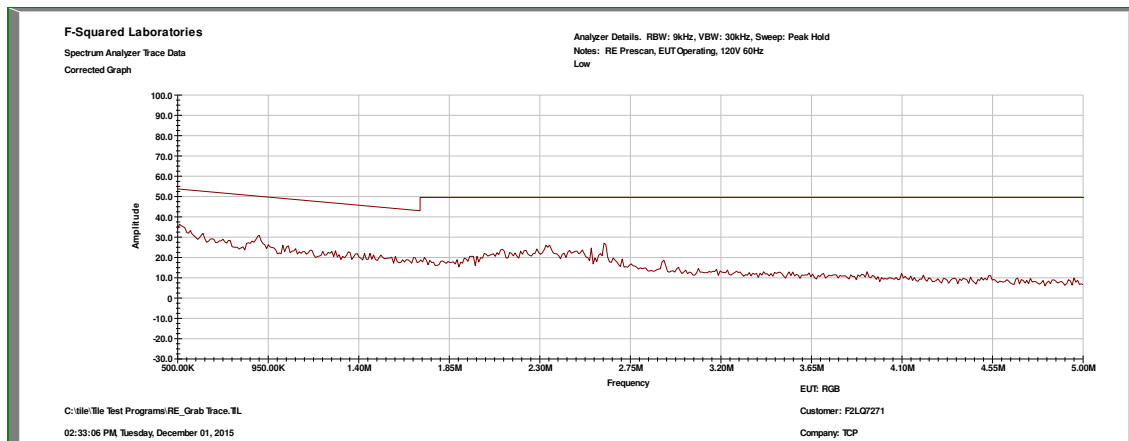


Order Number: F2LQ7271B

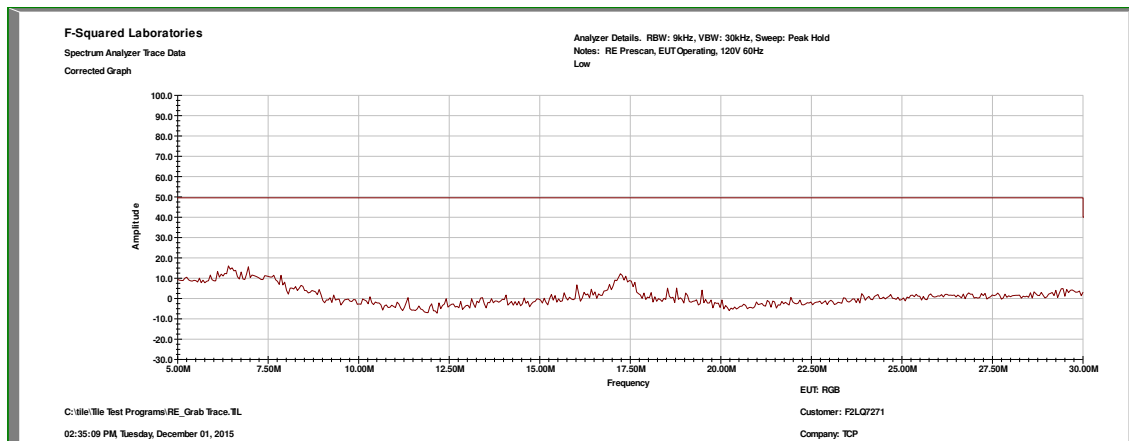
Client: Technical Consumer Products, Inc.

Model: A19RGB001

### Low Channel: 0.5 MHz to 5 MHz

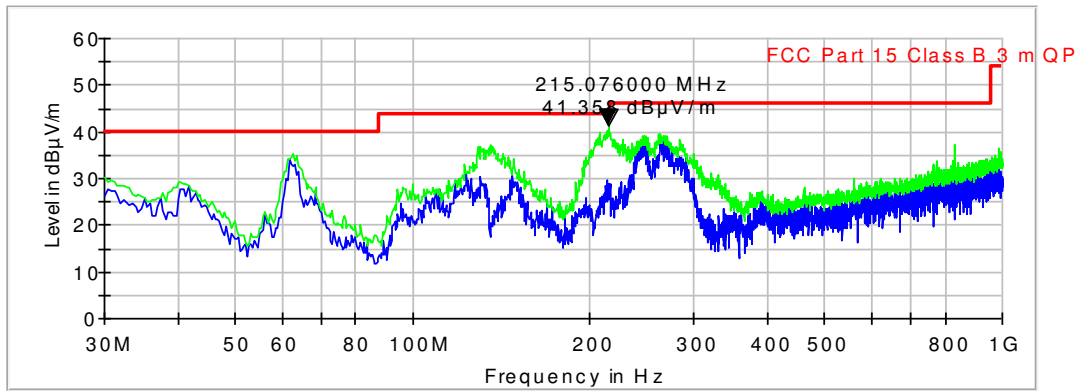


### Low Channel: 5 MHz to 30 MHz

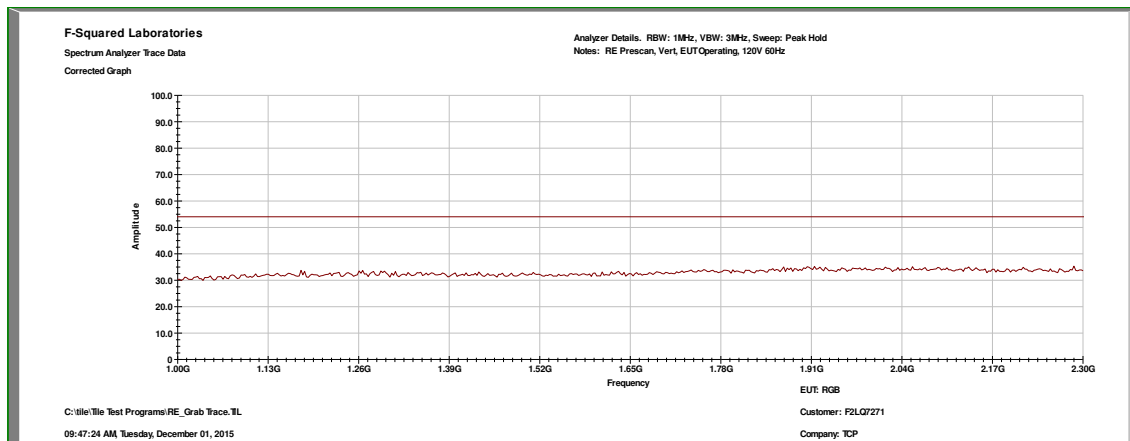




### Low Channel: 30 MHz to 1 GHz, Vertical



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



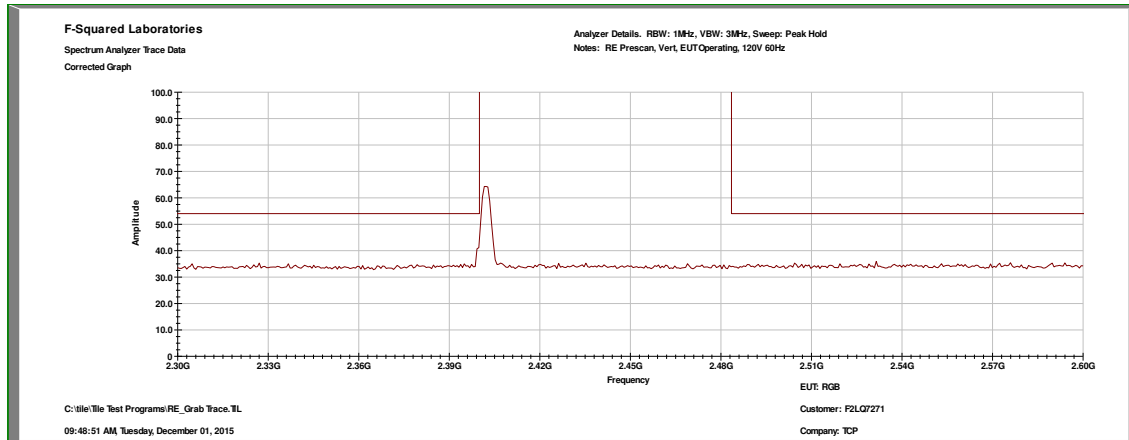


Order Number: F2LQ7271B

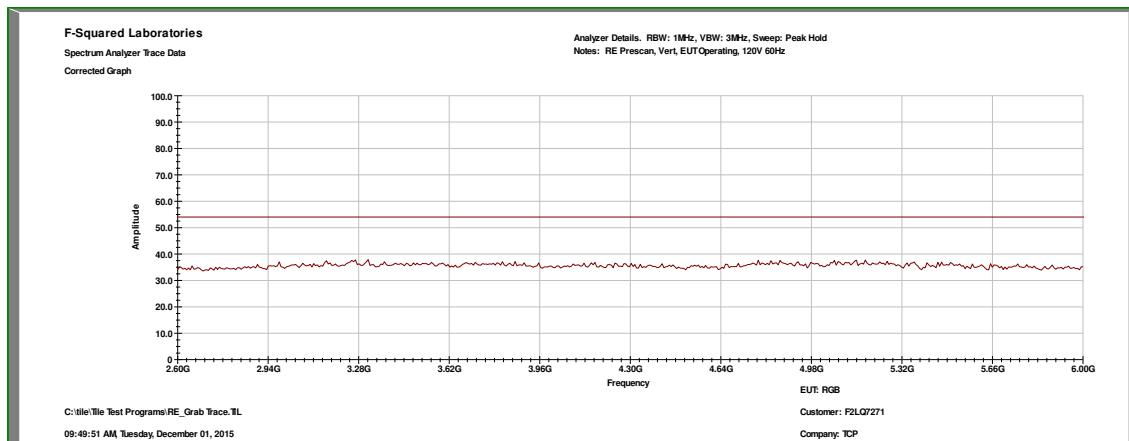
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



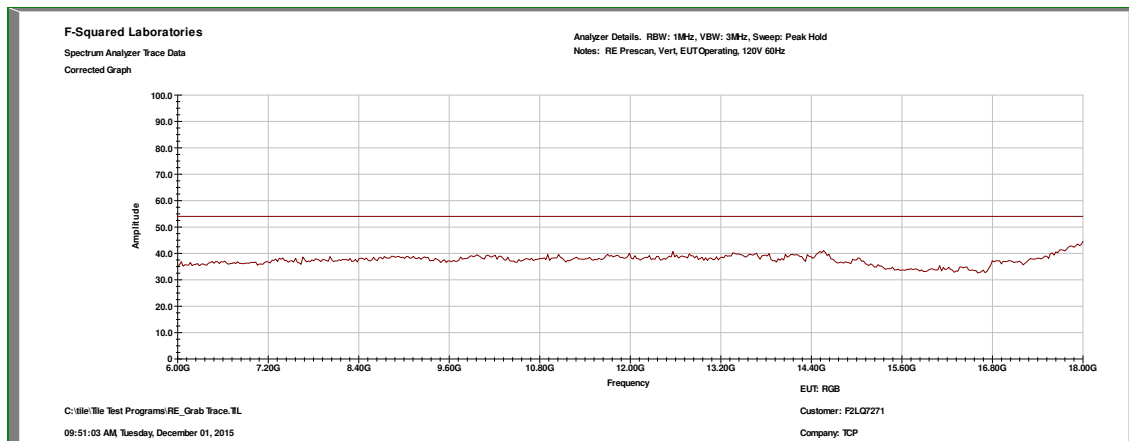


Order Number: F2LQ7271B

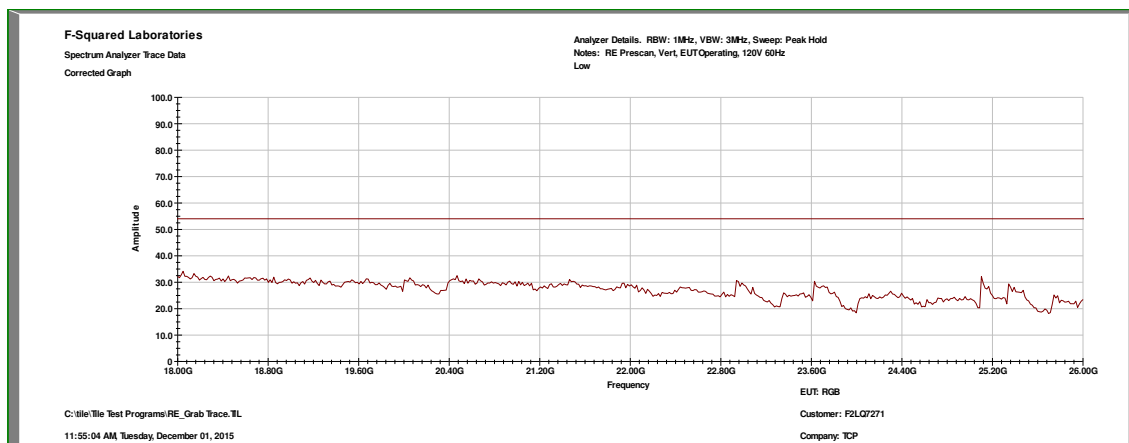
Client: Technical Consumer Products, Inc.

