EMC Test Report

Project Number: **3101838**

Report Number: **3101838EMC02** **Revision Level:** **1**

Client: **Radio Systems**

Equipment Under Test: **Invisible Fence pet containment unit**

Model Name: **Invisible Fence GPSC**

Model Number: **RIG00-13671**

Applicable Standards: **FCC Part 95J**

Report issued on: **12 June 2013**

Test Result: **Compliant**

Tested by: _____
Brian Forster
EMC Engineer

Reviewed by: _____
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
Emissions Testing		
Radiated Spurious Emissions	Part 2.1053	Compliant
Conducted Spurious Emissions	Part 2.1051 and 95.635	Compliant
Occupied Bandwidth	Part 2.1049 and 95.633	Compliant
95J Emissions Mask	Part 2.1051	Compliant
Output Power	Part 2.1046 and 95.639(h)	Compliant
Radiated Power: ERP		Reported
Frequency Stability over Temperature and Voltage Variation	Part 2.1055 and Part 95.632	Compliant

1.1 *Modifications Required to Compliance*

None

2 General Information

2.1 *Client Information*

Name: Radio Systems
Address: 10427 Petsafe Way
City, State, Zip, Country: Knoxville TN 37932

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 Name: GPS Mobile Unit (GPSC)
Model Number: RIG00-13671
Hardware Version: 00
Software Version: V0.407
Rated Voltage: 3.7VDC
Test Voltage: 3.7VDC

Sample Received Date: 20MAR2013
Dates of testing: 27MAR to 03APR2013

2.4 *Operating Modes and Conditions*

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

2.5 *EUT Connection Block Diagram*

2.6 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Radio Systems	EUT	RIG00-13727	NA

2.7 *Cable List*

None

3 Field strength of spurious radiation

3.1 *Test Result*

Test Description	Basic Standards	Test Result
Field strength of spurious radiation	FCC Part 2.1053 FCC Part 95, Subpart J TIA-603C	Compliant

3.2 *Test Method*

The EUT was set to operate at maximum power with the antenna port fitted with a 50 ohm non-radiating load. The initial preliminary exploratory scans were performed from 30 MHz to 2GHz 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 receiver's 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 below.

Radiated emissions limit is defined outside the fundamental frequency by more than 12.5 kHz as being attenuated from the highest emission by 50 + 10log(P); which is -20 dBm, which was converted to a field strength measurement limit of 75.2 dBµV at 3m. Any emissions within 20 dB of the limit were measured using the substitution method.

3.3 *Test Site*

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

Environmental Conditions

Temperature:	22.7 °C
Relative Humidity:	51.0 %
Atmospheric Pressure:	101.5 kPa

3.4 *Test Equipment*

Test Start Date: 3/28/2013 Tested By: BKF
Test End Date: 3/28/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
BiLog Antenna	JB6	Sunol	B079690	12-Sep-13
Spectrum Analyzer	ZVL	R & S	B09799	24-Sep-13
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	13-Aug-13
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079661	13-Aug-13

Note: The calibration period equipment is 1 year.

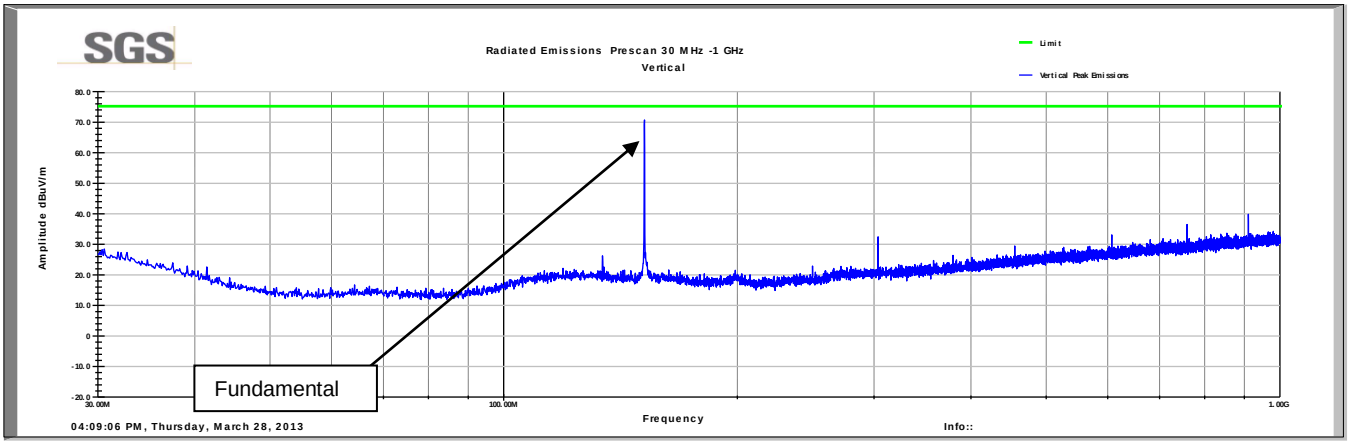
Software:
"Radiated Emissions" TILE! profile dated 28MAR2013

