

EMC Test Report

Project Number: 3692330

Report Number: 3692330EMC01

Revision Level: 1

Client: PLUS Location Systems

Equipment Under Test: PLUS Transmit only UWB Tag

Model Name: Tag Module

Model Number 2111

Applicable Standards: FCC Part 15.519

Report issued on: 28 February 2015

Test Result: Compliant

Tested by:


David Schramm, EMC/RF/SAR/HAC Manager

Reviewed by:


Jeremy O. Pickens, Senior EMC Engineer

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.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or Testing done by SGS International Electrical Approvals in connection with distribution or use of the product described in this report must be approved by SGS international Electrical Approvals in writing.

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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: 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

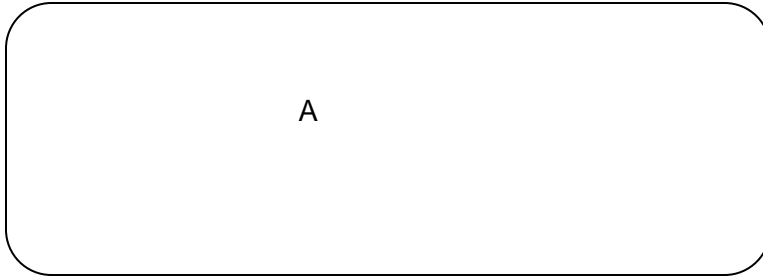
2.3 General Information of EUT

Product Name: Transmit only UWB Tags
Model Name: Tag Module
FCC ID: ZEH0215
Sample Received Date: 2 February 2015
Dates of testing: 2-3 February 2015

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 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 receivers 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 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

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

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 20.6%

Atmospheric Pressure: 98.0 kPa

3.4 Test Equipment

Test Date: 2-Feb-2015

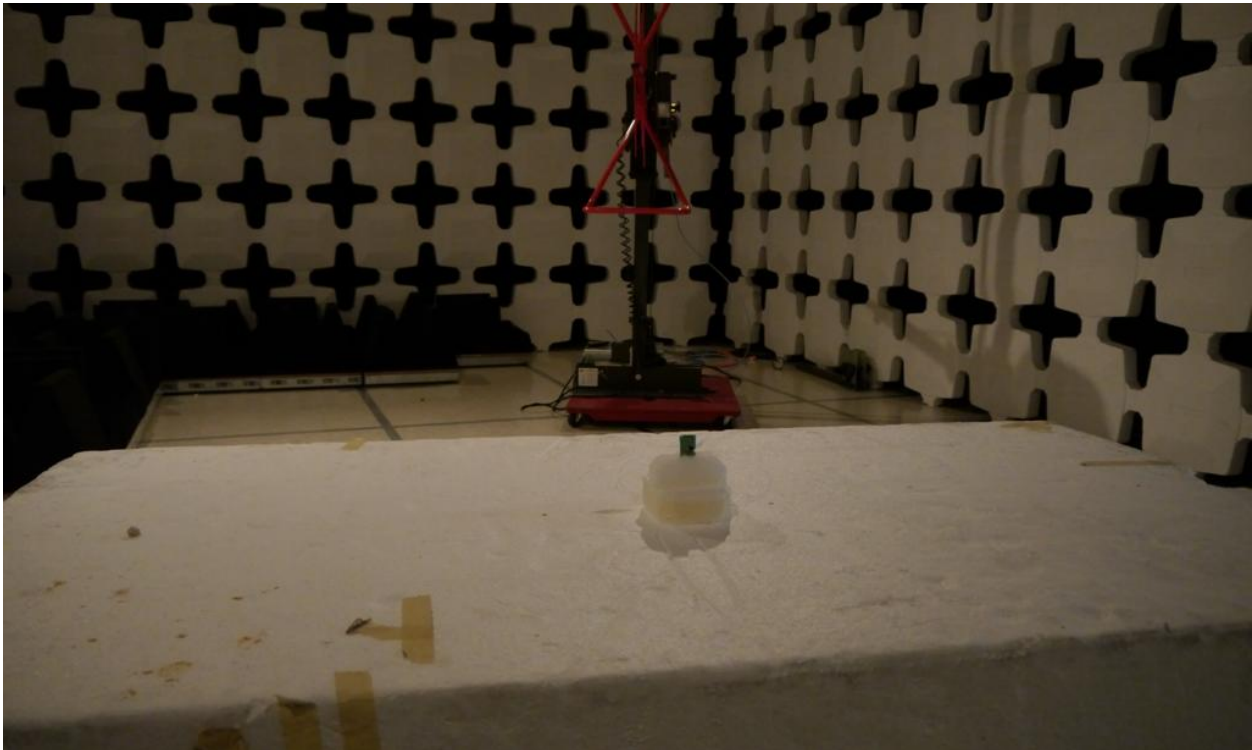
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079689	3-Sep-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	4-Aug-2015
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015

Note: The calibration period equipment is 1 year.

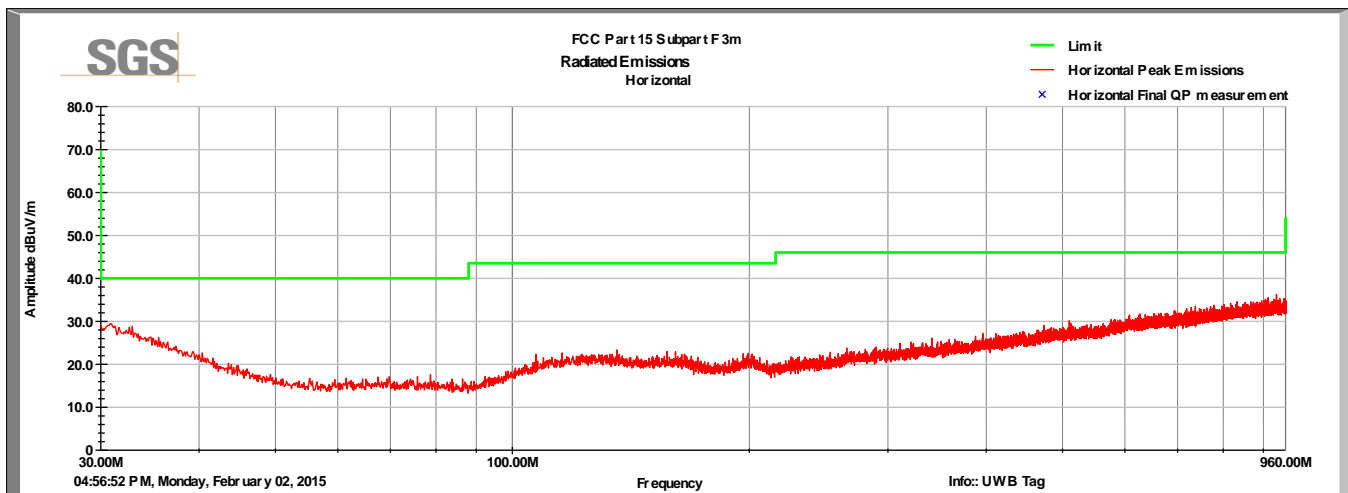
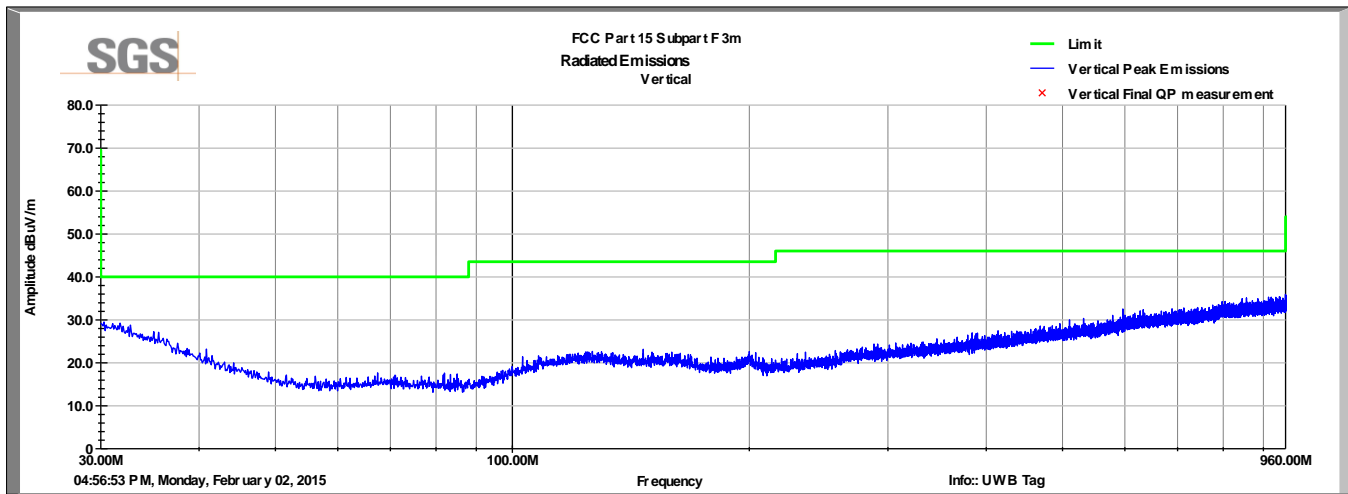
Software:

