EMC Test Report

Project Number: 2596347
Report Number: 2596347EMC-001 **Revision Level:** 0
Client: PLUS Location Systems

Equipment Under Test: UWB transmitter
Model Name: Region 1 Vertical Asset Tag
Model Number: 1101

Applicable Standards: FCC Part 15.250

Report issued on: 16 December 2011
Test Result: Compliant

Tested by: Brian Forster

Reviewed by: David Schramm

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

Reference	Description	Test Result
15.250(a)	10dB bandwidth contained within 5925 to 7250 MHz	Compliant
15.250(b)	10dB bandwidth greater than 50 MHz	Compliant
15.250(d)(1)	Radiated emissions above 960 MHz	Compliant
15.250(d)(2)	Radiated emissions in GPS receive band	Compliant
15.250(d)(3)	Peak emission in a 50 MHz bandwidth	Compliant
15.250(d)(4)	Radiated emissions below 960 MHz per 15.209	Compliant

1.1 *Modifications Required to Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Kevin Trach
Address:	4955 Corporate Drive Suite 101
City, State, Zip, Country:	Huntsville AL 35805

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:	UWB Transmitter Tag
Model Name:	Region 1 Vertical Asset Tag
Model Number:	1101
Serial Number:	002
Hardware Version:	300-0192 REV A
Voltage:	3Vdc cell / CR1632
Sample Received Date:	December 15, 2011
Dates of testing:	December 15 to December 16, 2011

2.4 *Operating Modes and Conditions*

The EUT was programmed by the manufacturer to run continuously exercising all modes of operation.

3 UWB Bandwidth requirements

3.1 *Test Result*

Test Description	Reference	Test Result
10dB bandwidth contained within 5925 to 7250 MHz	15.250(a)	Compliant
10dB bandwidth greater than 50 MHz	15.250(b)	Compliant

3.2 *Test Method*

1) The –10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925–7250 MHz band under all conditions of operation including the effects from stepped frequency, frequency hopping or other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.
2) 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).
3) 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.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.4 to 24.7℃
Relative Humidity: 37 to 47 %

3.4 *Test Equipment*

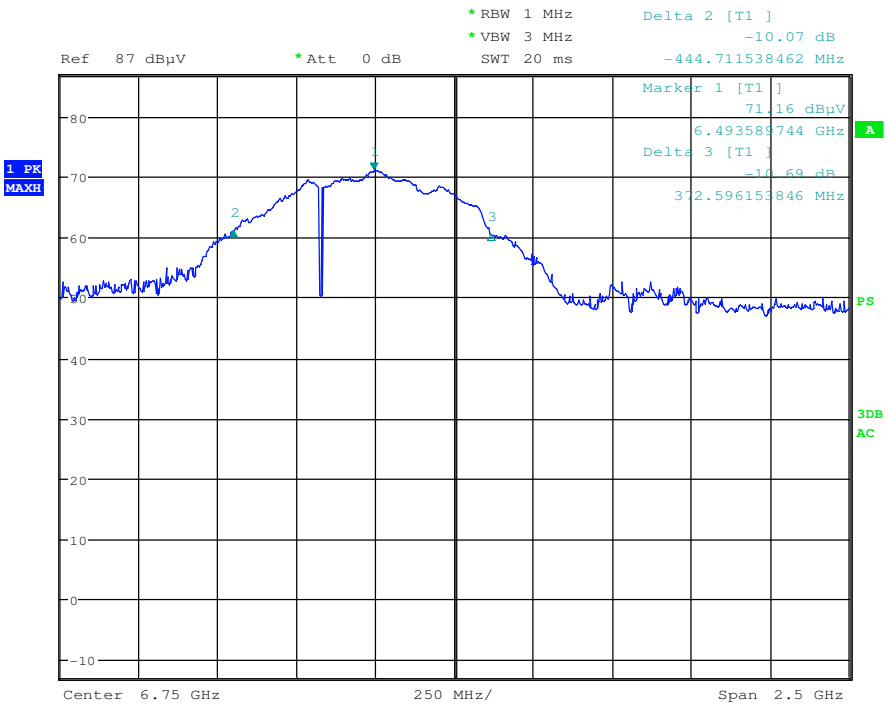
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ESU8	Rohde & Schwarz	B085759	19 May 2012
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2012
RF Preamplifier	NSP1800-25-HG	Miteq	B085930	10/14/2012
RF Cable	Sucoflex 106	Huber+Suhner	B079711	24 Aug 2012
RF Cable	Sucoflex 106	Huber+Suhner	B079713	24 Aug 2012

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

3.5 *Test Data*

Test Date: 15 DEC 2011
Operator: Brian Forster

Bandwidth Plot



Test Date: 15 DEC 2011
Operator: Brian Forster

Bandwidth Results					
Antenna Polarity	Frequency 10dB below peak MHz	Frequency 10dB above peak MHz	10 dB bandwidth MHz	Bandwidth requirement >500 MHz	Detectors / RBW / VBW
V	6,048.878	6,866.186	817.31	Compliant	RMS 1MHz / 3MHz

4 Radiated emissions above 960 MHz

4.1 *Test Result*

Test Description	Reference	Test Result
Radiated emissions above 960 MHz	15.250(d)(1)	Compliant

4.2 *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 in dBm	EIRP (dBµV/m) at 3m	EIRP (dBµV/m) at 1m
960–1610	-75.3	19.9	29.4
1610–1990	-63.3	31.9	41.4
1990–3100	-61.3	33.9	43.4
3100–5925	-51.3	43.9	53.4
5925–7250	-41.3	53.9	63.4
7250–10600	-51.3	43.9	53.4
Above 10600	-61.3	33.9	43.4

Because the limits are so low, some bands may have been scanned at a distance closer than 1 meter. If any emissions were detected in these bands, final measurements were made at distance of 1 meter or greater. The actual distance for final measurement was indicated in the measurement data.