3.5 *Test Setup Photographs*

Photographs are contained in a separate exhibit

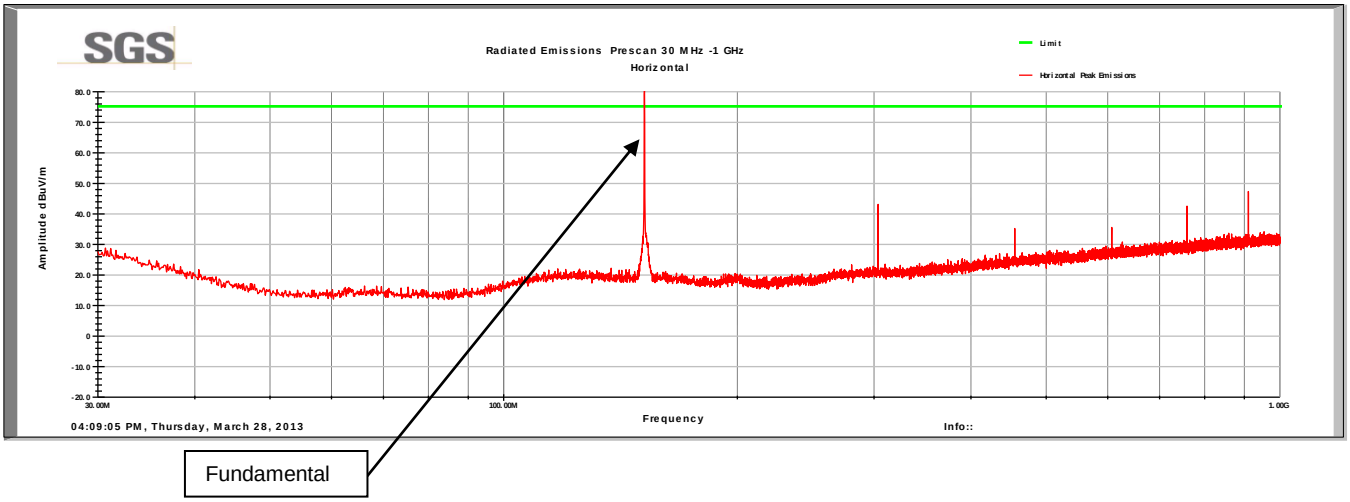
3.6 *Test Data*

30 – 1000 MHz
Vertical Radiated Emissions Plot



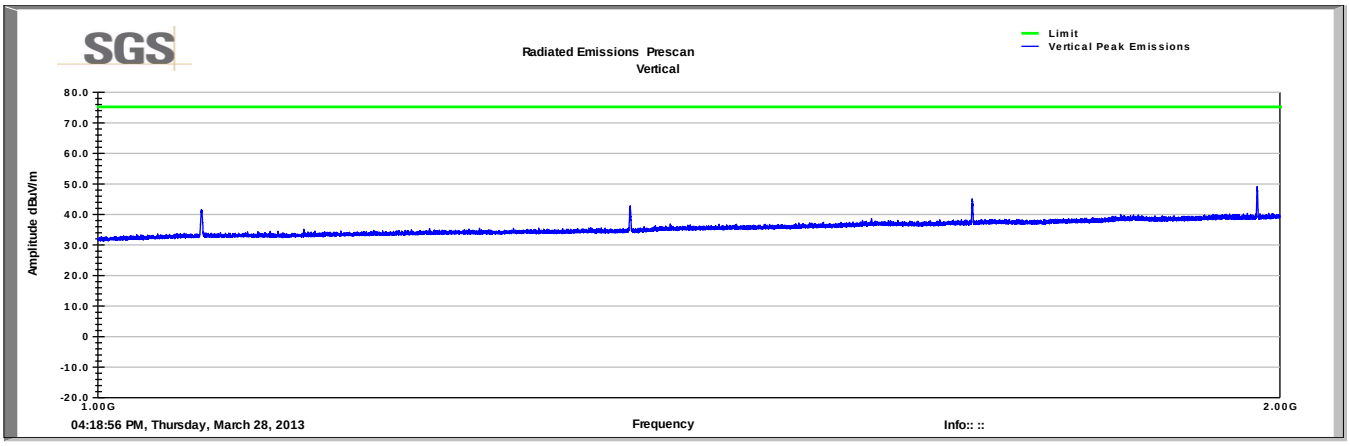
Note: No spurious emissions within 20 dB of the limit measured