“Radiated Emissions” TILE! profile dated 15 Oct 2011

3.5 Test Setup Photographs



3.6 Test Data



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: 23.7 °C

Relative Humidity: 25.4%

Atmospheric Pressure: 97.4 kPa

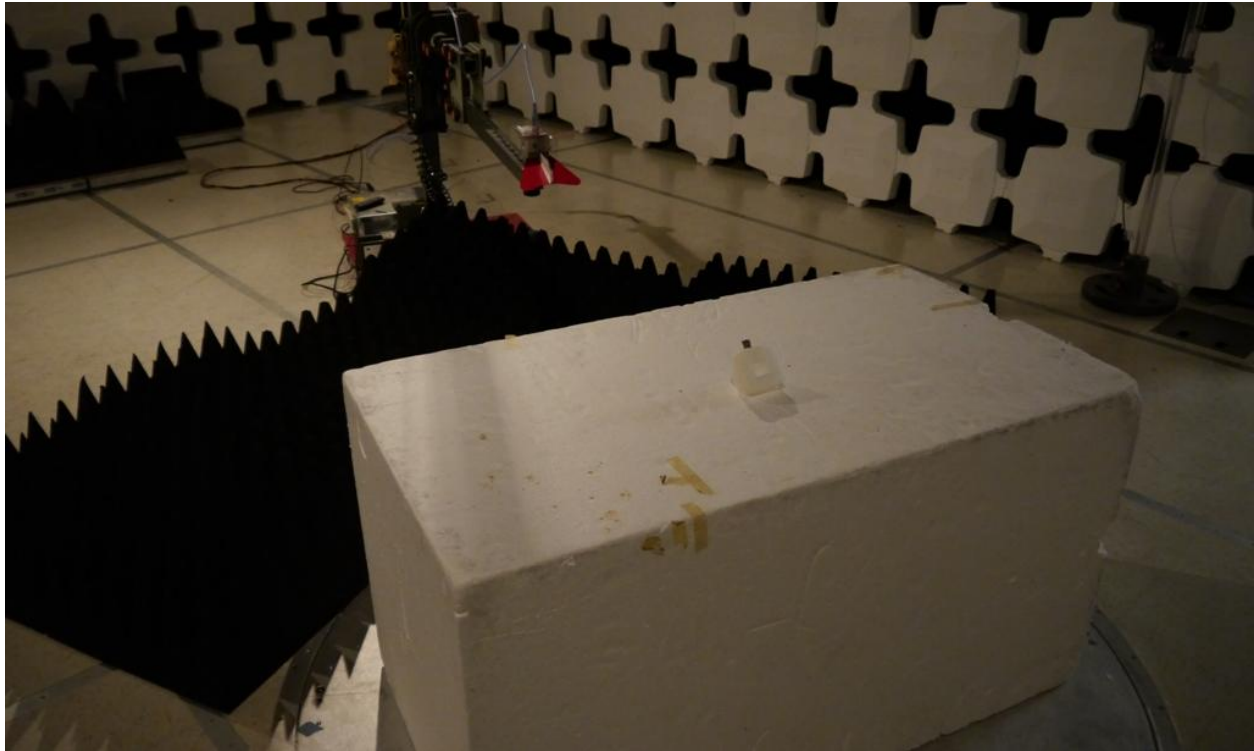
4.4 Test Equipment

Test Date: 2-Feb-2015

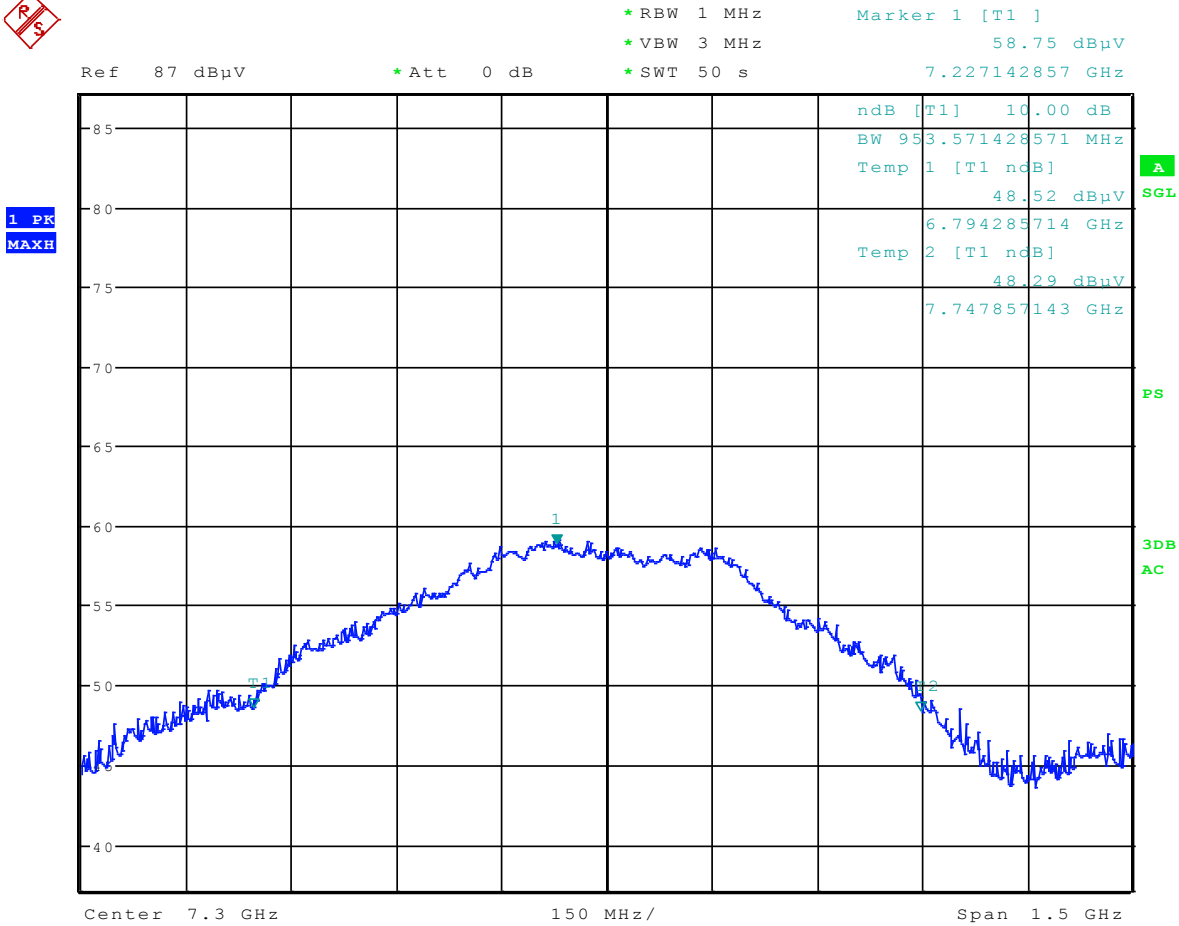
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	10-Apr-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	4-Aug-2015

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

4.5 Test Setup Photographs



