

# EMC Test Report

**Project Number:** 3292714

**Report Number:** 3292714EMC01 **Revision Level:** 4

**Client:** PLUS Location Systems

**Equipment Under Test:** PLUS Transmit only UWB Tags

**Model Name:** Tag

**Model Number** 2106

**Applicable Standards:** FCC Part 15.519

**Report issued on:** 29JAN2014

**Test Result:** Compliant

Tested by:



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Brian Forster, EMC Engineer

Reviewed by:



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David Schramm, EMC 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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## 1 Summary of Test Results

Basic Standards	Test Result
15.519(3)(c) / 15.209, Radiated Emissions below 1 GHz	Compliant
15.519(3)(d), Radiated Emissions in GPS Receive Bands	Compliant
15.519(3)(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: Kevin Trach  
Address: 6767 Madison Pike NW Suite 310  
City, State, Zip, Country: Huntsville AL 35806

### 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*

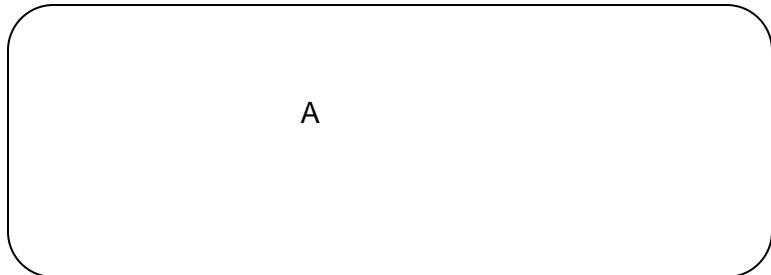
Product Name: Transmit only UWB Tags  
Model Name: Tag

Sample Received Date: 25SEP2013  
Dates of testing: 25-26SEP2013

### 2.4 *Operating Modes and Conditions*

The EUT was programmed by the manufacturer to transmit continuously.

## 2.5 ***EUT Block Diagram***



### 3 Radiated Emissions below 1 GHz

#### 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 below 1GHz and a Peak and Average detector above 1GHz. The receivers resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. 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 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 dB $\mu$ V/m)	Distance
30 – 88	40	3m
88 – 216	43.52	3m
216 – 960	46	3m

### 3.3 Test Site

3m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

#### Environmental Conditions

Temperature: 24.5 °C  
Relative Humidity: 60.1%  
Atmospheric Pressure: 98.9 kPa

### 3.4 Test Equipment

Test Start Date: 9/27/2013

Tested By: bkf

Test End Date: 9/27/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	22-Aug-14
DRWG Antenna	3117	ETS-Lindgren	B079691	10-Jun-14
Receiver	ESU8	R&S	B085759	21-Jun-14
Pre-Amplifier	TS-PPR18	R&S	B094463	12-Oct-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	6-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079661	6-Aug-14

Note: The calibration period equipment is 1 year.

#### Software:

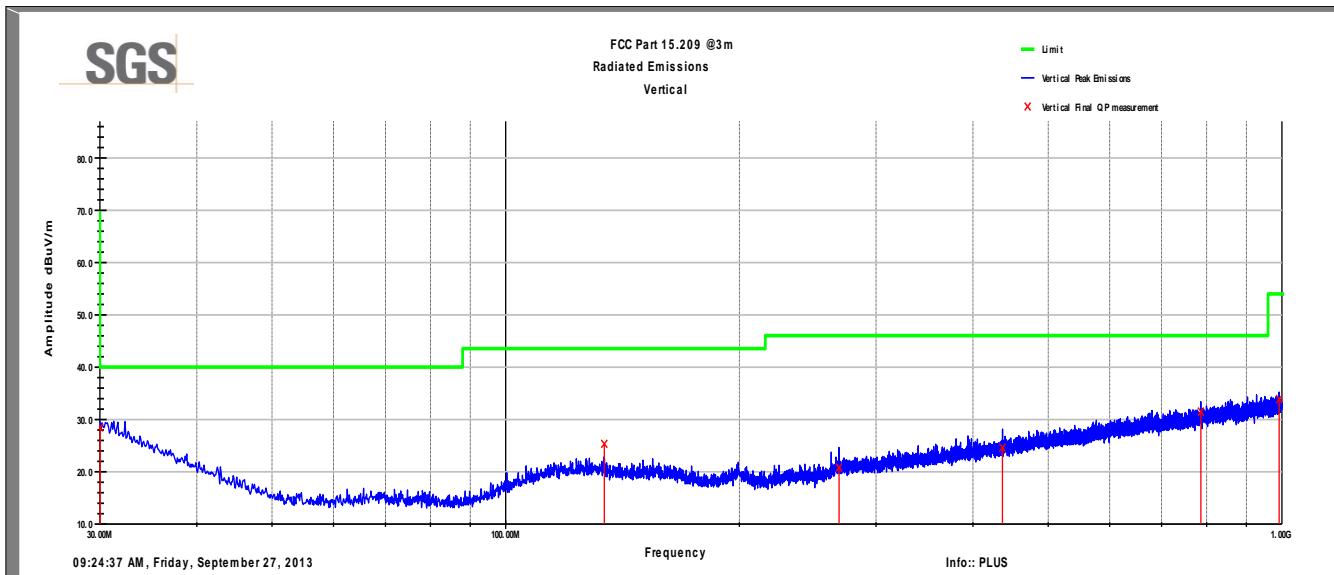
“Radiated Emissions” TILE! profile dated 15 Oct 2011

