

# EMC Test Report

**Project Number:** 3951780

**Report Number:** 3951780EMC01

**Revision Level:** 1

**Client:** Vayyar Imaging Ltd.

**Equipment Under Test:** Handheld UWB Device

**Model Number** vMaker

**FCC ID:** 2AHIS-VMaker

**Applicable Standards:** FCC Part 15.519

ANSI C63.10:2013

**Report issued on:** 7 April 2016

**Test Result:** Compliant

Tested by:



\_\_\_\_\_  
Fabian Nica, Senior Engineering Technician

Reviewed by:



\_\_\_\_\_  
David Schramm, EMC/RF/SAR/HAC Manager

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Table of Contents

<b>1</b>	<b>SUMMARY OF TEST RESULTS.....</b>	<b>3</b>
1.1	MODIFICATIONS REQUIRED TO COMPLIANCE.....	3
<b>2</b>	<b>GENERAL INFORMATION.....</b>	<b>3</b>
2.1	CLIENT INFORMATION.....	3
2.2	TEST LABORATORY.....	3
2.3	GENERAL INFORMATION OF EUT.....	3
2.4	OPERATING MODES AND CONDITIONS.....	3
2.5	EUT BLOCK DIAGRAM.....	4
2.6	SYSTEM CONFIGURATIONS.....	4
2.7	CABLE LIST.....	4
<b>3</b>	<b>RADIATED EMISSIONS BELOW 960 MHZ.....</b>	<b>5</b>
3.1	TEST RESULT.....	5
3.2	TEST METHOD.....	5
3.3	TEST SITE.....	6
3.4	TEST EQUIPMENT.....	6
3.5	TEST DATA.....	7
<b>4</b>	<b>BANDWIDTH REQUIREMENTS.....</b>	<b>9</b>
4.1	TEST RESULT.....	9
4.2	TEST METHOD.....	9
4.3	TEST SITE.....	9
4.4	TEST EQUIPMENT.....	9
4.5	TEST DATA.....	10
<b>5</b>	<b>PEAK POWER WITHIN A 50 MHZ BANDWIDTH.....</b>	<b>11</b>
5.1	TEST RESULT.....	11
5.2	TEST METHOD.....	11
5.3	TEST SITE.....	11
5.4	TEST EQUIPMENT.....	11
5.5	TEST DATA.....	12
<b>6</b>	<b>RADIATED EMISSIONS (EIRP).....</b>	<b>13</b>
6.1	TEST RESULT.....	13
6.2	TEST METHOD.....	13
6.3	TEST SITE.....	14
6.4	TEST EQUIPMENT.....	14
6.5	TEST DATA.....	15
<b>7</b>	<b>CONDUCTED EMISSIONS.....</b>	<b>26</b>
7.1	TEST RESULT.....	26
7.2	TEST METHOD.....	26
7.3	TEST SITE.....	26
7.4	TEST EQUIPMENT.....	26
7.5	TEST SETUP PHOTOGRAPHS.....	27
7.6	TEST DATA.....	28
<b>8</b>	<b>REVISION HISTORY.....</b>	<b>32</b>

## 1 Summary of Test Results

Basic Standards	Test Result
15.519(c) / 15.209, Radiated Emissions below 960 MHz	Compliant
15.519(d), Radiated Emissions in GPS Receive Bands	Compliant
15.519(b), UWB Bandwidth requirement	Compliant
15.519(c) Radiated power density(EIRP)	Compliant
15.519(e), Peak Power within a 50MHz bandwidth	Compliant

### 1.1 Modifications Required to Compliance

None

## 2 General Information

### 2.1 Client Information

Name: Vayyar Imaging Ltd.  
 Address: 11 Altalef St.  
 City, State, Zip, Country: Yahud, Israel, 5621608

### 2.2 Test Laboratory

Name: SGS North America, Inc.  
 Address: 620 Old Peachtree Road NW, Suite 100  
 City, State, Zip, Country: Suwanee, GA 30024, USA

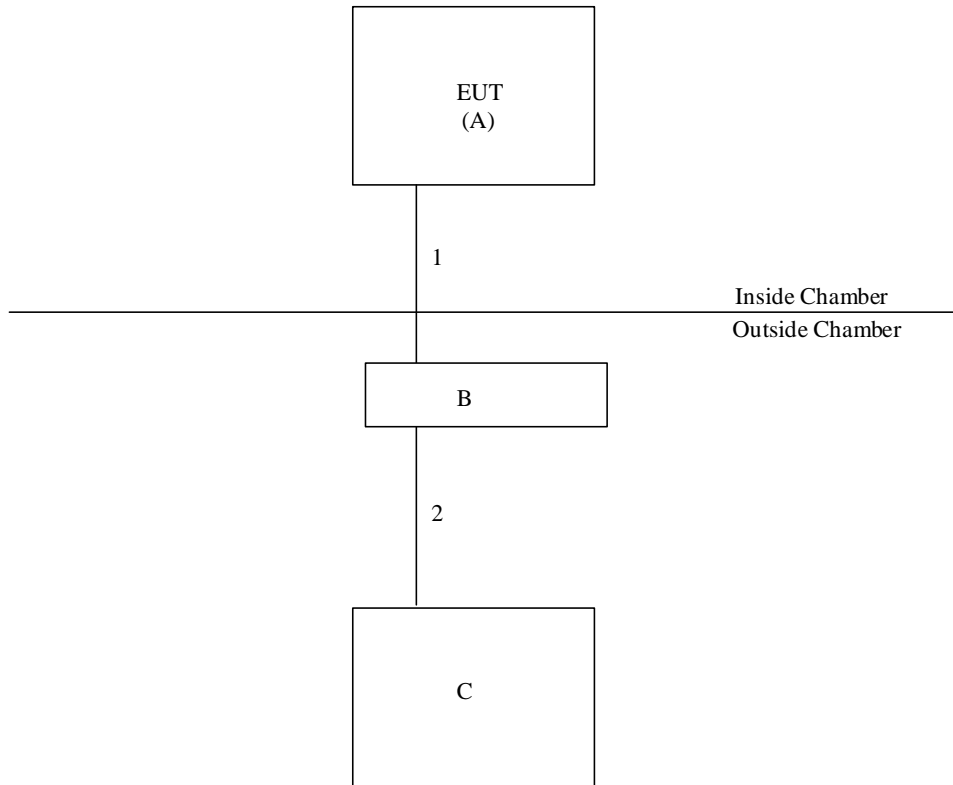
### 2.3 General Information of EUT

Model Number: vMaker18, vMaker15, vMaker3  
 Firmware Version: FCC  
 FCC ID: 2AHIS-VMaker  
 Sample Received Date: 7 March 2016  
 Dates of testing: 7 to 30 March 2016

### 2.4 Operating Modes and Conditions

The EUT was programmed by the manufacturer to transmit continuously.

## 2.5 EUT Block Diagram



## 2.6 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Vayyar Imaging	UWB device	vMaker18 vMaker15 vMaker3	T20160014 AOI389035 AOI2846894
Support Equipment				
B	Unitek	USB 3.0 7-Port Hub	Y-3187	NSN
C	Lenovo	Laptop	E450	NSN

## 2.7 Cable List

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
1	USB	EUT	USB Hub	12	N	Y
2	USB	USB Hub	Laptop	1	N	Y

### 3 Radiated Emissions below 960 MHz

#### 3.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Emissions	FCC15.519(3) (c)	Compliant

#### 3.2 Test Method

Exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector. The receiver's resolution bandwidth was set to 120 kHz. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The EUT was manipulated through 3 orthogonal axes. The radiated measurements were recorded and compared to the limits indicated in the table below.

Radiated emissions limit below 1 GHz		
Frequency Range(MHz)	Limit(QP dBμV/m)	Distance
30 – 88	40	3m
88 – 216	43.52	3m
216 – 960	46	3m

### 3.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

#### Environmental Conditions

Temperature: 24.3 °C  
 Relative Humidity: 36.3%  
 Atmospheric Pressure: 98.5 kPa

### 3.4 Test Equipment

Test Date: 9-Mar-2016

Tester: FRN

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	21-Oct-2016
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	3-Aug-2016
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079713	3-Aug-2016
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	3-Aug-2016
TYPE N CABLE	104PE	HUBER&SUHNER	B079793	4-Aug-2016
PREAMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	24-Aug-2016
6DB ATTENUATOR 50 Ohm	15542	Mini Circuit	15017	3-Aug-2016
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	9-Jul-2016

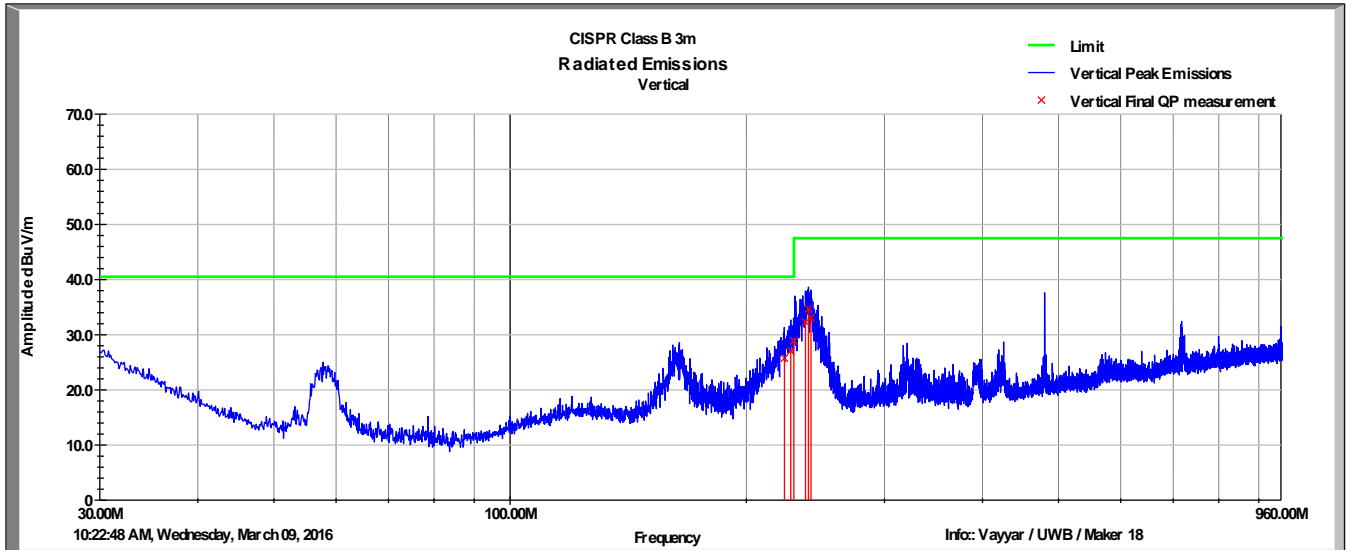
Note: The calibration period equipment is 1 year.

#### Software:

“RE 30-1000 MHz (12-2015)” TILE!