4.6 Test Data



Date: 2.FEB.2015 10:18:58

Bandwidth = 953.57 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.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.7 °C

Relative Humidity: 25.4%

Atmospheric Pressure: 97.4 kPa

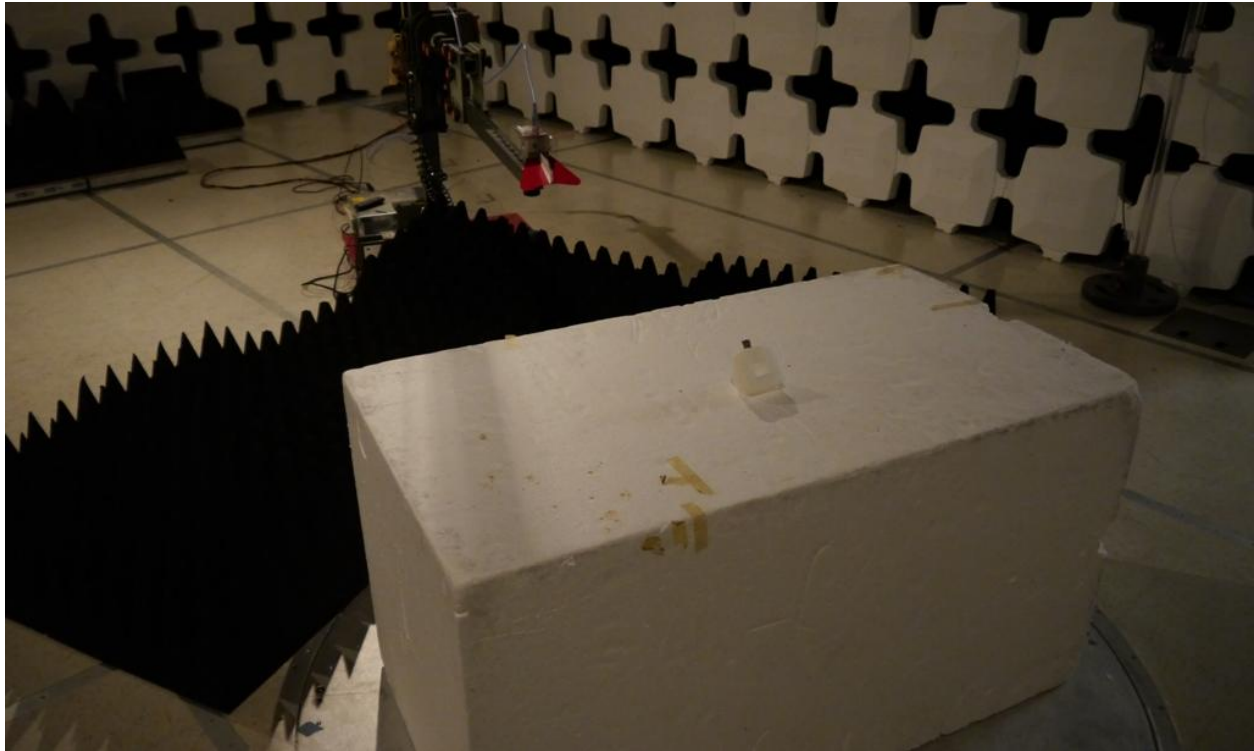
5.4 Test Equipment

Test Date: 2-Feb-2015

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	10-Apr-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	4-Aug-2015

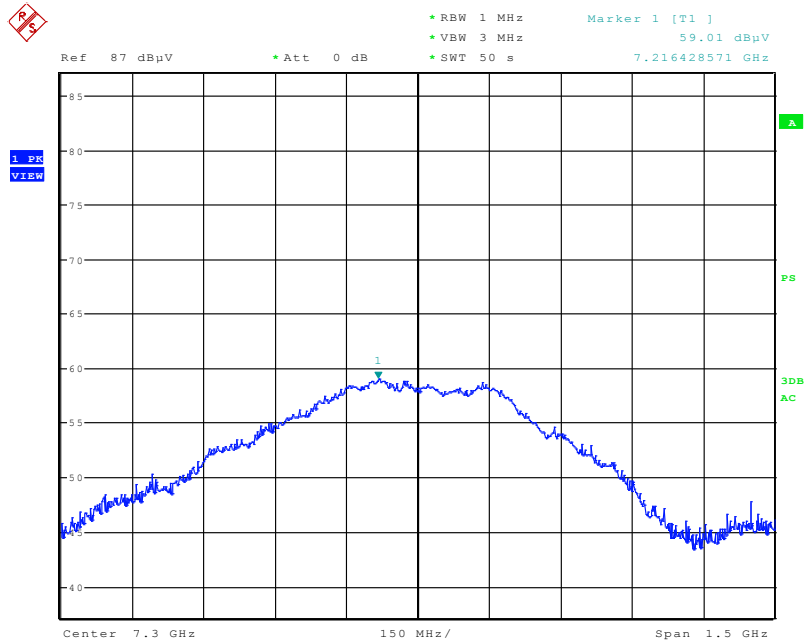
Note: The calibration period for this equipment is 1 year.

