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Test Report

Prepared for: Medical Simulation Corporation

Model: COMPASS-1

Description: Portable Endovascular Medical Simulator

FCC ID: O88-COMPASS1

To

FCC Part 15.247 DTS

Date of Issue: June 5, 2012

On the behalf of the applicant:	**Medical Simulation Corporation** **4643 South Ulster** **Suite 650** **Denver, CO 80237**
Attention of:	**Tim Threlkeld, Sr. Software Engineer** **Ph: (303) 483-2831** **E-mail: Tim.Threlkeld@medsimulation.com**

Prepared By
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Project No: p1240009

John Erhard
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	June 5, 2012	John Erhard	Original Document

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009)

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

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Testing Certificate Number: **2152.01**

FCC OATS Reg, #933597

IC Reg. #2044A-1

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21 - Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) - Special Accessories

Equipment marked to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (° C)	**Humidity (%)**	**Pressure (mbar)**
23.50	**34.30**	**961.000**

EUT Description

Model: COMPASS-1
Description: Portable Endovascular Medical Simulator
Firmware: N/A
Software: N/A
Additional Information: None

EUT Operation during Tests

The EUT utilized specialized test software for manual operation of the radio for RF testing.

This is a single channel device operating on 2462 MHz.

Accessories:

Qty	Description	Mfg	Model	S/N
1	Standard USB mouse and keyboard	N/A		
1	Standard USB memory device	N/A		

Cables: None

Modifications: None

15.203: Antenna Requirement:

X	The antenna is permanently attached to the EUT
	The antenna uses a unique coupling
	The EUT must be professionally installed
	The antenna requirement does not apply

Test Reports Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	Pass	
RSS-Gen 6.2	Receiver Spurious Emission Limits	Pass	

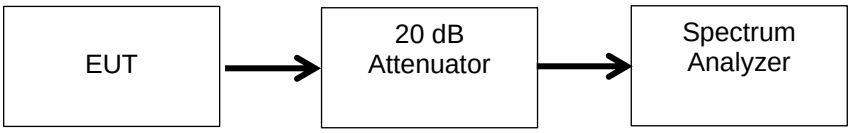
Peak Output Power

Name of Test:	Peak Output Power	**Engineer:** John Erhard
Test Equipment Utilized:	i00331	**Test Date:** 5/31/2012

Test Procedure

The EUT was connected directly to a spectrum analyzer input.
The peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2462	19.18	1 W (30 dBm)	Pass

Conducted Spurious Emission

Name of Test:	Conducted Spurious Emissions	**Engineer:** John Erhard
Test Equipment Utilized:	i00331	**Test Date:** 5/31/2012

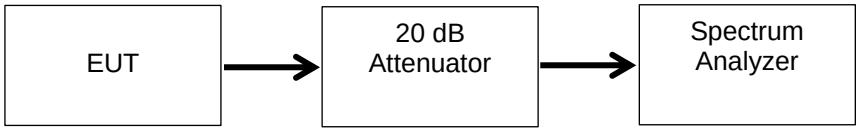
Test Procedure

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed.

The delta between the peak output power and the measured value is recorded as the corrected value in –dBc.

Only the worst case is recorded in the Conducted Spurious Emissions Summary Test Table.