Model: A19RGB001

### Low Channel: 6 GHz to 18 GHz



### Low Channel: 18 GHz to 26 GHz



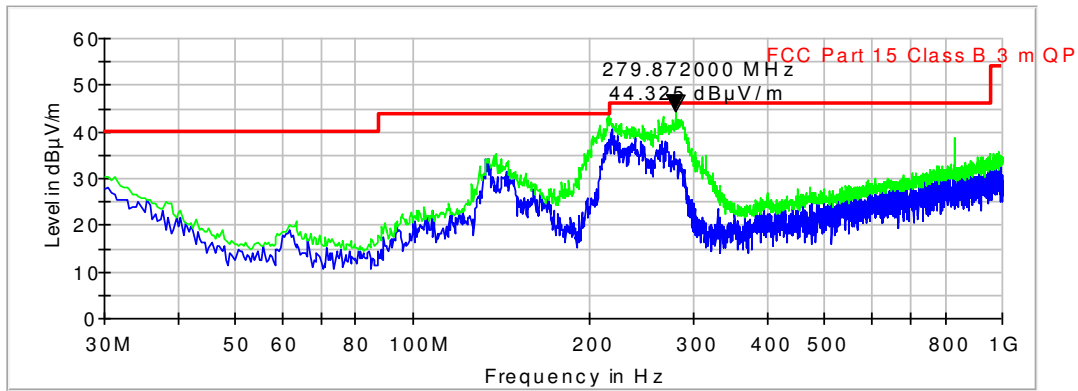


Order Number: F2LQ7271B

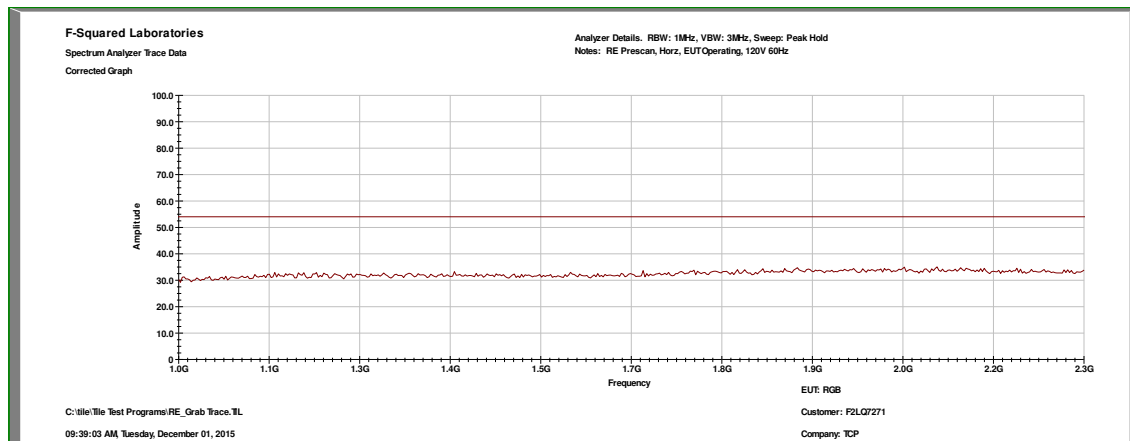
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



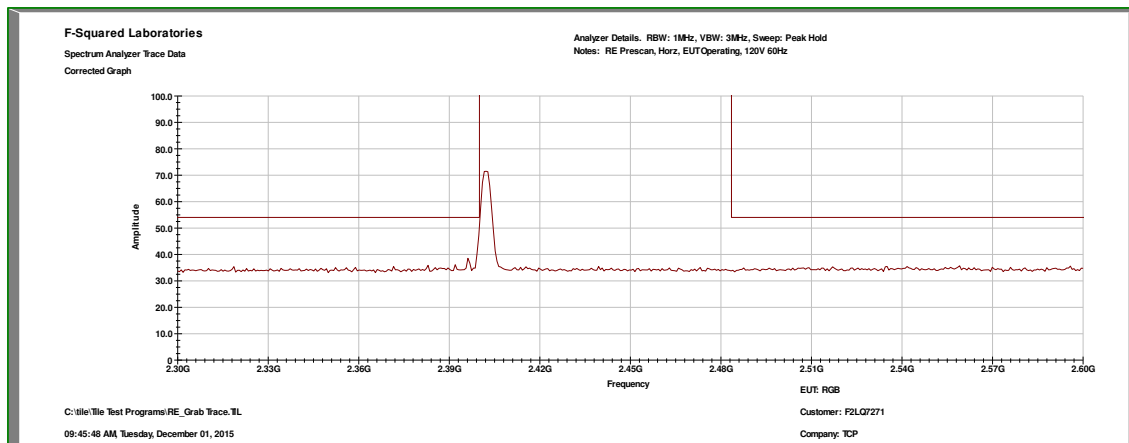


Order Number: F2LQ7271B

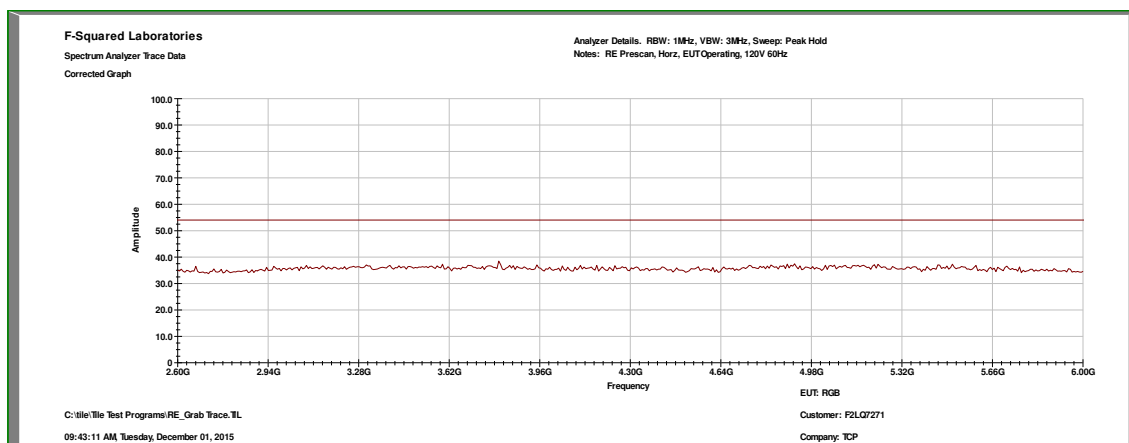
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



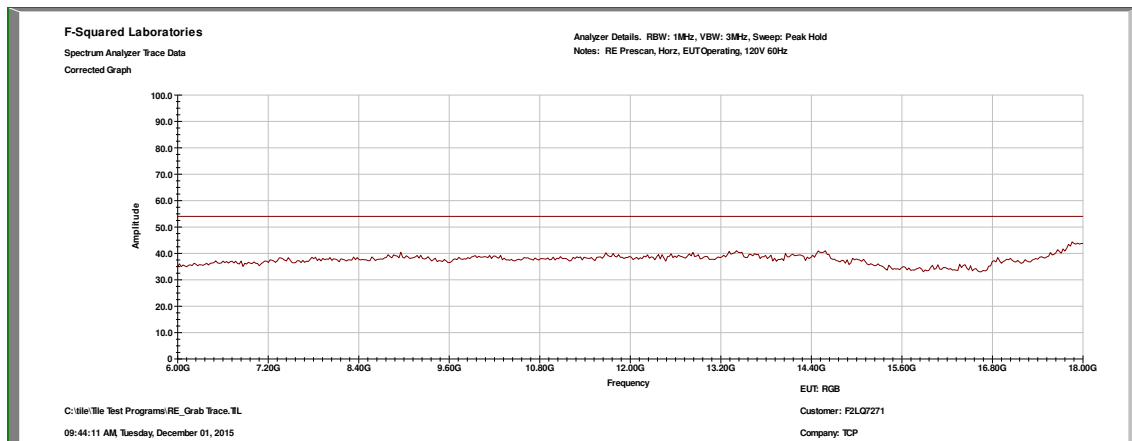


Order Number: F2LQ7271B

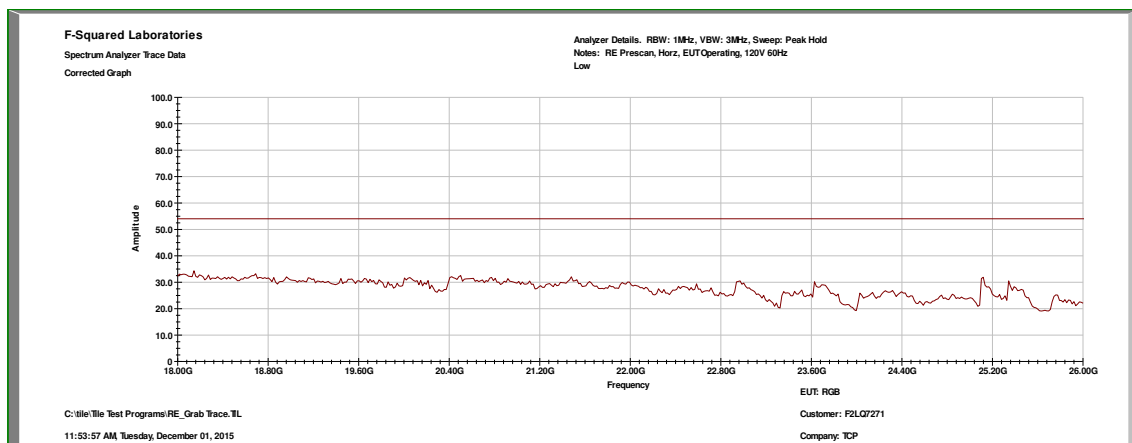
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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

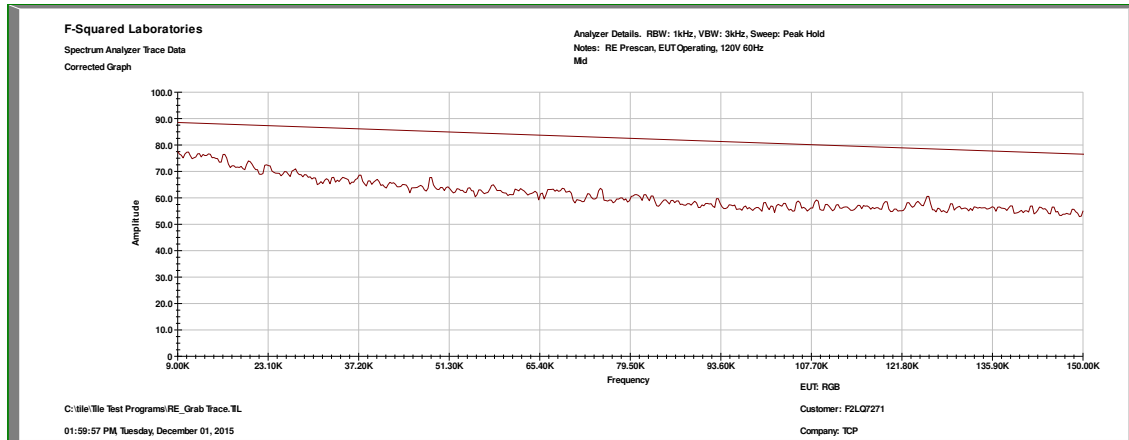


### Low Channel: 18 GHz to 26 GHz, Horizontal

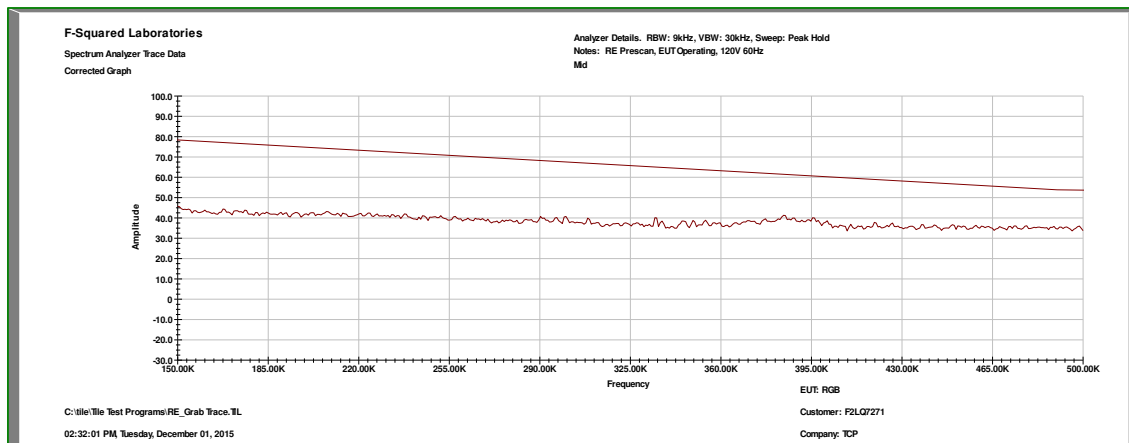




### Mid Channel: 0.009 MHz to 0.15 MHz



### Mid Channel: 0.15 MHz to 0.5 MHz



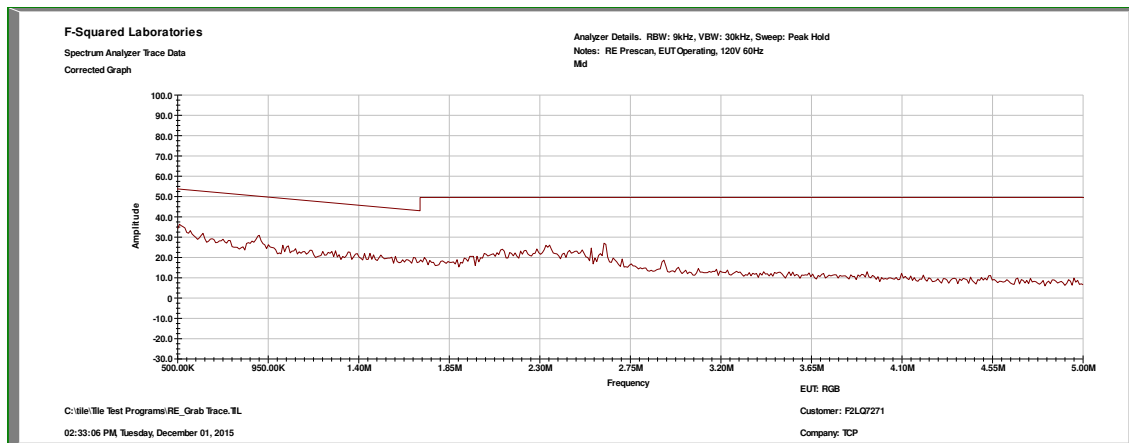


Order Number: F2LQ7271B

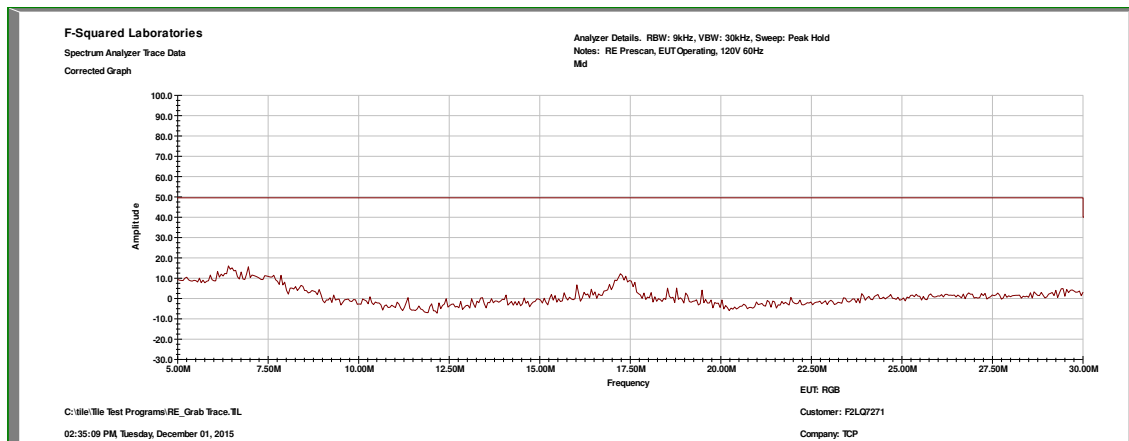
Client: Technical Consumer Products, Inc.