30 – 1000 MHz
Horizontal Radiated Emissions Plot



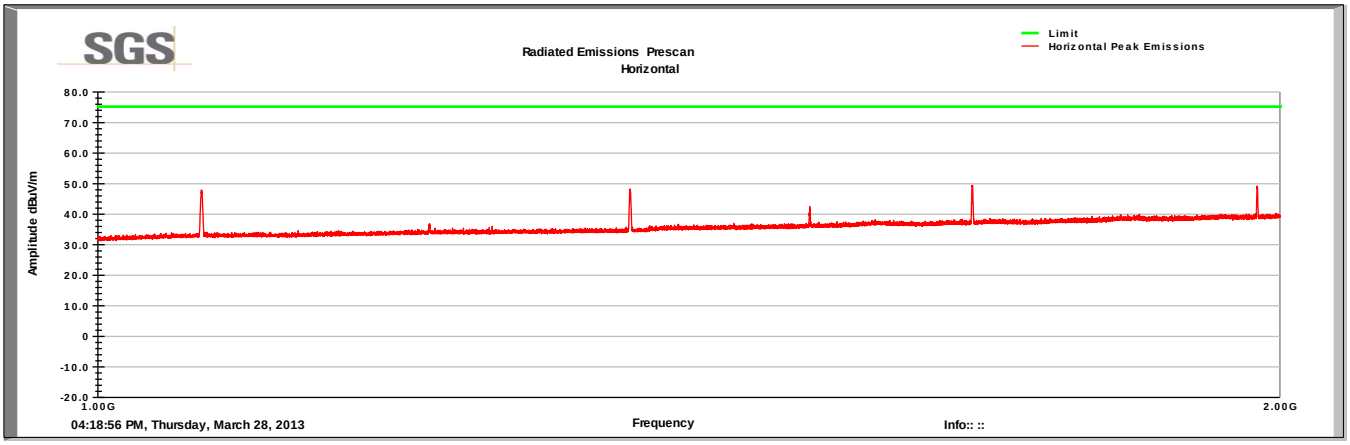
Note: No spurious emissions within 20 dB of the limit measured

1 – 2 GHz
Vertical Radiated Emissions Plot



Note: No emissions detected within 20 dB of the Limit

Horizontal Radiated Emissions Plot



Note: No emissions detected within 20 dB of the Limit

4 Conducted Spurious Emissions

4.1 *Test Result*

Test Description	Basic Standards	Test Result
Conducted Spurious Emissions	FCC Part 2.1051 FCC Part 95, Subpart J TIA-603C	Compliant

4.2 *Test Method*

With the spectrum analyzer resolution bandwidth set to 100 kHz the initial preliminary exploratory scans were performed over the measuring frequency range using a max hold mode incorporating a Peak detector. The final test data was measured using a Peak detector and compared against the limit of 50+10log(P) relative to the highest emission detected, which was calculated to be -20dBm.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.4 °C
Relative Humidity:	45.4 %
Atmospheric Pressure:	100.7 kPa

4.4 *Test Equipment*

Note: The calibration period equipment is 1 year.

Test Start Date: 4/3/2013 Tested By: BKF
Test End Date: 4/3/2013

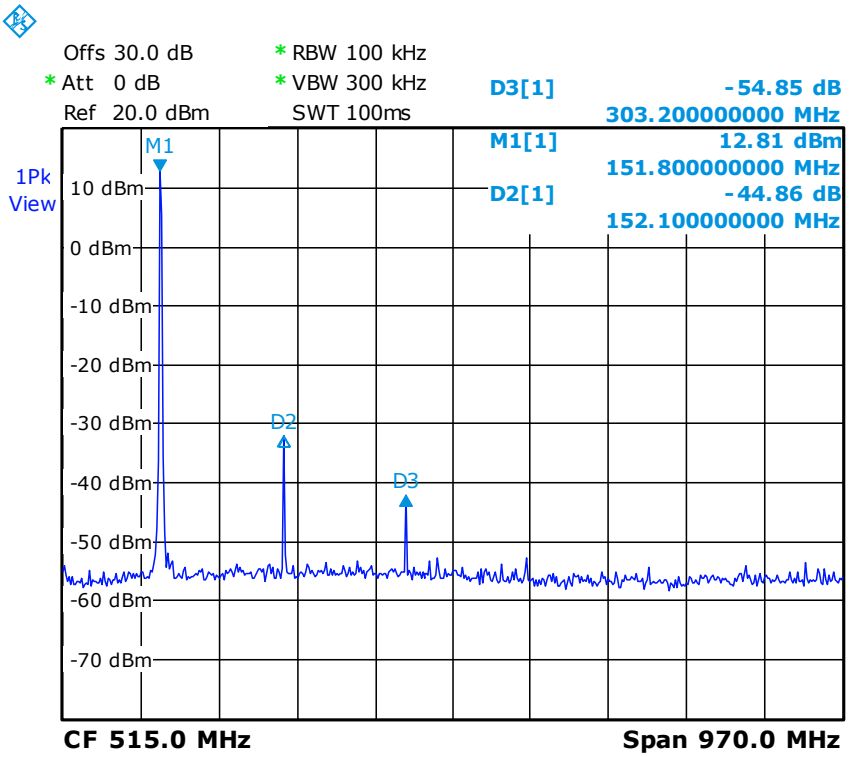
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ZVL	R & S	B079799	24-Sep-13
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	2-Dec-13