5.5 Test Setup Photographs



5.6 Test Data

Frequency MHz	Raw Peak (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Conversion 1 to 50MHz	Conversion F.S. to ERP	Peak Value dBm	Limit (dBm)	Margin (dB)
7216.43	59.0	V	182.1	101.2	35.8	8.8	33.3	34.0	104.7	-0.4	0.0	-0.4
Peak Value = Raw Peak + AF + CL - Amp + 50MHz Conv + FStoERP Conv												
Margin = Peak Value - Limit												



Date: 2.FEB.2015 10:38:47

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 above 960 MHz. The scan was performed at a distance of 1 meter or 0.5 meter field strength measurement to EIRP. If emissions were detected, the final emissions will be performed at a distance on 1 meter. The distance of the scan is indicated on each scan.

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

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

Environmental Conditions

Temperature: 23.6 °C
Relative Humidity: 24.9%
Atmospheric Pressure: 97.6 kPa

6.4 Test Equipment

Test Date: 2-Feb-2015

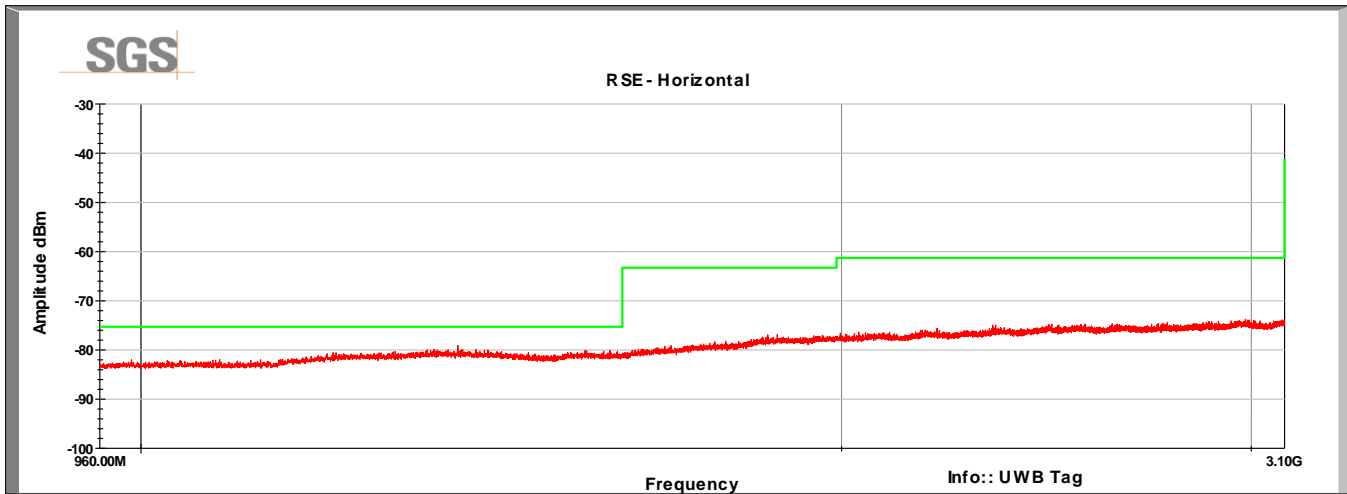
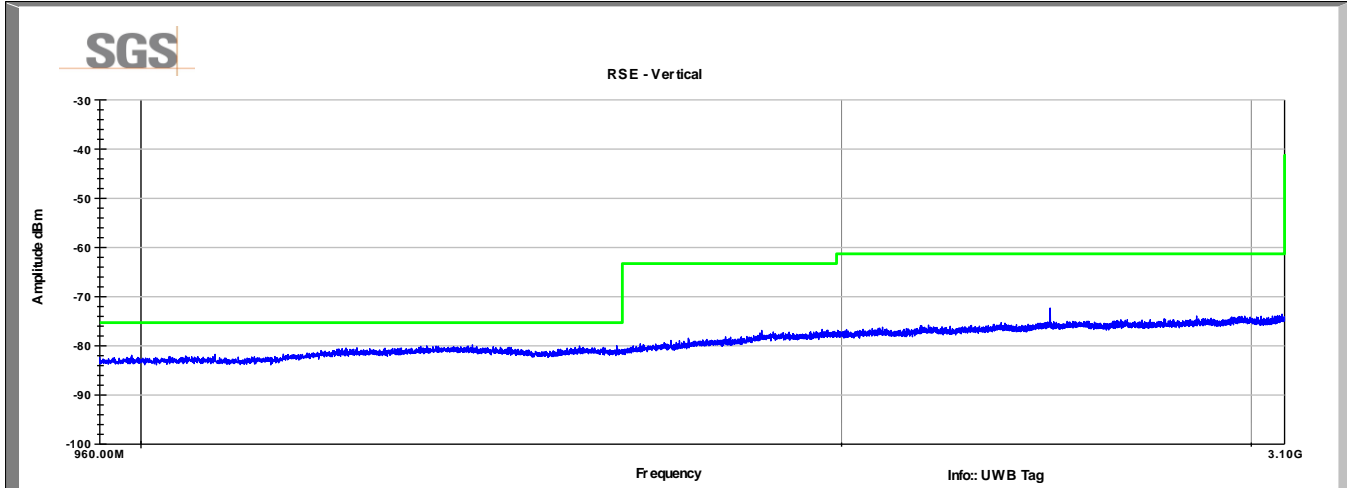
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	10-Apr-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079716	4-Aug-2015
FILTER	LPM17270	MICRO-TRONICS	B093646	7-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	6-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079824	6-Aug-2015
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079695	13-Mar-2015
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	14-Oct-2015

Note: The calibration period equipment is 1 year.