Model: A19RGB001

### Mid Channel: 0.5 MHz to 5 MHz

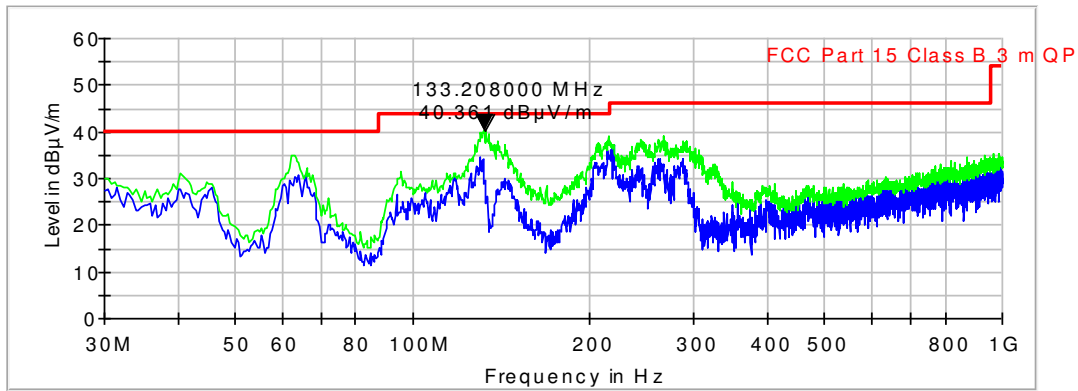


### Mid Channel: 5 MHz to 30 MHz

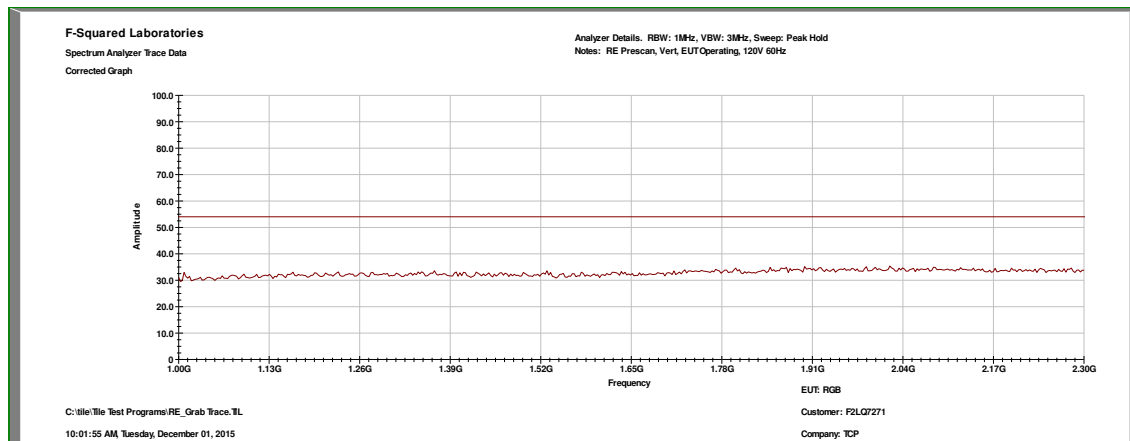




Mid Channel: 30 MHz to 1 GHz, Vertical



Mid Channel: 1 GHz to 2.3 GHz, Vertical



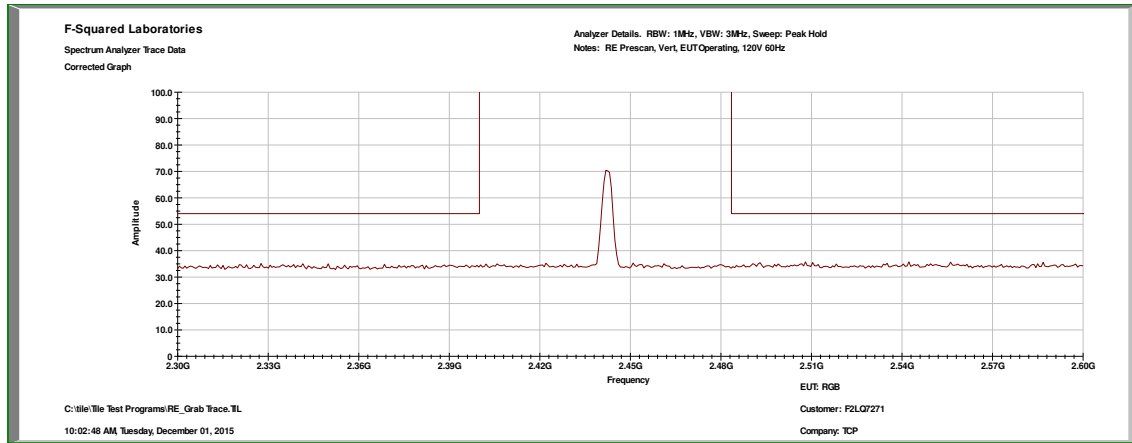


Order Number: F2LQ7271B

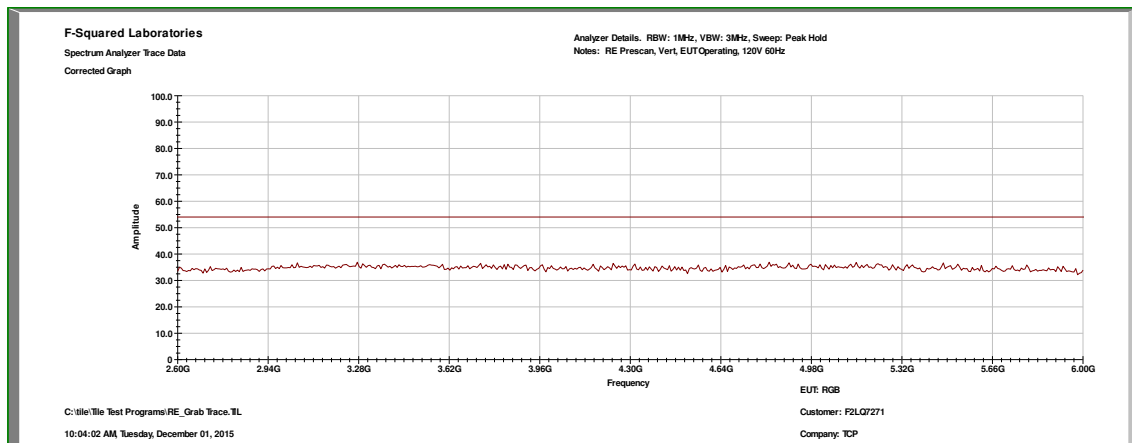
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



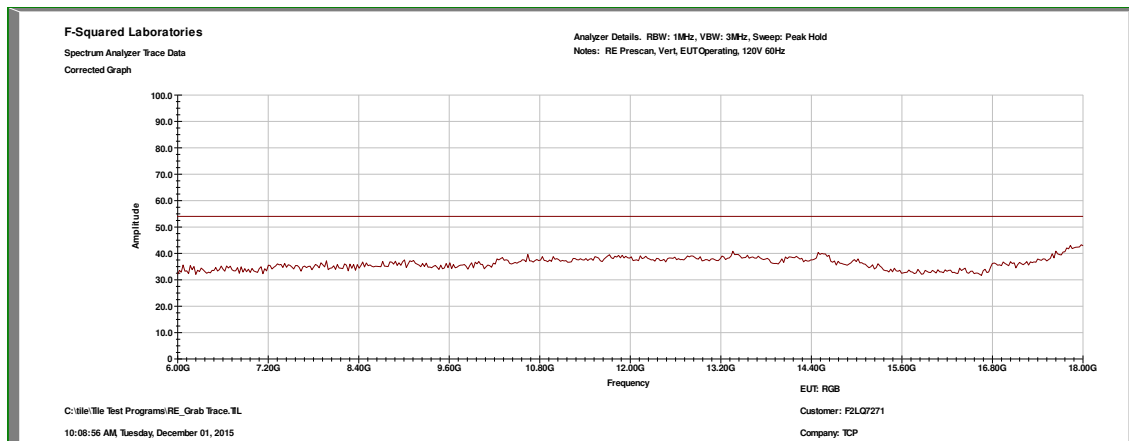


Order Number: F2LQ7271B

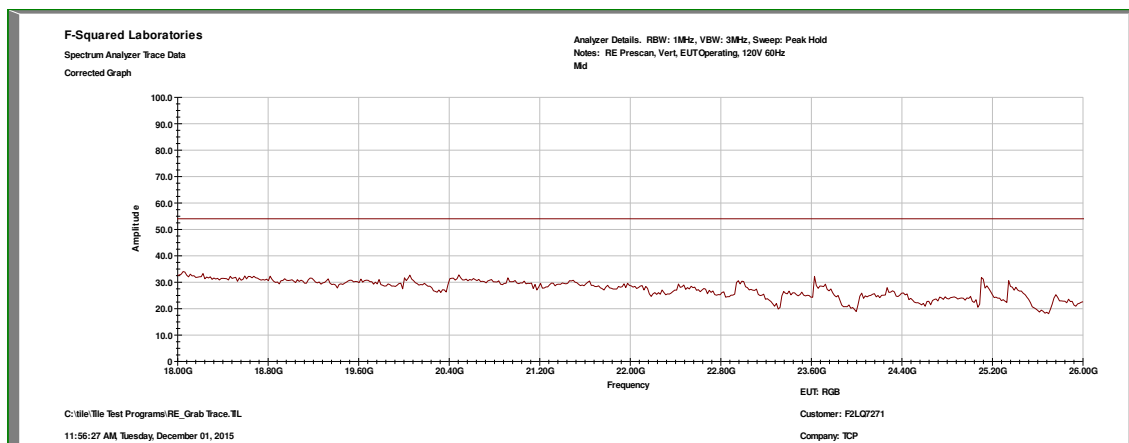
Client: Technical Consumer Products, Inc.

Model: A19RGB001

### Mid Channel: 6 GHz to 18 GHz

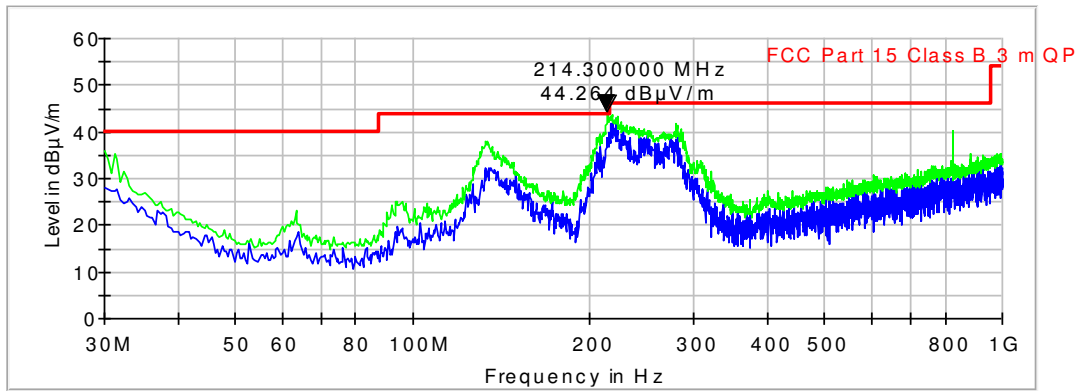


### Mid Channel: 18 GHz to 26 GHz

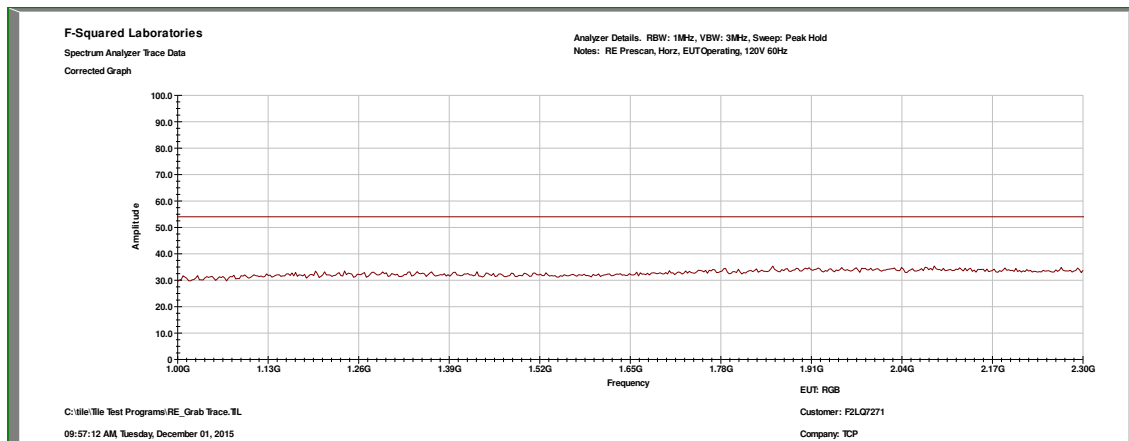




Mid Channel: 30 MHz to 1 GHz, Horizontal



Mid Channel: 1 GHz to 2.3 GHz, Horizontal



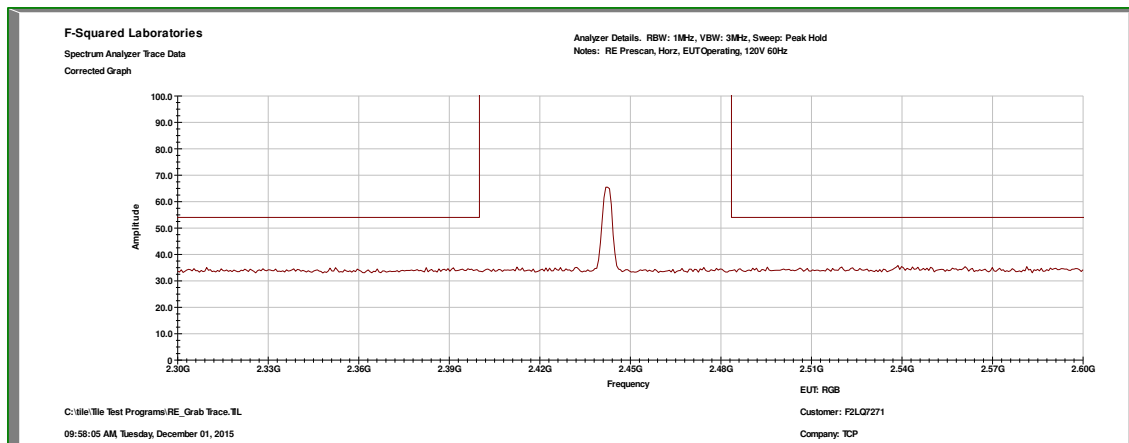


Order Number: F2LQ7271B

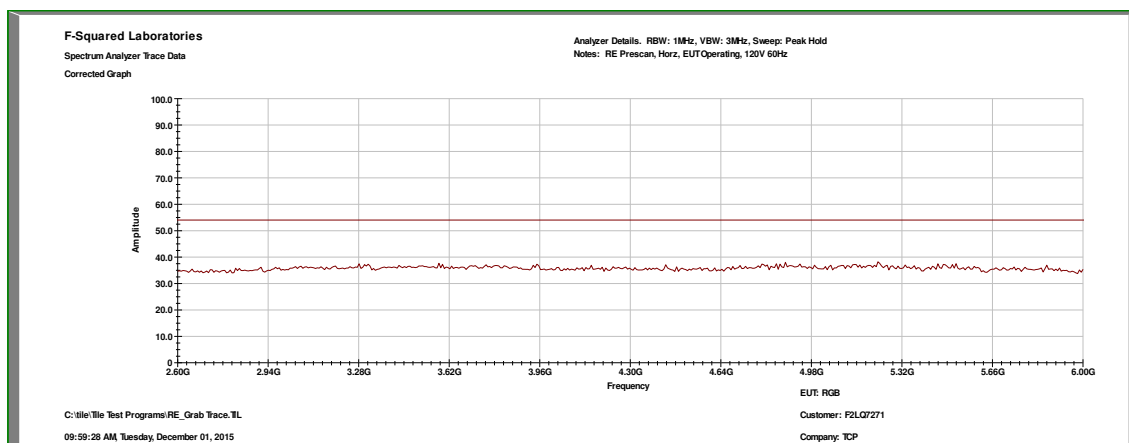
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