### 3.5 Test Data

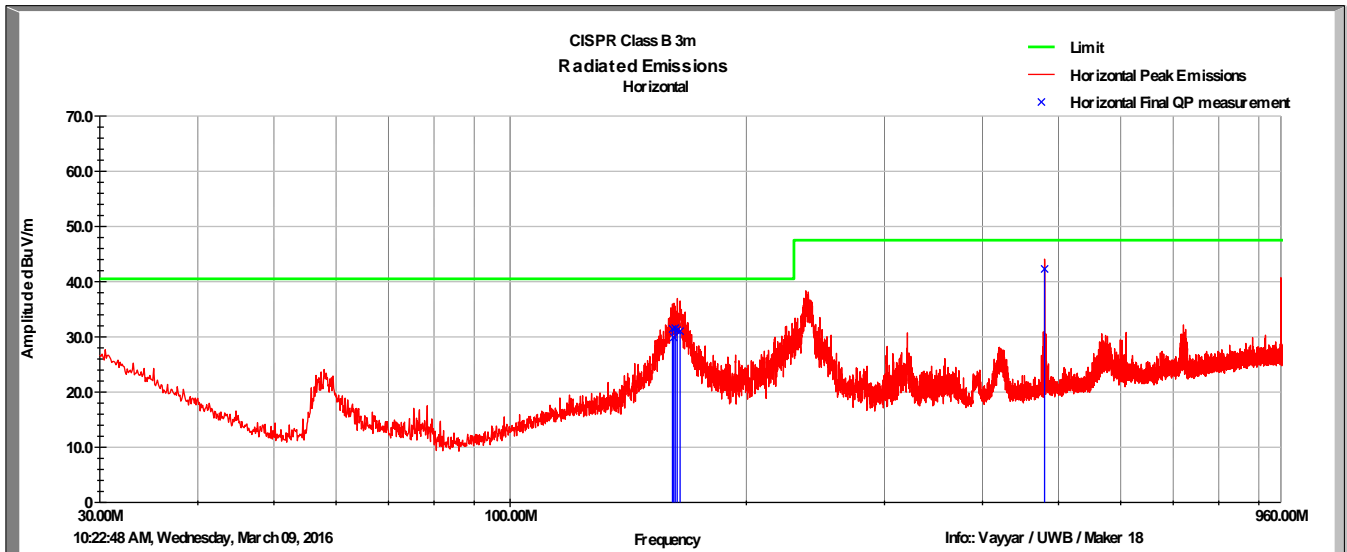
#### Vertical Radiated Emissions Plot



#### Vertical Radiated Emissions Data

Frequency (MHz)	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
223.70	40.5	V	195.0	233.0	11.6	7.6	34.0	25.8	40.5	-14.7
227.85	41.6	V	44.0	100.0	11.8	7.6	33.9	27.0	40.5	-13.5
229.91	43.3	V	189.0	166.0	11.8	7.6	33.8	28.9	40.5	-11.6
237.94	46.4	V	315.0	100.0	12.2	7.6	33.9	32.3	47.5	-15.2
239.96	48.8	V	181.0	165.0	12.2	7.6	33.9	34.7	47.5	-12.8
241.79	47.1	V	190.0	138.0	12.2	7.6	33.9	33.1	47.5	-14.4
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										

### Horizontal Radiated Emissions Plot



### Horizontal Radiated Emissions Data

Frequency (MHz)	Raw QP (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	Loss (dB)	Amp (dB)	QP Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)
161.07	45.2	H	3.0	212.0	12.8	7.3	33.9	31.4	40.5	-9.1
161.66	43.7	H	13.0	108.0	12.8	7.3	34.0	29.9	40.5	-10.6
162.34	45.4	H	13.0	140.0	12.8	7.3	34.0	31.6	40.5	-8.9
163.26	45.1	H	17.0	138.0	12.7	7.3	34.0	31.2	40.5	-9.3
164.70	45.1	H	2.0	122.0	12.6	7.4	34.0	31.0	40.5	-9.5
479.99	49.9	H	77.0	204.0	17.9	8.3	33.8	42.3	47.5	-5.2
QP Value = Level + AF + CL - Amp										
Margin = QP Value - Limit										



## 4 Bandwidth requirements

### 4.1 Test Result

Test Description	Basic Standards	Test Result
Bandwidth requirement (-10 dB requirements)	15.503 (d), 15.519 (3)(b)	Compliant

### 4.2 Test Method

- 1) The -10 dB bandwidth of the fundamental emission shall be at least 500 MHz. For transmitters that employ frequency hopping, stepped frequency or similar modulation types, measurement of the -10 dB minimum bandwidth specified in this paragraph shall be made with the frequency hop or step function disabled and with the transmitter operating continuously at a fundamental frequency following the provisions of §15.31(m).
- 2) The -10 dB bandwidth is based on measurement using a peak detector, a 1 MHz resolution bandwidth, and a video bandwidth greater than or equal to the resolution bandwidth.

### 4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.3 °C

Relative Humidity: 25.1%

Atmospheric Pressure: 98.8 kPa

### 4.4 Test Equipment

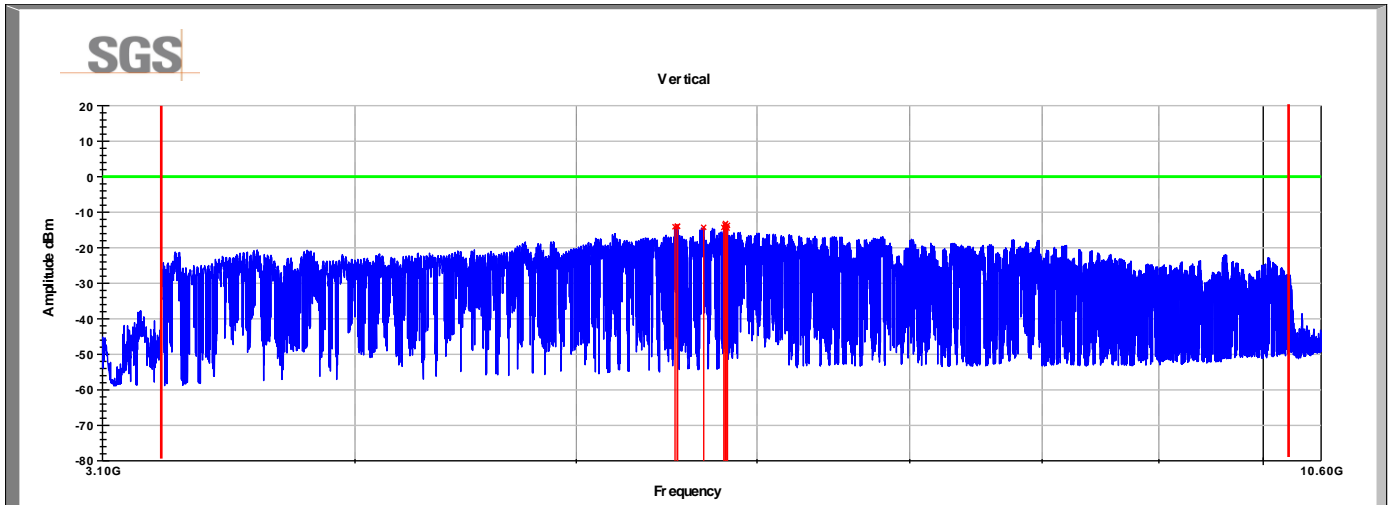
Test Date: 7-Mar-2016

Tester: DJS

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	14-Apr-2016
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
RF CABLE	SF106	HUBER&SUHNER	B085892	3-Aug-2016
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
COAXIAL CABLE	SUCOFLEX 100	HUBER&SUHNER	B108523	27-Oct-2016

Note: The calibration period for this equipment is 1 year.

## 4.5 Test Data



**Lower (-10 dB): 3.3 GHz**  
**Upper (10 dB): 10.3 GHz**

**Bandwidth = 7000 MHz**

## 5 Peak Power within a 50 MHz bandwidth

### 5.1 Test Result

Test Description	Basic Standards	Test Result
Peak Power in a 50 MHz Bandwidth	15.519 (3)(e)	Compliant

### 5.2 Test Method

- 1) There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs,  $f_M$ . That limit is 0 dBm EIRP.
- 2) The peak EIRP limit is  $20 \log (RBW/50)$  dBm where RBW is the resolution bandwidth in megahertz that is employed by the measurement instrument. RBW shall not be lower than 1 MHz or greater than 50 MHz. The video bandwidth of the measurement instrument shall not be less than RBW.

If RBW is greater than 3 MHz, the application for certification filed with the Commission shall contain a detailed description of the test procedure, calibration of the test setup, and the Test Site.

Scans were performed with the EUT oriented in 3 orthogonal axes. The worst case orientation was reported.

### 5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.8 °C  
 Relative Humidity: 18.4%  
 Atmospheric Pressure: 98.5 kPa

### 5.4 Test Equipment

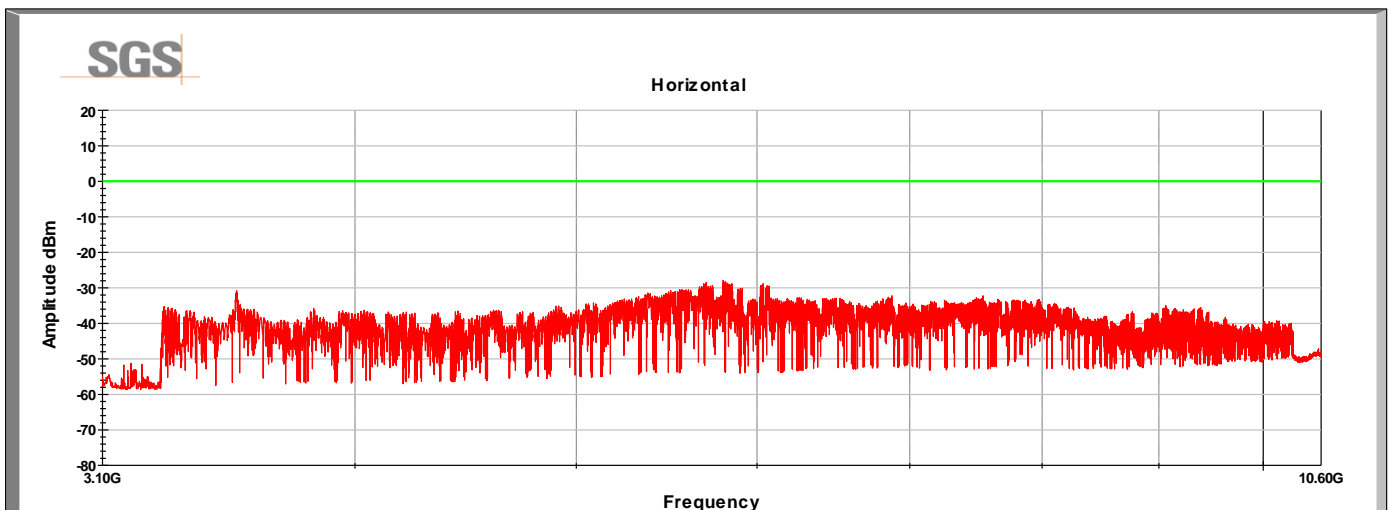
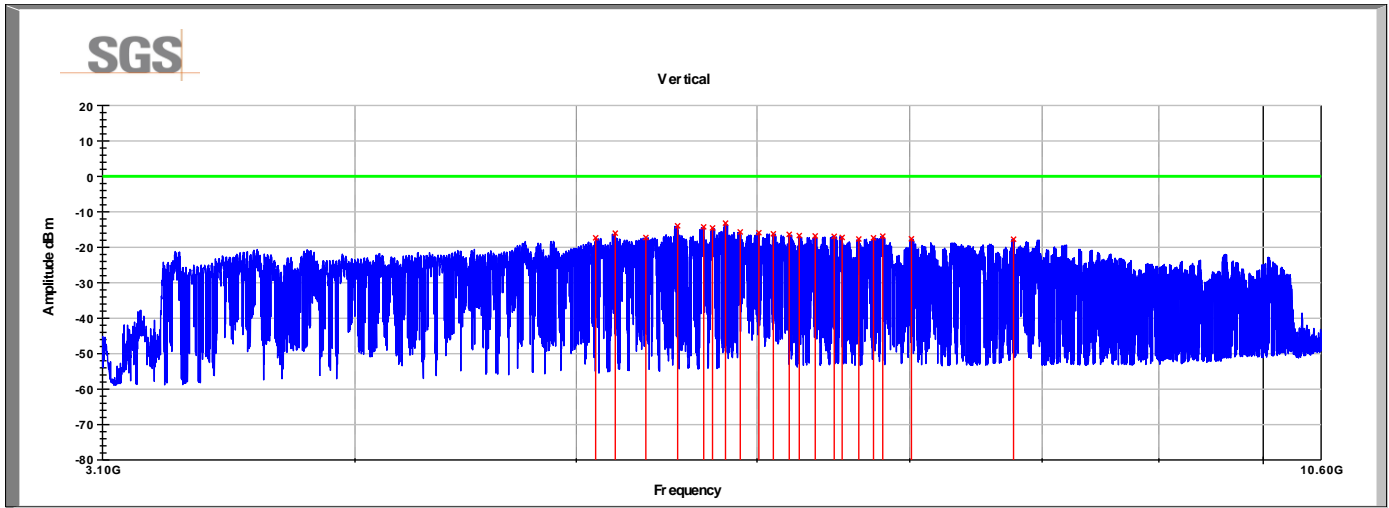
Test Date: 7-Mar-2016

Tester: DJS

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	9-Jul-2016
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	3-Aug-2016
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The calibration period for this equipment is 1 year.