4.5 *Test Setup Photographs*

Photographs are contained in a separate exhibit

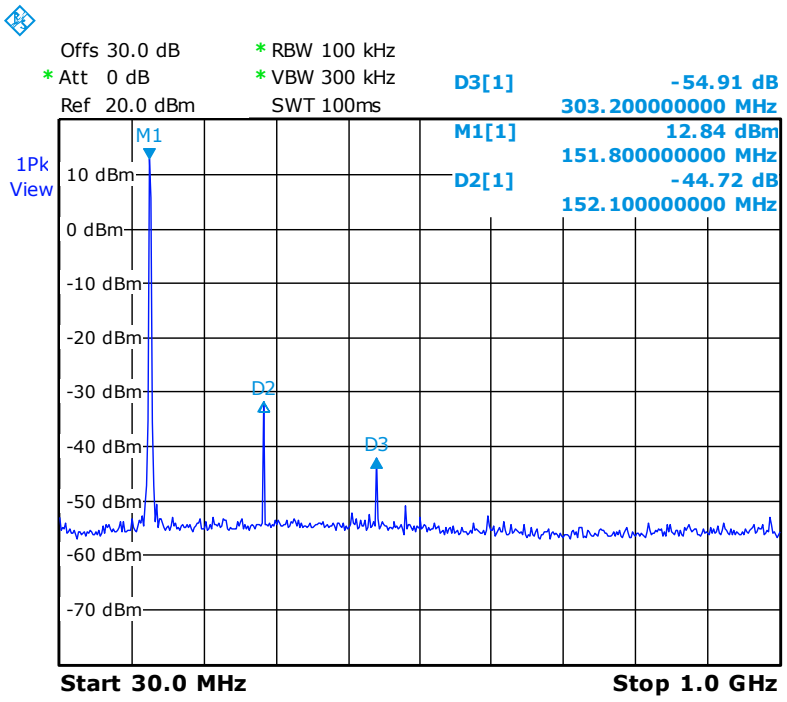
4.6 *Test Data*

Conducted Emissions Plot
30MHz to 1GHz
CW



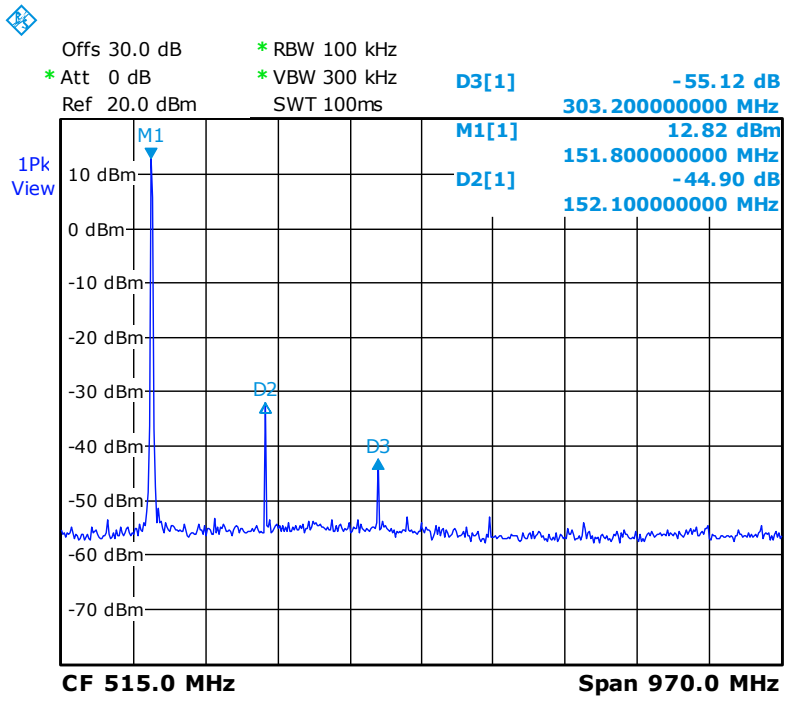
Date: 29.MAR.2013 05:04:11

1010 Data



Date: 29.MAR.2013 05:03:06

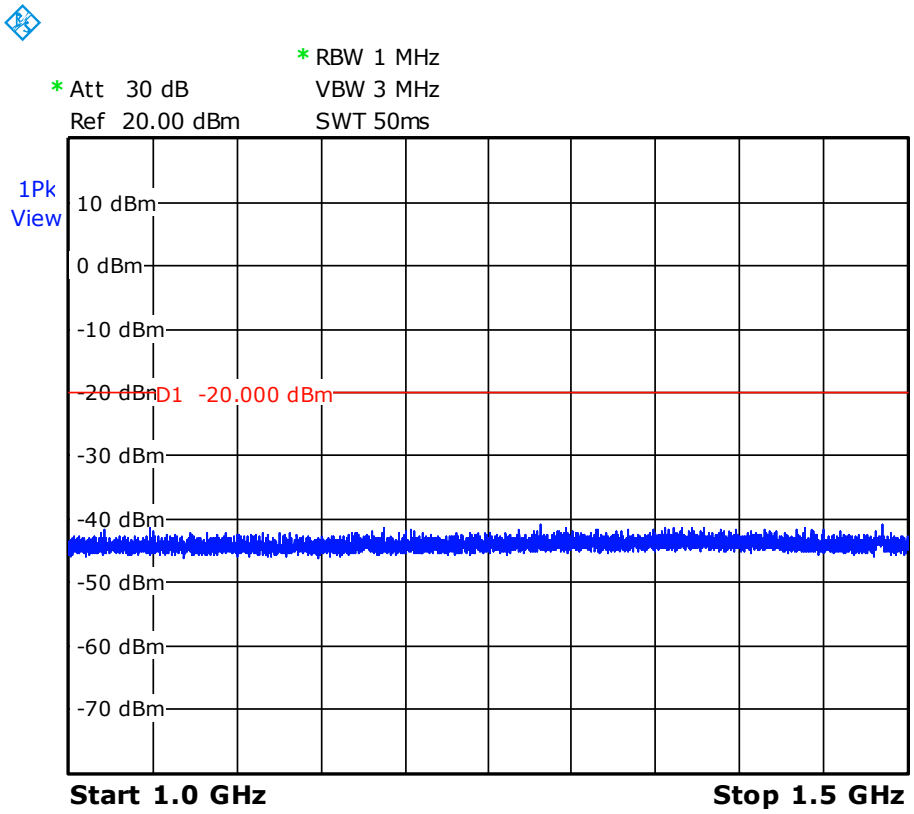
PN9 Data



Date: 29.MAR.2013 05:04:45

5

Conducted Emissions Data
1 to 1.5 GHz



Date: 3.APR.2013 19:17:41

5 Occupied Bandwidth

5.1 *Test Result*

Test Description	Basic Standards	Test Result
Occupied Bandwidth	FCC Part 2.1049 FCC Part 95 Subpart J Part 95.633 f(1)	Compliant

5.2 *Test Method*