4.3 *Test Site*

10m Absorber Lined Shielded Enclosure, SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.4 to 24.7℃
Relative Humidity: 37 to 47 %

4.4 *Test Equipment*

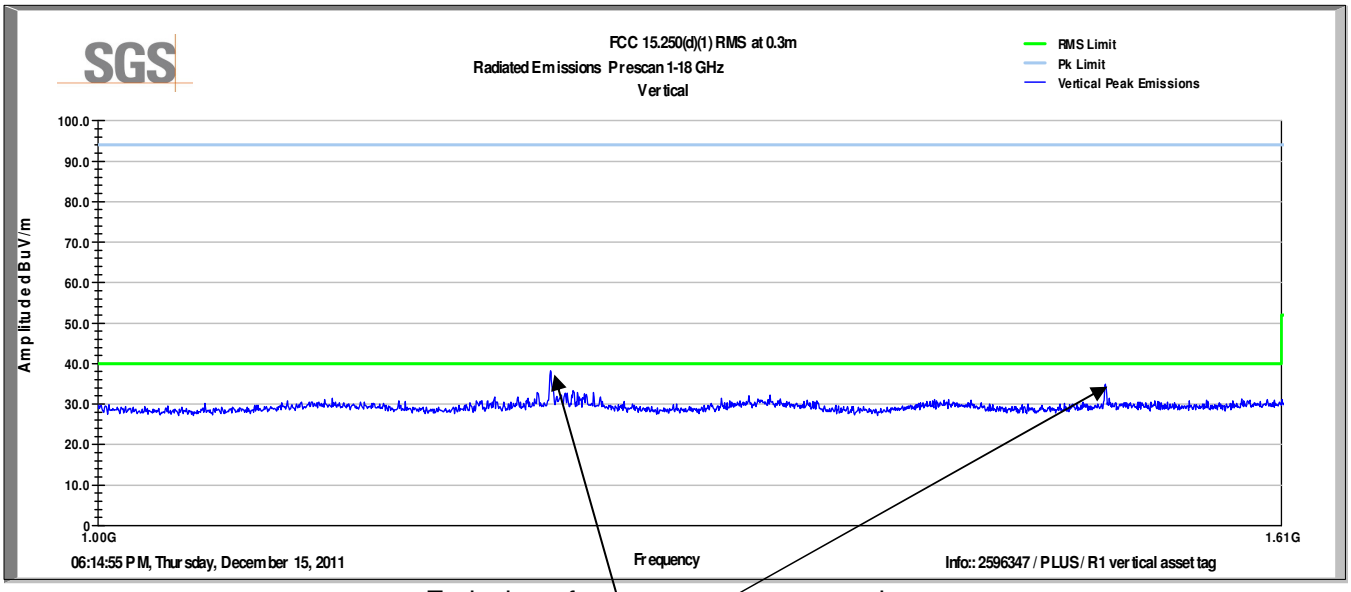
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ESU8	Rohde & Schwarz	B085759	19 May 2012
Spectrum Analyzer	ESU40	Rohde & Schwarz	B079629	25 Aug 2012
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2012
DRWG Antenna	3116B	ETS-Lindgren	B079695	11 Jan 2012
RF Preamplifier	NSP1800-25-HG	Miteq	B085930	10/14/2012
RF Preamplifier	NSP1840-HG	Miteq	B087572	10/14/2012
RF Cable	Sucoflex 106	Huber+Suhner	B079711	24 Aug 2012
RF Cable	Sucoflex 106	Huber+Suhner	B079713	24 Aug 2012
RF Cable	Sucoflex 102	Huber+Suhner	B079822	23 Nov 2012
RF Cable	Sucoflex 102	Huber+Suhner	B079823	23 Nov 2012

Note: The calibration period equipment is 1 year.

4.5 *Test Data*

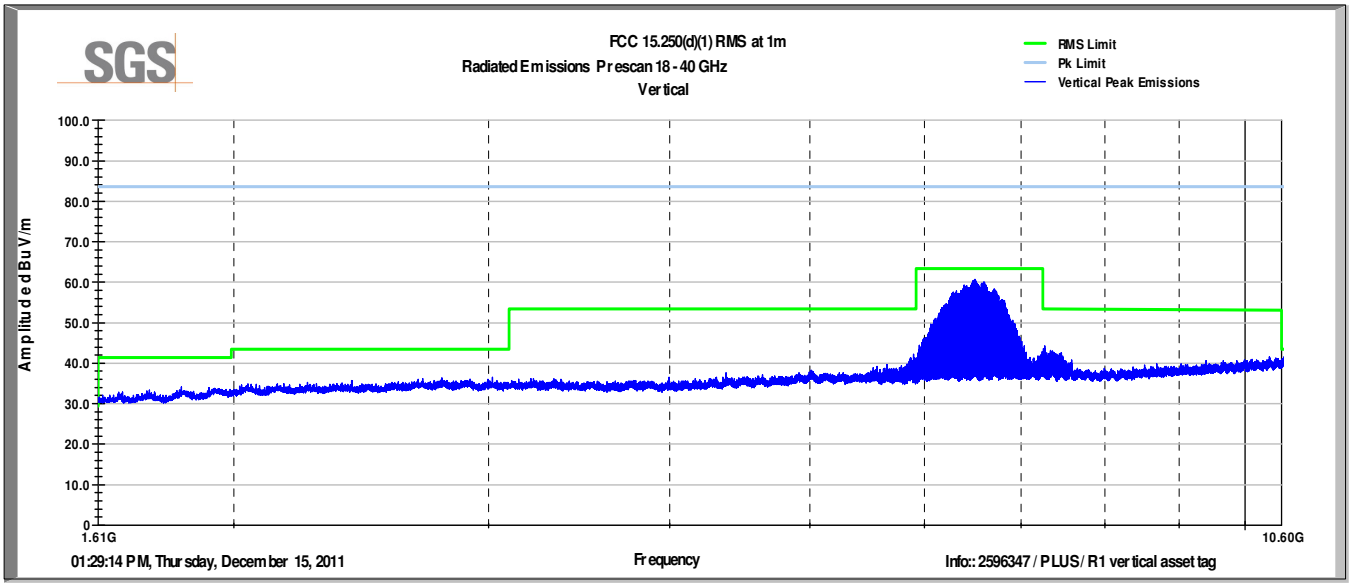
Test Date: 15 DEC 2011
Operator: Brian Forster