### 3.5 ***Test Setup Photographs***

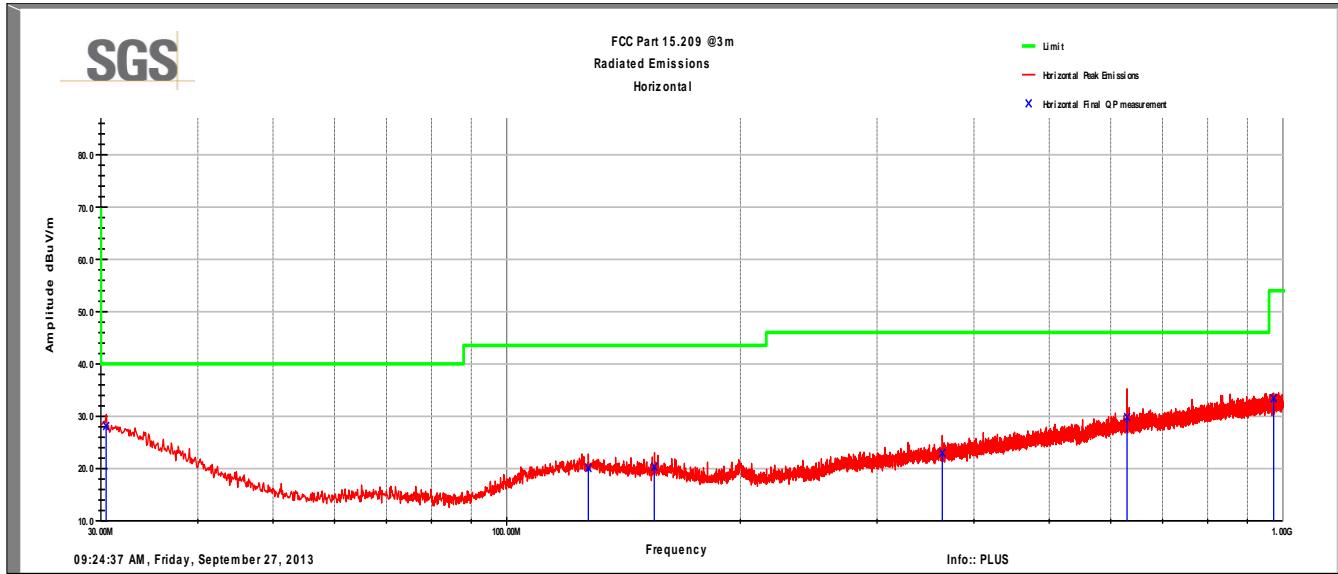


### 3.6 Test Data

Vertical Radiated Emissions Plot



## Horizontal Radiated Emissions Plot



## 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 50 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: 24.5 °C  
Relative Humidity: 50.1%  
Atmospheric Pressure: 97.9 kPa

### 4.4 Test Equipment

Test Start Date: 9/25/2013

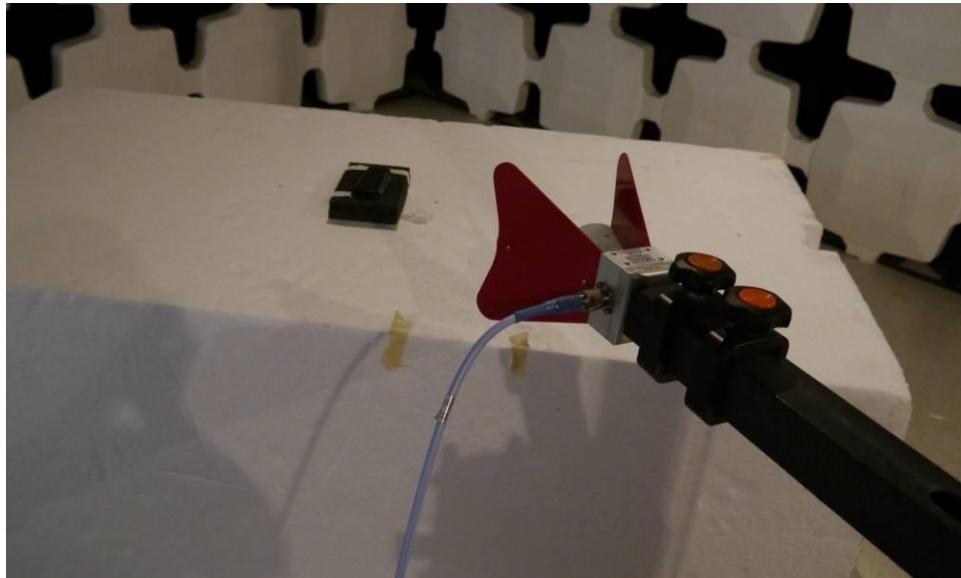
Tested By: bkf

Test End Date: 9/25/2013

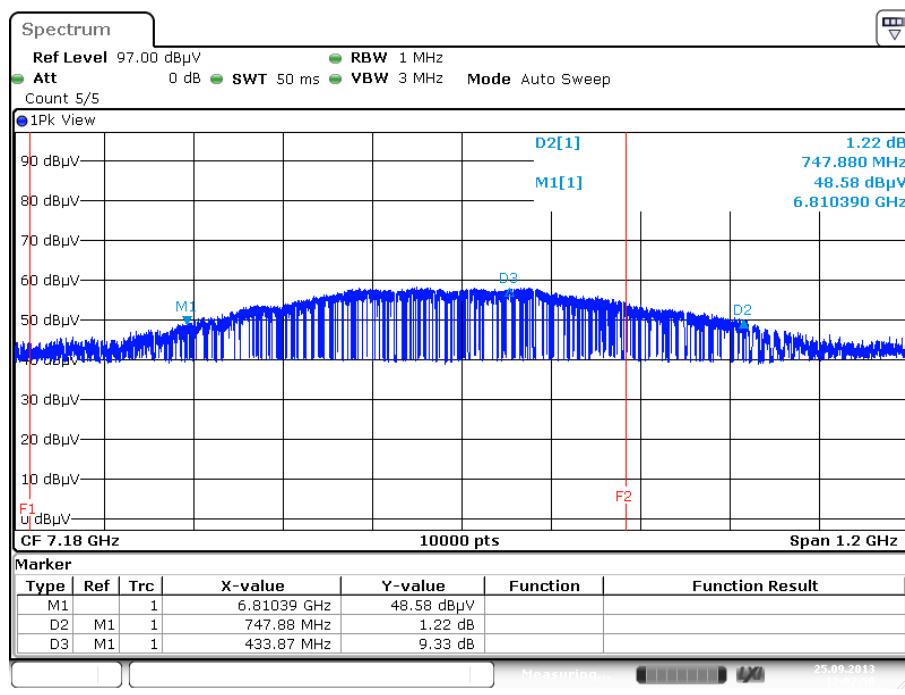
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV	R&S	B085749	28-Aug-14
DRWG Antenna	3117	ETS-Lindgren	B079691	10-Jun-14
Pre-Amplifier	TS-PPR18	R&S	B094463	12-Oct-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	6-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079661	6-Aug-14