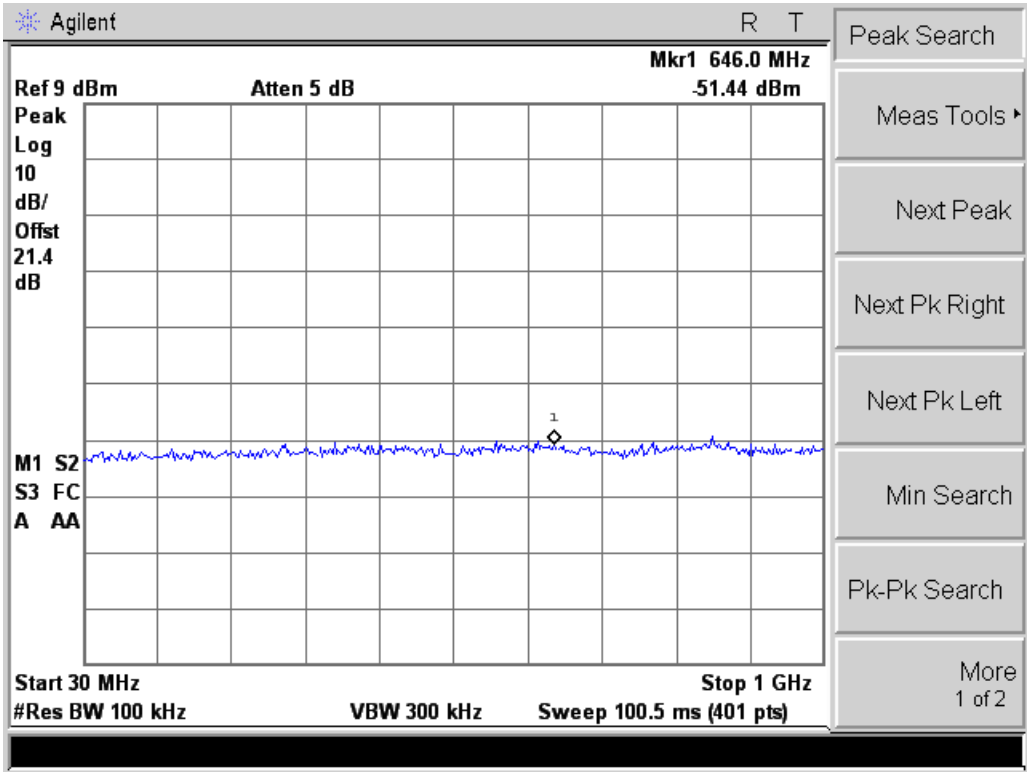
Test Setup

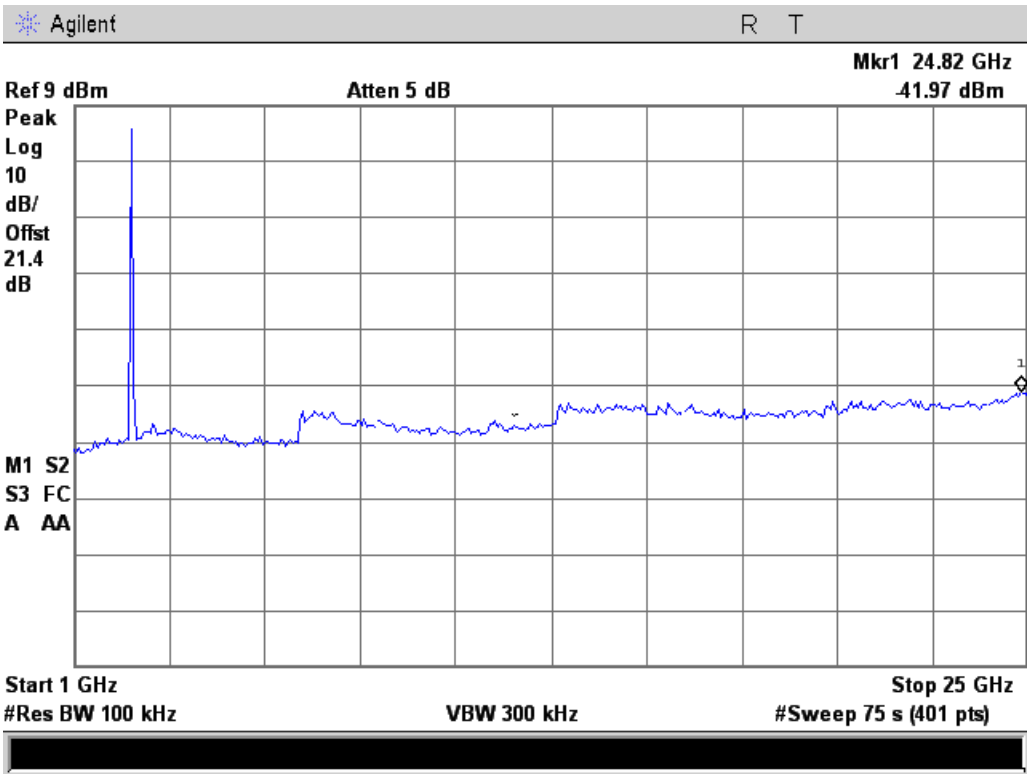


Conducted Spurious Emissions Summary Test Table

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBm)	Peak Power (dBm)	Corrected Value (dBc)	Specification Limit (dBc)	Result
2462	24820	-41.97	19.18	-61.15	-20	Pass

Conducted Spurious Emissions
2462 MHz





Radiated Spurious Emissions

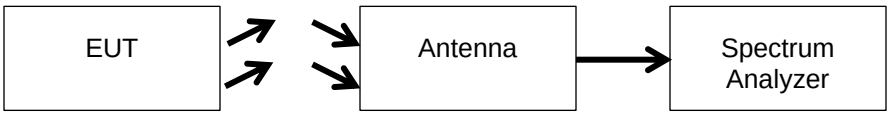
Name of Test:	Radiated Spurious Emissions	**Engineer:**	John Erhard
Test Equipment Utilized:	i00033, i00103, i00267, i00271, i00331	**Test Date:**	6/4/2012

Test Procedure
Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized. All emissions from 30 MHz to the 10th harmonic were examined. Measured Level includes antenna and receiver cable correction factors. Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 120 KHz
VBW = 300 KHz
Detector – Quasi Peak