### 5.5 Test Data



Frequency MHz	Raw Peak dBuV	Polarity (V/H)	Axis (x,y,z)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Measurement BW	Conversion to 50MHz	Test Distance m	Conversion FS to EIRP	Peak Value dBm	Limit dBm	Margin (dB)
5098.75	81.0	V	y	0.0	187.0	35.0	1.2	33.4	10.0	14.0	0.3	115.2	-17.3	0.0	-17.3
5200.75	82.0	V	y	0.0	187.0	35.2	1.2	33.3	10.0	14.0	0.3	115.2	-16.0	0.0	-16.0
5363.50	80.8	V	y	0.0	187.0	35.1	1.2	33.2	10.0	14.0	0.3	115.2	-17.3	0.0	-17.3
5538.25	84.2	V	y	0.0	187.0	34.9	1.2	33.2	10.0	14.0	0.3	115.2	-14.0	0.0	-14.0
5686.00	83.9	V	y	0.0	187.0	35.0	1.3	33.2	10.0	14.0	0.3	115.2	-14.3	0.0	-14.3
5737.00	83.5	V	y	0.0	187.0	35.1	1.3	33.3	10.0	14.0	0.3	115.2	-14.5	0.0	-14.5
5812.75	84.8	V	y	0.0	187.0	35.2	1.2	33.3	10.0	14.0	0.3	115.2	-13.2	0.0	-13.2
5899.75	82.1	V	y	0.0	187.0	35.4	1.3	33.4	10.0	14.0	0.3	115.2	-15.7	0.0	-15.7
6011.50	81.6	V	y	0.0	187.0	35.8	1.3	33.4	10.0	14.0	0.3	115.2	-15.9	0.0	-15.9
6100.00	81.2	V	y	0.0	187.0	35.8	1.3	33.4	10.0	14.0	0.3	115.2	-16.2	0.0	-16.2
6198.25	81.0	V	y	0.0	187.0	35.9	1.3	33.4	10.0	14.0	0.3	115.2	-16.4	0.0	-16.4
6261.25	80.6	V	y	0.0	187.0	35.9	1.3	33.4	10.0	14.0	0.3	115.2	-16.7	0.0	-16.7
6363.25	80.5	V	y	0.0	187.0	35.9	1.3	33.4	10.0	14.0	0.3	115.2	-16.8	0.0	-16.8
6486.25	80.3	V	y	0.0	187.0	35.9	1.4	33.4	10.0	14.0	0.3	115.2	-16.9	0.0	-16.9
6538.75	80.0	V	y	0.0	187.0	35.9	1.4	33.4	10.0	14.0	0.3	115.2	-17.2	0.0	-17.2
6649.00	79.7	V	y	0.0	187.0	35.9	1.4	33.4	10.0	14.0	0.3	115.2	-17.7	0.0	-17.7
6748.75	80.0	V	y	0.0	187.0	35.9	1.4	33.4	10.0	14.0	0.3	115.2	-17.3	0.0	-17.3
6811.75	80.4	V	y	0.0	187.0	36.0	1.4	33.4	10.0	14.0	0.3	115.2	-16.9	0.0	-16.9
7012.00	79.5	V	y	0.0	187.0	36.1	1.4	33.4	10.0	14.0	0.3	115.2	-17.6	0.0	-17.6
7773.25	79.2	V	y	0.0	187.0	36.0	1.5	33.2	10.0	14.0	0.3	115.2	-17.7	0.0	-17.7
Peak Value = Level + AF + CL - Amp + Conversion(28/50) + Conversion (FS/EIRP)															
Margin = Peak Value - Limit															

## 6 Radiated Emissions (EIRP)

### 6.1 Test Result

Test Description	Basic Standards	Test Result
Radiated power density	15.519 (c)	Compliant

### 6.2 Test Method

Exploratory scan was performed on a test site that meets the requirements of ANSI C63.4:2014 above 960 MHz. The scan was performed at a distance of 1 meter. Field strength measurements were converted to EIRP. The distance of the scan is indicated on each scan.

Scans were performed with the EUT oriented in 3 orthogonal axes.

The conversion factor was calculated using  $95.2 + 20 \cdot \log(3/D)$  where D is the measurement distance.

Emissions from a transmitter operating under this section shall not exceed the following equivalent isotropically radiated power (EIRP) density levels:

- 1) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following RMS average limits based on measurements using a 1 MHz resolution bandwidth:

Frequency (MHz)	EIRP (dBm)
960–1610	-75.3
1610–1990	-63.3
1990–3100	-61.3
3100–10600	-41.3
Above 10600	-61.3

- 2) In addition to the radiated emission limits specified in the table in paragraph (d)(1) of this section, transmitters operating under the provisions of this section shall not exceed the following RMS average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency (MHz)	EIRP (dBm)
1164–1240	-85.3
1559–1610	-85.3

### 6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 24.7 °C  
 Relative Humidity: 24.8%  
 Atmospheric Pressure: 98.5 kPa

### 6.4 Test Equipment

Test Date: 7-Mar-2016

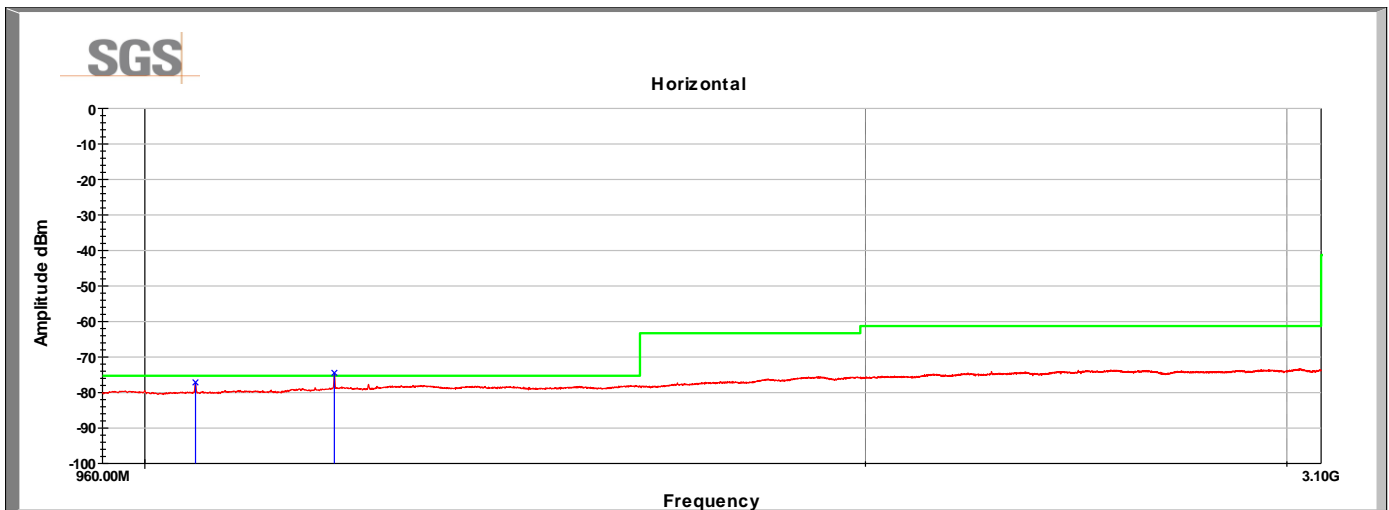
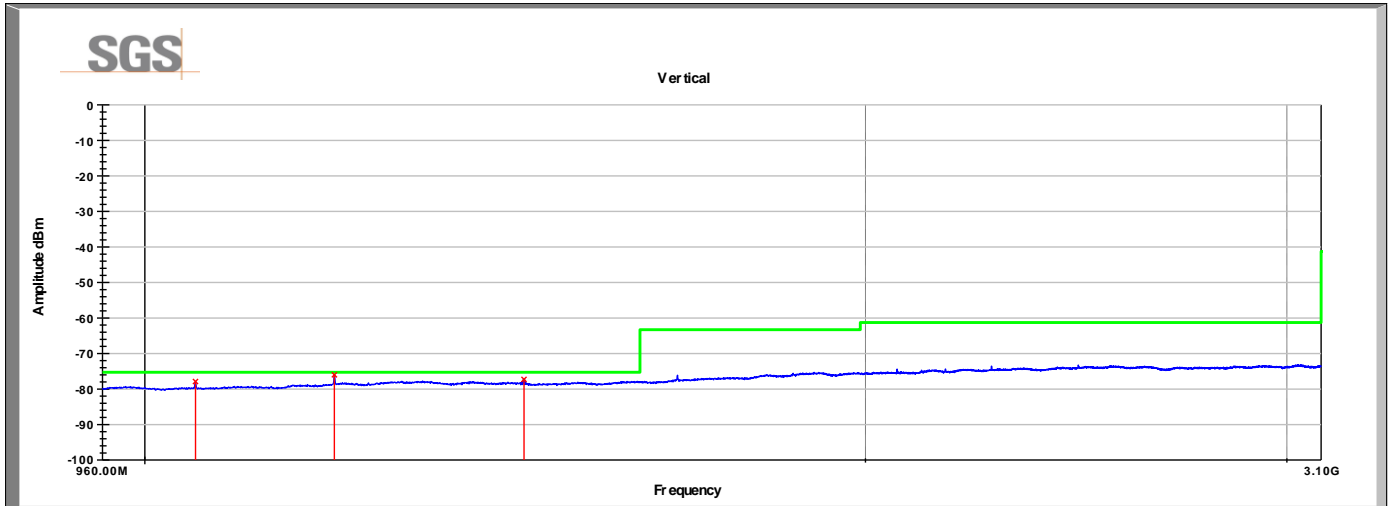
Tester: DJS

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	14-Apr-2016
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	4-Aug-2016
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	4-Aug-2016
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	3-Aug-2016
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
SMALL HORN	LB-180400-20-C_KF	A-INFO	15007	11-Mar-2016
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	4-Aug-2016
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079823	4-Aug-2016
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	15-Oct-2016
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079695	19-Mar-2016
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The calibration period for this equipment is 1 year except for B085749, which is on a 2 year cycle.

### 6.5 Test Data

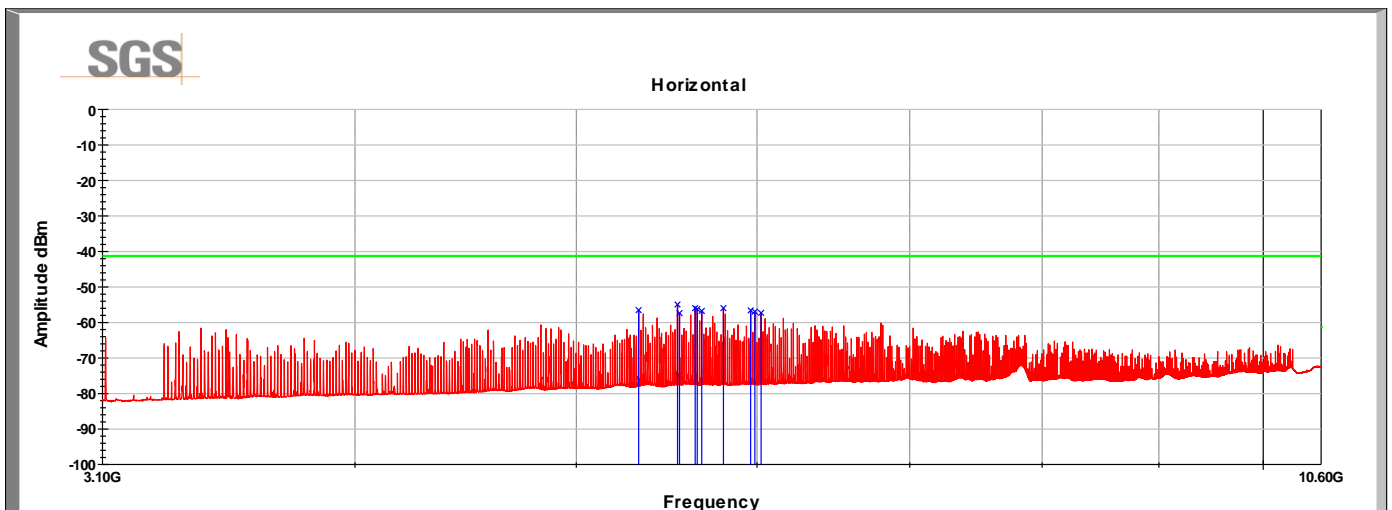
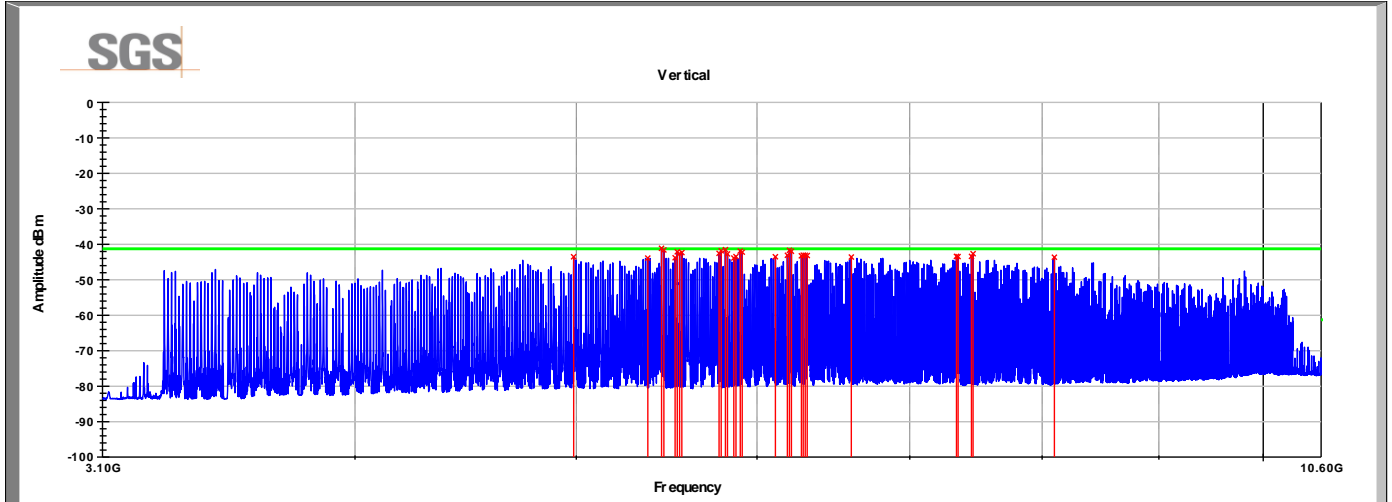
960 to 3100 MHz  
Test distance: 1m