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

#### 4.5 Test Setup Photographs



#### 4.6 Test Data



## 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, fM . 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.
- 3) 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 instrumentation employed in the testing.

### 5.3 Test Site

3m Absorber Lined Shielded Enclosure, SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 24.5 °C  
Relative Humidity: 50.1%  
Atmospheric Pressure: 97.9 kPa

### 5.4 Test Equipment

Test Start Date: 9/25/2013

Tested By: bkf

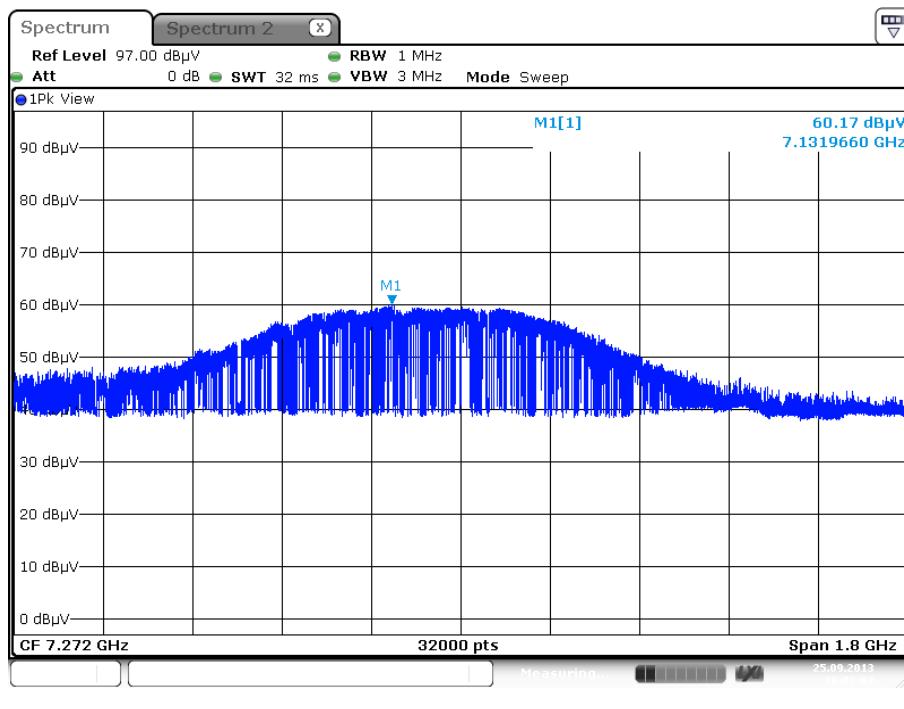
Test End Date: 9/25/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DRWG Antenna	3117	ETS-Lindgren	B079691	10-Jun-14
Pre-Amplifier	TS-PPR18	R&S	B094463	12-Oct-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	6-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079661	6-Aug-14
Spectrum Analyzer	FSV	R&S	B085749	28-Aug-14

Note: The calibration period equipment is 1 year.

## 5.5 Test Data

Frequency MHz	Raw Peak dB $\mu$ V	AF (dB/m)	CL (dB)	Amp (dB)	dBm to FS Conversion	50MHz Correction	EIRP Value dBm	Limit (dBm)	Margin (dB)
7127.58	60.2	36.3	7.5	33.6	104.7	-34.0	-0.4	0.0	-0.4



## 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

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

3m Absorber Lined Shielded Enclosure, SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 24.5 °C  
Relative Humidity: 50.1%  
Atmospheric Pressure: 97.9 kPa