Test Setup



Radiated Spurious Emissions

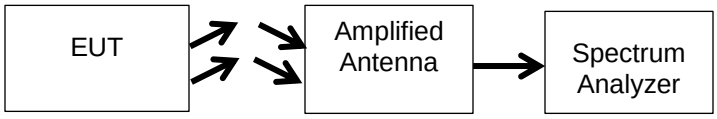
Emission Freq (MHz)	Measured Value (dBuV/m)	Corr. Factor (dB)	Corr. Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarity (V/H)	Antenna Height (cm)	Turntable Position (deg)
36.700	19.68	6.19	25.87	40	-14.13	H	98	108
157.550	20.74	1.92	22.66	43.5	-20.84	H	98	108
356.550	9.51	6.54	16.05	46	-29.95	H	98	108
515.450	7.43	9.87	17.30	46	-28.7	H	98	108
705.850	6.40	12.65	19.05	46	-26.95	H	98	108
924.500	9.98	16.04	26.02	46	-19.98	H	98	108

All emissions were general elevation of the system noise floor emitting from the power supply end of the EUT.
No emissions were above the limit.

Test Procedure for
Radiated Spurious Emissions above 1 GHz

The EUT was tested in a semi anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording the Measured Level to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As Necessary
Average	1 MHz	3 MHz	As Necessary

Radiated Spurious Emissions

Tuned Freq (MHz)	Emission Freq (MHz)	Peak Measured Value (dBuV/m)	Peak Limit (dBuV/m)	Average Measured Value (dBuV/m)	Average Limit (dBuV/m)	Result
2462	4924	39.19	74.0	34.54	54.0	Pass
2462	7386	42.00	74.0	39.87	54.0	Pass
2462	9848	42.87	74.0	41.97	54.0	Pass

No other emissions were detectable. All emissions were greater than -20 dBc.

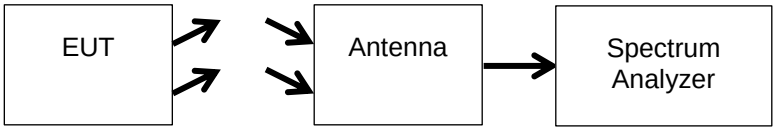
Emissions at Band Edges

Name of Test: Emissions at Band Edges **Engineer:** John Erhard
Test Equipment Utilized: i00103, i00331 **Test Date:** 6/4/2012

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for band edge and restricted band for both peak and average measurements. The cable and antenna correction factors were input into the analyzer as a reference level offset to ensure accurate readings were obtained. For the restricted band the amplifier and band reject filter correction factors were also input to the spectrum analyzer.

Test Setup



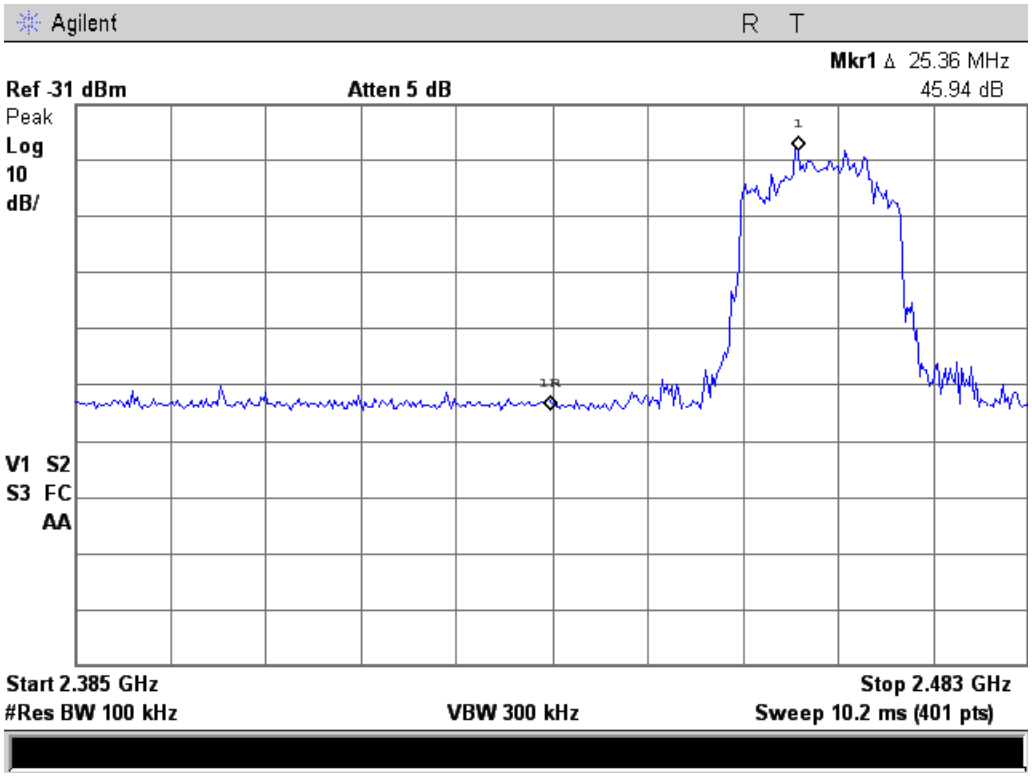
Band Edge Emissions Summary

Tuned Freq (MHz)	Emission Freq (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
2462	2400	-45.94	Peak	-20 dBc	Pass
2462	2483.5	-47.53	Peak	-20 dBc	Pass