Frequency MHz	Raw RMS dBuV	Polarity (V/H)	Axis (x,y,z)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Conversion FS to EIRP	RMS Value dBm	Limit dBm	Margin (dB)	Note
1049.88	30.9	V	Y	180.0	175.0	27.4	1.7	33.1	104.7	-77.7	-75.3	-2.4	1
1200.00	31.5	V	Y	180.0	175.0	28.4	1.9	33.1	104.7	-76.0	-75.3	-0.7	1
1440.00	29.7	V	Y	180.0	175.0	28.7	2.1	33.1	104.7	-77.3	-75.3	-2.0	1
1049.88	31.5	H	Y	180.0	175.0	27.4	1.7	33.1	104.7	-77.1	-75.3	-1.8	1
1200.00	33.0	H	Y	180.0	175.0	28.4	1.9	33.1	104.7	-74.5	-75.3	0.8	1
Peak Value = Level + AF + CL - Amp + Conversion (FS/EIRP)													
Margin = RMS Value - Limit													

Note (1): The emissions were not associated with the transmissions from the EUT. The source of these emissions was traced to our EMI receiver, which was located near the test environment in order to minimize cable loss during the test.

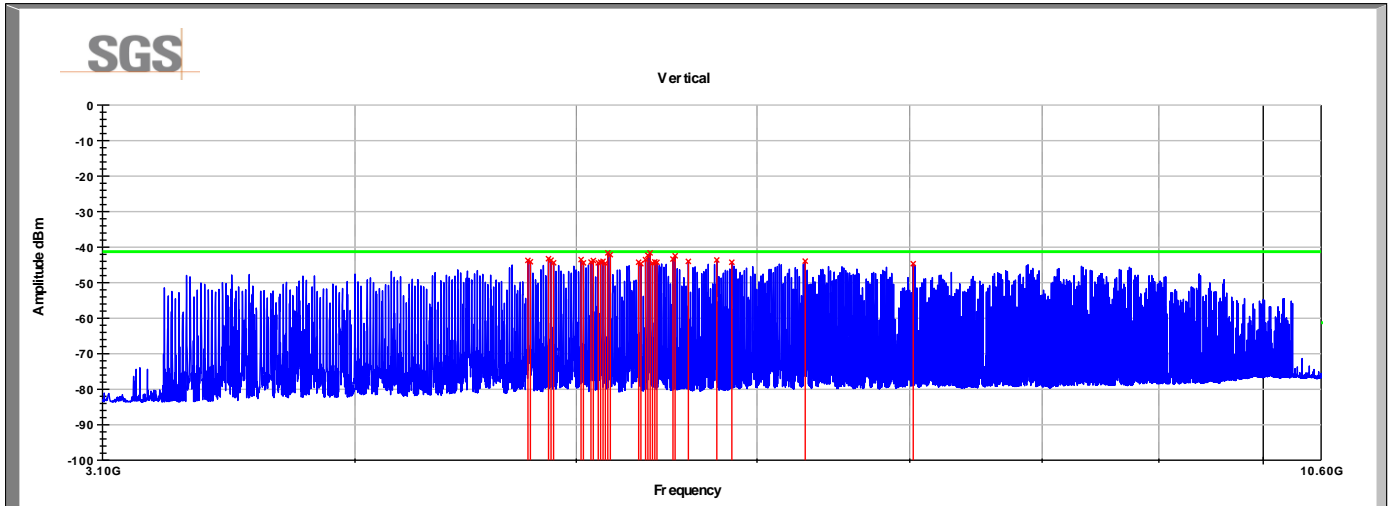
3.1 to 10.6 GHz  
 Test distance: 1m  
 vMaker 18







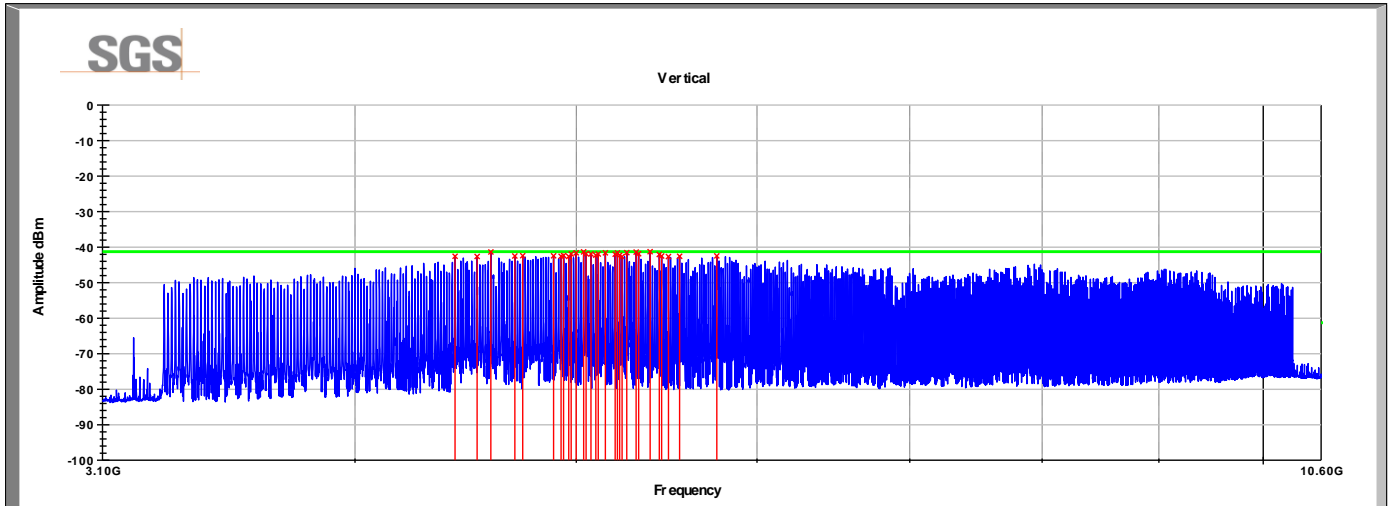
vMaker 15



Emissions in the horizontal polarization are significantly lower than when in vertical.

Frequency MHz	Raw RMS dBuV	Polarity (V/H)	Axis (x,y,z)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Conversion FS to EIRP	RMS Value dBm	Limit dBm	Margin (dB)
4687.00	68.9	V	Y	0.0	160.0	34.7	1.1	33.4	115.2	-43.8	-41.3	-2.5
4699.00	68.4	V	Y	0.0	160.0	34.7	1.1	33.4	115.2	-44.3	-41.3	-3.0
4861.75	69.2	V	Y	0.0	160.0	35.0	1.1	33.4	115.2	-43.3	-41.3	-2.0
4874.25	68.3	V	Y	0.0	160.0	35.0	1.1	33.4	115.2	-44.2	-41.3	-2.9
4886.75	67.0	V	Y	0.0	160.0	35.0	1.1	33.4	115.2	-45.4	-41.3	-4.1
5024.50	68.6	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-43.8	-41.3	-2.5
5037.00	68.1	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-44.3	-41.3	-3.0
5049.50	69.2	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-43.2	-41.3	-1.9
5087.00	68.0	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-44.3	-41.3	-3.0
5099.50	68.0	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-44.3	-41.3	-3.0
5112.00	68.7	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-43.5	-41.3	-2.2
5137.00	68.0	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-44.1	-41.3	-2.8
5149.50	68.0	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-44.1	-41.3	-2.8
5162.00	68.0	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-44.1	-41.3	-2.8
5174.50	68.0	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-44.1	-41.3	-2.8
5187.00	68.0	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-44.1	-41.3	-2.8
5199.50	70.5	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-41.7	-41.3	-0.4
5212.00	70.2	V	Y	0.0	160.0	35.2	1.2	33.3	115.2	-41.9	-41.3	-0.6
5362.00	68.7	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-43.4	-41.3	-2.1
5374.50	68.4	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-43.7	-41.3	-2.4
5399.50	69.2	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-42.9	-41.3	-1.6
5412.00	70.0	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-42.1	-41.3	-0.8
5424.50	70.4	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-41.7	-41.3	-0.4
5437.00	68.7	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-43.4	-41.3	-2.1
5449.50	68.4	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-43.7	-41.3	-2.4
5462.00	68.8	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-43.4	-41.3	-2.1
5537.00	69.4	V	Y	0.0	160.0	34.9	1.2	33.2	115.2	-42.8	-41.3	-1.5
5549.50	69.7	V	Y	0.0	160.0	34.9	1.2	33.2	115.2	-42.5	-41.3	-1.2
5612.00	69.0	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-43.2	-41.3	-1.9
5749.50	69.4	V	Y	0.0	160.0	35.1	1.3	33.3	115.2	-42.7	-41.3	-1.4
5824.50	69.6	V	Y	0.0	160.0	35.2	1.2	33.3	115.2	-42.4	-41.3	-1.1
6312.25	68.8	V	Y	0.0	160.0	35.9	1.3	33.4	115.2	-42.6	-41.3	-1.3
8037.25	68.3	V	Y	0.0	160.0	35.9	1.5	33.2	115.2	-42.6	-41.3	-1.3
RMS Value = Level + AF + CL - Amp - Conversion (FS/EIRP)												
Margin = RMS Value - Limit												