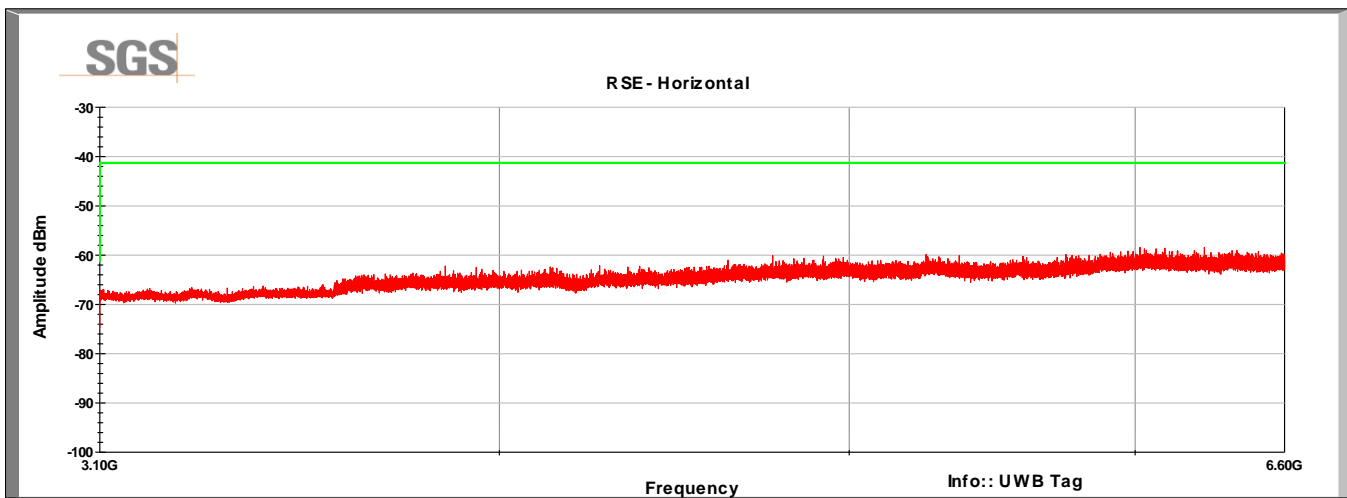
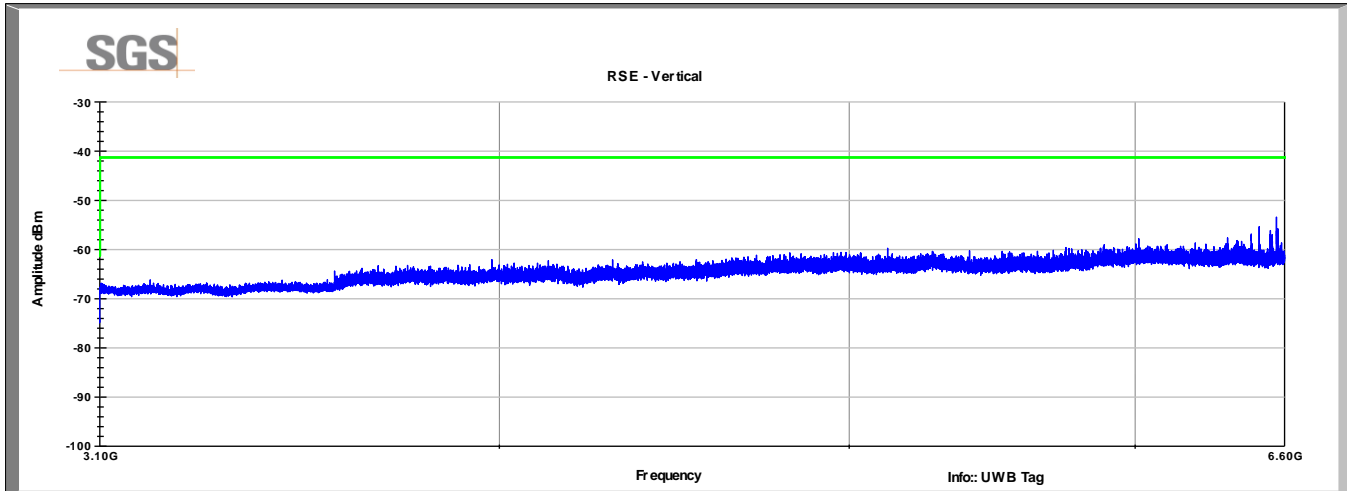
6.5 Test Data

960 to 3100 MHz

Test distance: 1m



3100 to 6600 MHz
Test distance: 1m

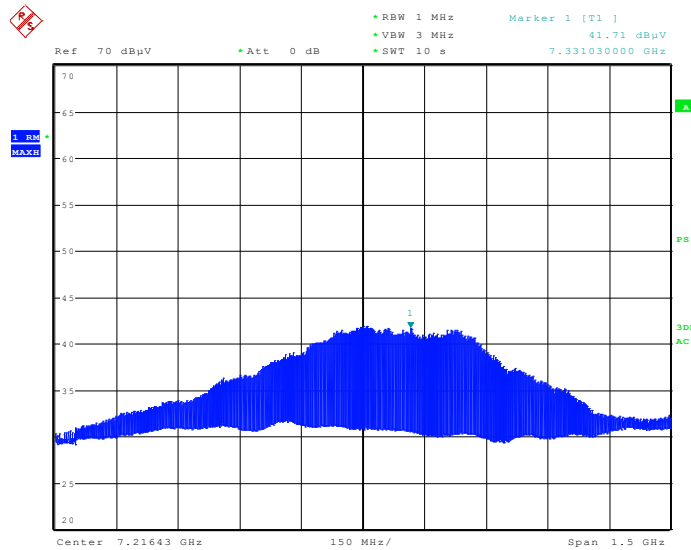


6600 to 8000 MHz

Test distance: 1m

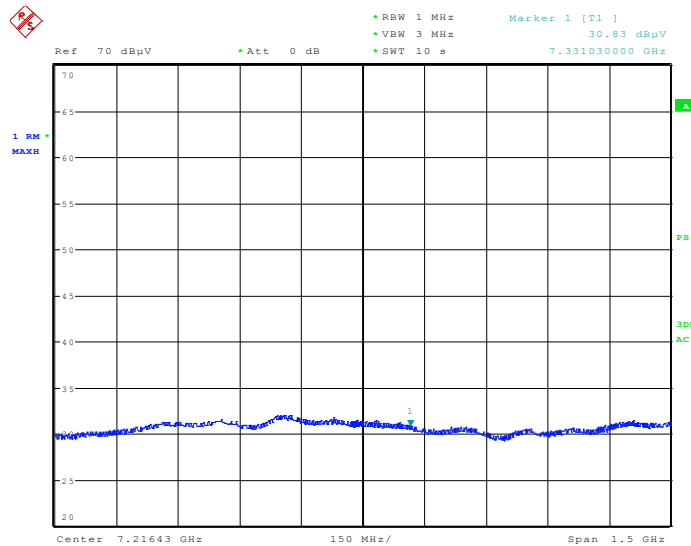
Frequency MHz	Raw Peak (dBuV)	Polarity (V/H)	Azimuth (degrees)	Height (cm)	AF (dB/m)	CL (dB)	Amp (dB)	Conversion F.S. to EIRP	Peak Value dBm	Limit (dBm)	Margin (dB)
7331.03	41.7	V	182.1	101.2	35.8	8.8	33.3	104.7	-51.7	-41.3	-10.4
Peak Value = Raw Peak + AF + CL - Amp + FStoEIRP Conv											
Margin = Peak Value - Limit											