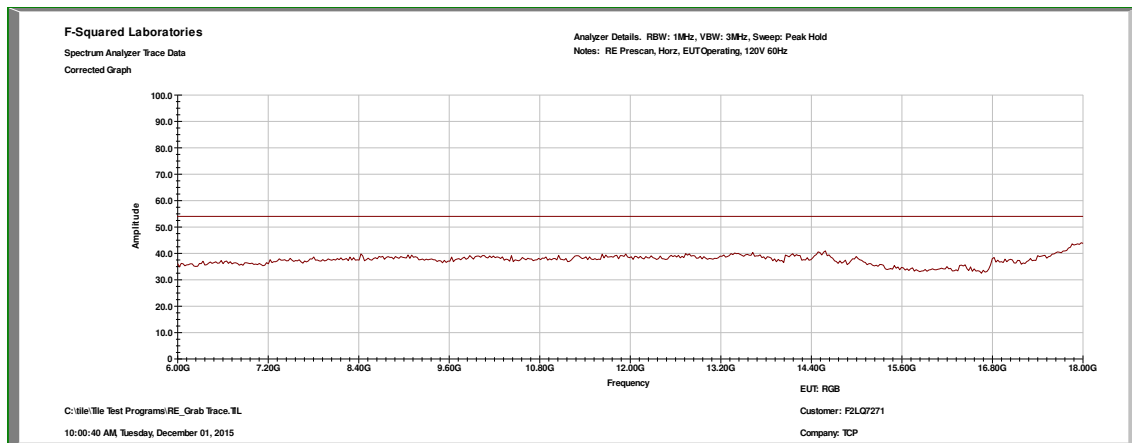


Order Number: F2LQ7271B

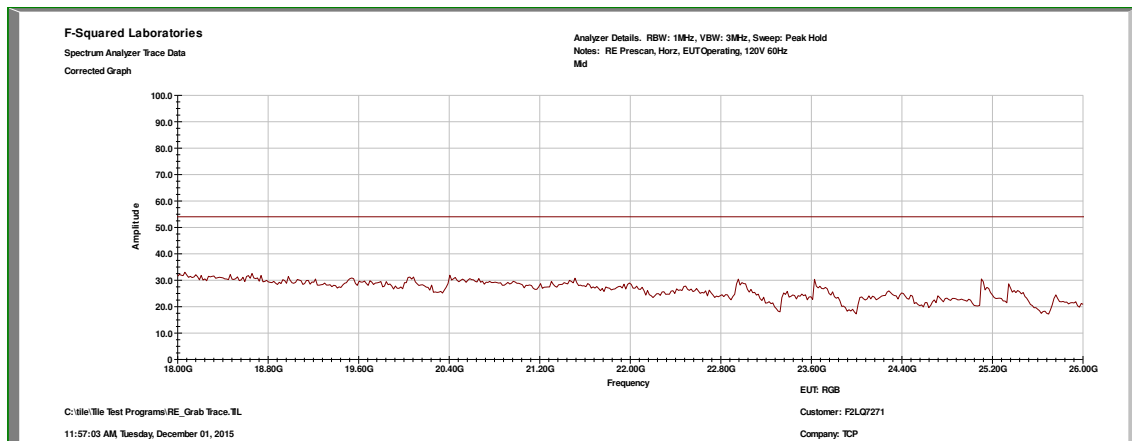
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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

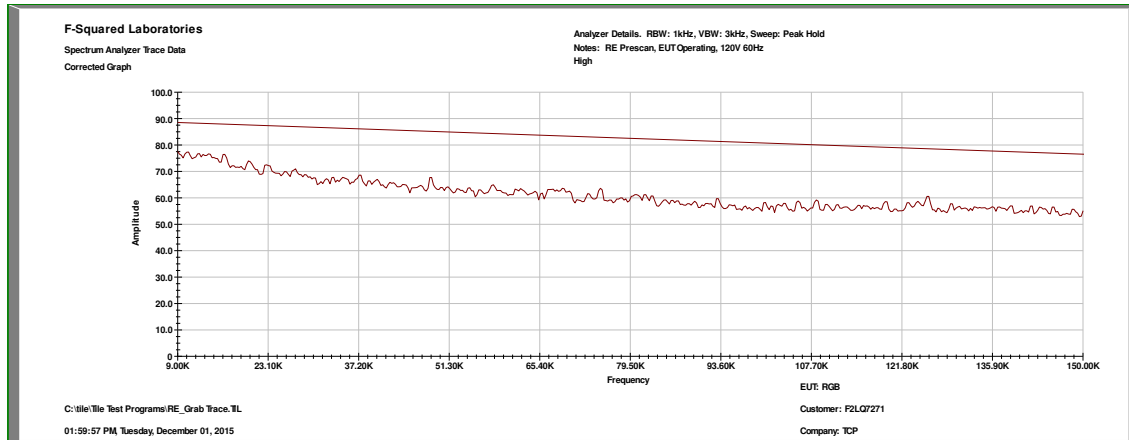


### Mid Channel: 18 GHz to 26 GHz, Horizontal

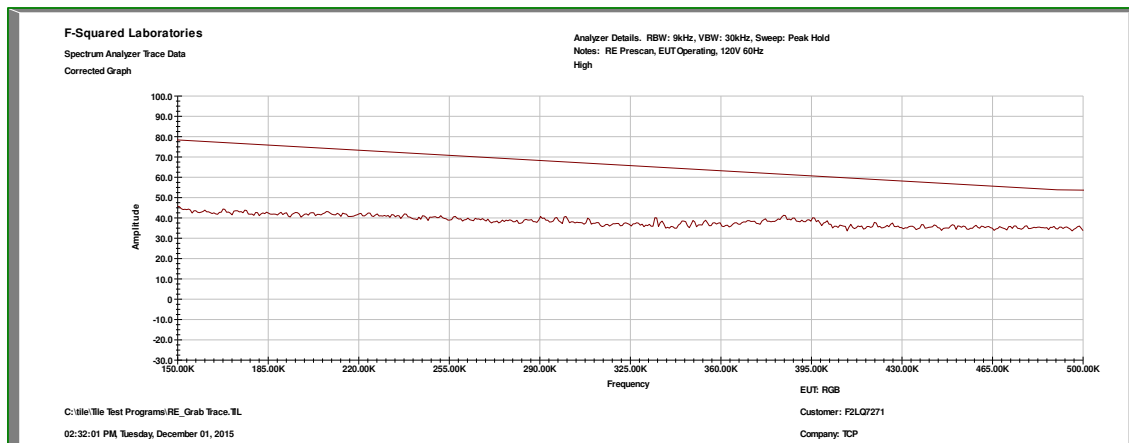




### High Channel: 0.009 MHz to 0.15 MHz



### High Channel: 0.15 MHz to 0.5 MHz



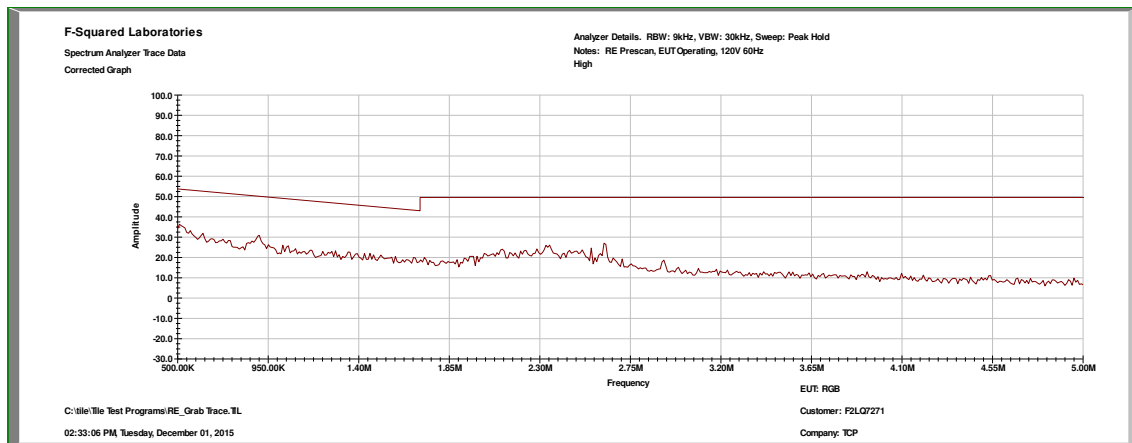


Order Number: F2LQ7271B

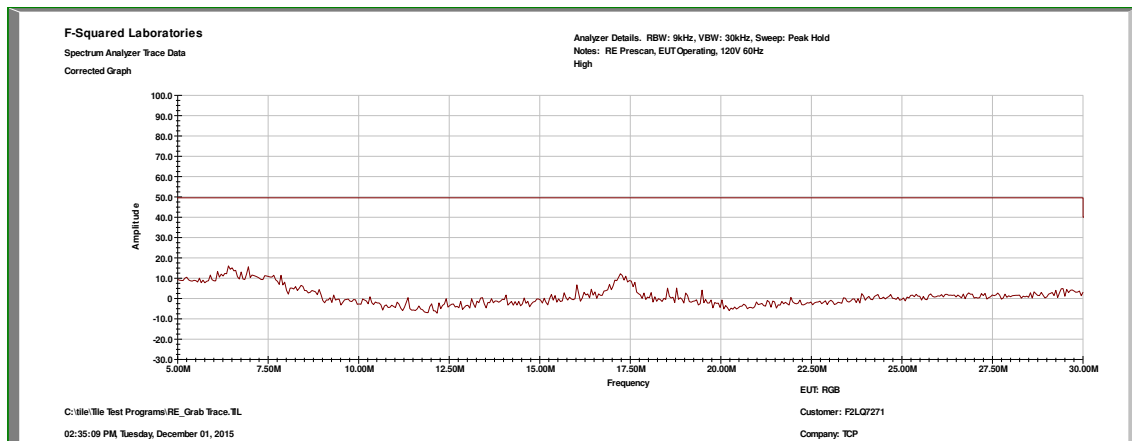
Client: Technical Consumer Products, Inc.