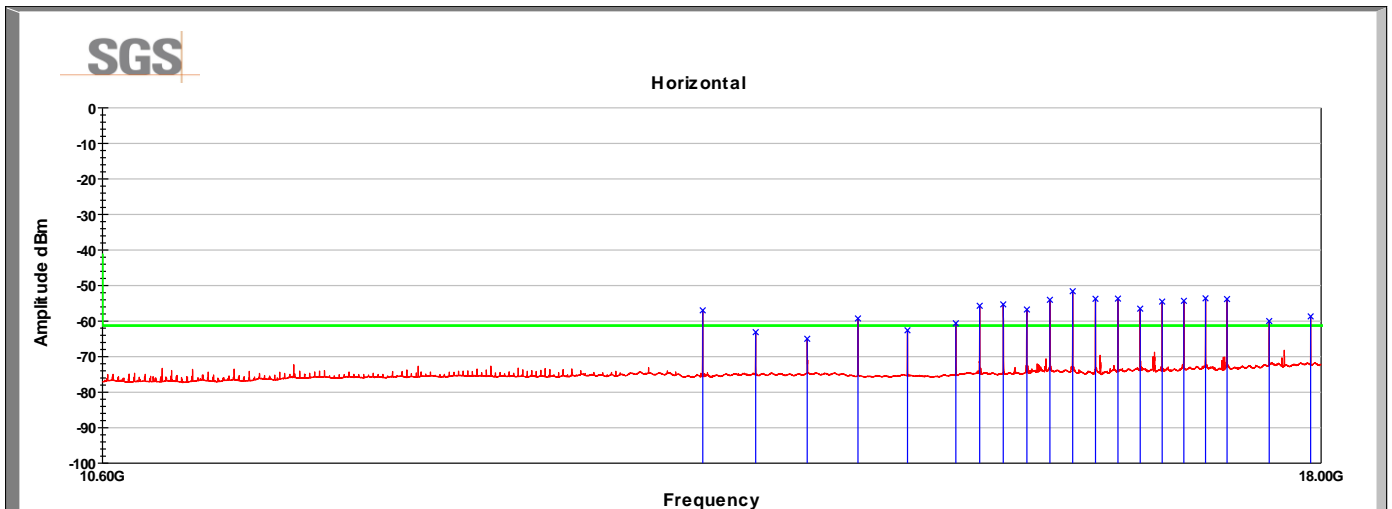
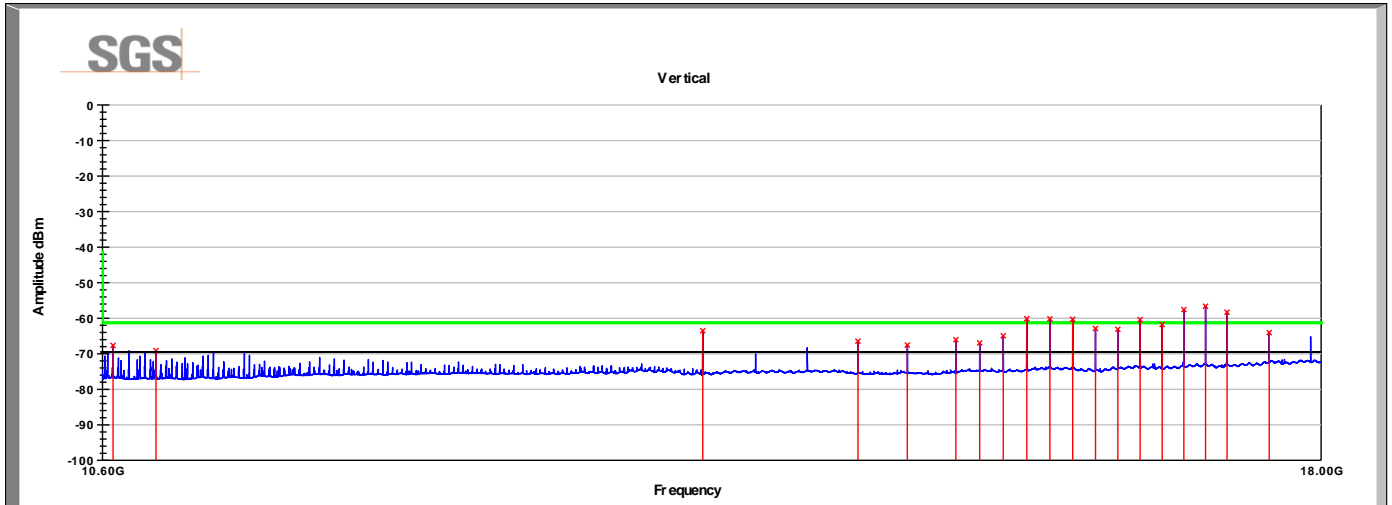
vMaker 3



Emissions in the horizontal polarization are significantly lower than when in vertical.

Frequency MHz	Raw RMS dBuV	Polarity (V/H)	Axis (x,y,z)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Conversion FS to EIRP	RMS Value dBm	Limit dBm	Margin (dB)
4319.50	70.6	V	Y	0.0	160.0	34.0	1.1	33.2	115.2	-42.8	-41.3	-1.5
4424.50	70.5	V	Y	0.0	160.0	34.1	1.1	33.2	115.2	-42.8	-41.3	-1.5
4711.75	67.9	V	Y	0.0	160.0	34.7	1.1	33.4	115.2	-44.8	-41.3	-3.5
4724.50	68.1	V	Y	0.0	160.0	34.7	1.1	33.4	115.2	-44.6	-41.3	-3.3
4762.00	67.8	V	Y	0.0	160.0	34.9	1.1	33.4	115.2	-44.8	-41.3	-3.5
4799.50	70.3	V	Y	0.0	160.0	34.9	1.1	33.4	115.2	-42.2	-41.3	-0.9
4887.25	67.8	V	Y	0.0	160.0	35.0	1.1	33.4	115.2	-44.6	-41.3	-3.3
4924.75	67.6	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-44.8	-41.3	-3.5
4987.00	68.4	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-44.0	-41.3	-2.7
4999.00	70.7	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-41.7	-41.3	-0.4
5086.75	70.3	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-42.0	-41.3	-0.7
5099.50	69.8	V	Y	0.0	160.0	35.0	1.2	33.4	115.2	-42.5	-41.3	-1.2
5112.25	68.9	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-43.3	-41.3	-2.0
5137.00	69.9	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-42.3	-41.3	-1.0
5149.75	67.2	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-45.0	-41.3	-3.7
5161.75	69.0	V	Y	0.0	160.0	35.1	1.2	33.3	115.2	-43.2	-41.3	-1.9
5224.00	68.0	V	Y	0.0	160.0	35.2	1.2	33.3	115.2	-44.1	-41.3	-2.8
5249.50	67.2	V	Y	0.0	160.0	35.2	1.2	33.3	115.2	-44.9	-41.3	-3.6
5262.25	69.9	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-42.2	-41.3	-0.9
5275.00	67.1	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-45.0	-41.3	-3.7
5324.50	68.2	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-43.9	-41.3	-2.6
5350.00	67.2	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-44.9	-41.3	-3.6
5374.75	68.7	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-43.4	-41.3	-2.1
5386.75	68.4	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-43.7	-41.3	-2.4
5399.50	68.8	V	Y	0.0	160.0	35.1	1.2	33.2	115.2	-43.3	-41.3	-2.0
5411.50	68.0	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-44.1	-41.3	-2.8
5440.00	68.1	V	Y	0.0	160.0	35.0	1.2	33.2	115.2	-44.1	-41.3	-2.8
5799.25	68.9	V	Y	0.0	160.0	35.2	1.3	33.3	115.2	-43.1	-41.3	-1.8

10.6 to 18 GHz  
 Test distance: 0.3m



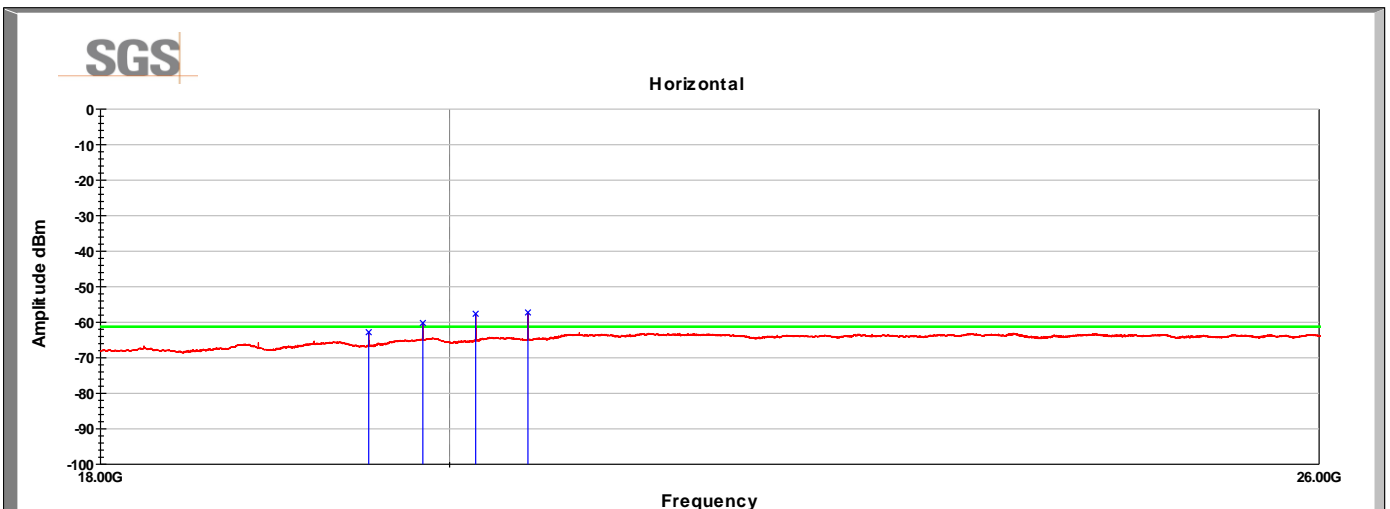
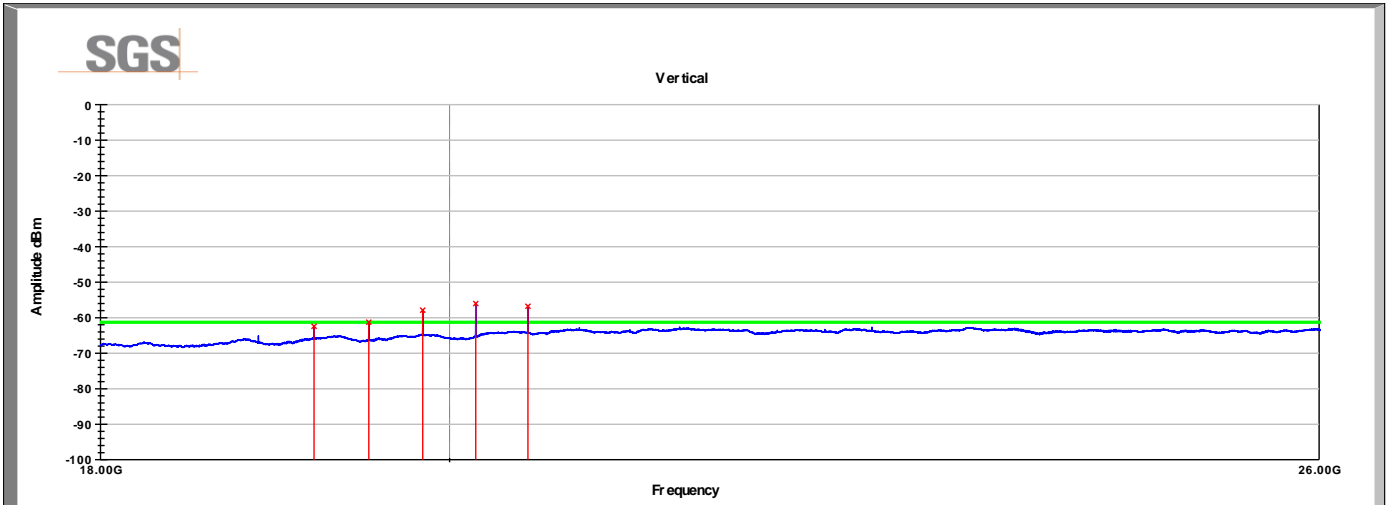
Frequency MHz	Raw RMS dBuV	Polarity (V/H)	Axis (x,y,z)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Test Distance m	Conversion FS/EIRP	RMS Value dBm	Limit dBm	Margin (dB)	Notes
10648.84	34.8	V	y	0.0	187.0	38.2	1.8	33.0	0.3	115.2	-67.7	-61.3	-6.4	3
10849.68	39.0	V	y	0.0	187.0	38.3	1.8	33.1	0.3	115.2	-69.1	-61.3	-7.8	3
13759.06	43.1	V	y	0.0	187.0	39.1	2.7	33.3	0.3	115.2	-63.5	-61.3	-2.2	3
14718.84	39.9	V	y	0.0	187.0	40.0	2.2	33.5	0.3	115.2	-66.5	-61.3	-5.2	3
15038.52	39.1	V	y	0.0	187.0	39.9	2.3	33.6	0.3	115.2	-67.5	-61.3	-6.2	3
15358.94	39.9	V	y	0.0	187.0	40.3	2.3	33.5	0.3	115.2	-66.1	-61.3	-4.8	3
15518.78	38.9	V	y	0.0	187.0	40.5	2.3	33.5	0.3	115.2	-67.0	-61.3	-5.7	3
15678.62	40.8	V	y	0.0	187.0	40.6	2.4	33.6	0.3	115.2	-65.0	-61.3	-3.7	3
15839.20	45.6	V	y	0.0	187.0	40.7	2.4	33.6	0.3	115.2	-60.1	-61.3	1.2	3
15999.04	45.1	V	y	0.0	187.0	41.0	2.4	33.6	0.3	115.2	-60.3	-61.3	1.0	3
16158.88	45.1	V	y	0.0	187.0	41.1	2.3	33.7	0.3	115.2	-60.3	-61.3	1.0	3
16319.46	42.5	V	y	0.0	187.0	41.1	2.4	33.8	0.3	115.2	-62.9	-61.3	-1.6	3
16478.56	42.1	V	y	0.0	187.0	41.4	2.4	33.8	0.3	115.2	-63.1	-61.3	-1.8	3
16639.14	44.8	V	y	0.0	187.0	41.4	2.4	33.8	0.3	115.2	-60.4	-61.3	0.9	3
16799.72	42.4	V	y	0.0	187.0	41.3	2.4	33.6	0.3	115.2	-62.7	-61.3	-1.4	3
16958.85	47.1	V	y	0.0	187.0	41.3	2.4	33.5	0.3	115.2	-57.8	-61.3	3.5	3
17118.66	47.9	V	y	0.0	187.0	41.6	2.4	33.5	0.3	115.2	-56.7	-61.3	4.6	3
17279.24	45.9	V	y	0.0	187.0	41.7	2.4	33.4	0.3	115.2	-58.5	-61.3	2.8	3
17598.92	39.5	V	y	0.0	187.0	42.3	2.4	33.3	0.3	115.2	-64.3	-61.3	-3.0	3
15518.78	48.8	H	x	180.0	187.0	40.5	2.3	33.5	0.3	115.2	-57.1	-61.3	4.2	3
15678.62	42.8	H	x	180.0	187.0	40.6	2.4	33.6	0.3	115.2	-62.9	-61.3	-1.6	3
15679.36	41.0	H	x	180.0	187.0	40.6	2.4	33.6	0.3	115.2	-64.8	-61.3	-3.5	3
15638.46	46.2	H	x	180.0	187.0	40.7	2.4	33.6	0.3	115.2	-59.5	-61.3	1.8	3
15839.20	43.2	H	x	180.0	187.0	40.7	2.4	33.6	0.3	115.2	-62.5	-61.3	-1.2	3
15998.30	44.9	H	x	180.0	187.0	41.0	2.4	33.6	0.3	115.2	-60.5	-61.3	0.8	3
15999.04	50.0	H	x	180.0	187.0	41.0	2.4	33.6	0.3	115.2	-55.4	-61.3	5.9	3
15999.78	50.2	H	x	180.0	187.0	41.0	2.4	33.6	0.3	115.2	-55.2	-61.3	6.1	3
16158.88	49.1	H	x	180.0	187.0	41.1	2.3	33.7	0.3	115.2	-56.3	-61.3	5.0	3
16318.72	51.7	H	x	180.0	187.0	41.1	2.4	33.8	0.3	115.2	-53.8	-61.3	7.5	3
16319.46	54.2	H	x	180.0	187.0	41.1	2.4	33.8	0.3	115.2	-51.3	-61.3	10.0	3
16479.30	51.9	H	x	180.0	187.0	41.4	2.4	33.8	0.3	115.2	-53.3	-61.3	8.0	3
16639.14	51.9	H	x	180.0	187.0	41.4	2.4	33.8	0.3	115.2	-53.3	-61.3	8.0	3
16798.98	48.3	H	x	180.0	187.0	41.3	2.4	33.6	0.3	115.2	-56.8	-61.3	4.5	3
16958.82	50.9	H	x	180.0	187.0	41.3	2.4	33.5	0.3	115.2	-54.0	-61.3	7.3	3
16959.56	50.9	H	x	180.0	187.0	41.3	2.4	33.5	0.3	115.2	-54.0	-61.3	7.3	3
17118.66	51.3	H	x	180.0	187.0	41.6	2.4	33.5	0.3	115.2	-53.3	-61.3	8.0	3
17119.40	51.3	H	x	180.0	187.0	41.6	2.4	33.5	0.3	115.2	-53.3	-61.3	8.0	3
17278.50	44.4	H	x	180.0	187.0	41.7	2.4	33.4	0.3	115.2	-60.0	-61.3	1.3	3
17279.24	45.8	H	x	180.0	187.0	41.7	2.4	33.4	0.3	115.2	-58.6	-61.3	2.7	3
RMS Value = Level + AF + CL - Amp + 20*log(Distance/1) + Conversion (FS/EIRP)														
Margin = Peak Value - Limit														