Vertical Scan



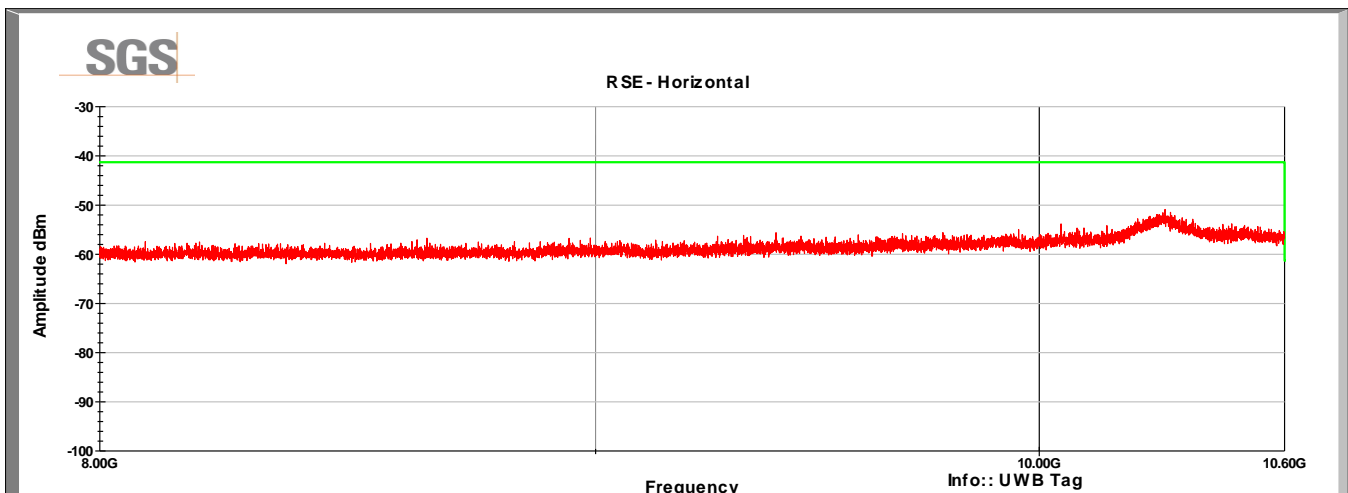
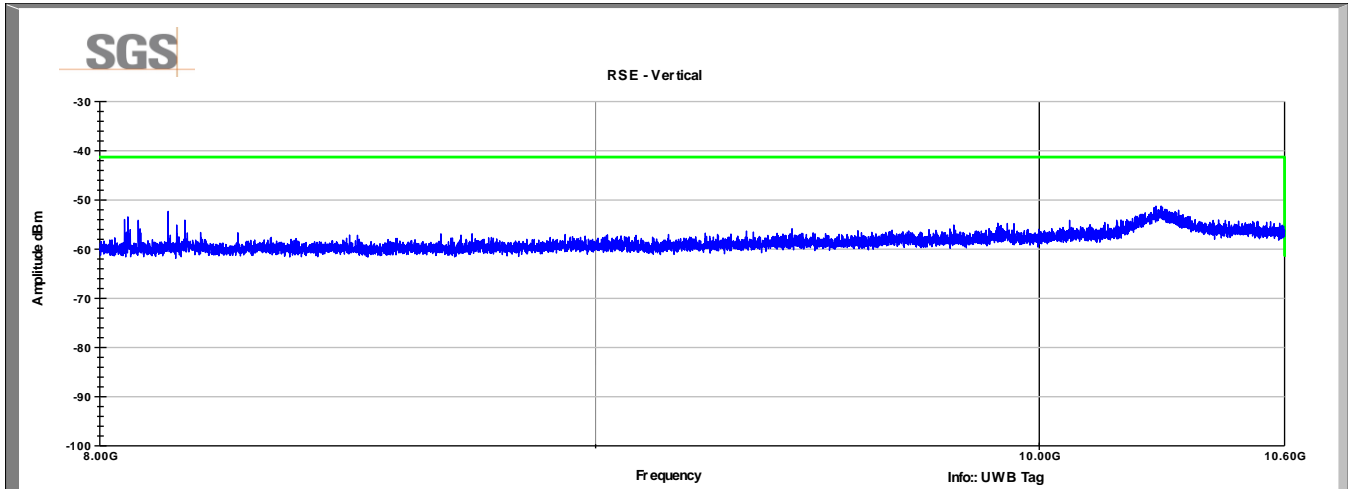
Date: 2.FEB.2015 10:51:05

Horizontal Scan

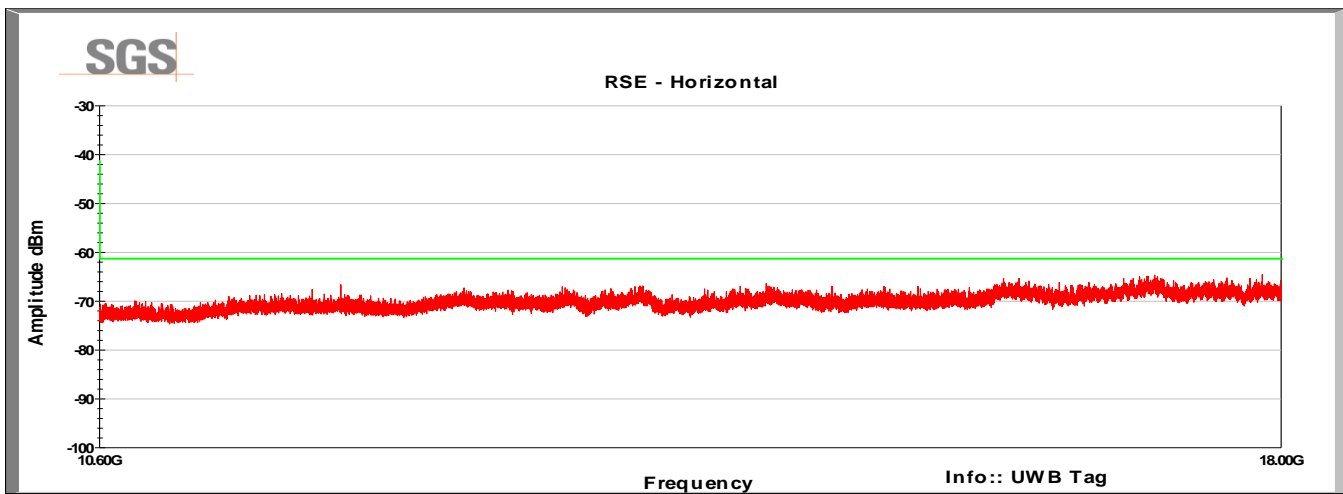
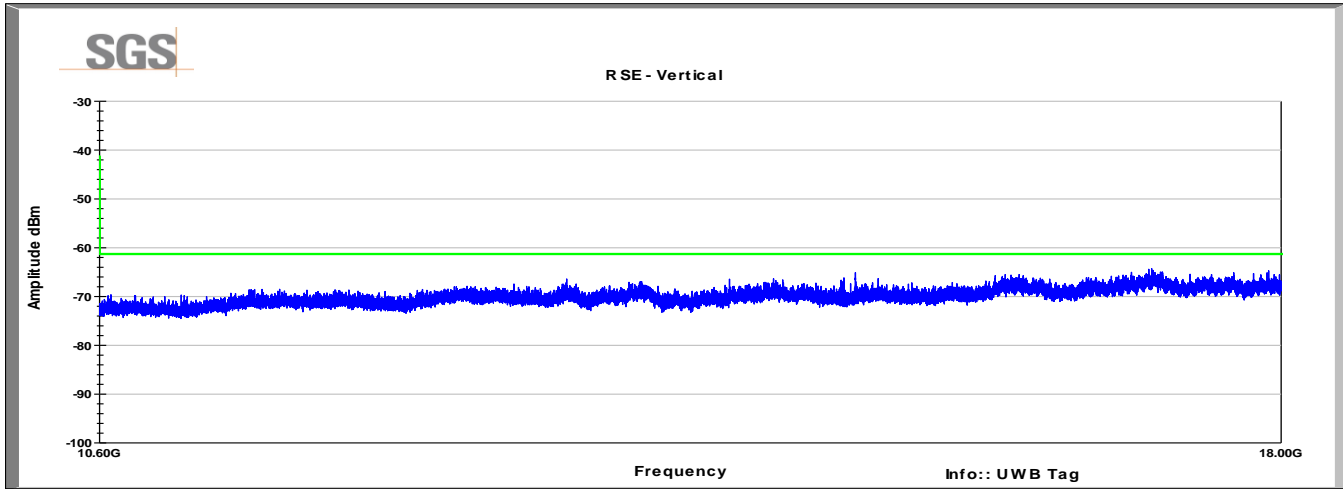