Model: A19RGB001

## High Channel: 0.5 MHz to 5 MHz

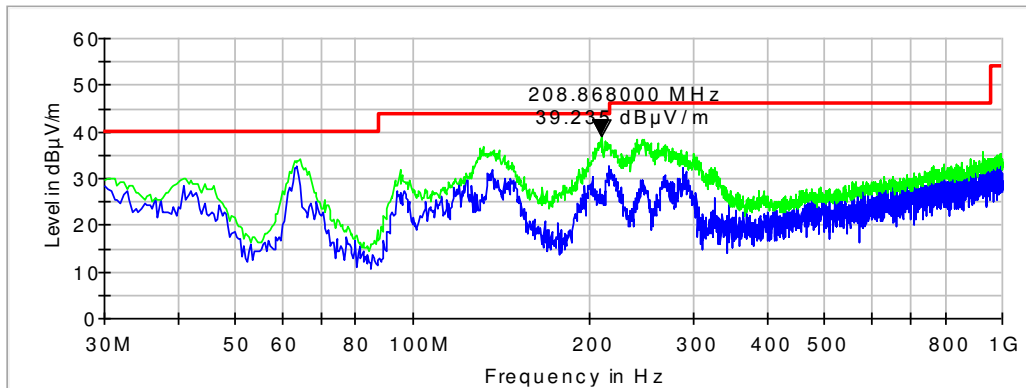


## High Channel: 5 MHz to 30 MHz

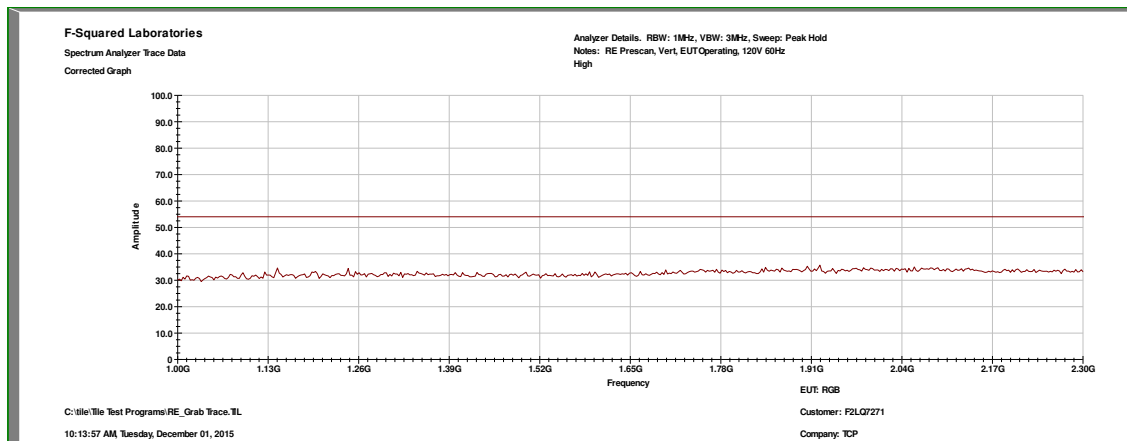




### High Channel: 30 MHz to 1 GHz, Vertical



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



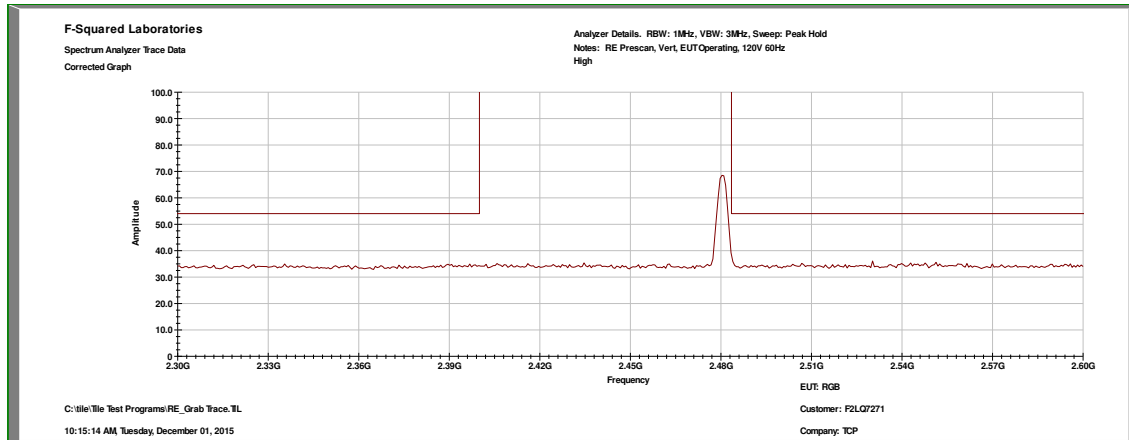


Order Number: F2LQ7271B

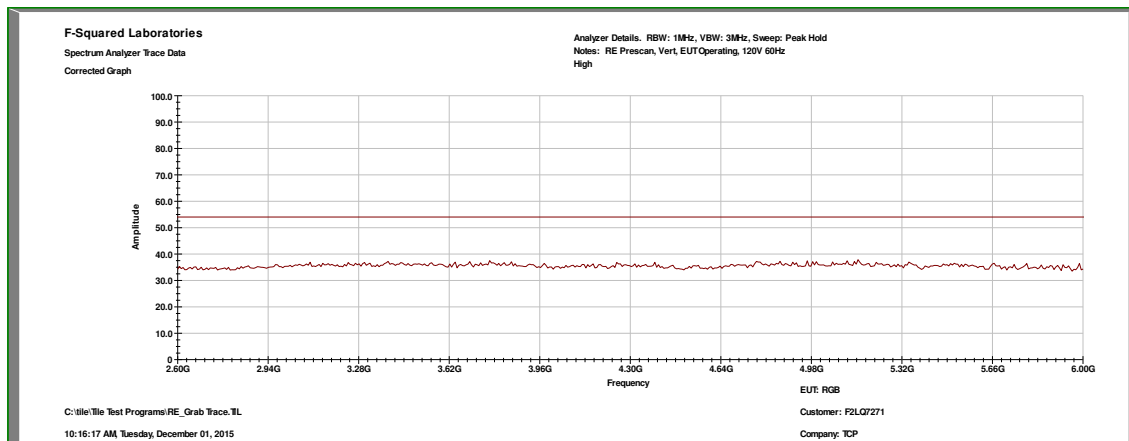
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



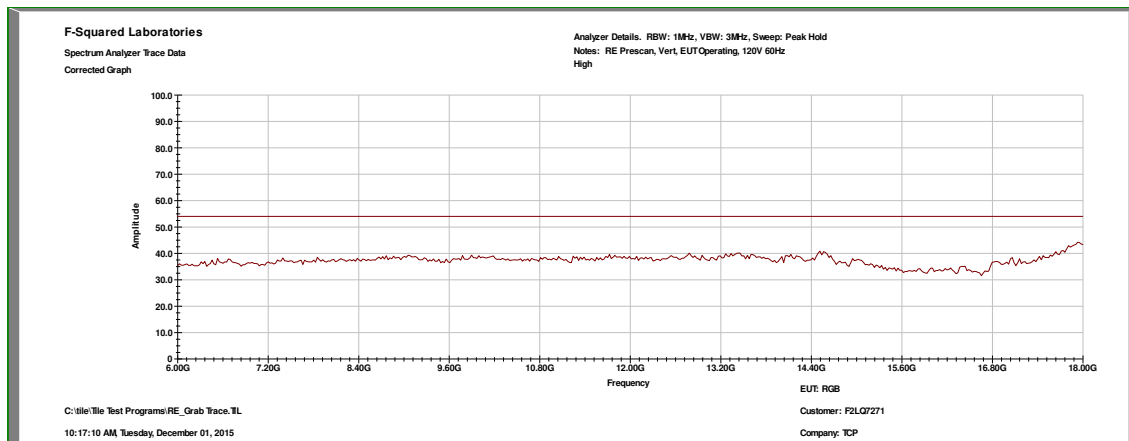


Order Number: F2LQ7271B

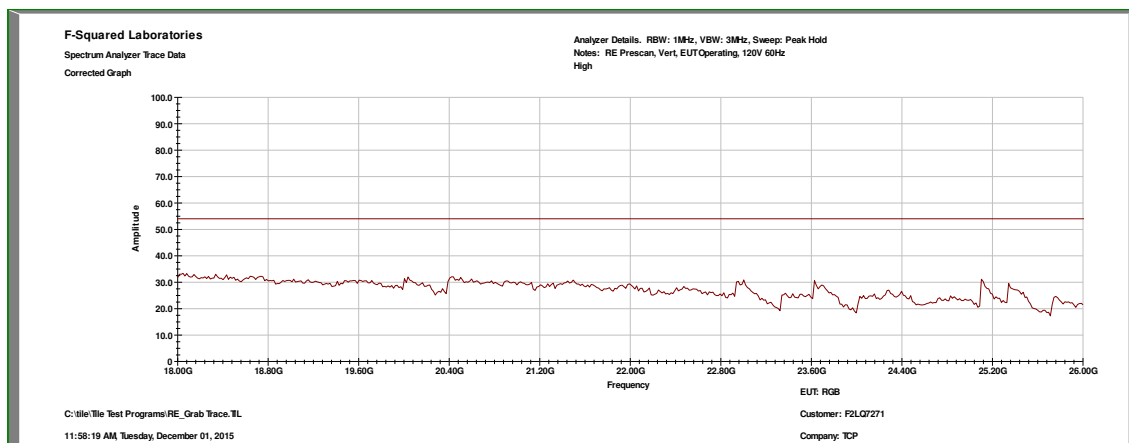
Client: Technical Consumer Products, Inc.

Model: A19RGB001

## High Channel: 6 GHz to 18 GHz

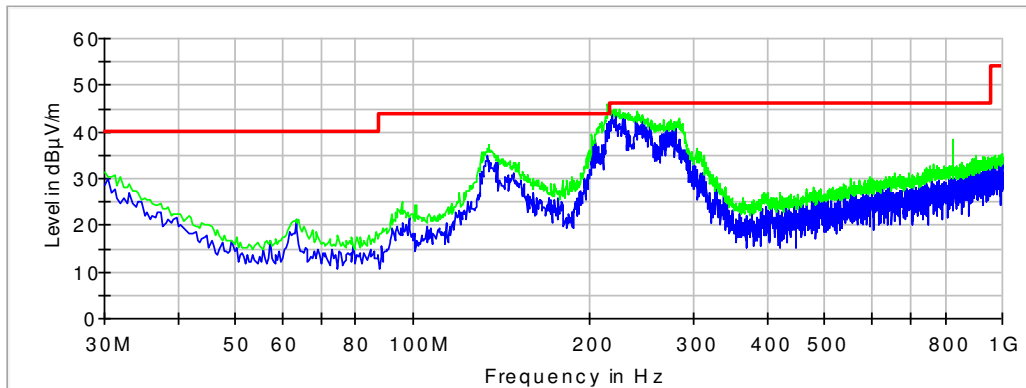


## High Channel: 18 GHz to 26 GHz

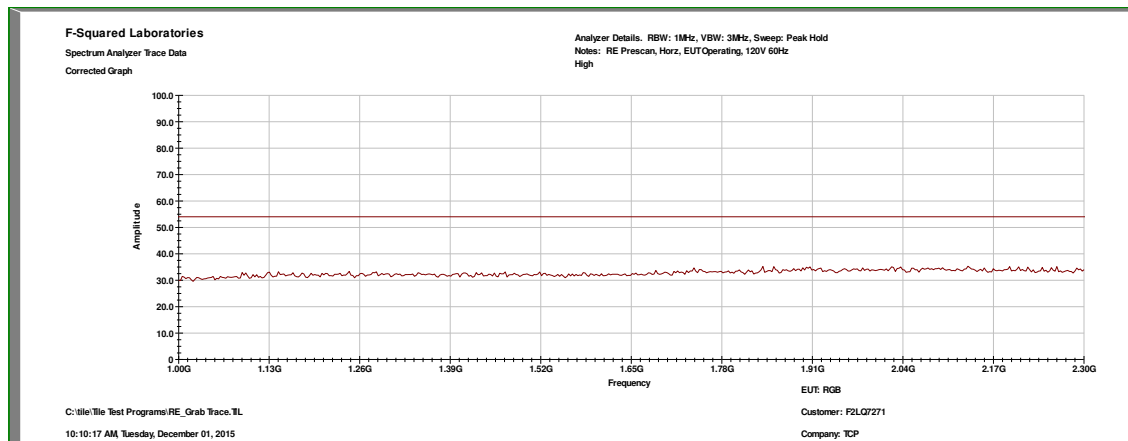




### High Channel: 30 MHz to 1 GHz, Horizontal



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



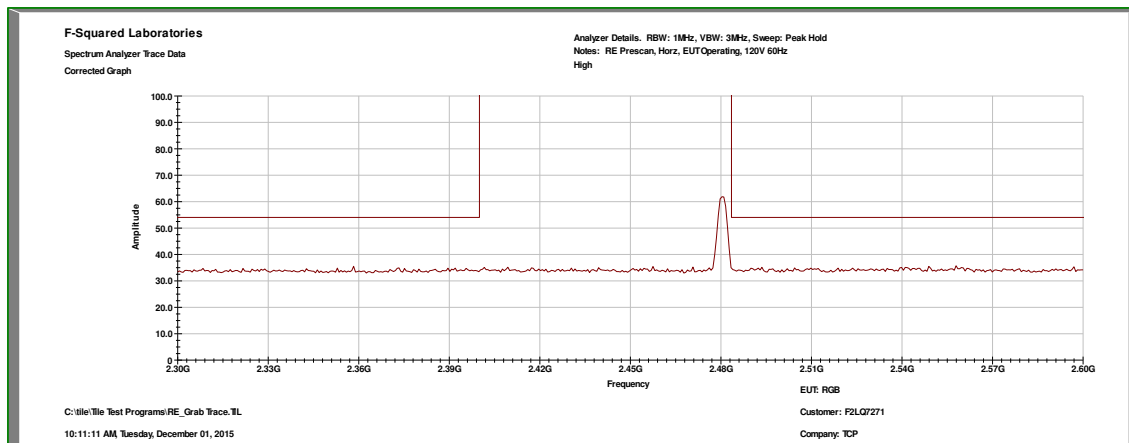


Order Number: F2LQ7271B

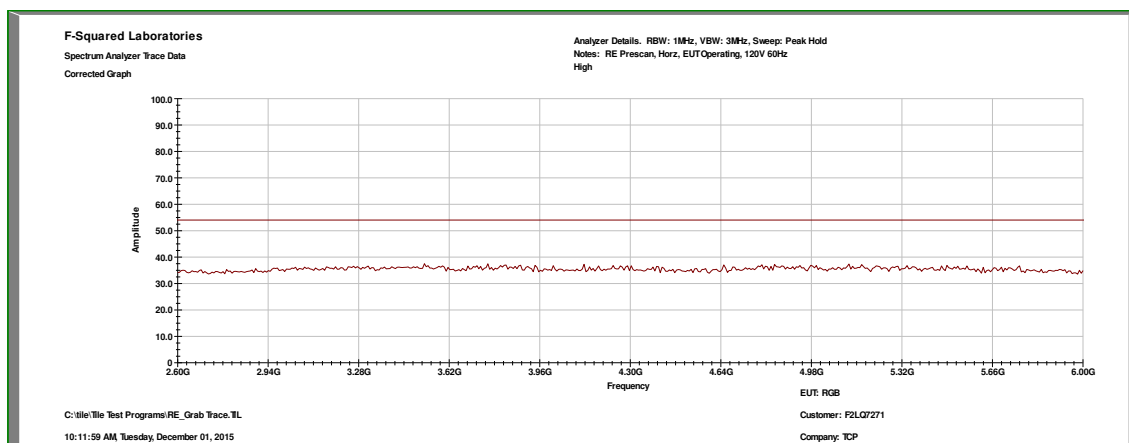
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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



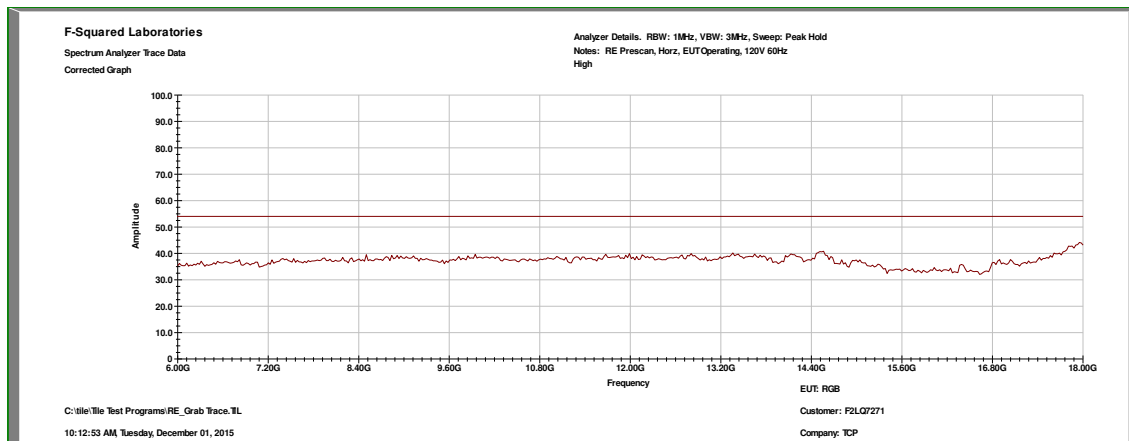


Order Number: F2LQ7271B

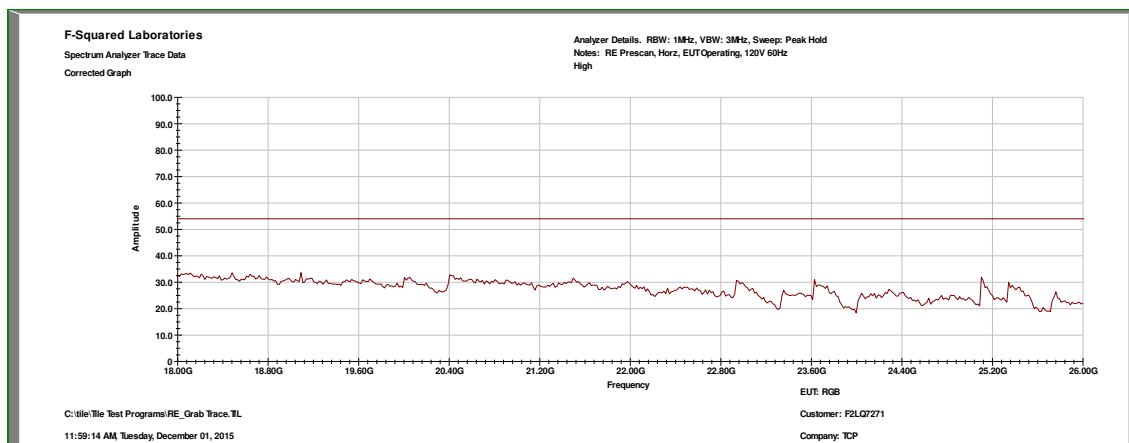
Client: Technical Consumer Products, Inc.