Note 1: Digital emissions traced to the USB or other digital emission of the EUT.

Note 2: Emissions from the measurement receiver which is located in the chamber to reduce measurement noise floor.

Note 3: Emissions from the device under test whose amplitude does not fluctuate when the UWB power level is substantially reduced. As non-UWB emissions, they all meet the 500 microvolt/m (-41.3 dBm) limit of 15.209.

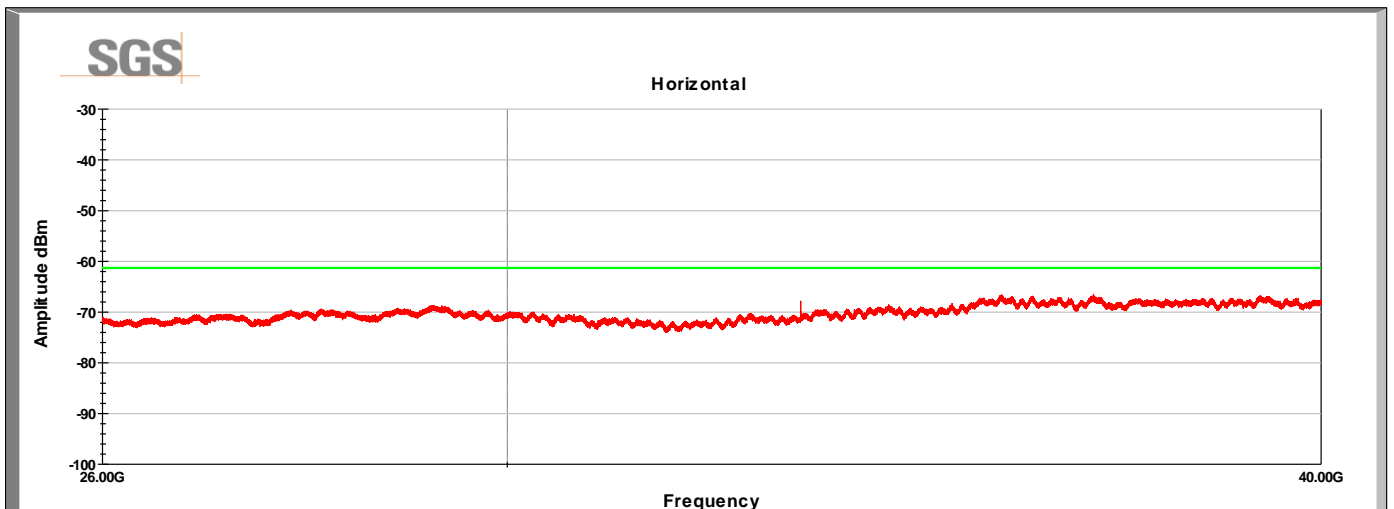
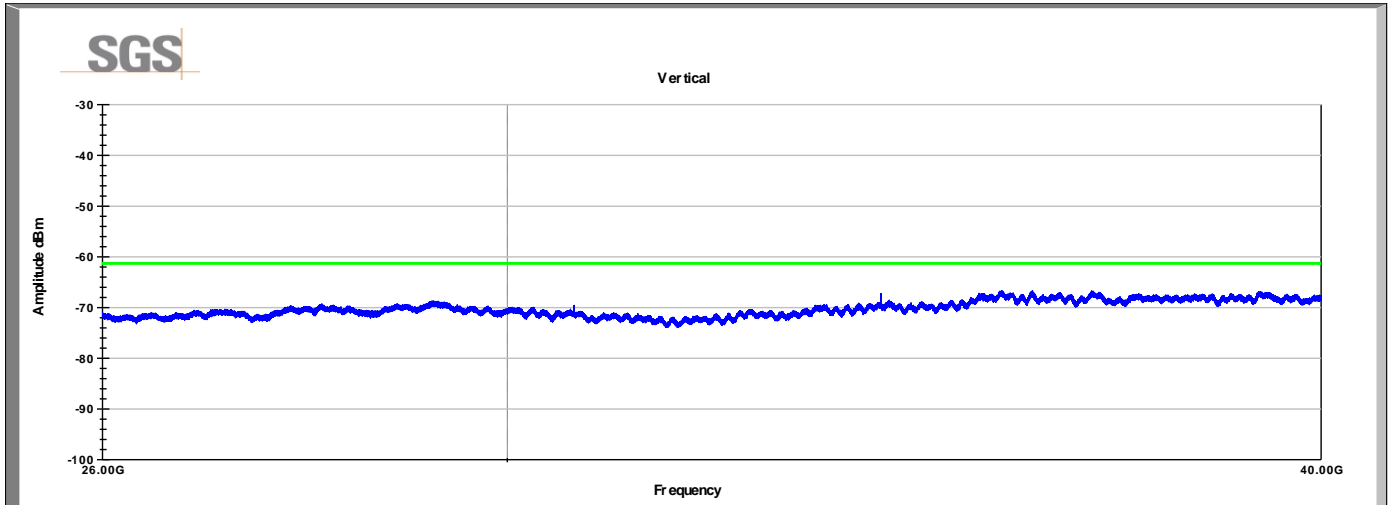
18 to 26 GHz  
Test distance: 0.3m



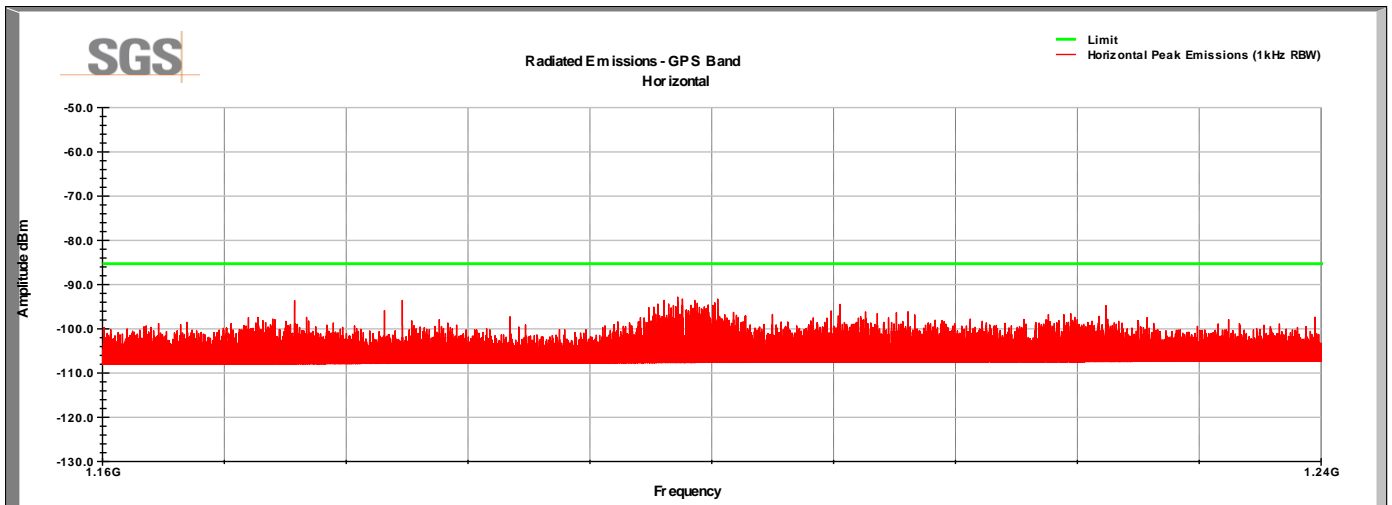
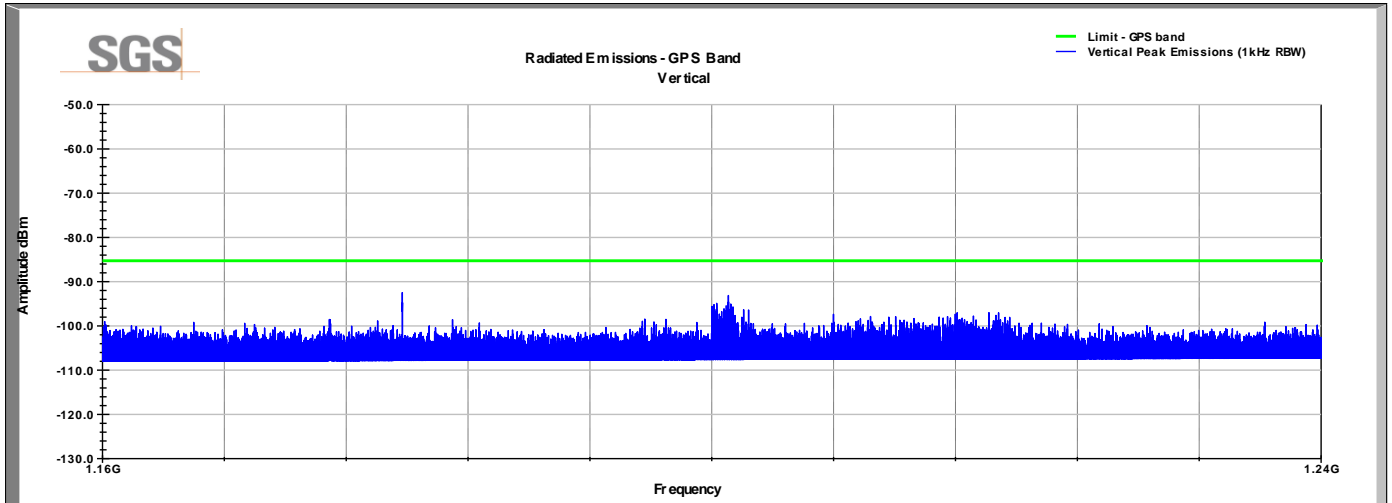
Frequency MHz	Raw RMS dBuV	Polarity (V/H)	Axis (x,y,z)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Test Distance m	Conversion FS/ERF	RMS Value dBm	Limit dBm	Margin (dB)	Notes
19198.50	50.8	V	y	23.0	187.0	45.0	7.7	50.7	0.3	115.2	-62.4	-61.3	-1.1	1
19518.50	51.9	V	y	0.0	187.0	45.3	7.8	51.1	0.3	115.2	-61.3	-61.3	0.0	1
19838.70	54.7	V	y	44.0	187.0	45.7	7.9	51.0	0.3	115.2	-57.9	-61.3	3.4	1
20158.80	56.7	V	y	0.0	187.0	45.9	7.9	51.4	0.3	115.2	-56.0	-61.3	5.3	1
20478.30	55.6	V	y	23.0	187.0	46.2	8.0	51.4	0.3	115.2	-56.8	-61.3	4.5	1
19518.00	50.3	V	y	0.0	187.0	45.3	7.8	51.1	0.3	115.2	-62.8	-61.3	-1.5	1
19839.20	52.4	H	x	180.0	187.0	45.7	7.9	51.0	0.3	115.2	-60.2	-61.3	1.1	1
20158.20	55.1	H	x	180.0	187.0	45.9	7.9	51.4	0.3	115.2	-57.6	-61.3	3.7	1
20478.80	55.2	H	x	0.0	187.0	46.2	8.0	51.4	0.3	115.2	-57.3	-61.3	4.0	1
RMS Value = Level + AF + CL - Amp + 20*log(Distance/1) + Conversion (FS/ERF)														
Margin = Peak Value - Limit														