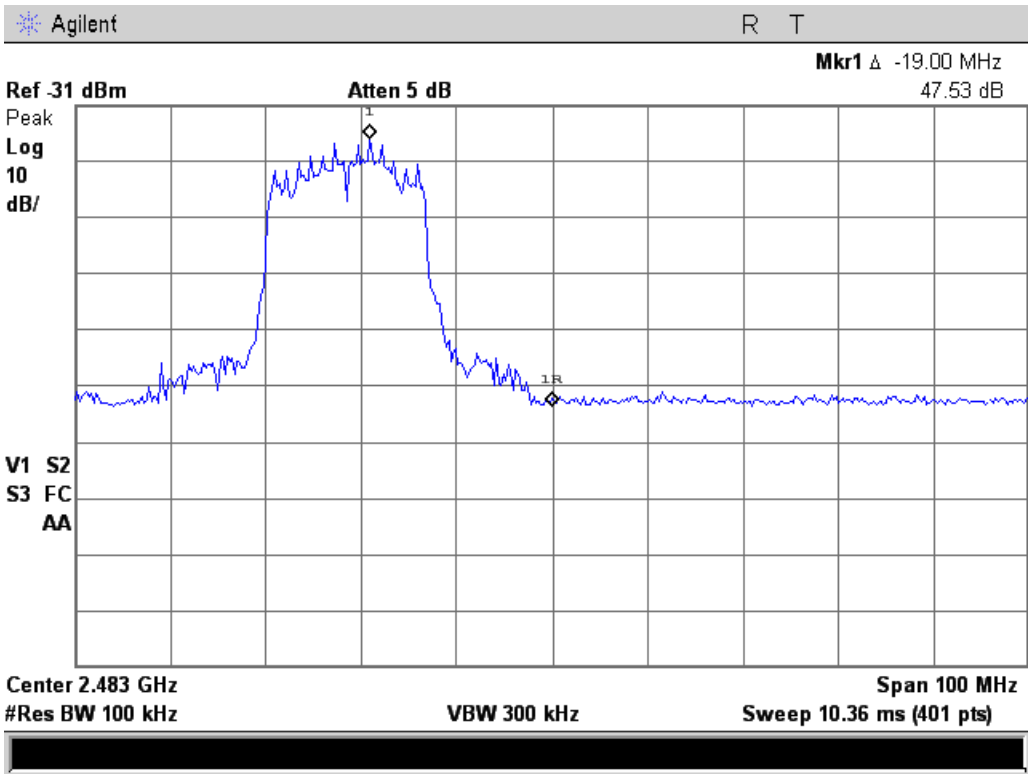
Restricted Band Emissions Summary

Restricted Band (MHz)	Tuned Freq (MHz)	Emission Freq (MHz)	Measured Value (dBuV/m)	Detector	Limit (dBuV/m)	Result
2300 – 2390	2462	2337.75	48.54	Peak	74	Pass
2300 – 2390	2462	2343.925	44.35	Average	54	Pass
2483.5 - 2500	2462	2483.79	48.56	Peak	74	Pass
2483.5 - 2500	2462	2557.19	44.98	Average	54	Pass