Model: A19RGB001

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



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

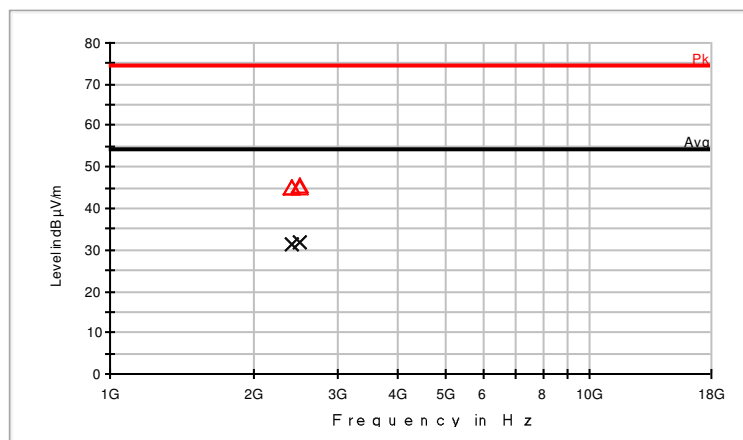


**Measurements****Radiated Spurs, >1 GHz****Low Channel - MaxPeak**

| Frequency (MHz) | Antenna Polarization | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 2390.000000     | V                    | 38.4                 | 6.7                              | 45.10                   | 74.0                 | -28.9       |
| 2390.000000     | H                    | 38.4                 | 6.7                              | 45.10                   | 74.0                 | -28.9       |
| 2483.500000     | V                    | 38.6                 | 6.9                              | 45.50                   | 74.0                 | -28.5       |
| 2483.500000     | H                    | 38.7                 | 6.9                              | 45.60                   | 74.0                 | -28.4       |

**Low Channel - Average**

| Frequency (MHz) | Antenna Polarization | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 2390.000000     | V                    | 24.7                 | 6.7                              | 31.40                   | 54.0                 | -22.6       |
| 2390.000000     | H                    | 24.7                 | 6.7                              | 31.40                   | 54.0                 | -22.6       |
| 2483.500000     | V                    | 24.7                 | 6.9                              | 31.60                   | 54.0                 | -22.4       |
| 2483.500000     | H                    | 24.8                 | 6.9                              | 31.70                   | 54.0                 | -22.3       |

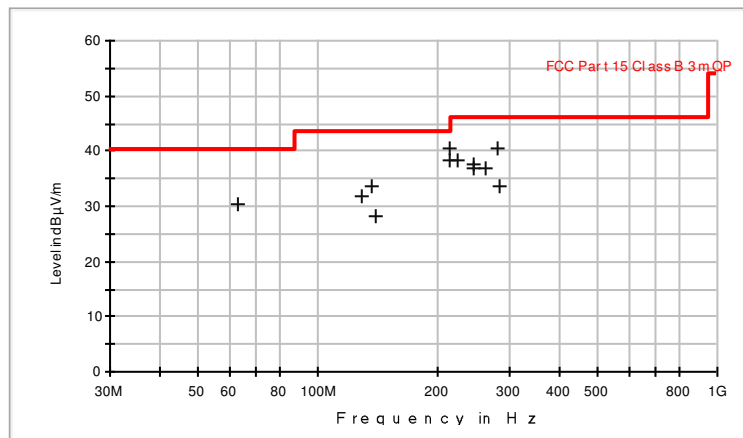




## Radiated Spurs, &lt;1 GHz

## Low Channel - QuasiPeak

| Frequency (MHz) | Antenna Polarization | Reading (dBμV) | Cable Loss & Antenna Factor (dB) | Emission (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|----------------|----------------------------------|-------------------|----------------|-------------|
| 62.592000       | V                    | 22.4           | 7.9                              | 30.30             | 40.0           | -9.7        |
| 128.940000      | V                    | 17.6           | 14.2                             | 31.80             | 43.5           | -11.7       |
| 136.700000      | V                    | 19.9           | 13.7                             | 33.60             | 43.5           | -9.9        |
| 138.640000      | H                    | 14.5           | 13.5                             | 28.00             | 43.5           | -15.5       |
| 213.136000      | V                    | 26.9           | 11.3                             | 38.20             | 43.5           | -5.3        |
| 213.912000      | H                    | 29.1           | 11.3                             | 40.40             | 43.5           | -3.1        |
| 224.000000      | H                    | 26.6           | 11.6                             | 38.20             | 46.0           | -7.8        |
| 245.728000      | V                    | 24.5           | 12.3                             | 36.80             | 46.0           | -9.2        |
| 246.116000      | H                    | 25.3           | 12.3                             | 37.60             | 46.0           | -8.4        |
| 262.024000      | V                    | 23.8           | 13.1                             | 36.90             | 46.0           | -9.1        |
| 282.588000      | H                    | 26.6           | 13.8                             | 40.40             | 46.0           | -5.6        |
| 284.140000      | V                    | 19.8           | 13.8                             | 33.60             | 46.0           | -12.4       |

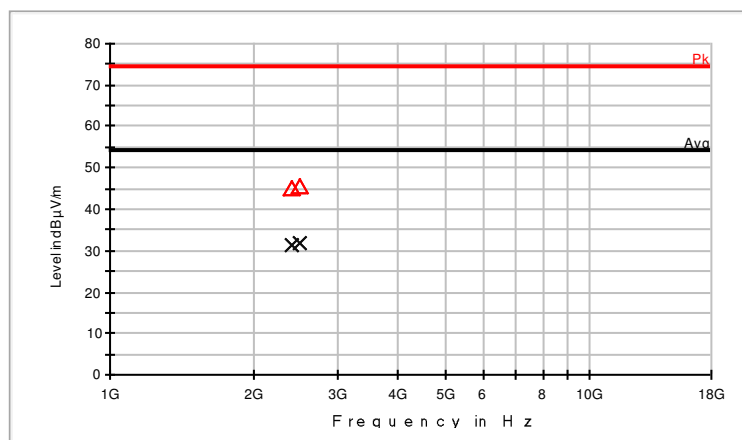


**Radiated Spurs, >1 GHz****Mid Channel - MaxPeak**

| Frequency (MHz) | Antenna Polarization | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 2390.000000     | V                    | 38.7                 | 6.7                              | 45.40                   | 74.0                 | -28.6       |
| 2390.000000     | H                    | 38.5                 | 6.7                              | 45.20                   | 74.0                 | -28.8       |
| 2483.500000     | H                    | 38.9                 | 6.9                              | 45.80                   | 74.0                 | -28.2       |
| 2483.500000     | V                    | 38.8                 | 6.9                              | 45.70                   | 74.0                 | -28.3       |

**Low Channel - Average**

| Frequency (MHz) | Antenna Polarization | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 2390.000000     | V                    | 24.7                 | 6.7                              | 31.40                   | 54.0                 | -22.6       |
| 2390.000000     | H                    | 24.7                 | 6.7                              | 31.40                   | 54.0                 | -22.6       |
| 2483.500000     | H                    | 24.8                 | 6.9                              | 31.70                   | 54.0                 | -22.3       |
| 2483.500000     | V                    | 24.8                 | 6.9                              | 31.70                   | 54.0                 | -22.3       |

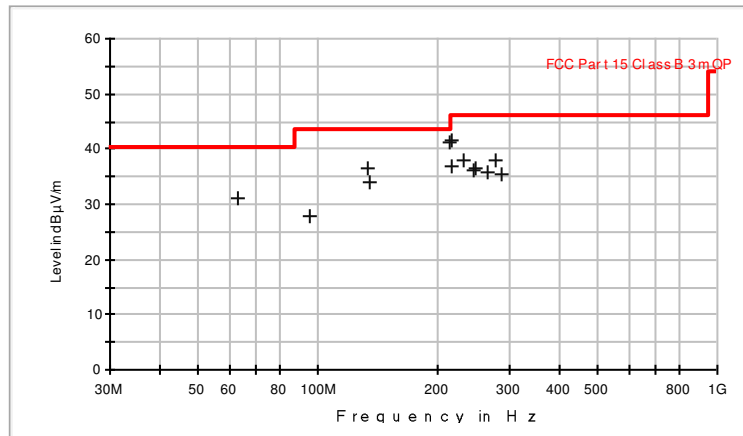




## Radiated Spurs, &lt;1 GHz

## Mid Channel - QuasiPeak

| Frequency (MHz) | Antenna Polarization | Reading (dBμV) | Cable Loss & Antenna Factor (dB) | Emission (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|----------------|----------------------------------|-------------------|----------------|-------------|
| 62.592000       | V                    | 23.2           | 7.9                              | 31.10             | 40.0           | -8.9        |
| 95.572000       | V                    | 19.0           | 9.0                              | 28.00             | 40.0           | -12.0       |
| 133.208000      | V                    | 22.4           | 14.0                             | 36.40             | 43.5           | -7.1        |
| 133.984000      | H                    | 20.2           | 13.9                             | 34.10             | 43.5           | -9.4        |
| 214.300000      | H                    | 29.8           | 11.3                             | 41.10             | 43.5           | -2.4        |
| 214.688000      | V                    | 25.6           | 11.3                             | 36.90             | 43.5           | -6.6        |
| 216.628000      | H                    | 30.2           | 11.4                             | 41.60             | 46.0           | -4.4        |
| 231.760000      | H                    | 25.9           | 11.9                             | 37.80             | 46.0           | -8.2        |
| 244.176000      | V                    | 23.9           | 12.3                             | 36.20             | 46.0           | -9.8        |
| 246.504000      | H                    | 24.2           | 12.3                             | 36.50             | 46.0           | -9.5        |
| 266.292000      | V                    | 22.1           | 13.6                             | 35.70             | 46.0           | -10.3       |
| 279.484000      | H                    | 24.1           | 13.9                             | 38.00             | 46.0           | -8.0        |
| 287.632000      | V                    | 21.7           | 13.8                             | 35.50             | 46.0           | -10.5       |





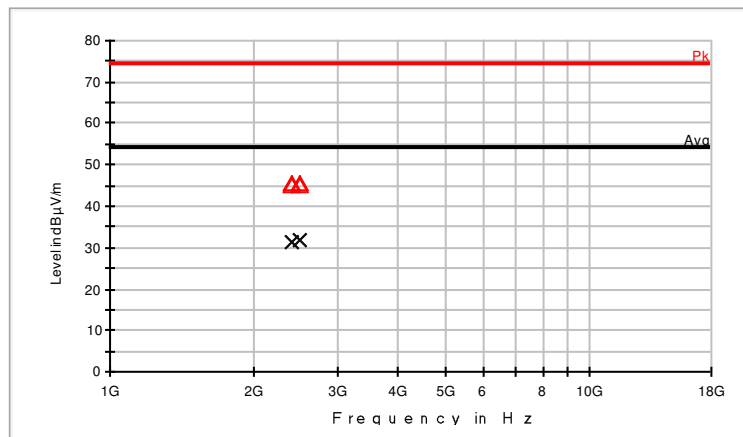
## Radiated Spurs, &gt;1 GHz

## High Channel - MaxPeak

| Frequency (MHz) | Antenna Polarization | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 2390.000000     | H                    | 38.4                 | 6.7                              | 45.10                   | 74.0                 | -28.9       |
| 2390.000000     | V                    | 39.0                 | 6.7                              | 45.70                   | 74.0                 | -28.3       |
| 2483.500000     | V                    | 38.4                 | 6.9                              | 45.30                   | 74.0                 | -28.7       |
| 2483.500000     | H                    | 38.9                 | 6.9                              | 45.80                   | 74.0                 | -28.2       |

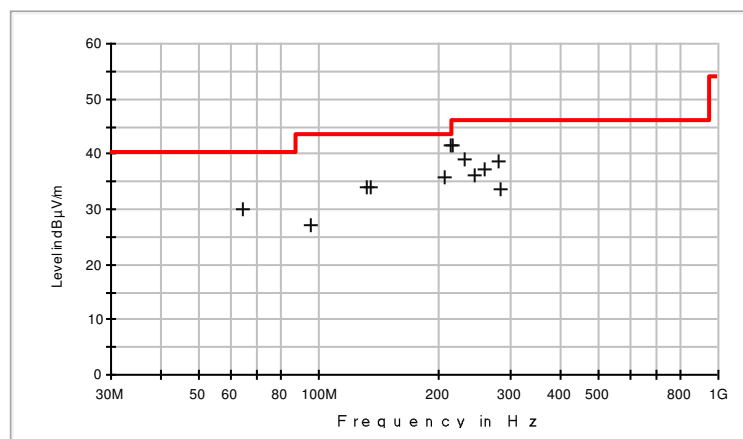
## High Channel - Average

| Frequency (MHz) | Antenna Polarization | Reading (dB $\mu$ V) | Cable Loss & Antenna Factor (dB) | Emission (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-----------------|----------------------|----------------------|----------------------------------|-------------------------|----------------------|-------------|
| 2390.000000     | H                    | 24.7                 | 6.7                              | 31.40                   | 54.0                 | -22.6       |
| 2390.000000     | V                    | 24.7                 | 6.7                              | 31.40                   | 54.0                 | -22.6       |
| 2483.500000     | V                    | 24.9                 | 6.9                              | 31.80                   | 54.0                 | -22.2       |
| 2483.500000     | H                    | 24.8                 | 6.9                              | 31.70                   | 54.0                 | -22.3       |