Note 1: Emissions from the device under test whose amplitude does not fluctuate when the UWB power level is substantially reduced. As non-UWB emissions, they all meet the 500 microvolt/m (-41.3 dBm) limit of 15.209.

26 to 40 GHz  
Test distance: 0.3m

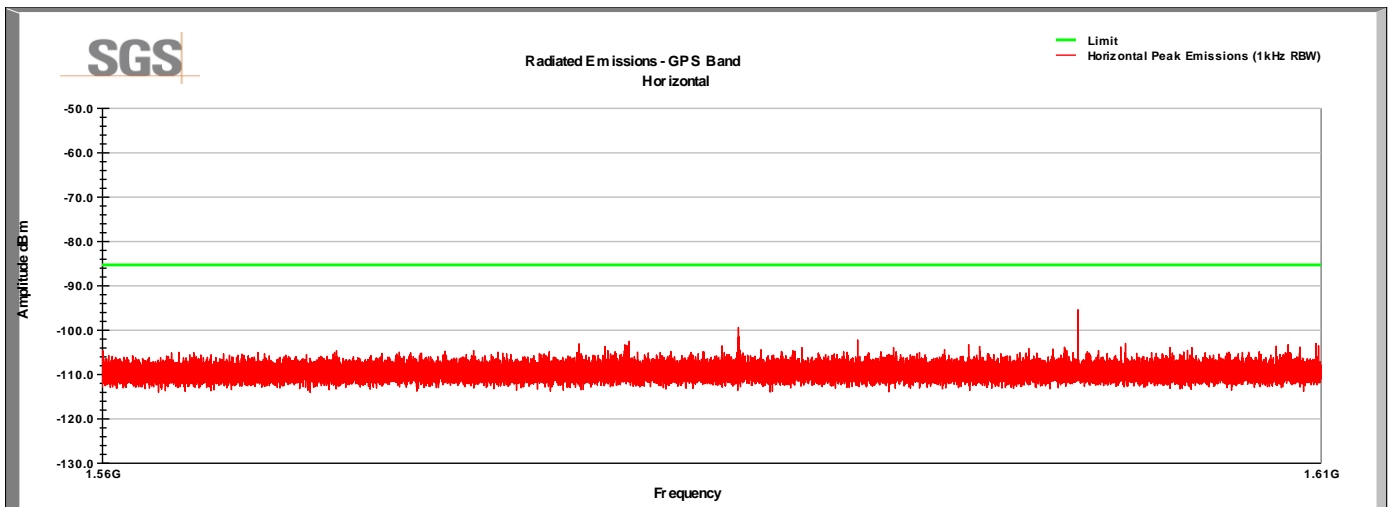
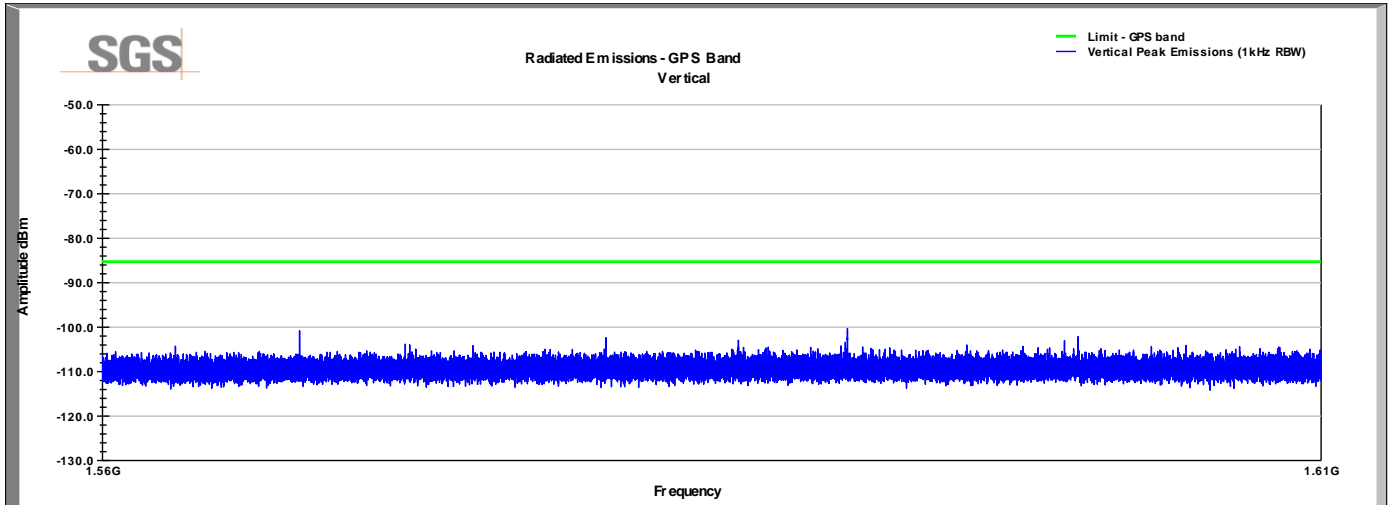


Lower GPS Band  
Test distance: 1m





Upper GPS Band  
Test distance: 1m



## 7 Conducted Emissions

### 7.1 Test Result

Test Description	Basic Standards	Test Result
Conducted Emissions Class B	ANSI C63.4:2014	Compliant

### 7.2 Test Method

With the receiver resolution bandwidth set to 9 kHz, exploratory scans were performed over the measuring frequency range (0.15MHz to 30MHz) using a max hold mode incorporating a Peak detector and Average detector and using the TILE! software. The final test data was measured using a Quasi-Peak detector and Average detector and compared against the limits indicated in the table below.

Frequency Range	Class A Limits (dBuV)		Class B Limits (dBuV)	
	FCC	CISPR	FCC	CISPR
0.15 to 0.5 MHz	Avg 66 QP 79		Avg 56 to 46 QP 66 to 56	
0.5 to 5 MHz	Avg 60 QP 73		Avg 46 Pk 56	
5 to 30 MHz	Avg 60 QP 73		Avg 50 Pk 60	

### 7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.9 °C

Relative Humidity: 32.5%

Atmospheric Pressure: 98.4kPa

### 7.4 Test Equipment

Test Start Date: 8-Mar-2016

Tester: FN

Test End Date: 9-Mar-2016

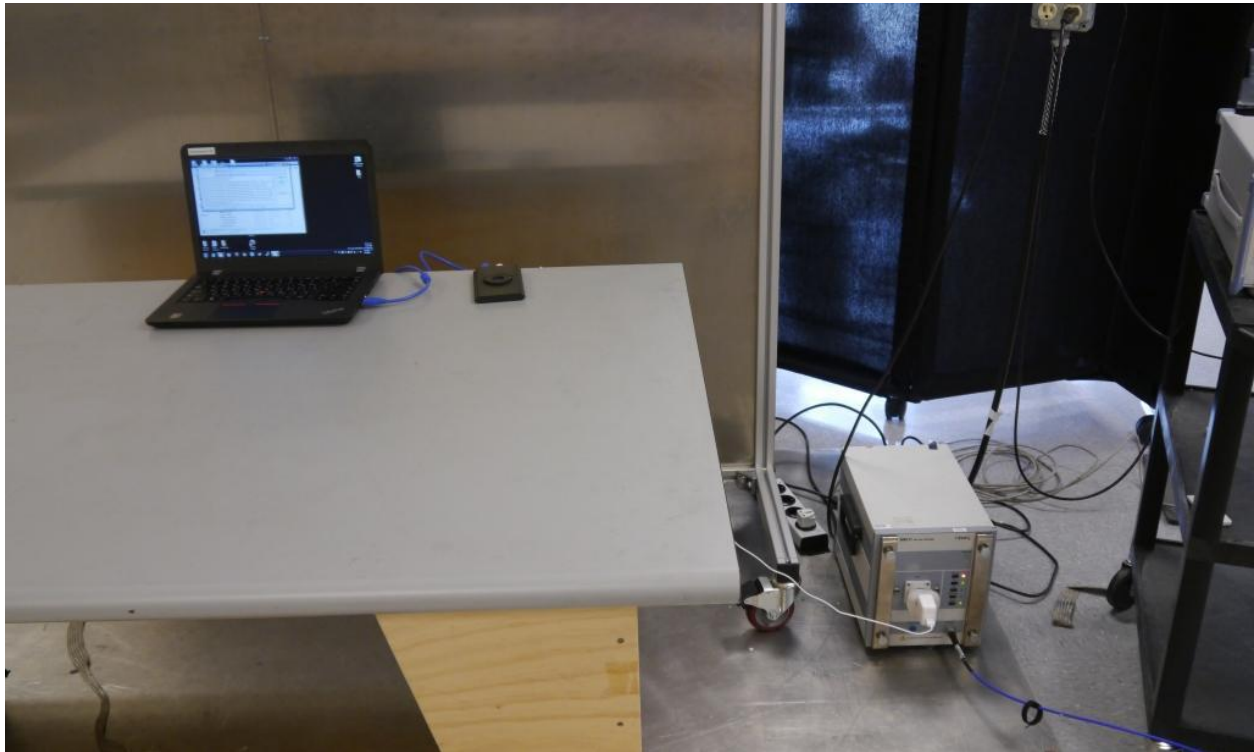
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	4-Aug-2016
TWO-LINE V-NETWORK	NNB 51	TESEQ	B087573	12-Nov-2016
COAXIAL CABLE	CBL-25FT-NMNM	MINI-CIRCUIT	B094941	4-Aug-2016

Note: The calibration period equipment is 1 year.