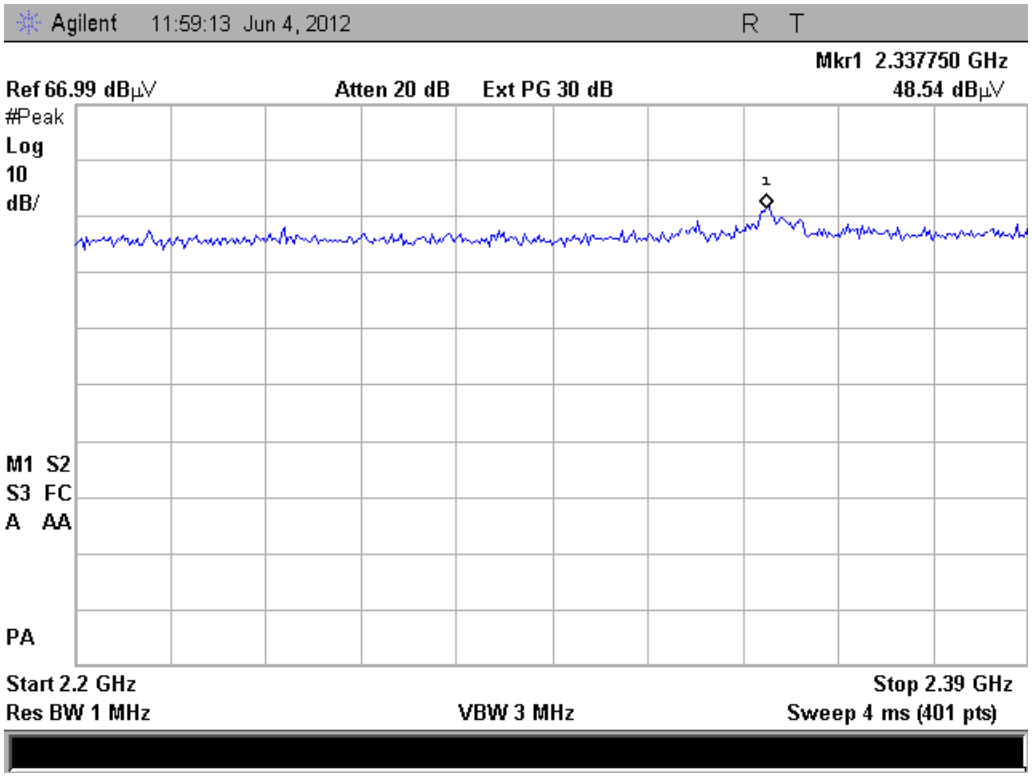
Band Edge 2400 MHz



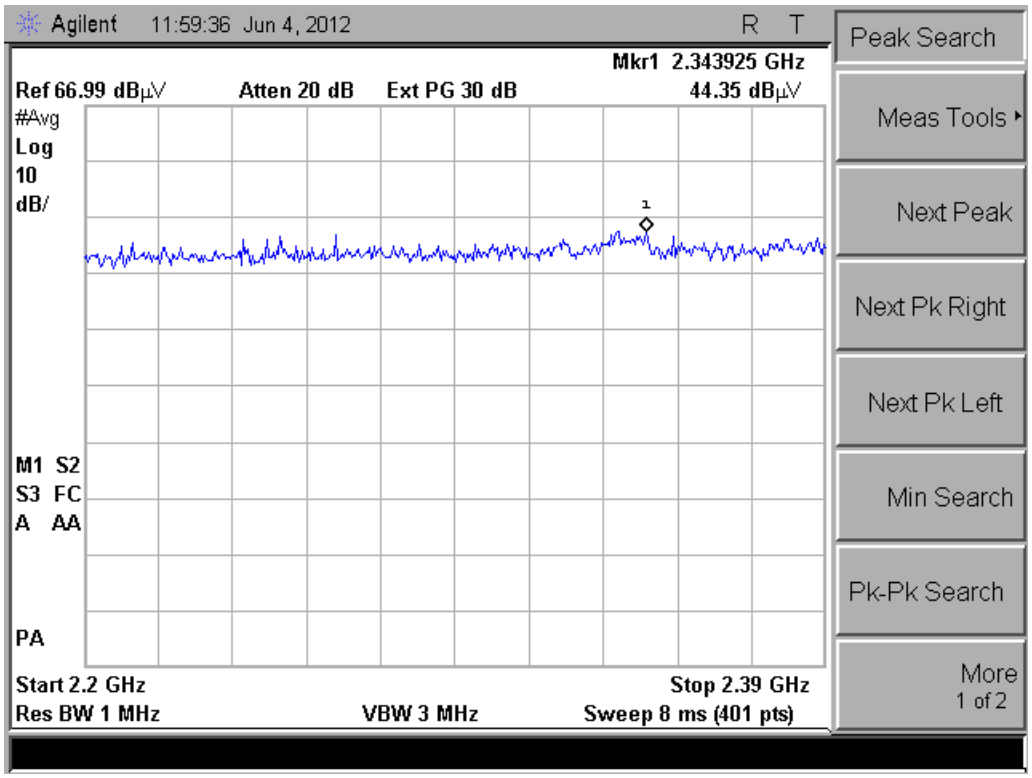
Band Edge 2483.5 MHz



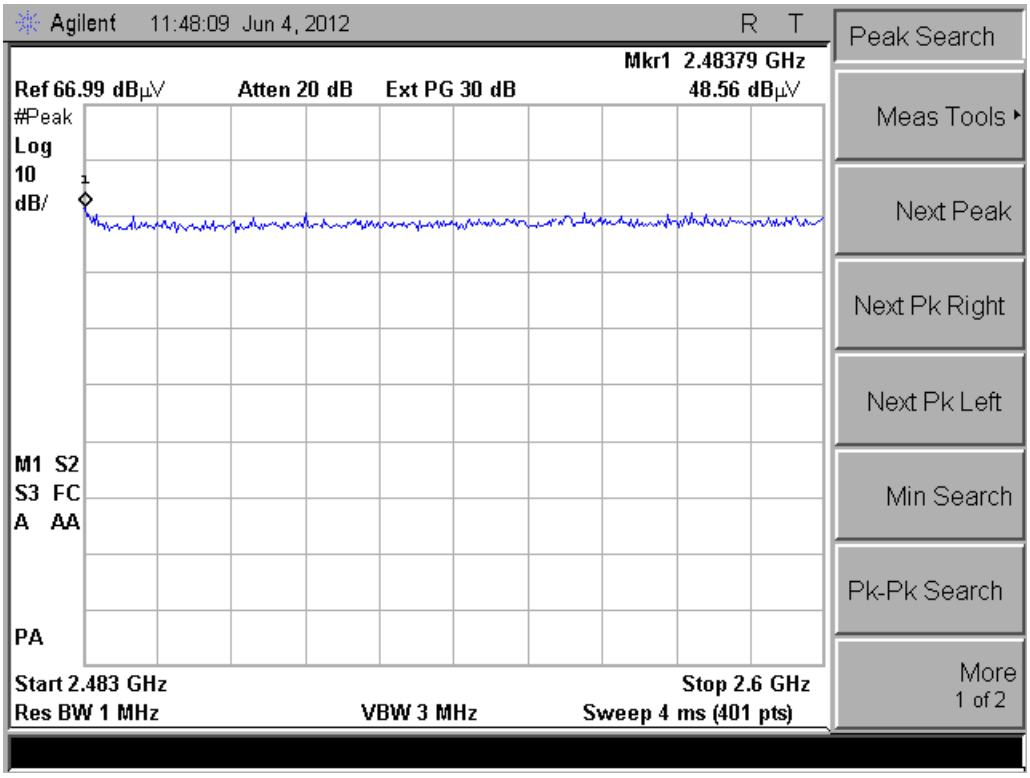
Restricted Band 2390 MHz Peak



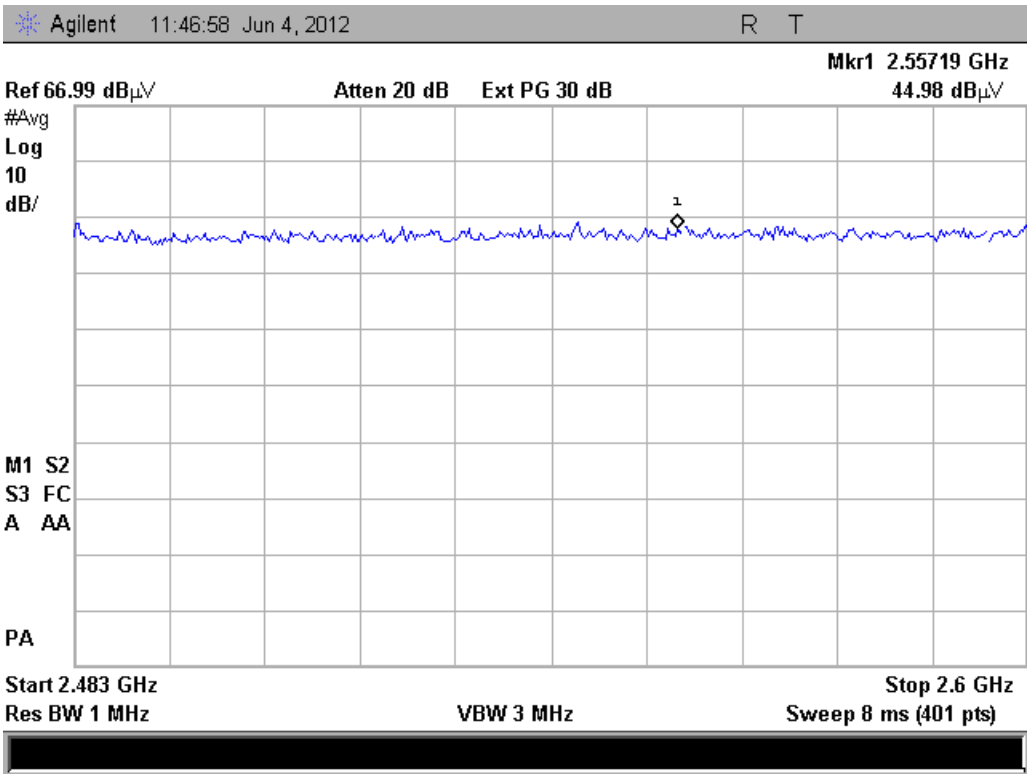
Restricted Band 2390 MHz Average



Restricted Band 2483.5 MHz Peak



Restricted Band 2483.5 MHz Average



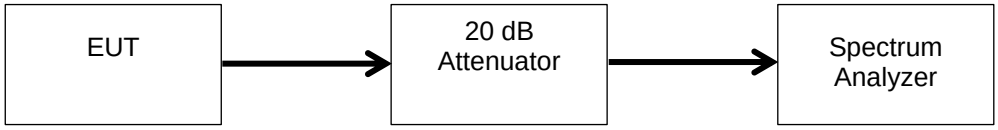
Occupied Bandwidth