Plot: Vertical Emissions Pre-scan from 1 to 1.61 GHz at 0.3m

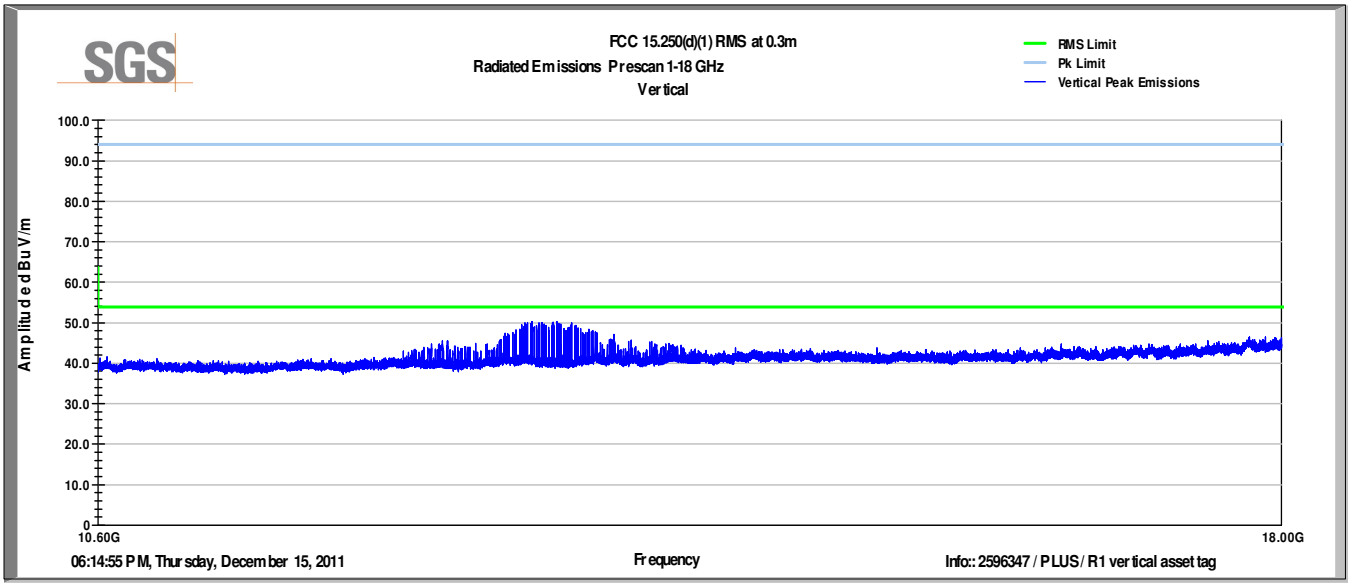


Emissions from measurement receiver

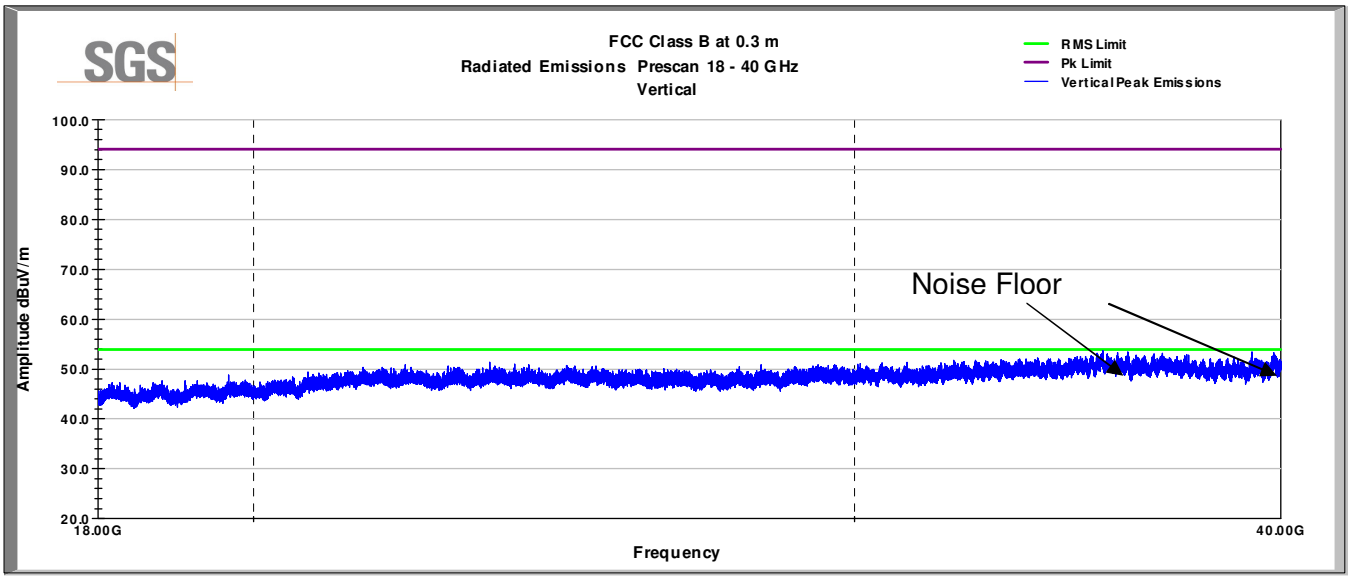
Plot: Vertical Emissions Pre-scan from 1.61 to 10.6 GHz at 1m