The maximum emission was determined via conducted measurement, the signal above and below the highest emission frequency at 26 dB down was measured and the difference in marker frequencies was reported as the occupied bandwidth. The authorized bandwidth for 151.82 MHz is 11.25 kHz.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.7 °C
Relative Humidity:	51.0 %
Atmospheric Pressure:	101.5 kPa

5.4 *Test Equipment*

Note: The calibration period equipment is 1 year.

Test Start Date: 3/29/2013 Tested By: BKF

Test End Date: 3/29/2013

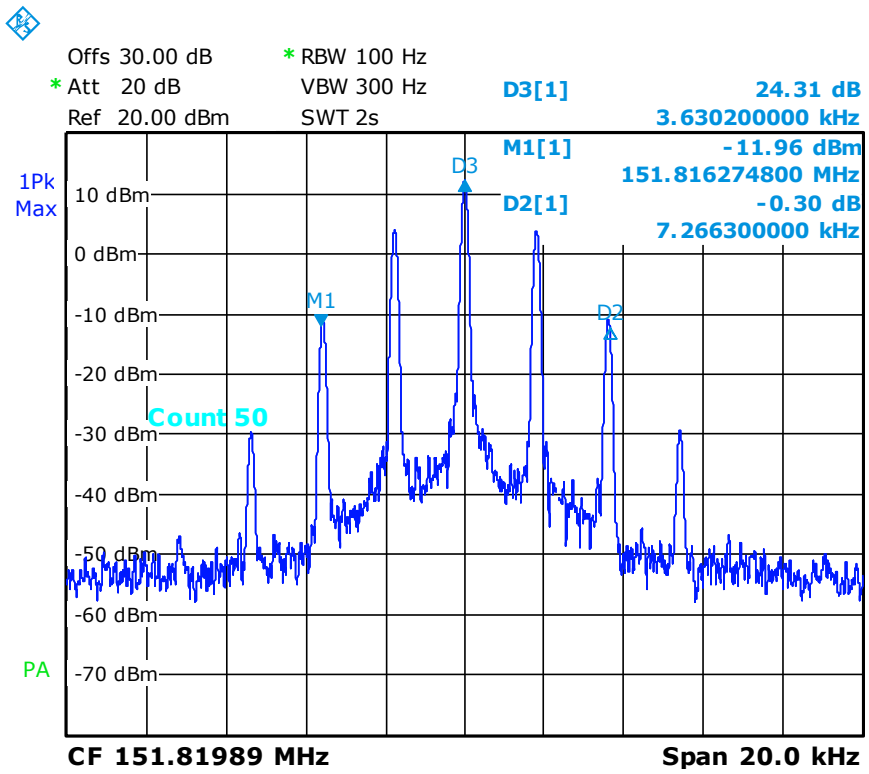
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ZVL	R & S	B079799	1-Jul-13
30dB attenuator	BW-S30W24	Mini-Circuits	NA	NA
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	2-Dec-13