## 6.4 **Test Equipment**

Test Start Date: 9/26/2013

Tested By: bkf

Test End Date: 9/26/2013

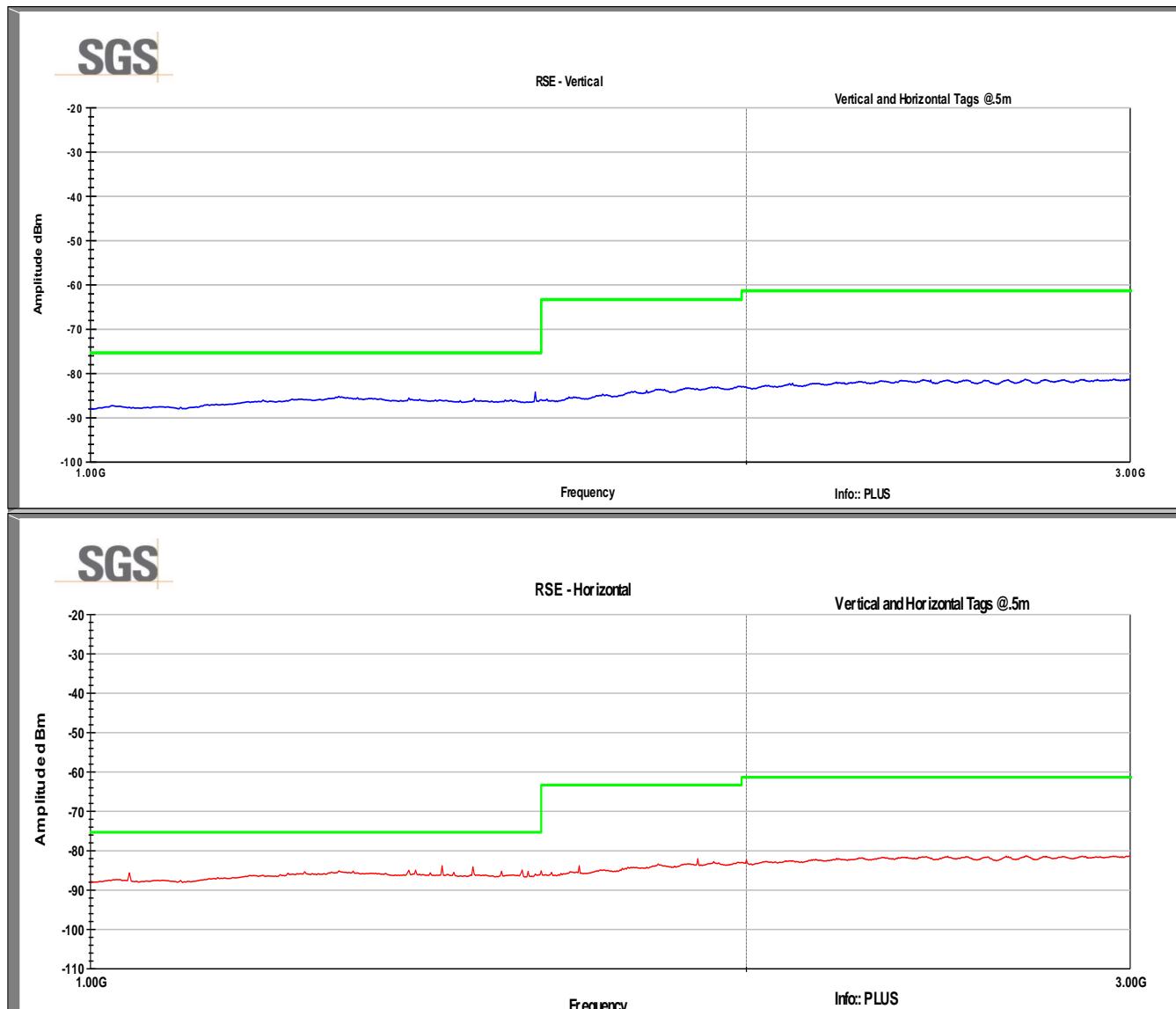
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	22-Aug-14
DRWG Antenna	3117	ETS-Lindgren	B079691	10-Jun-14
DRWG Antenna	3116B	ETS Lindgren	B079697	1-Feb-14
Pre-amplifier	NSP1840-HG	Miteq	B087572	22-Oct-13