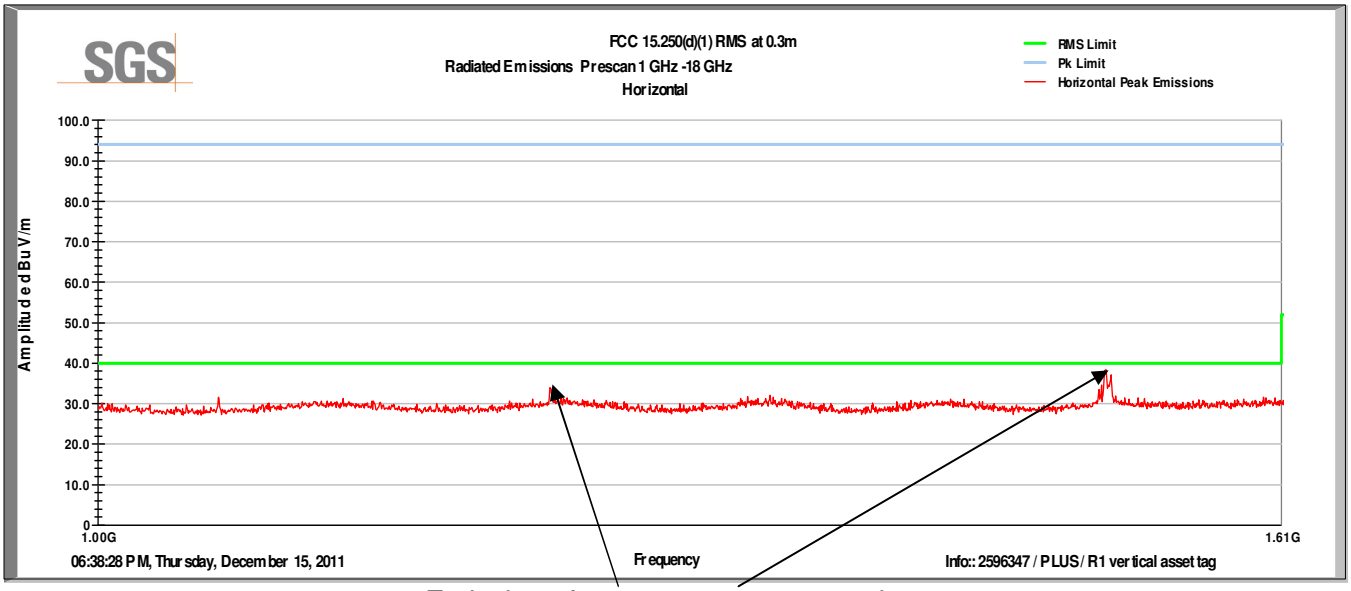
Plot: Vertical Emissions Pre-scan from 10.6 to 18 GHz at 0.3m