5.5 *Test Results*

Modulation	Bandwidth(kHz)
1010 data	7.260
PN9	6.950

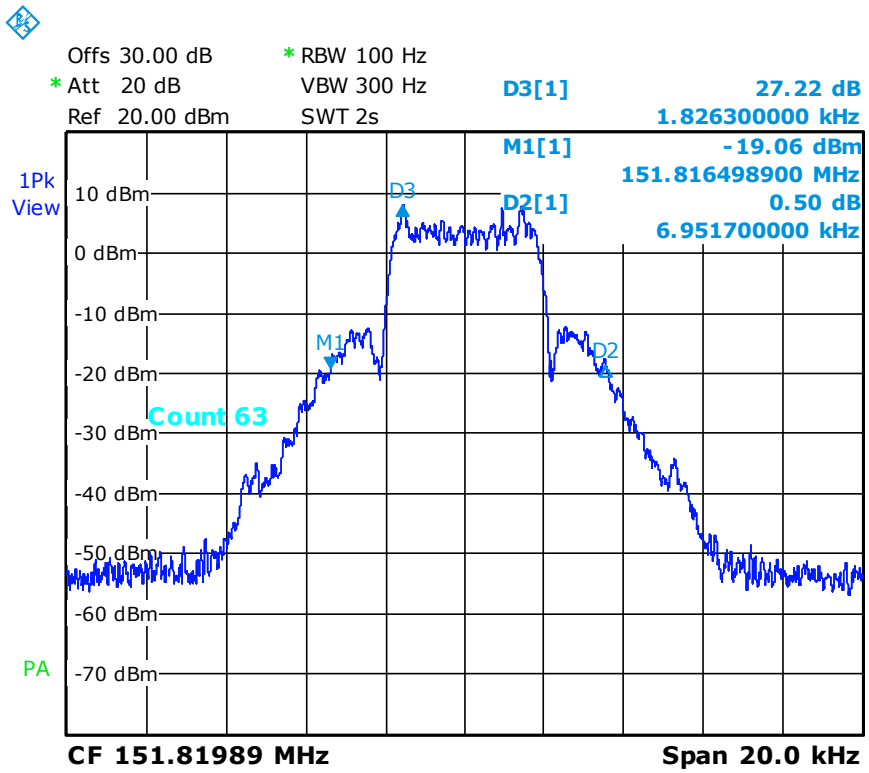
5.6 *Test Data*

1010 Data



Date: 29.MAR.2013 19:10:25

PN9 Data



Date: 29.MAR.2013 19:08:10

6 Emissions Mask

6.1 *Test Result*

Test Description	Basic Standards	Test Result
Emissions Mask	FCC Part 2.1049 FCC Part 95, 635 e(1)ii	Compliant

6.2 *Test Method*

The EUT was connected to a spectrum analyzer and caused to transmit in both modulation modes available. The modulation envelope was compared to the Emissions Mask 1 limits.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.7 °C
Relative Humidity:	51.0 %
Atmospheric Pressure:	101.5 kPa

6.4 *Test Equipment*

Note: The calibration period equipment is 1 year.

Test Start Date: 3/27/2013 Tested By: BKF
Test End Date: 3/27/2013

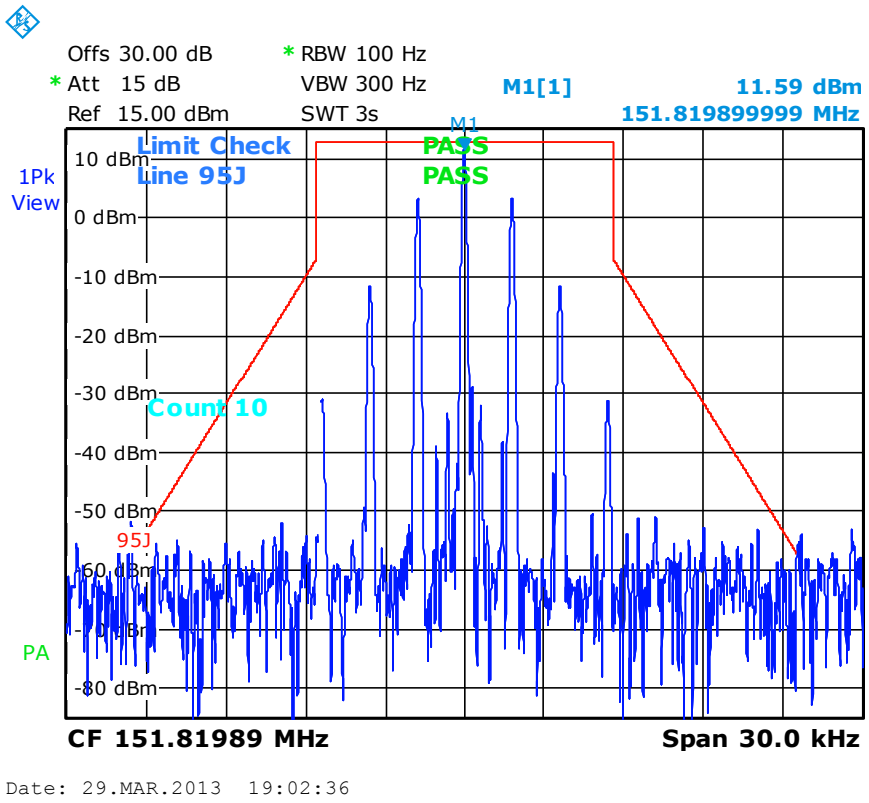
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ZVL	R & S	B079799	1-Jul-13
30dB attenuator	BW-S30W24	Mini-Circuits	NA	NA
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	2-Dec-13