Name of Test: Occupied Bandwidth
Engineer: John Erhard
Test Equipment Utilized: i00331
Test Date: 5/31/2012

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured the 6dB and 99% bandwidths were measured to verify the bandwidth met the specification.

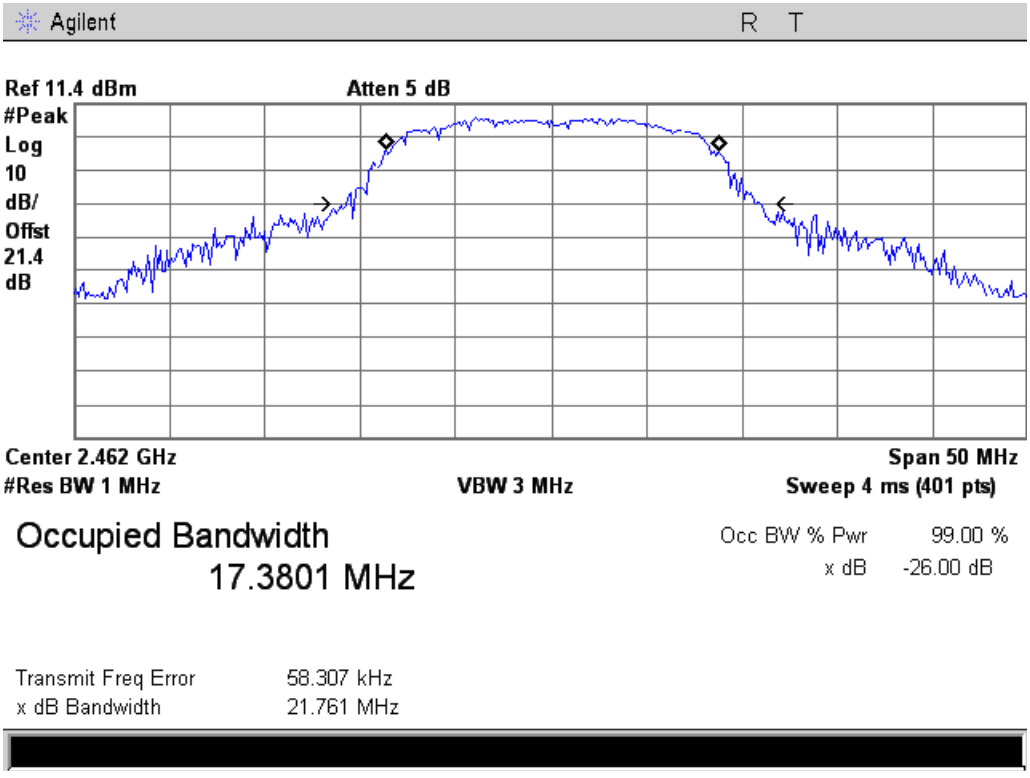
Test Setup



Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (MHz)	Specification Limit (kHz)	Result
2462	17.38	≥ 500	Pass

Bandwidth 2462 MHz



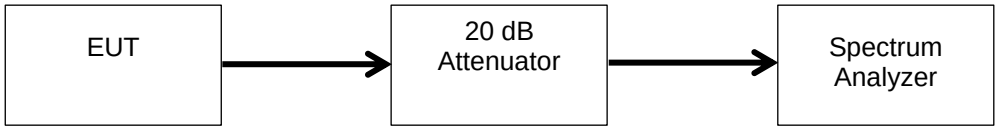
Transmitter Power Spectral Density (PSD)

Name of Test: Transmitter Power Spectral Density (PSD) **Engineer:** John Erhard
Test Equipment Utilized: i00331 **Test Date:** 6/7/2012

Test Procedure

The EUT was connected directly to a spectrum analyzer.
The test was performed per section 6.11.2.3 of C63.10 - 2009 “Procedure for determining PSD for DTS devices”.