Date: 2.FEB.2015 11:01:21

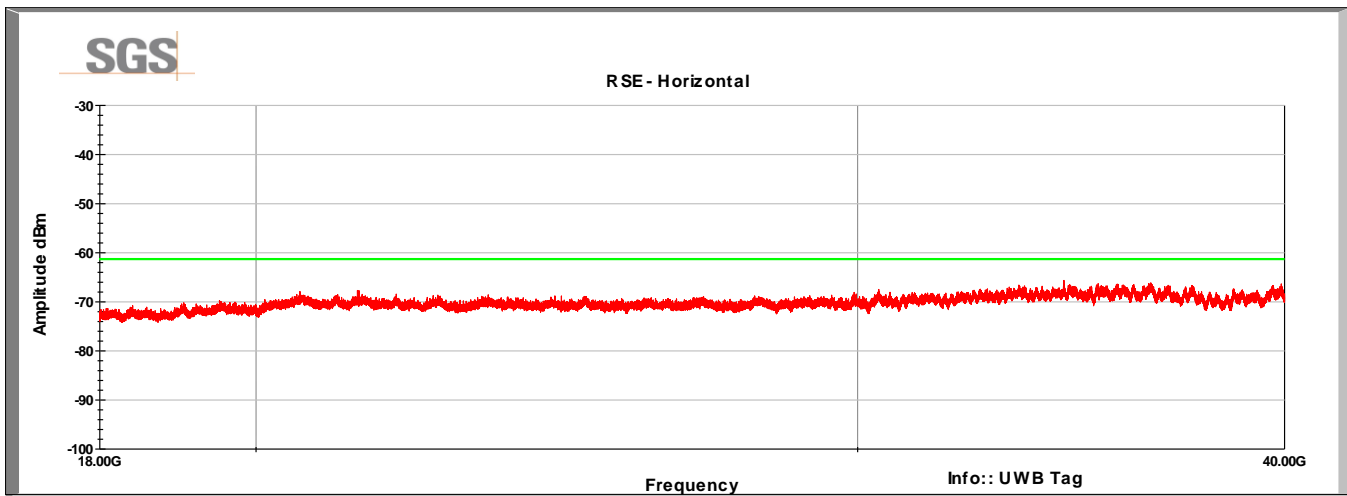
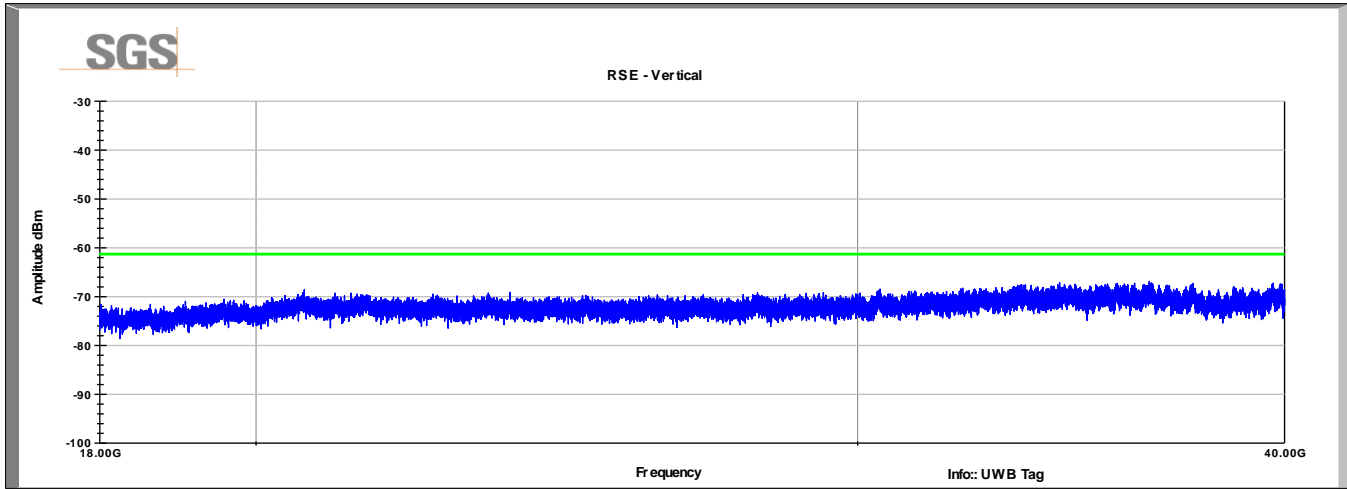
8000 to 10600 MHz
Test distance: 1m