Plot: Vertical Emissions Pre-scan from 18 to 40 GHz at 0.3m

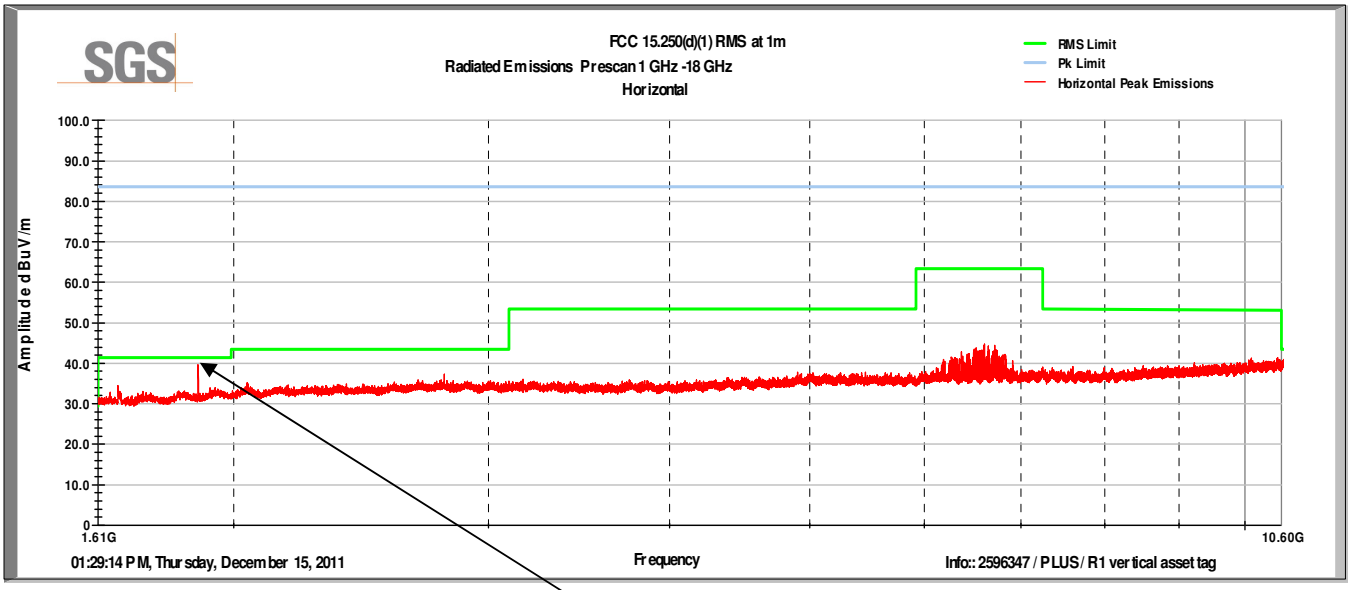


Plot: Horizontal Emissions Pre-scan from 1 to 1.61 GHz at 0.3m



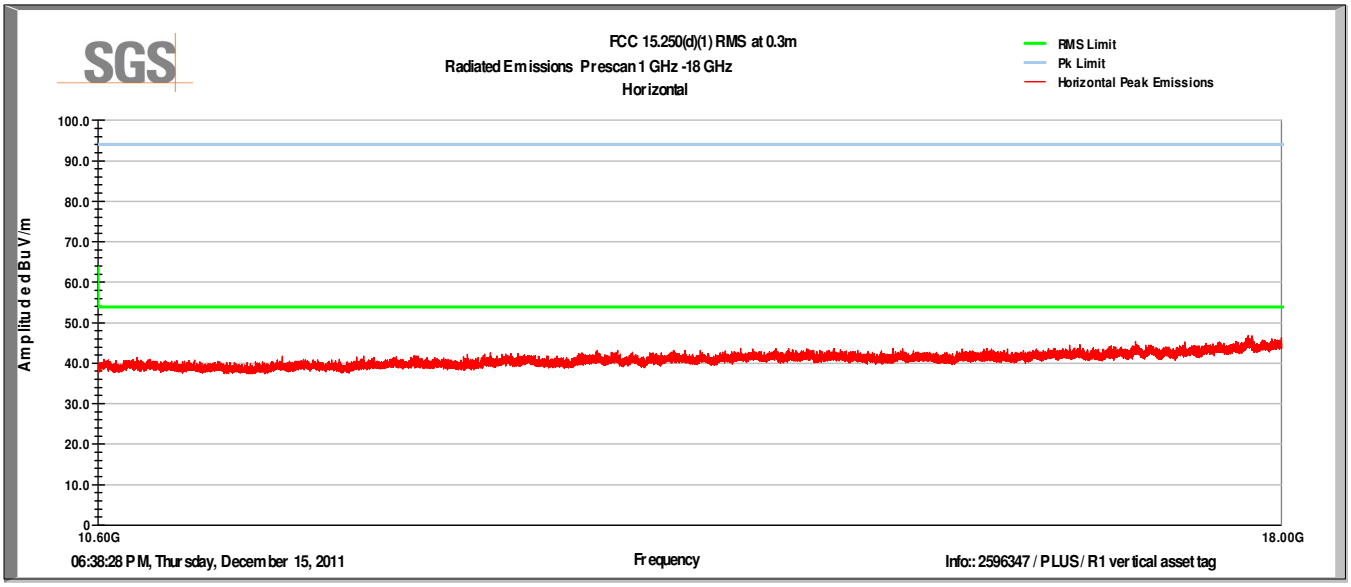
Emissions from measurement receiver

Plot: Horizontal Emissions Pre-scan from 1.61 to 10.6 GHz at 1m

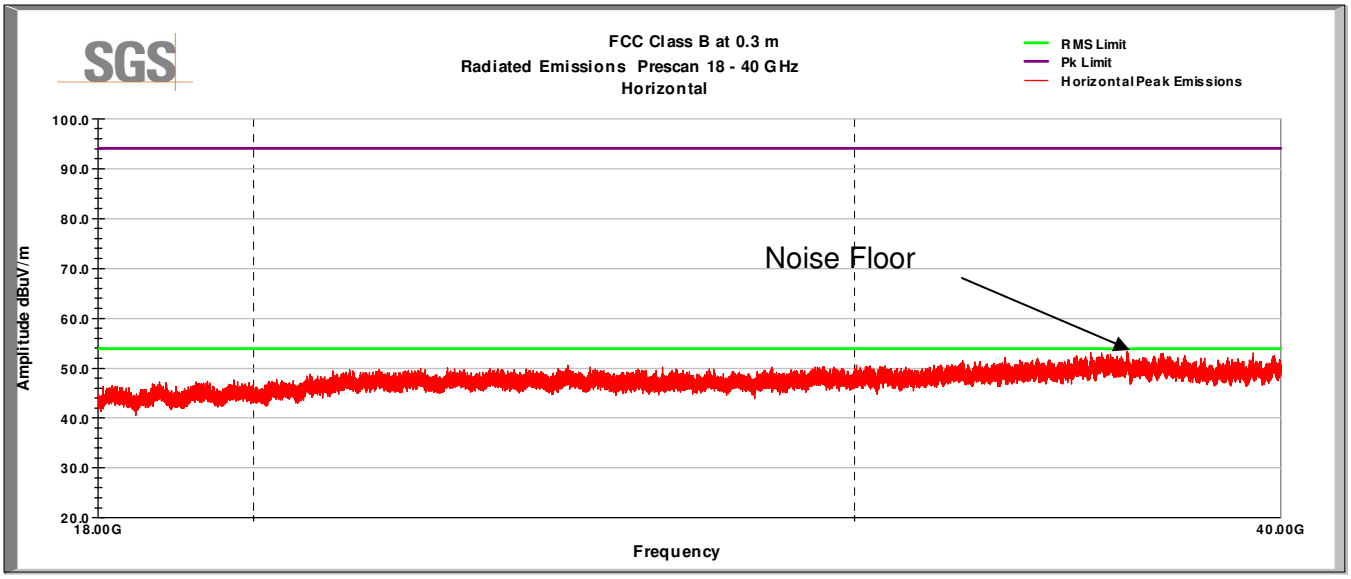


Emissions from measurement receiver

Plot: Horizontal Emissions Pre-scan from 10.6 to 18 GHz at 0.3m



Plot: Horizontal Emissions Pre-scan from 18 to 40 GHz at 0.3m



Radiated Power Density Results					
Antenna Polarity	Frequency MHz	Measurement at 1m dB(µV/m)	Limit at 1m dB(µV/m)	Margin dB	Detectors / RBW / VBW
V	6.49167	61.4	63.4	-2.0	RMS / 1 MHz / 3 MHz
There were no other emissions detected above the measurement equipment noise floor.					

5 Radiated emissions in GPS receive band

5.1 *Test Result*

Test Description	Reference	Test Result
Radiated emissions in GPS receive band	15.250(d)(2)	Compliant

5.2 *Test Method*

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	EIRP (dBµV/m) at 3m	EIRP (dBµV/m) at 1m
1164–1240	-85.3	9.9	19.4
1559–1610	-85.3	9.9	19.4

5.3 *Test Site*

10m Absorber Lined Shielded Enclosure, SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 23.4 to 24.7℃
Relative Humidity: 37 to 47 %