6.5 *Test Setup Photographs*

Photographs are contained in a separate exhibit

6.6 *Test Data*

1010 Data



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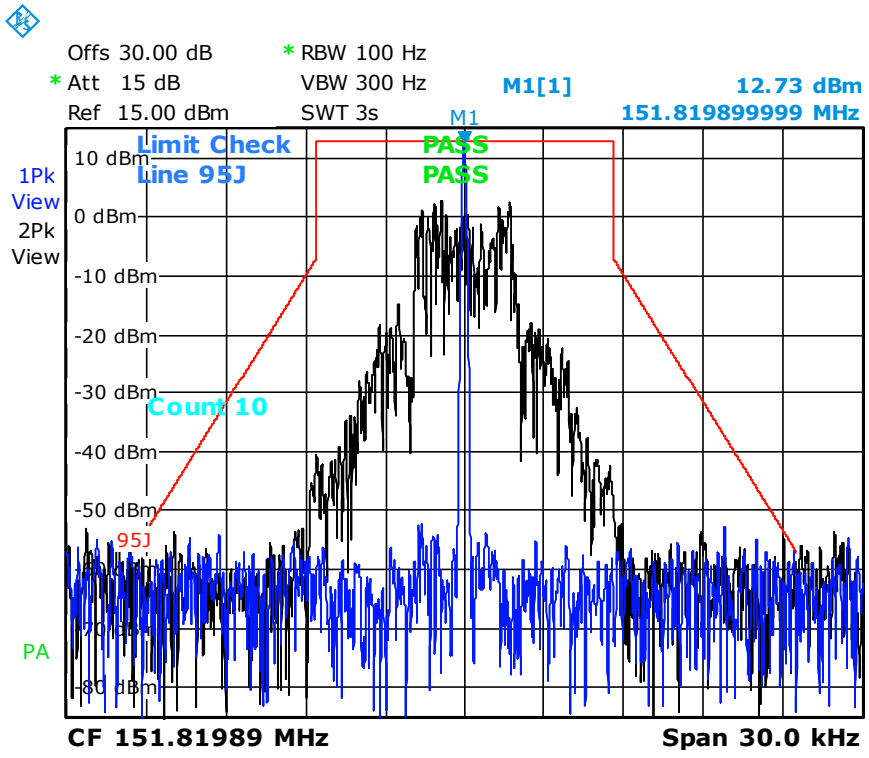
PN9 Data



Date: 29.MAR.2013 19:04:29

7 Output Power

7.1 *Test Result*

Test Description	Product Specific Standard	Test Result
Output Power	FCC Part 2.1049 FCC Part 95.639h	Compliant

7.2 *Test Method*

The EUT was connected to a spectrum analyzer with RBW greater than that of the occupied bandwidth, and tuned to the EUT fundamental frequency. The signal was measured and compared against the applicable limit of 2W(33dBm)

7.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	24.0 °C
Relative Humidity:	23.4 %
Atmospheric Pressure:	98.7 kPa

7.4 *Test Equipment*

Note: The calibration period equipment is 1 year.

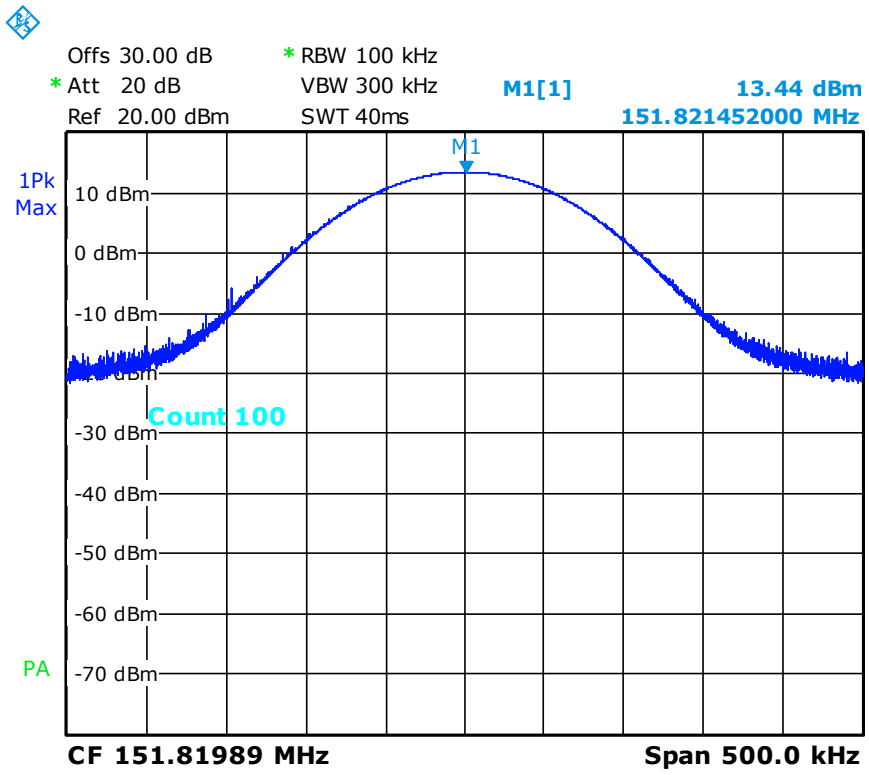
Test Start Date: 3/29/2013 Tested By: BKF