**Radiated Spurs, <1 GHz****High Channel - QuasiPeak**

| Frequency (MHz) | Antenna Polarization | Reading (dBμV) | Cable Loss & Antenna Factor (dB) | Emission (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|----------------|----------------------------------|-------------------|----------------|-------------|
| 64.532000       | V                    | 21.8           | 8.1                              | 29.90             | 40.0           | -10.1       |
| 95.184000       | V                    | 18.2           | 8.9                              | 27.10             | 43.5           | -16.4       |
| 131.656000      | V                    | 20.1           | 14.0                             | 34.10             | 43.5           | -9.4        |
| 134.760000      | H                    | 20.0           | 13.9                             | 33.90             | 43.5           | -9.6        |
| 206.540000      | V                    | 24.3           | 11.5                             | 35.80             | 43.5           | -7.7        |
| 214.300000      | H                    | 30.2           | 11.3                             | 41.50             | 43.5           | -2.0        |
| 215.076000      | H                    | 30.3           | 11.3                             | 41.60             | 43.5           | -1.9        |
| 232.148000      | H                    | 27.1           | 11.9                             | 39.00             | 46.0           | -7.0        |
| 244.564000      | V                    | 23.9           | 12.3                             | 36.20             | 46.0           | -9.8        |
| 260.472000      | H                    | 24.3           | 12.9                             | 37.20             | 46.0           | -8.8        |
| 282.588000      | H                    | 24.8           | 13.8                             | 38.60             | 46.0           | -7.4        |
| 284.528000      | V                    | 19.9           | 13.8                             | 33.70             | 46.0           | -12.3       |





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

Peak power spectral density measurements were performed.

### 11.1 Requirements:

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

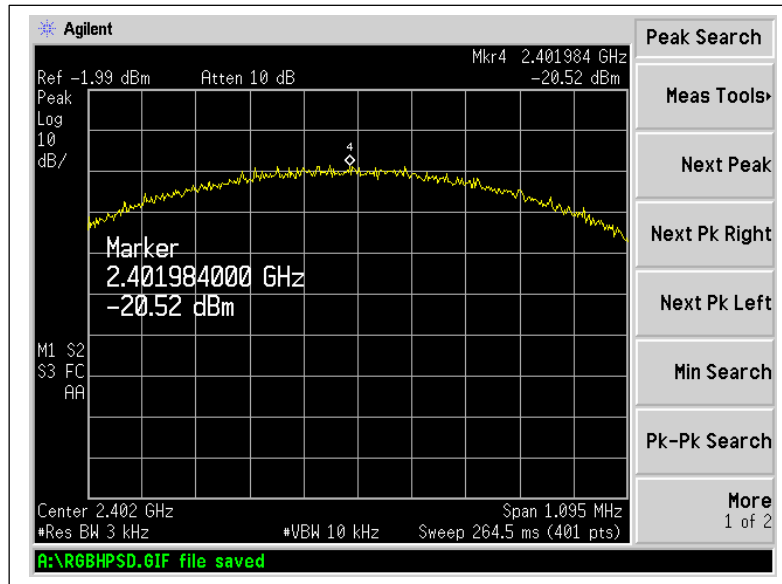
Power spectral density measurements were performed at a resolution bandwidth of 3 kHz (video bandwidth set at 10 KHz). The peak spectral densities were measured at the low, mid, and upper channels.



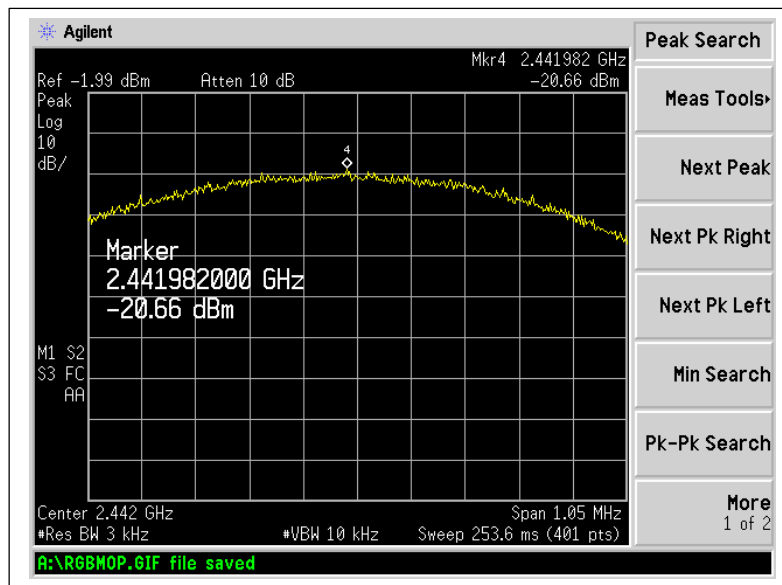
## 11.2 Peak Power Spectral Density Test Data

|               |                                     |                    |            |
|---------------|-------------------------------------|--------------------|------------|
| Test Date(s): | Nov. 30, 2015                       | Test Engineer:     | J. Knepper |
| Standards:    | CFR 47 Part 15.247(e);<br>KDB558074 | Air Temperature:   | 19.4°C     |
|               |                                     | Relative Humidity: | 46%        |

## Low Channel

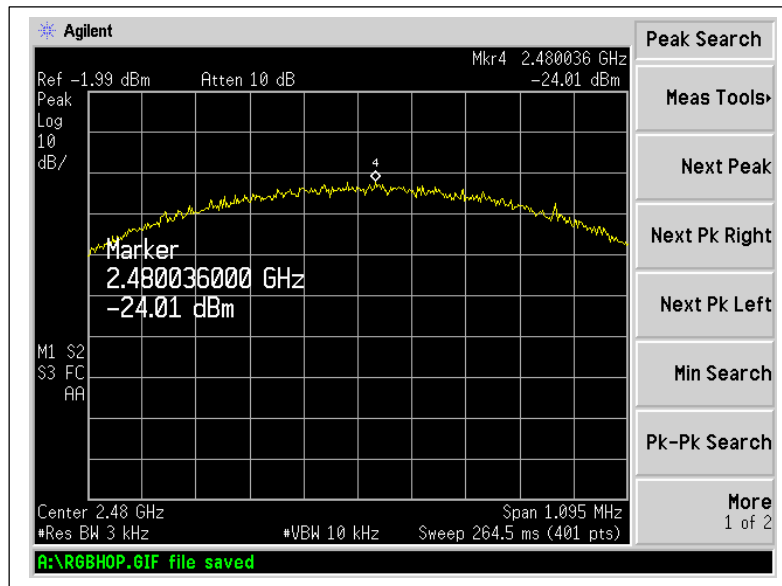


## Mid Channel





## High Channel





## 12 CONDUCTED EMISSIONS

### 12.1 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  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Emission (MHz) | Conducted Limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

### 12.2 Procedure

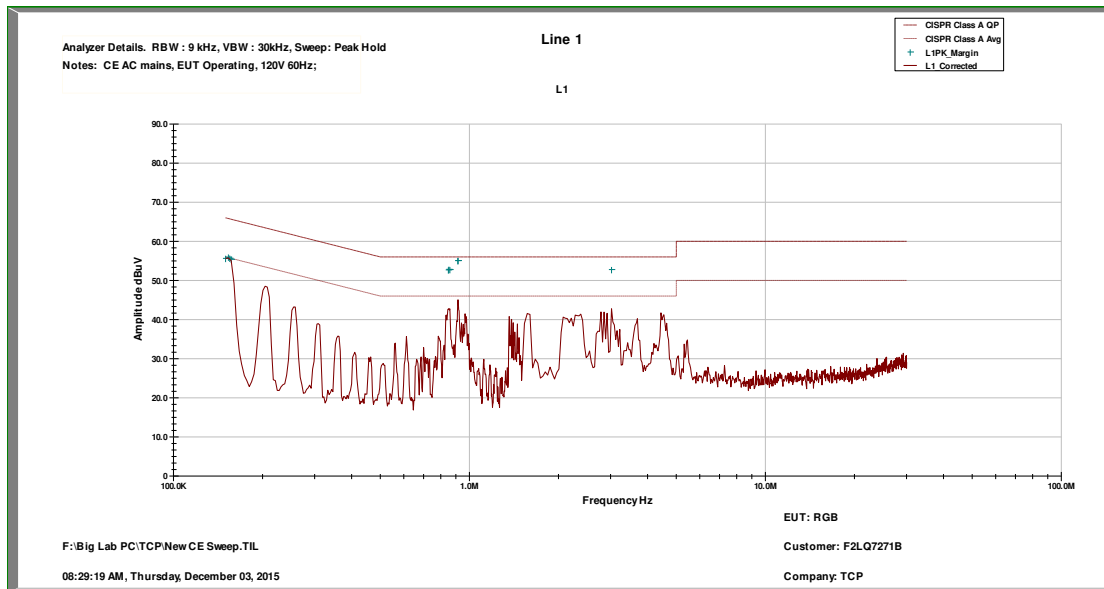
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power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



## 12.3 Conducted Emissions Test Data

|               |              |                    |            |
|---------------|--------------|--------------------|------------|
| Test Date:    | Dec. 3, 2015 | Test Engineer:     | J. Knepper |
| Rule:         | 15.207       | Air Temperature:   | 19.7° C    |
| Test Results: | Pass         | Relative Humidity: | 46%        |

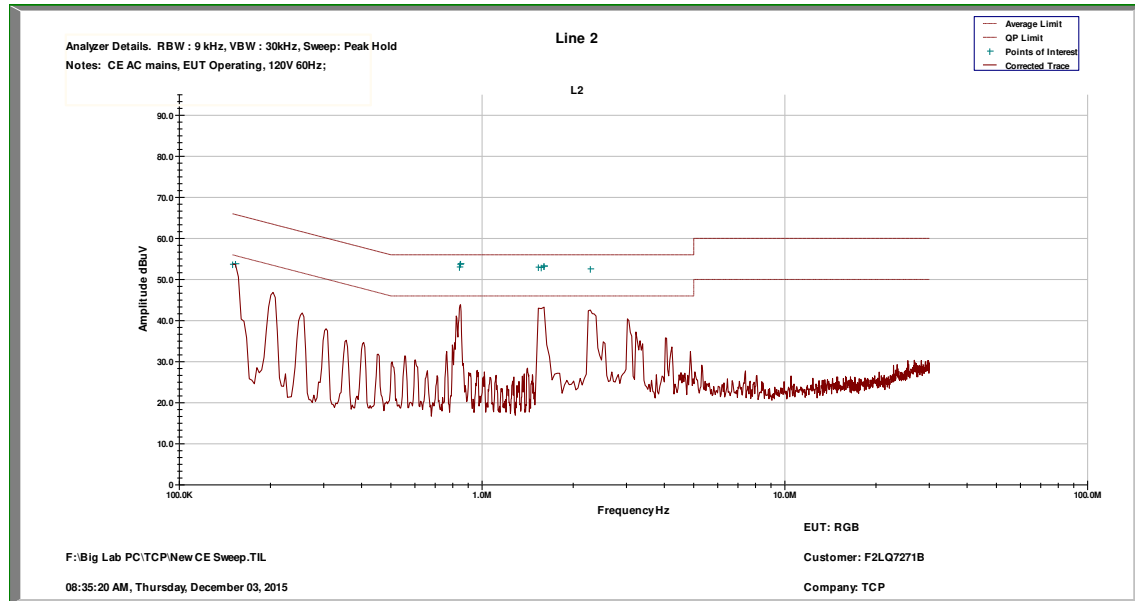
## Conducted Test – Line 1: 0.15 MHz to 30.0 MHz



| Top Discrete Measurements |           |                 |            |              |                 |                |              |             |
|---------------------------|-----------|-----------------|------------|--------------|-----------------|----------------|--------------|-------------|
| No.                       | Conductor | Frequency (MHz) | Detector   | Level (dBμV) | Adjustment (dB) | Results (dBμV) | Limit (dBμV) | Margin (dB) |
| 1                         | Line 1    | 0.15            | Quasi-Peak | 41.650       | 11.560          | 53.210         | 66.0         | -12.790     |
|                           |           | 0.15            | Average    | 32.132       | 11.560          | 43.692         | 56.0         | -12.308     |
| 2                         | Line 1    | 0.153375        | Quasi-Peak | 44.320       | 11.506          | 55.826         | 65.8         | -9.990      |
|                           |           | 0.153375        | Average    | 33.970       | 11.506          | 45.476         | 55.8         | -10.340     |
| 3                         | Line 1    | 0.155           | Quasi-Peak | 42.350       | 11.480          | 53.830         | 65.7         | -11.898     |
|                           |           | 0.155           | Average    | 32.173       | 11.480          | 43.653         | 55.7         | -12.075     |
| 4                         | Line 1    | 0.15675         | Quasi-Peak | 39.540       | 11.452          | 50.992         | 65.6         | -14.644     |
|                           |           | 0.15675         | Average    | 28.242       | 11.452          | 39.694         | 55.6         | -15.942     |
| 5                         | Line 1    | 0.848625        | Quasi-Peak | 29.610       | 10.280          | 39.890         | 56.0         | -16.11      |
|                           |           | 0.848625        | Average    | 12.485       | 10.280          | 22.765         | 46.0         | -23.235     |
| 6                         | Line 1    | 0.852           | Quasi-Peak | 29.380       | 10.280          | 39.660         | 56.0         | -16.340     |
|                           |           | 0.852           | Average    | 10.898       | 10.280          | 21.178         | 46.0         | -24.822     |
| 7                         | Line 1    | 0.85875         | Quasi-Peak | 23.370       | 10.280          | 33.650         | 56.0         | -22.350     |
|                           |           | 0.85875         | Average    | 7.713        | 10.280          | 17.993         | 46.0         | -28.007     |
| 8                         | Line 1    | 0.91275         | Quasi-Peak | 19.010       | 10.275          | 29.285         | 56.0         | -26.715     |
|                           |           | 0.91275         | Average    | 7.917        | 10.275          | 18.192         | 46.0         | -27.808     |
| 9                         | Line 1    | 0.916125        | Quasi-Peak | 26.730       | 10.274          | 37.004         | 56.0         | -18.996     |
|                           |           | 0.916125        | Average    | 6.710        | 10.274          | 16.984         | 46.0         | -29.016     |
| 10                        | Line 1    | 3.01875         | Quasi-Peak | 22.580       | 10.231          | 32.811         | 56.0         | -23.189     |
|                           |           | 3.01875         | Average    | 2.135        | 10.231          | 12.366         | 46.0         | -33.634     |