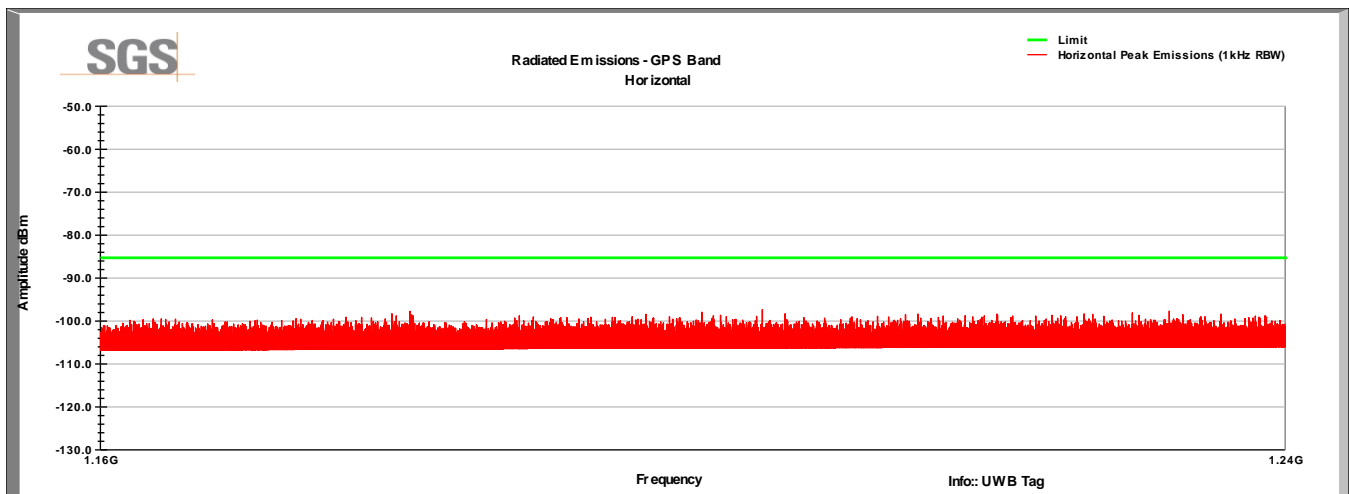
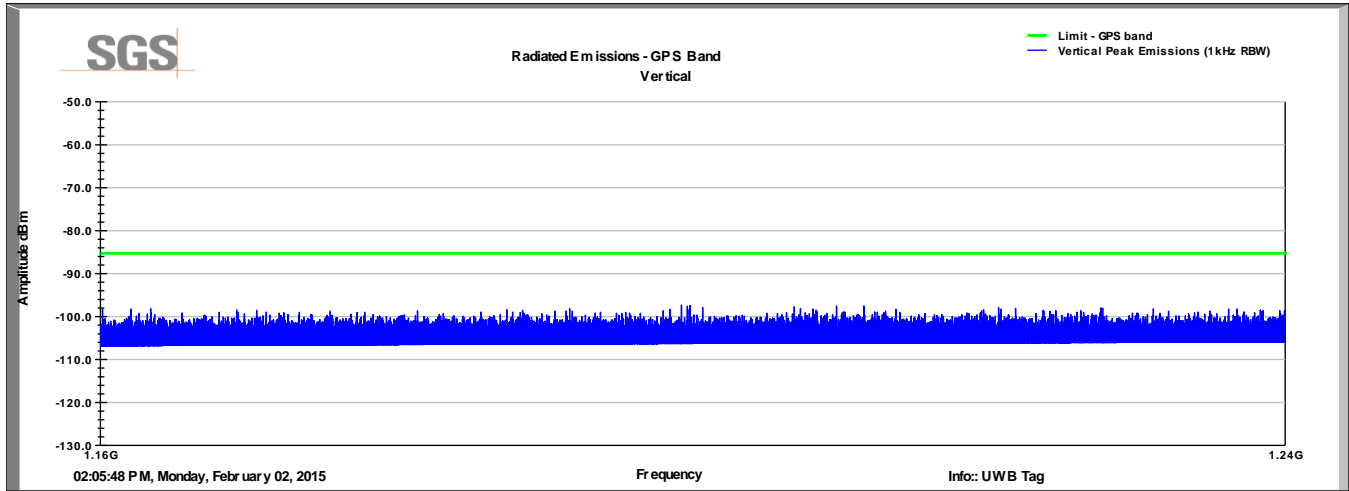
10.6 to 18 GHz
Test distance: 0.5m



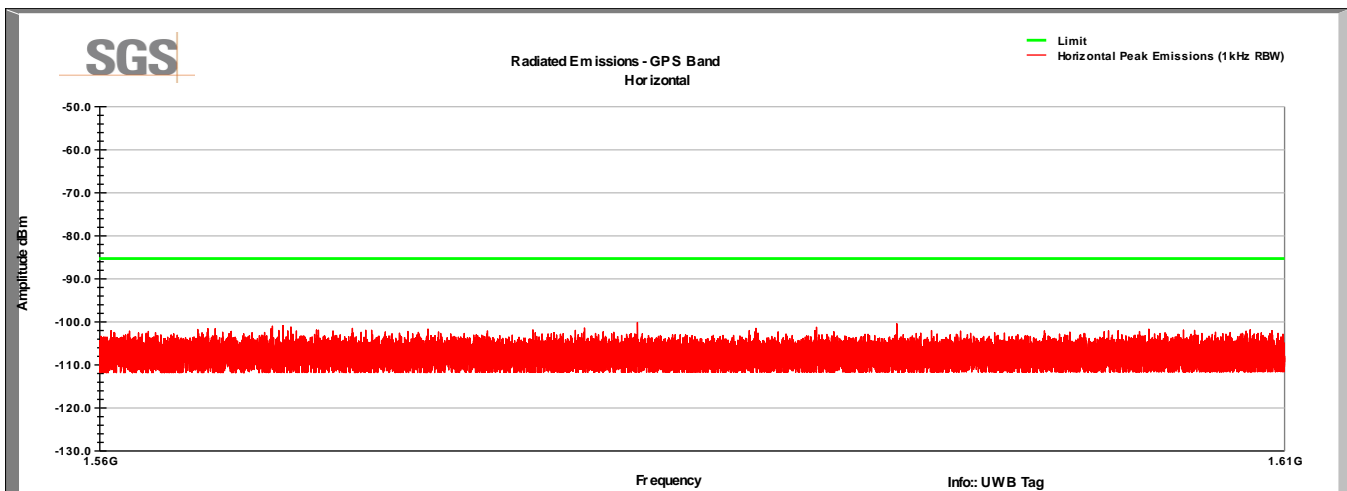
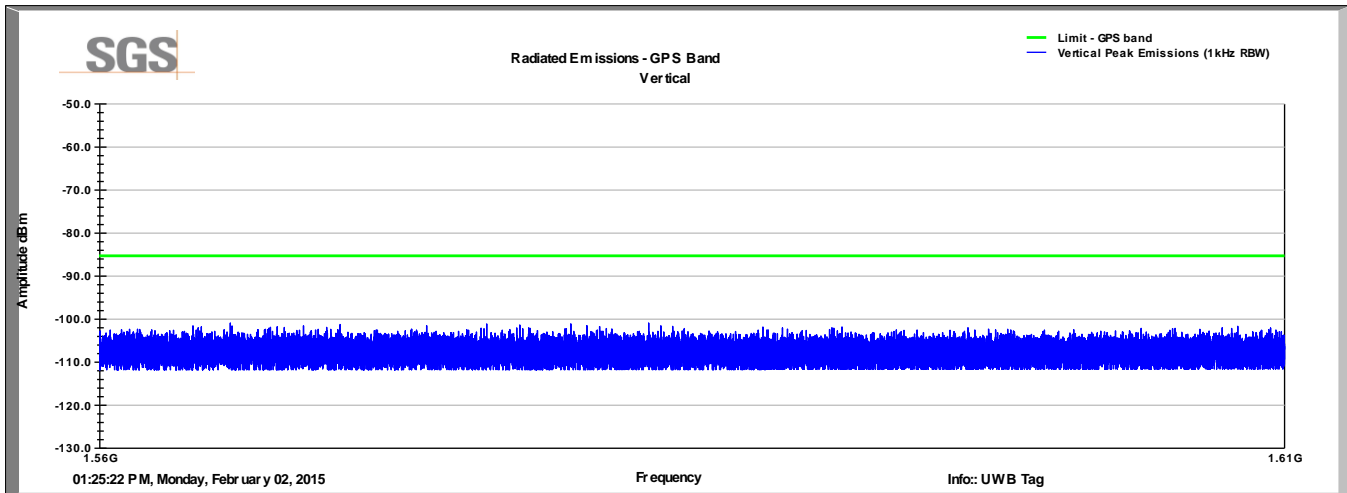
18 to 40 GHz
Test distance: 0.5m



Lower GPS Band
Test distance: 1m



Upper GPS Band
Test distance: 1m



7 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	3 Feb 2015
1	Corrected typos, replaced duplicate scan with correct scan.	28 Feb 2015