Pre-Amplifier	TS-PPR18	R&S	B094463	12-Oct-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	6-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079661	6-Aug-14
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079824	6-Aug-14
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	12-Dec-13
Spectrum Analyzer	N9030A	Agilent	1114338	8-Jun-14

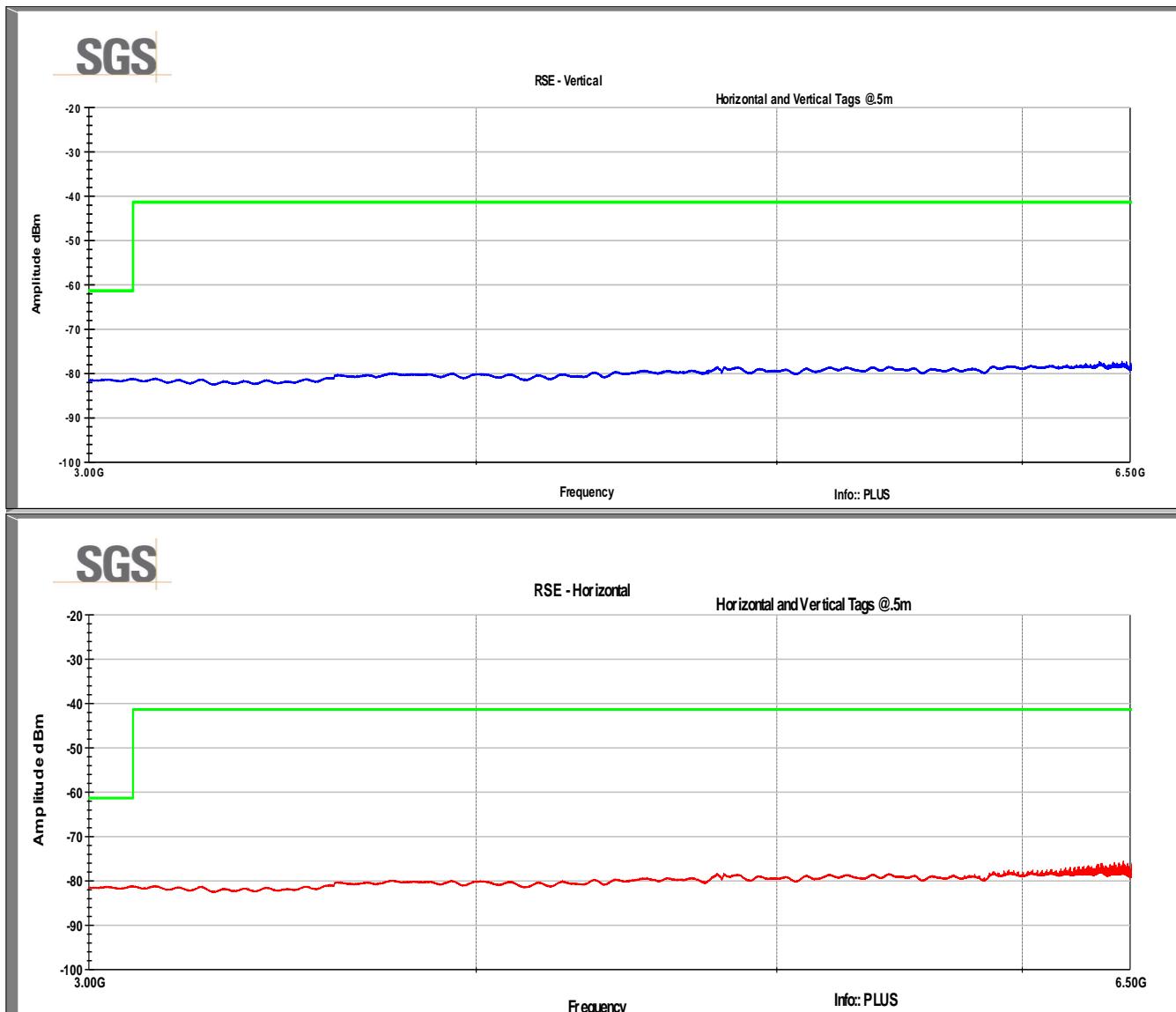
Note: The calibration period equipment is 1 year.