5.4 *Test Equipment*

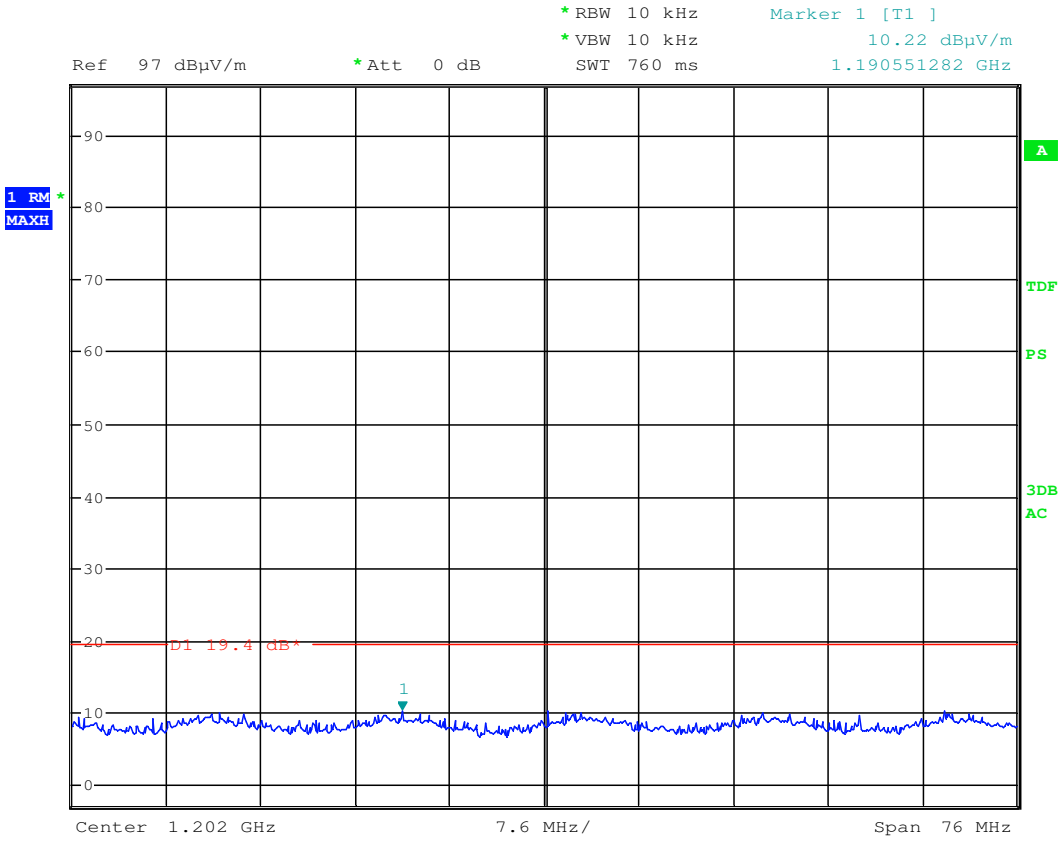
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ESU8	Rohde & Schwarz	B085759	19 May 2012
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2012
RF Preamplifier	NSP1800-25-HG	Miteq	B085930	10/14/2012
RF Cable	Sucoflex 106	Huber+Suhner	B079711	24 Aug 2012
RF Cable	Sucoflex 106	Huber+Suhner	B079713	24 Aug 2012

Note: The calibration period equipment is 1 year.

5.5 *Test Data*

Test Date: 15 DEC 2011
Operator: Brian Forster

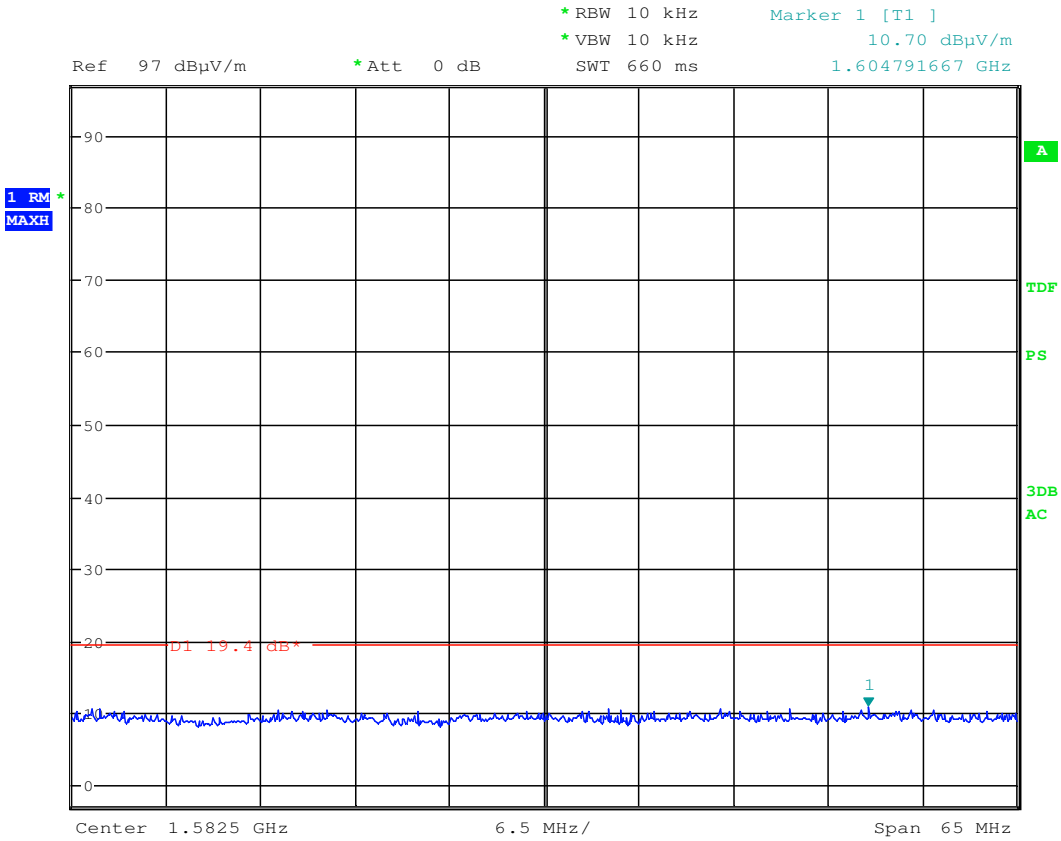
Plot: Radiated Emissions in lower GPS Receive Band



Data: Radiated Emissions in lower GPS Receive Band

There were no emissions detected above the measurement equipment noise floor.

Plot: Radiated Emissions in upper GPS Receive Band



Data: Radiated Emissions in upper GPS Receive Band

There were no emissions detected above the measurement equipment noise floor.

6 Peak Power within a 50 MHz bandwidth

6.1 *Test Result*

Test Description	Basic Standards	Test Result
Peak Power in a 50 MHz Bandwidth	15.250	Compliant

6.2 *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 and this 50 MHz bandwidth must be contained within the 5925–7250 MHz band.
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.