Software:

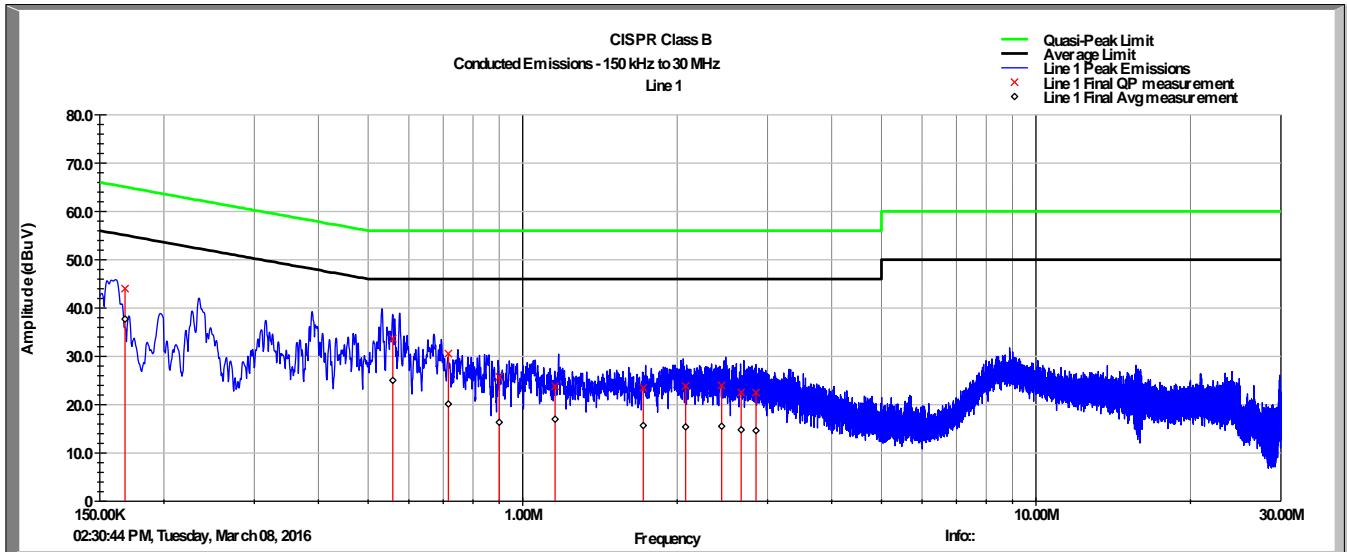
“Conducted Emissions” TILE! profile dated 16 Oct 2012

### 7.5 Test Setup Photographs



## 7.6 Test Data

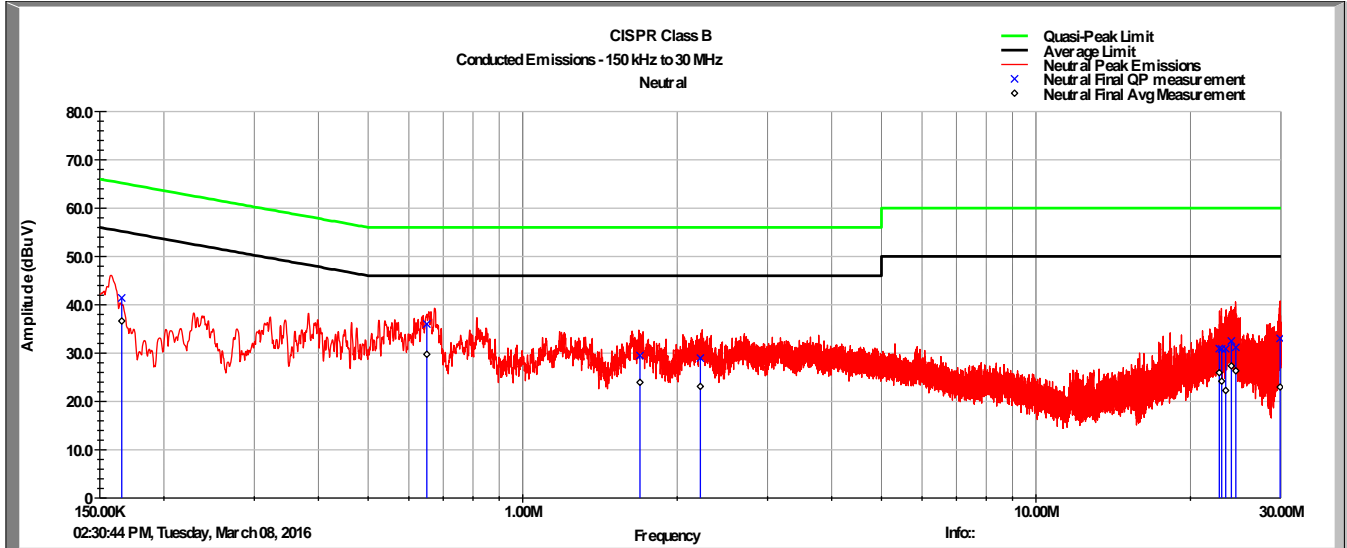
Line 1 Conducted Emissions Plot  
V Maker 15  
120V 60Hz



Line 1 Conducted Emissions Data  
V Maker 15  
120V 60Hz

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.168	44.0	65.1	-21.1	37.7	55.1	-17.4
0.559	33.7	56.0	-22.3	25.0	46.0	-21.0
0.716	30.6	56.0	-25.4	20.1	46.0	-25.9
0.900	25.7	56.0	-30.3	16.3	46.0	-29.7
1.157	23.8	56.0	-32.2	17.0	46.0	-29.0
1.718	23.5	56.0	-32.5	15.7	46.0	-30.3
2.077	23.9	56.0	-32.1	15.4	46.0	-30.6
2.441	24.0	56.0	-32.0	15.5	46.0	-30.5
2.665	22.5	56.0	-33.5	14.8	46.0	-31.2
2.848	22.5	56.0	-33.5	14.6	46.0	-31.4

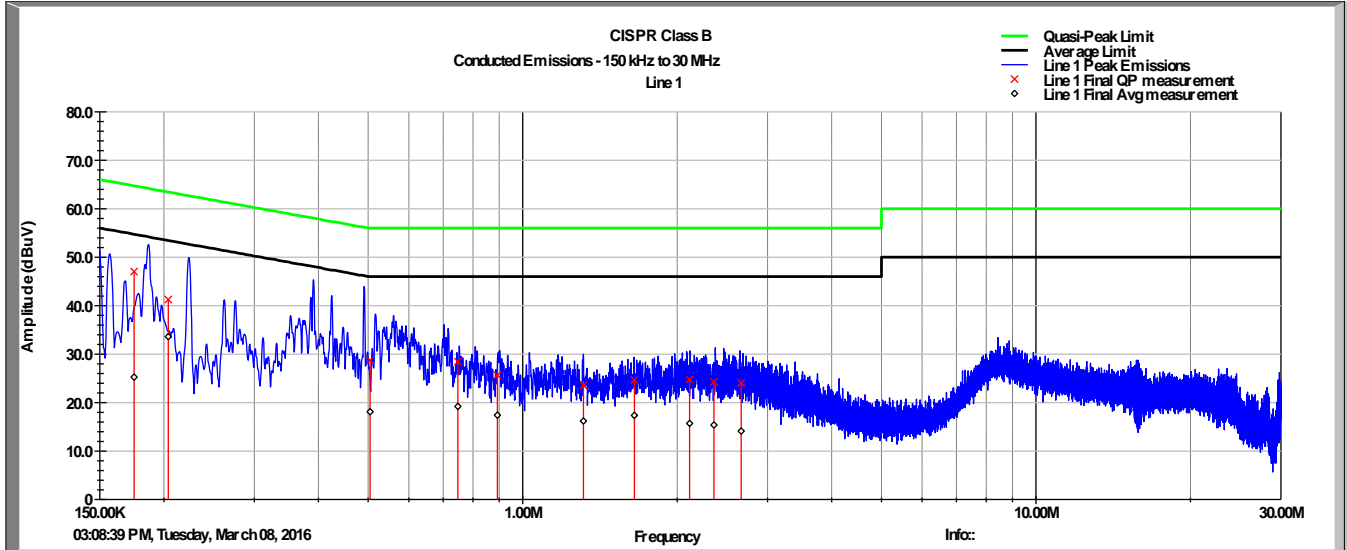
Neutral Conducted Emissions Plot  
 V Maker 15  
 120V 60Hz



Neutral Conducted Emissions Data  
 V Maker 15  
 120V 60Hz

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.166	41.4	65.2	-23.8	36.6	55.2	-18.6
0.651	36.0	56.0	-20.0	29.7	46.0	-16.3
1.693	29.5	56.0	-26.5	23.9	46.0	-22.1
2.220	28.9	56.0	-27.1	23.1	46.0	-22.9
22.758	30.9	60.0	-29.1	25.9	50.0	-24.1
22.999	30.8	60.0	-29.2	24.2	50.0	-25.8
23.422	30.9	60.0	-29.1	22.3	50.0	-27.7
24.028	32.5	60.0	-27.5	27.3	50.0	-22.7
24.504	31.2	60.0	-28.8	26.3	50.0	-23.7
29.897	33.0	60.0	-27.0	23.0	50.0	-27.0

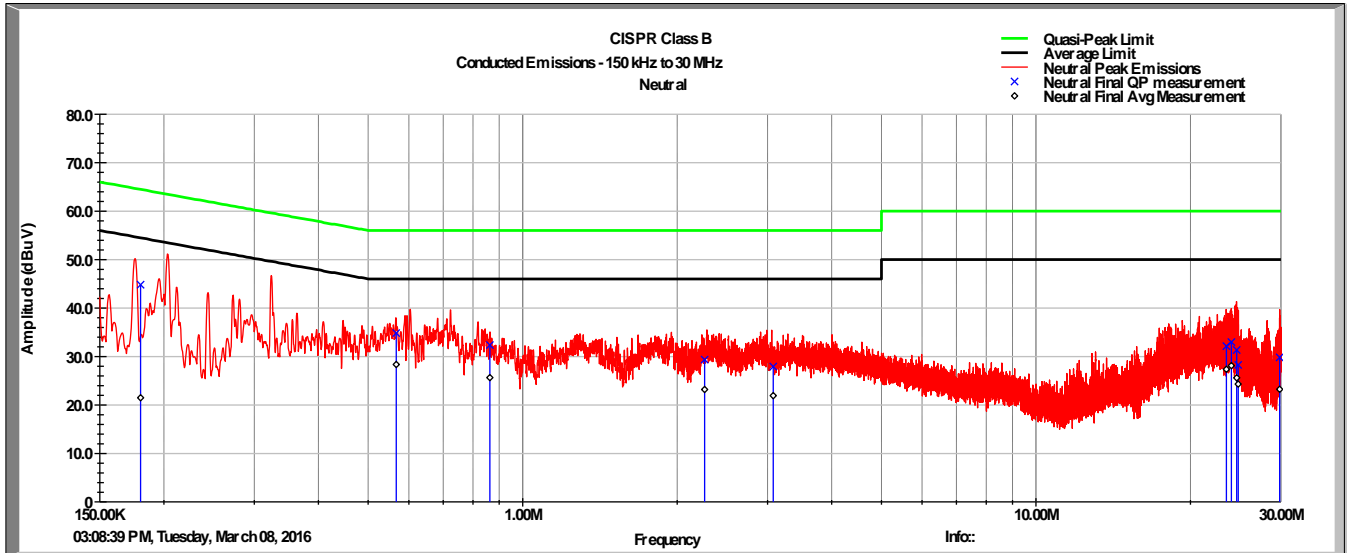
Line 1 Conducted Emissions Plot  
V Maker 18  
120V 60Hz



Line 1 Conducted Emissions Data  
V Maker 18  
120V 60Hz

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.175	47.0	64.7	-17.7	25.2	54.7	-29.5
0.204	41.3	63.4	-22.2	33.6	53.4	-19.8
0.504	28.7	56.0	-27.3	18.1	46.0	-27.9
0.748	28.4	56.0	-27.6	19.2	46.0	-26.8
0.893	25.7	56.0	-30.3	17.4	46.0	-28.6
1.313	23.5	56.0	-32.5	16.2	46.0	-29.8
1.651	24.6	56.0	-31.4	17.4	46.0	-28.6
2.115	24.8	56.0	-31.2	15.7	46.0	-30.3
2.359	24.3	56.0	-31.7	15.4	46.0	-30.6
2.664	24.1	56.0	-31.9	14.1	46.0	-31.9

Neutral Conducted Emissions Plot  
V Maker 18  
120V 60Hz



Neutral Conducted Emissions Data  
V Maker 18  
120V 60Hz

Frequency MHz	QP Value dBuV	QP Limit dBuV	QP Margin dB	Avg Value dBuV	Avg Limit dBuV	Avg Margin dB
0.180	44.8	64.5	-19.7	21.5	54.5	-33.0
0.567	34.8	56.0	-21.2	28.3	46.0	-17.7
0.863	32.4	56.0	-23.6	25.6	46.0	-20.4
2.262	29.4	56.0	-26.6	23.2	46.0	-22.8
3.078	27.9	56.0	-28.1	21.9	46.0	-24.1
23.499	32.1	60.0	-27.9	27.4	50.0	-22.6
24.028	33.0	60.0	-27.0	28.1	50.0	-21.9
24.611	31.3	60.0	-28.7	25.6	50.0	-24.4
24.771	28.3	60.0	-31.7	24.3	50.0	-25.7
29.838	29.8	60.0	-30.2	23.2	50.0	-26.8

## 8 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	6 April 2016
1	Added Section 7, Conducted Emissions on AC mains.	7 April 2016