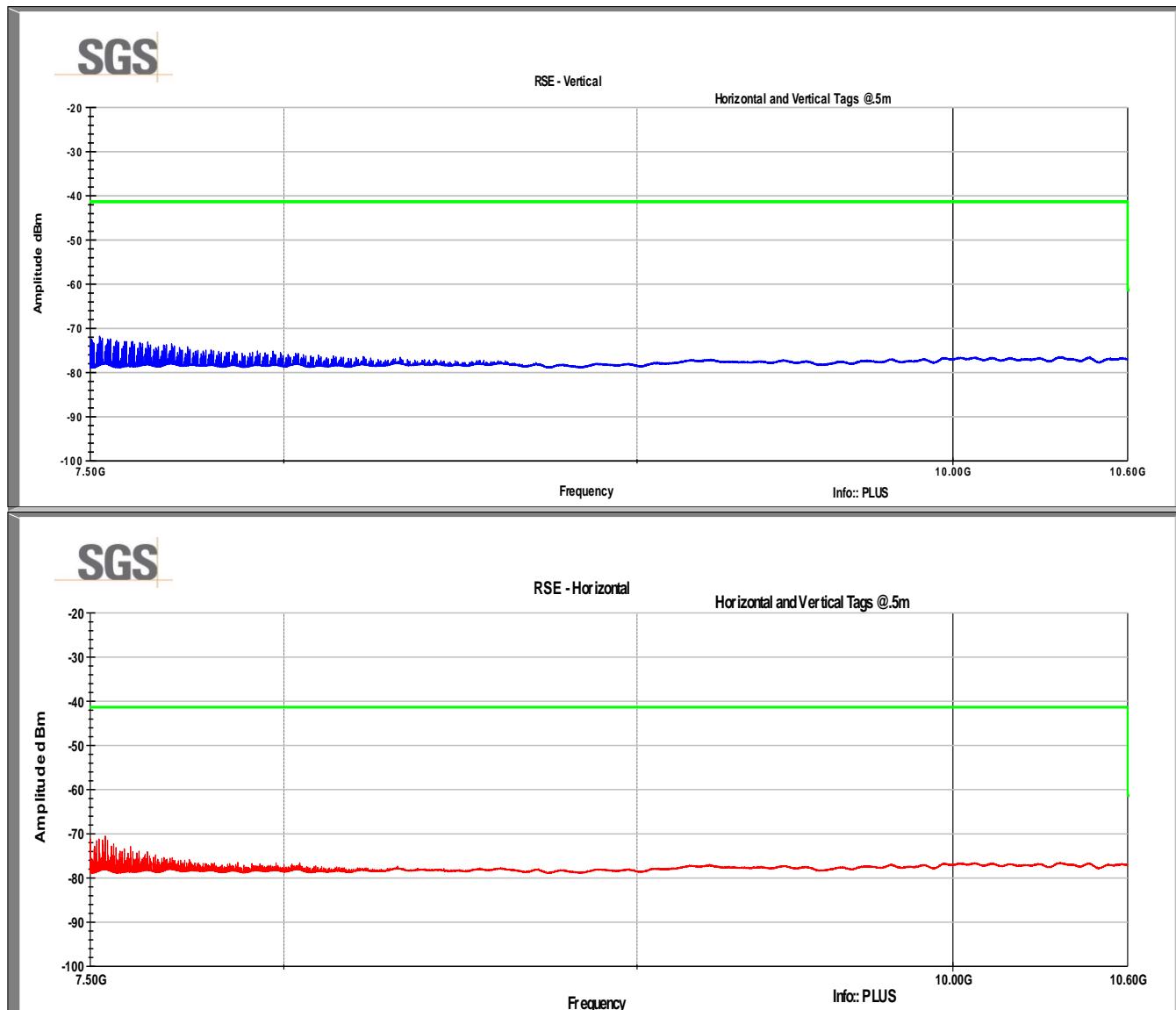
## 6.5 Test Data

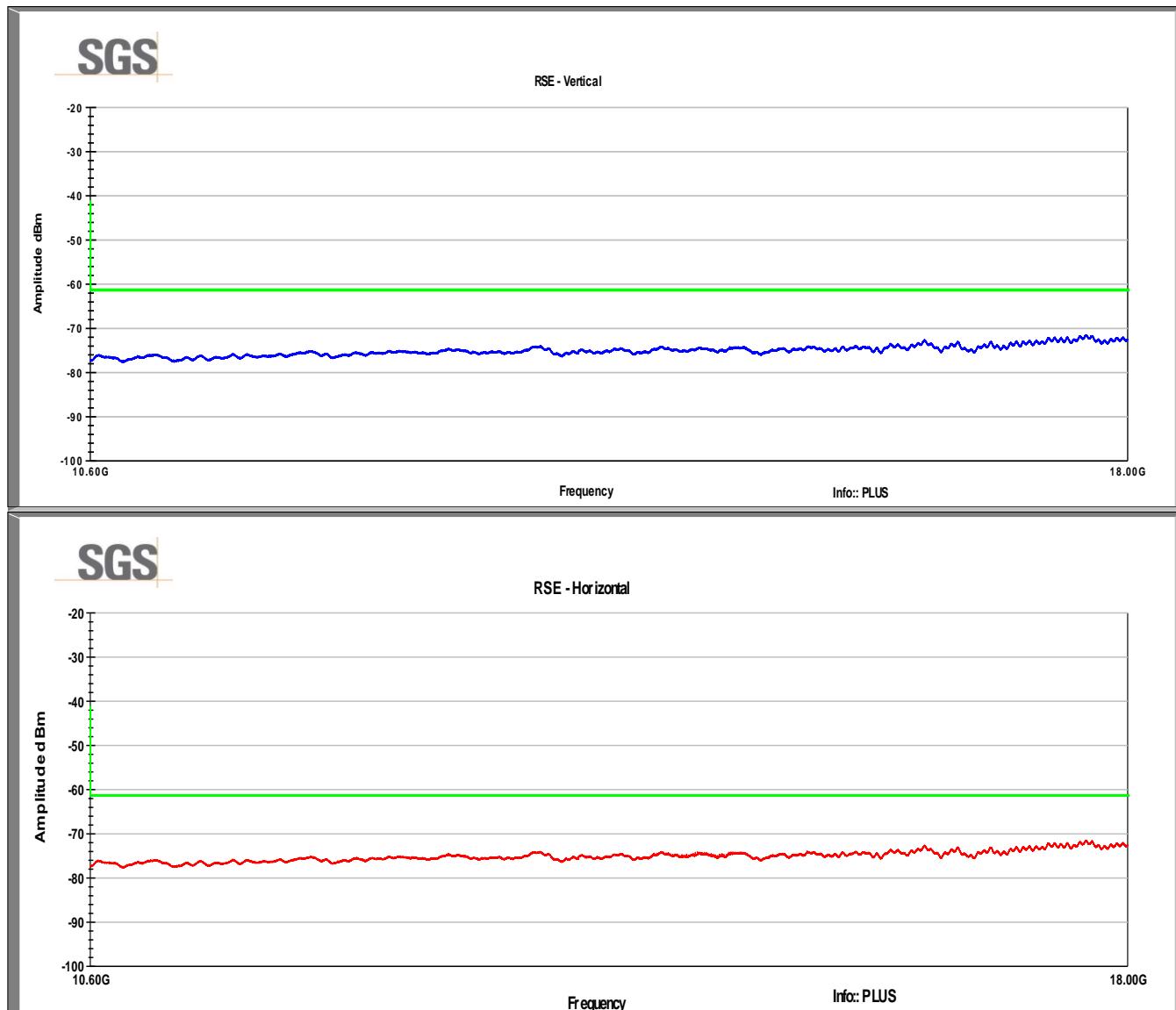
Final RMS Measurement  
1 meter

Frequency MHz	Raw RMS dBuV	AF (dB/m)	CL (dB)	Amp (dB)	FS to dBm Correction	EIRP Value dBm	Limit (dBm)	Margin (dB)
7361.53	43.7	36.1	7.5	33.6	104.7	-51.1	-41.3	-9.8