Frequency (MHz)	EIRP in 50 MHz BW dBm	EIRP in 50 MHz BW (dBµV/m) at 3m	EIRP in 50 MHz BW (dBµV/m) at 1m
5925 – 7250	0	95.2	104.7

Frequency (MHz)	EIRP in 1 MHz BW dBm	EIRP in 1 MHz BW (dBµV/m) at 3m	EIRP in 50 MHz BW (dBµV/m) at 1m
5925 – 7250	-34	95.2	104.7

6.3 *Test Site*

10m Absorber Lined Shielded Enclosure, SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 to 24.7℃
Relative Humidity: 37 to 47 %

6.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ESU8	Rohde & Schwarz	B085759	19 May 2012
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2012
RF Preamplifier	NSP1800-25-HG	Miteq	B085930	10/14/2012
RF Cable	Sucoflex 106	Huber+Suhner	B079711	24 Aug 2012
RF Cable	Sucoflex 106	Huber+Suhner	B079713	24 Aug 2012

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

6.5 *Test Data*

Test Date: 15 DEC 2011
Operator: Brian Forster

Peak Power Results						
Antenna Polarity	Frequency MHz	Field Strength at 1m dBµV/m	EIRP RBW: 1 MHz dBm	EIRP 1 MHz Limit dBm	Margin	Detectors / RBW / VBW
V	6.49167	66.0	-38.7	-34.0	-4.7	Peak 1MHz / 3MHz

EIRP = Field Strength (at 1m) – 104.74
Margin = EIRP - Limit

7 Radiated emissions below 960 MHz

7.1 *Test Result*

Test Description	Basic Standards	Test Result
Radiated Emissions	FCC Part 15.250(d)(4) and 15.209	Compliant

7.2 *Test Method*

The initial preliminary 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 dBµV/m)	Distance
30 – 88	40	3m
88 – 216	43.5	3m
216 – 960	46	3m

7.3 *Test Site*

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

Environmental Conditions
Temperature: 23.4 to 24.7℃
Relative Humidity: 37 to 47 %

7.4 *Test Equipment*

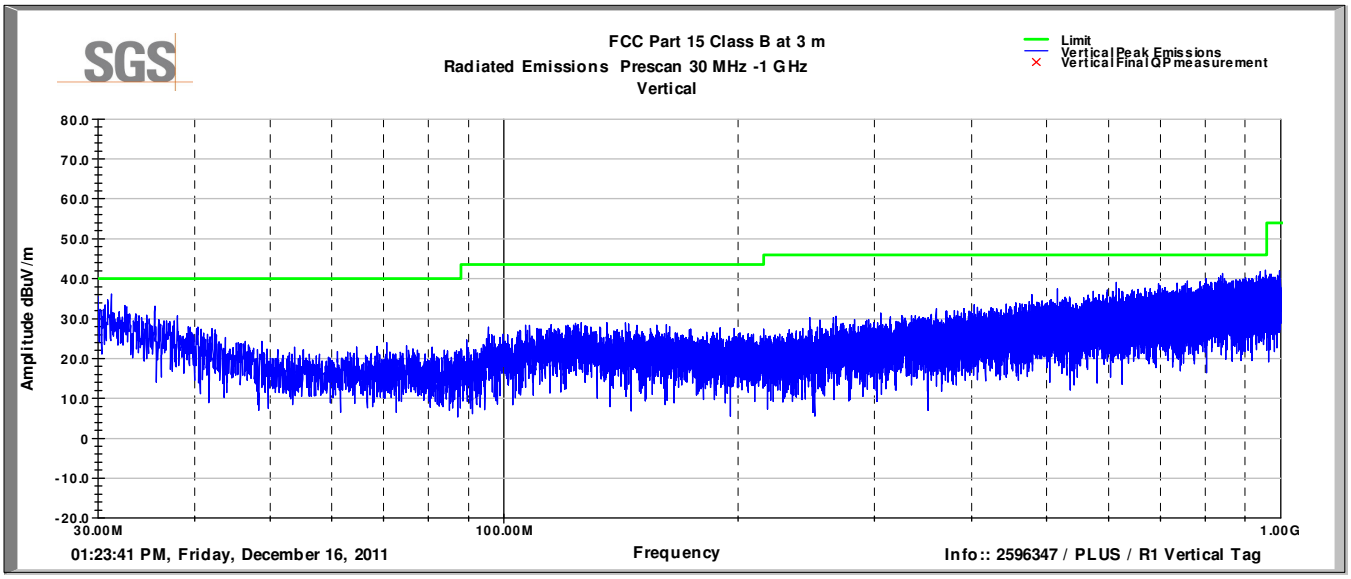
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	24 Aug 2012
Receiver	ESU8	Rohde & Schwarz	B085759	19 May 2012
Pre-Amplifier	NSP1800-25-HG	Mini-Circuits	B079817	
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079712	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079711	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B085888	26 Sep 2012

Note: The calibration period equipment is 1 year.
Software: “Radiated Emissions” TILE! profile dated 15 Oct 2011