Test End Date: 3/29/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ZVL	R & S	B079799	1-Jul-13
30dB attenuator	BW-S30W24	Mini-Circuits	NA	NA
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	2-Dec-13

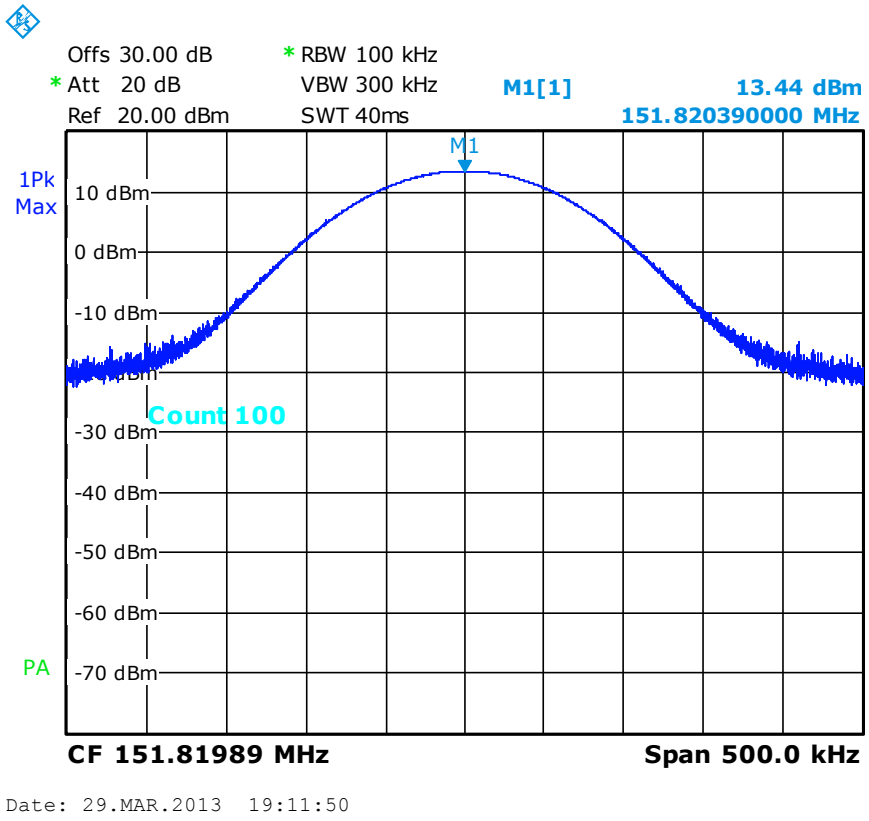
7.5 *Test Data*

1010 Data



Date: 29.MAR.2013 19:11:11

PN9 Data



7.6 *Measurement Results*

Modulation	Power(dBm)
1010 data	13.440
PN9	13.440

8 Frequency Stability

8.1 *Test Result*

Test Description	Product Specific Standard	Test Result
Frequency Stability	FCC Part 2.1055 FCC Part 95.632	Compliant

8.2 *Test Method*

The EUT was placed in a temperature controlled environment and connected to a spectrum analyzer. The temperature was varied from -30 to 50º C in 10º increments; allowing at least one half hour of temperature stabilization before a frequency measurement was taken. The PPM calculations were made as compared to a baseline frequency at 20ºC. A RBW of 1Hz, VBW of 30Hz and a 1s sweep settings were utilized.

The EUT was also connected to a variable voltage source and varied from 85% to 115% of rated voltage. The fundamental frequency for each voltage setting was compared to the 100% voltage ambient temperature measurement and reported as compared to the limit, which is 5ppm.

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

8.4 *Test Equipment*

Test Start Date: 4/2/2013 Tested By: BKF
Test End Date: 4/2/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ZVL	R & S	B079629	1-Jul-13
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	2-Dec-13

Note: The calibration period equipment is 1 year.

8.5 *Test Setup Photographs*

Photographs are contained in a separate exhibit

8.6 *Test Data*

Temperature Variation

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm
100%	3.70	Reference	151820000.000		
100%	3.70	-30	151819869.810	+130.19	+0.86
100%	3.70	-20	151819874.400	+125.60	+0.83
100%	3.70	-10	151819915.720	+84.28	+0.56
100%	3.70	0	151819934.835	+65.16	+0.43
100%	3.70	10.0	151819957.275	+42.72	+0.28
100%	3.70	20.0	151819954.110	+45.89	+0.30
100%	3.70	30.0	151819920.450	+79.55	+0.52
100%	3.70	40.0	151819878.210	+121.79	+0.80
100%	3.70	50.0	151819878.210	+121.79	+0.80

Voltage Variation

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm
100%	3.70	24.0	151819954.110		+0.00
85%	3.60	24.0	151819918.735	+35.38	+0.23
115%	4.20	24.0	151819921.665	+32.45	+0.21

9 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	10APR2013
1	Removed RF Exposure section to separate exhibit. Updated model name. Corrected Report Number.	12 June 2013