## 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    | 0.15            | Quasi-Peak | 42.060       | 11.560          | 53.620         | 66.0         | -12.380     |
|                           |           | 0.15            | Average    | 20.583       | 11.560          | 32.143         | 56.0         | -23.857     |
| 2                         | Line 2    | 0.153375        | Quasi-Peak | 53.320       | 11.506          | 64.826         | 65.8         | -0.990      |
|                           |           | 0.153375        | Average    | 22.408       | 11.506          | 33.914         | 55.8         | -21.902     |
| 3                         | Line 2    | 0.841875        | Quasi-Peak | 29.130       | 10.280          | 39.410         | 56.0         | -16.590     |
|                           |           | 0.841875        | Average    | 10.785       | 10.280          | 21.065         | 46.0         | -24.935     |
| 4                         | Line 2    | 0.84525         | Quasi-Peak | 30.990       | 10.280          | 41.270         | 56.0         | -14.730     |
|                           |           | 0.84525         | Average    | 11.972       | 10.280          | 22.252         | 46.0         | -23.748     |
| 5                         | Line 2    | 0.848625        | Quasi-Peak | 32.030       | 10.280          | 42.310         | 56.0         | -13.69      |
|                           |           | 0.848625        | Average    | 14.993       | 10.280          | 25.273         | 46.0         | -20.727     |
| 6                         | Line 2    | 1.53375         | Quasi-Peak | 30.410       | 10.213          | 40.623         | 56.0         | -15.377     |
|                           |           | 1.53375         | Average    | 7.643        | 10.213          | 17.856         | 46.0         | -28.144     |
| 7                         | Line 2    | 1.5675          | Quasi-Peak | 28.230       | 11.000          | 39.230         | 56.0         | -16.770     |
|                           |           | 1.5675          | Average    | 3.128        | 11.000          | 14.128         | 46.0         | -31.872     |
| 8                         | Line 2    | 1.6             | Quasi-Peak | 29.390       | 10.220          | 39.610         | 56.0         | -16.390     |
|                           |           | 1.6             | Average    | 3.440        | 10.220          | 13.660         | 46.0         | -32.340     |
| 9                         | Line 2    | 1.60125         | Quasi-Peak | 29.240       | 10.220          | 39.460         | 56.0         | -16.540     |
|                           |           | 1.60125         | Average    | 3.033        | 10.220          | 13.253         | 46.0         | -32.747     |
| 10                        | Line 2    | 2.27625         | Quasi-Peak | 21.710       | 10.227          | 31.937         | 56.0         | -24.063     |
|                           |           | 2.27625         | Average    | -1.067       | 10.227          | 9.160          | 46.0         | -36.840     |



## **13 FCC 15.31(e) - EXTREME VOLTAGES**

### **13.1 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.

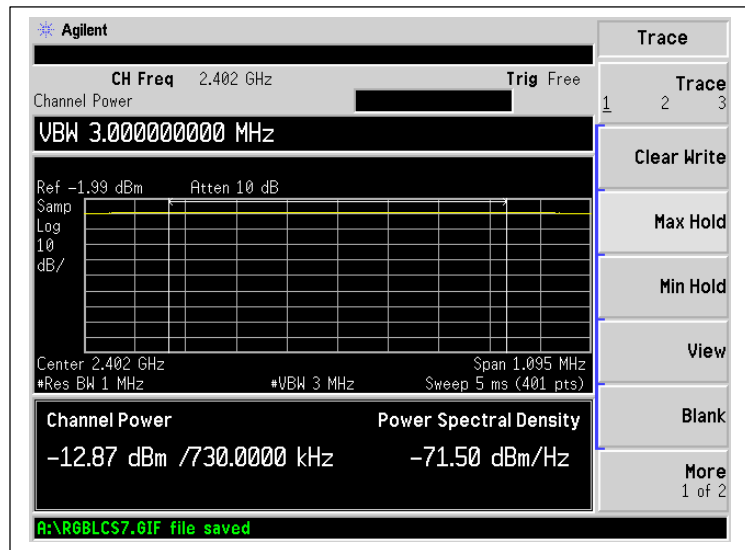


## 13.3 Voltage Variation Test Data

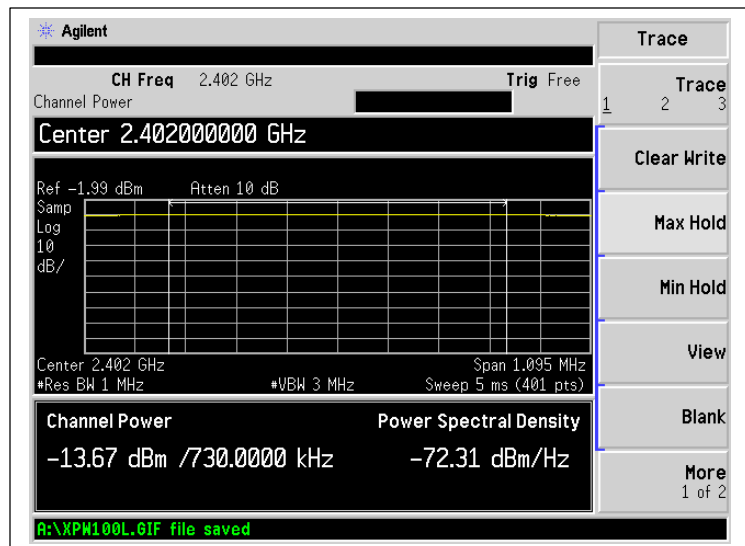
|               |               |                    |            |
|---------------|---------------|--------------------|------------|
| Test Date:    | Nov. 30, 2015 | Test Engineer:     | J. Knepper |
| Rule:         | 15.31(e)      | Air Temperature:   | 19.3° C    |
| Test Results: | Pass          | Relative Humidity: | 46%        |

## Low Channel

100V



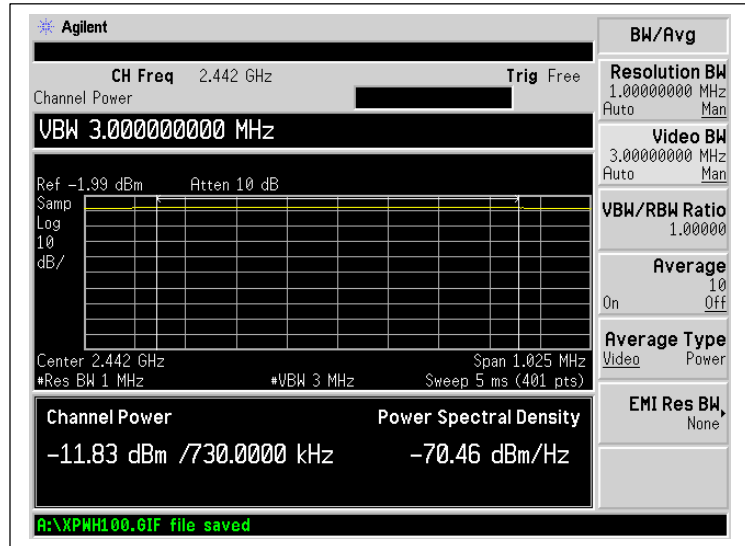
140V



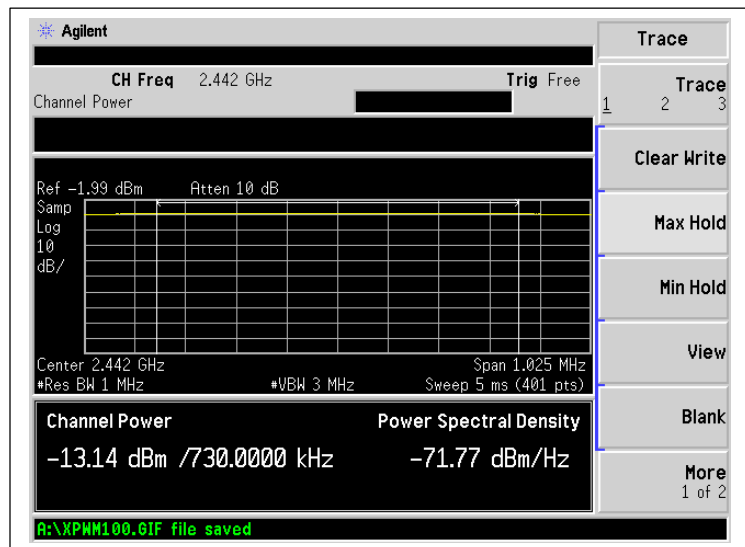


## Mid Channel

100V



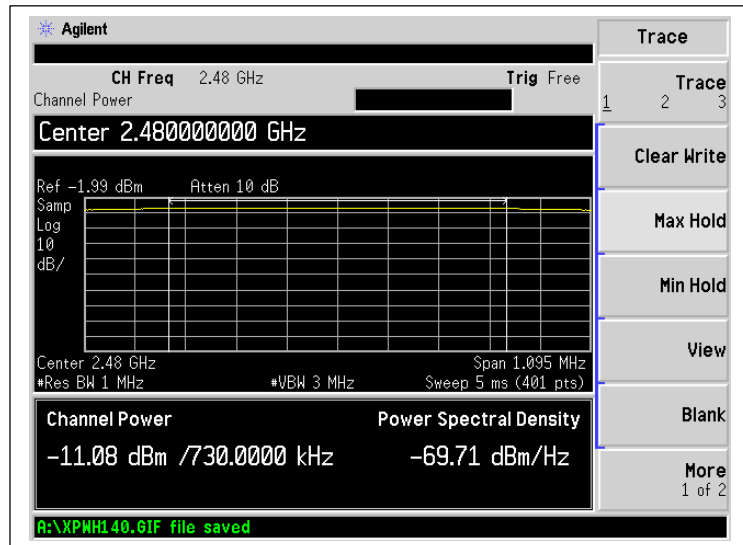
140V



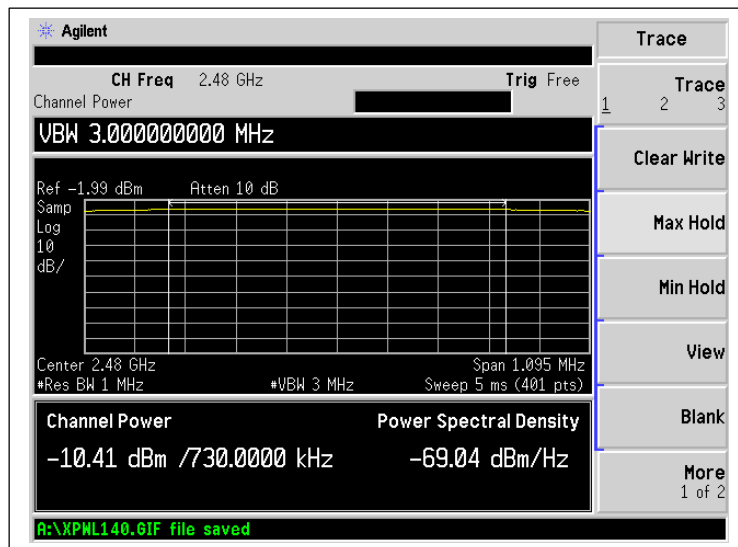


## High Channel

100V



140V

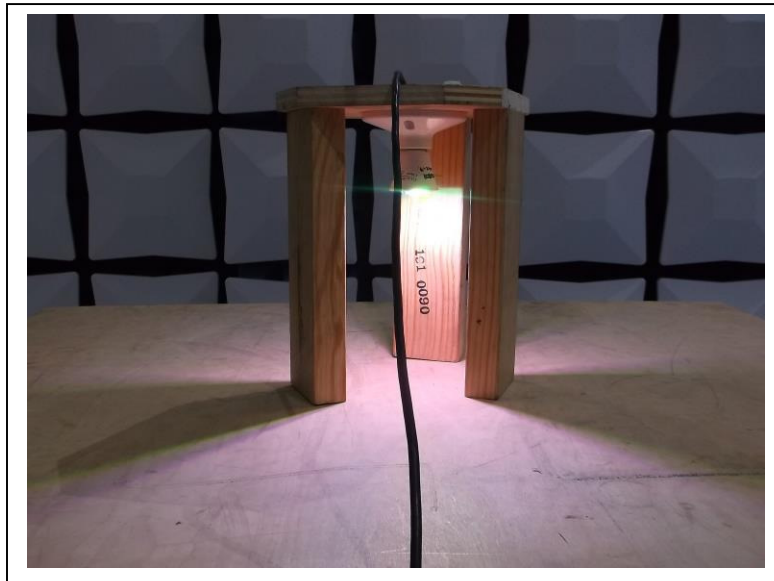


## 14 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

### Radiated Spurious Emission, <1 GHz

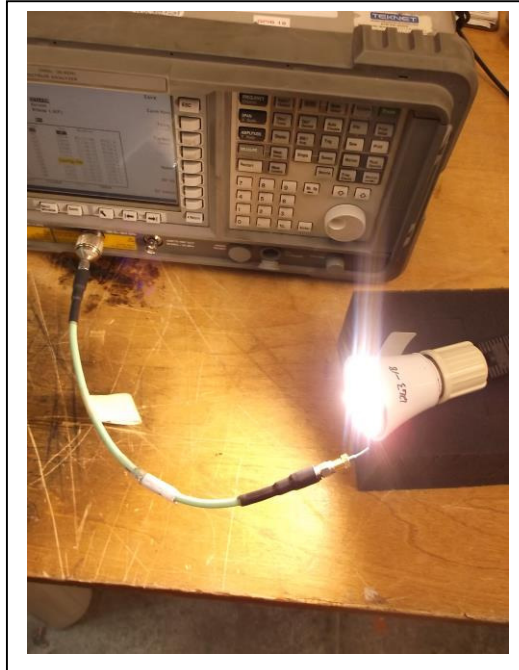


### Radiated Spurious Emission, >1 GHz





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



**Conducted Emissions**