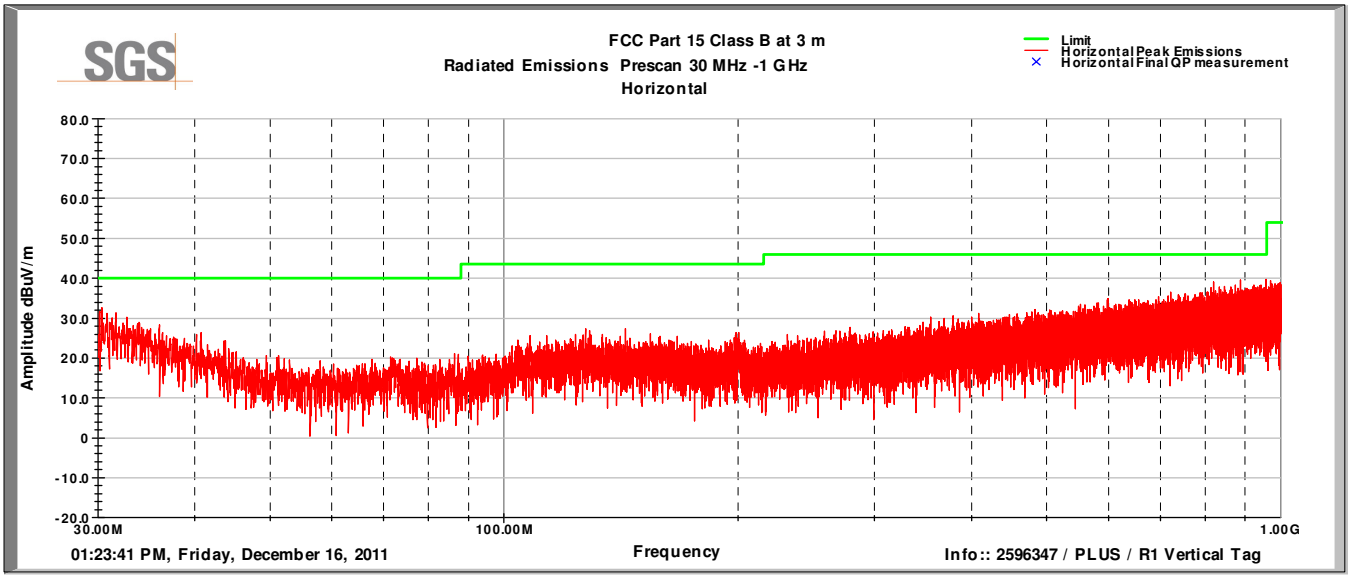
7.5 *Test Data*

Test Date: 16 DEC 2011
Operator: David Schramm

Vertical Radiated Emissions Plot

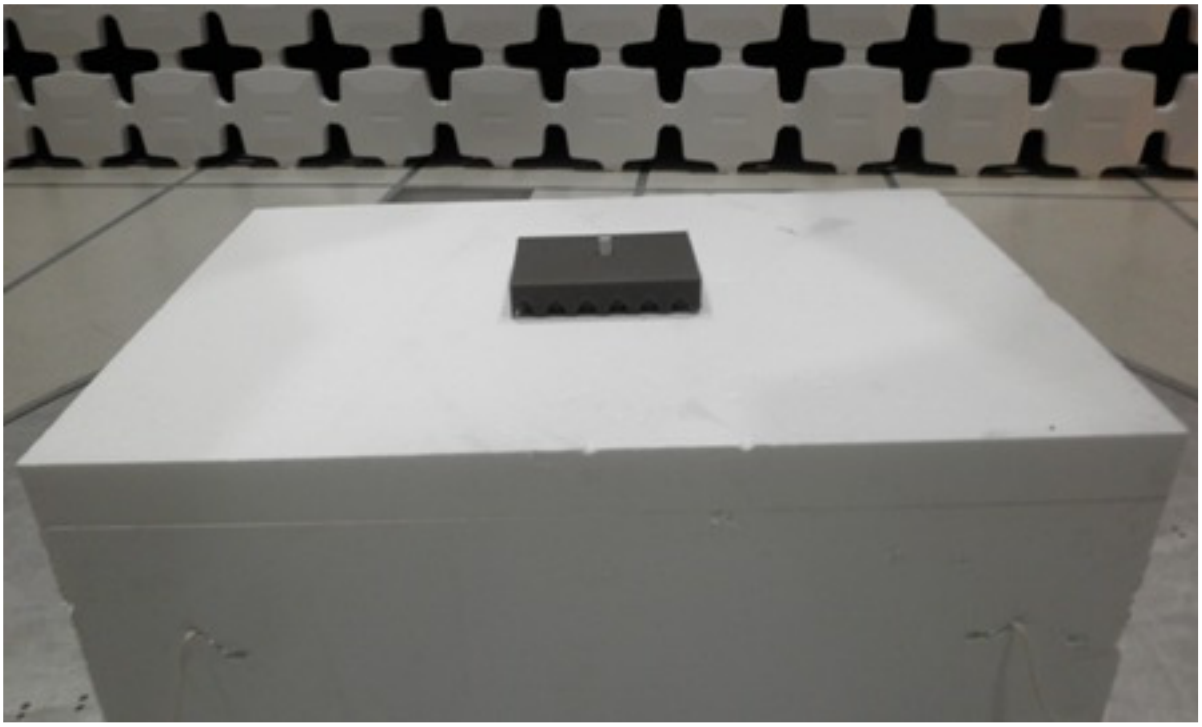


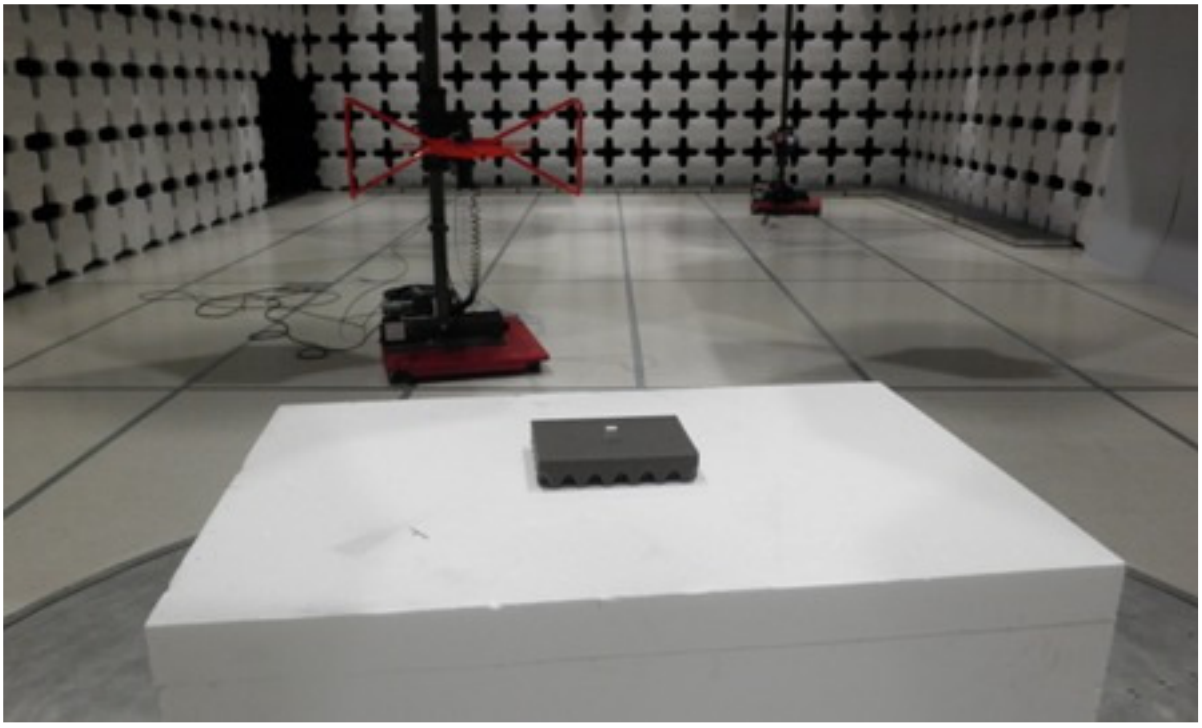
Horizontal Radiated Emissions Plot



Note: There were no emissions detected above the measurement noise floor.

8 Test Setup Photographs





9 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	16 Dec 2011