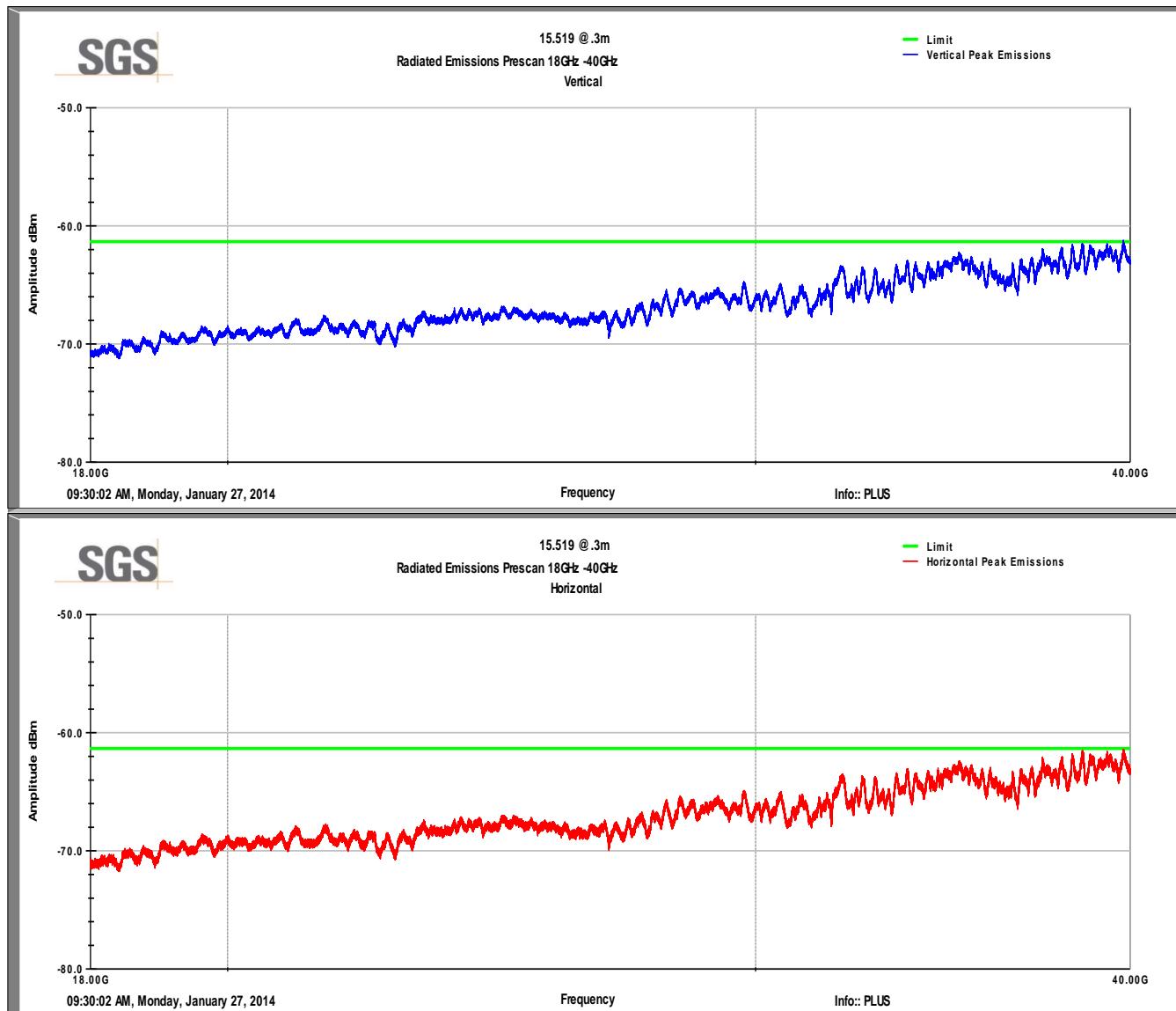






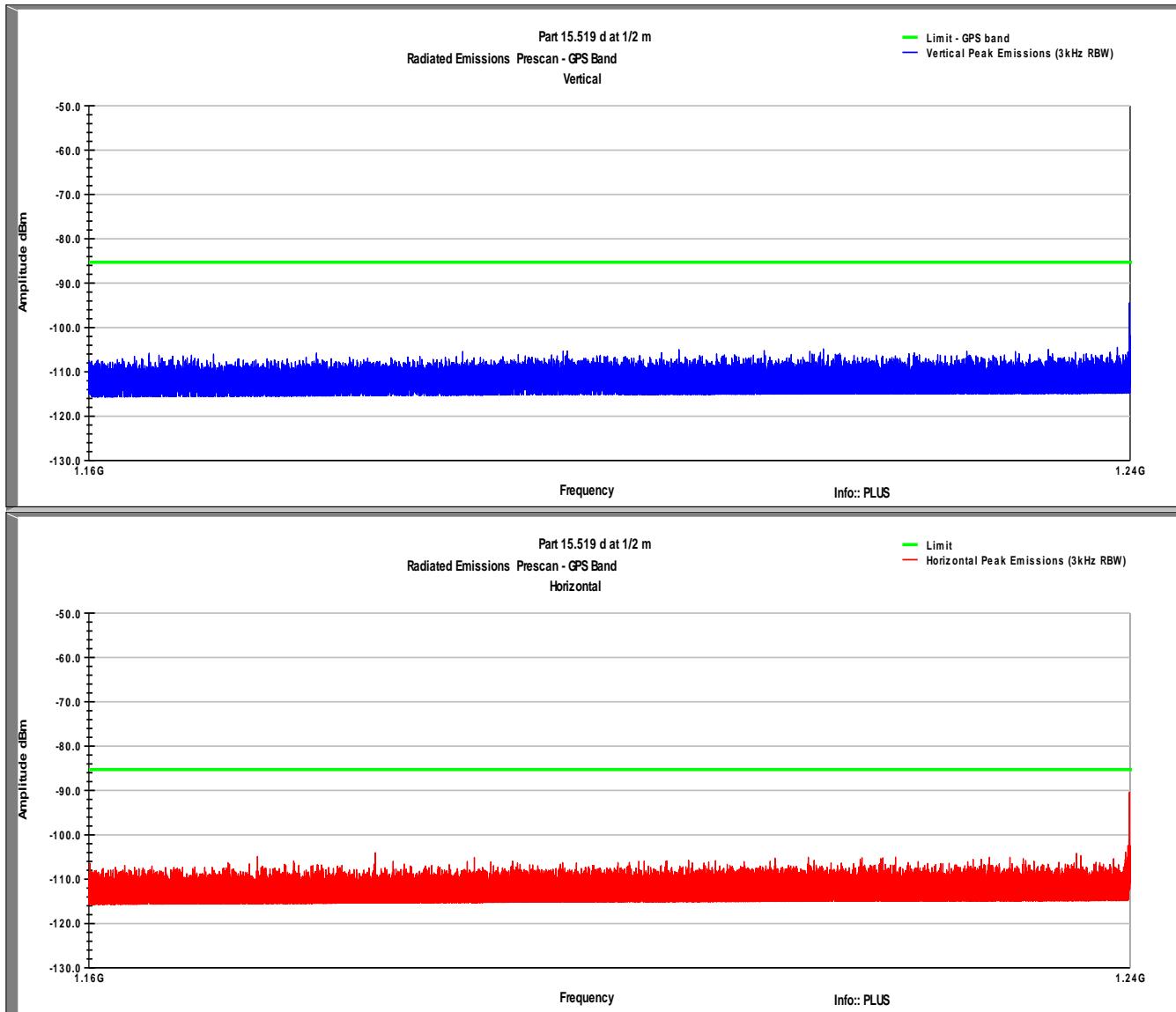


No emissions above equipment noise floor

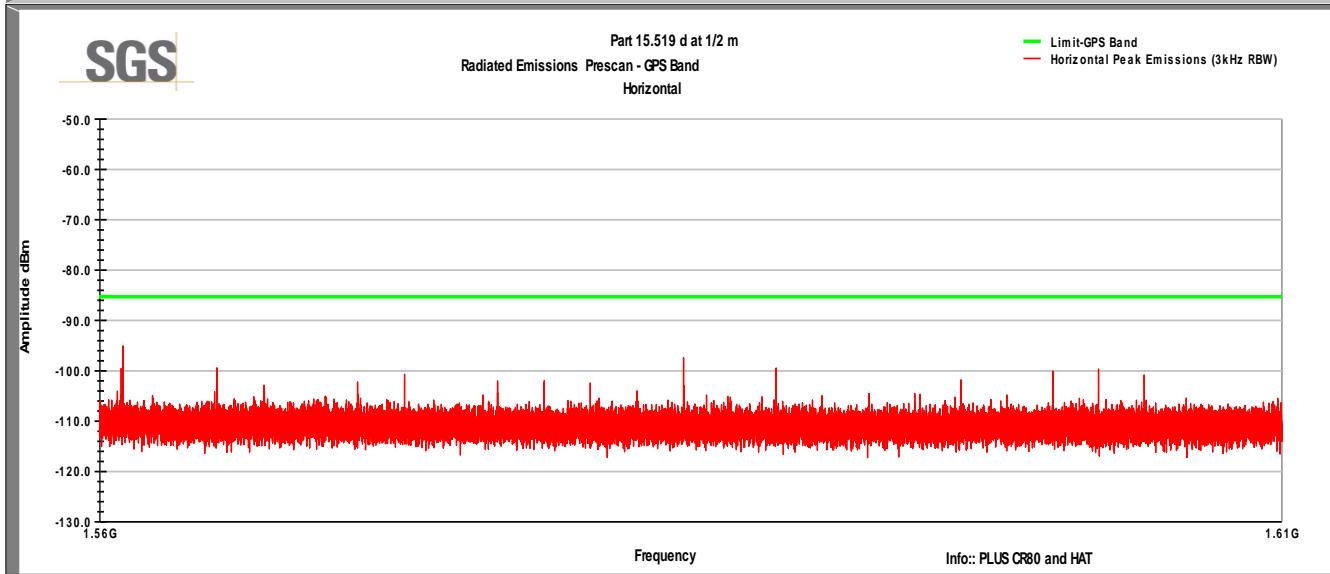
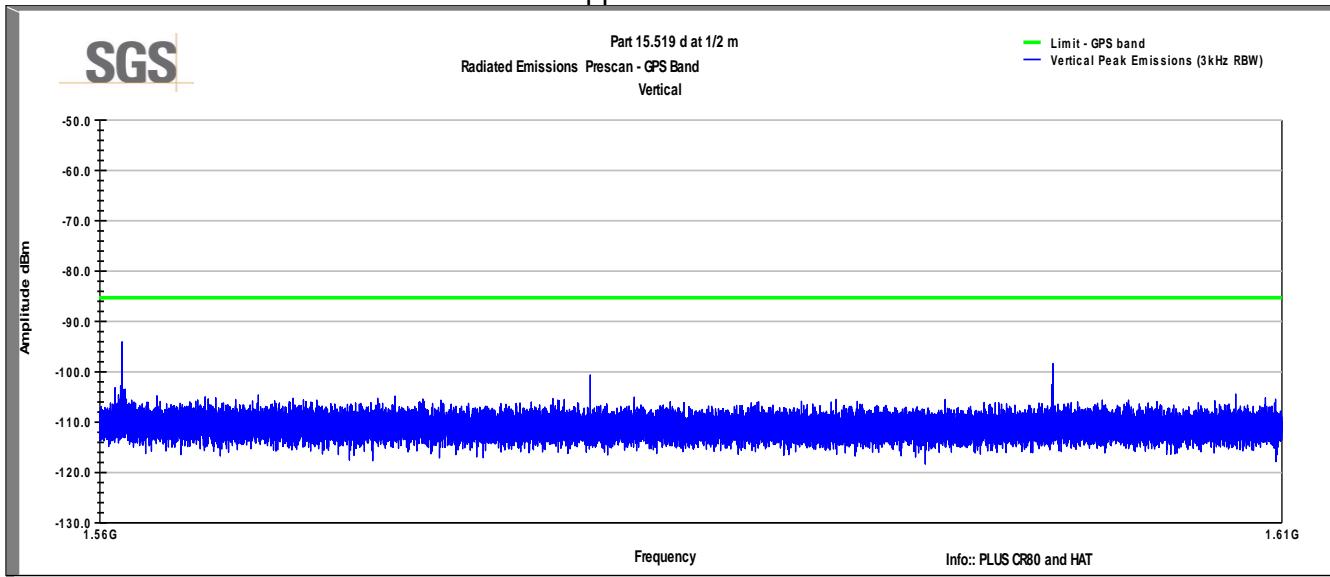


No emissions above equipment noise floor

## Lower GPS Band



## Upper GPS Band



## 7 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	09OCT2013
1	Updated model names and client address	11OCT2013
2	Updated model names	01NOV2013
3	Updated Header with correct model name	13NOV2013
4	Corrected unit mismatch in plots for radiated emissions and Final Measurement table	29JAN2014