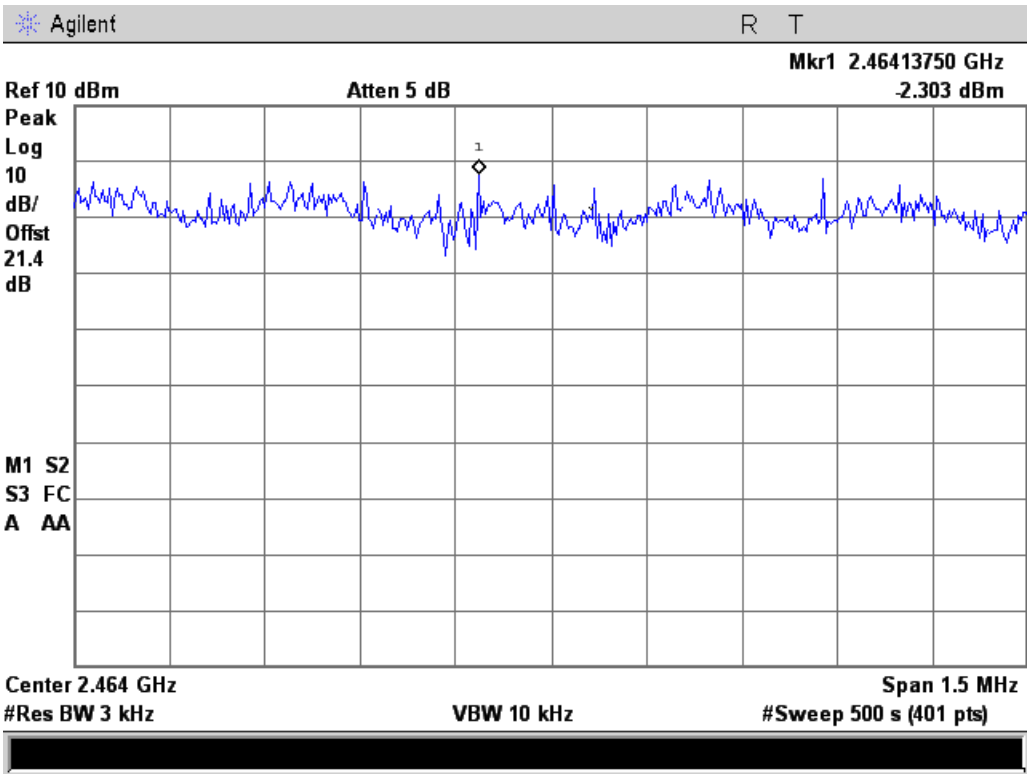
Test Setup



PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2462	-2.303	8	Pass

PSD 2462 MHz



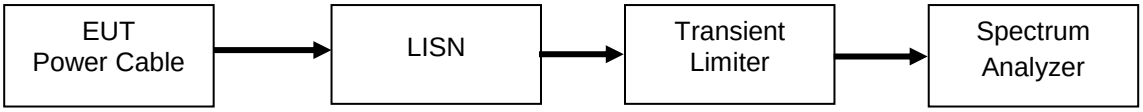
A/C Powerline Conducted Emission

Name of Test:	A/C Powerline Conducted Emissions	**Engineer:**	John Erhard
Test Equipment Utilized:	i00362, i00379, i00270, i00123	**Test Date:**	5/9/2012

Test Procedure

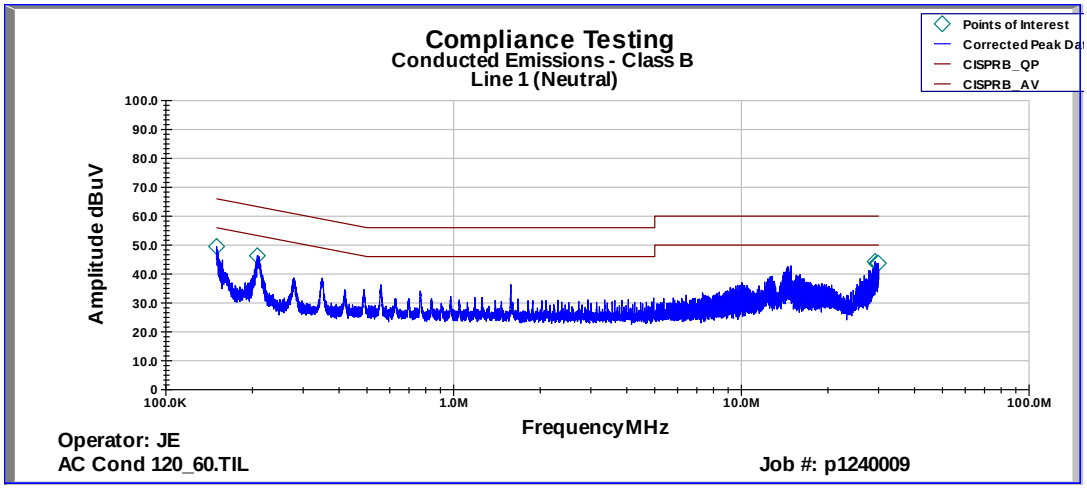
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup

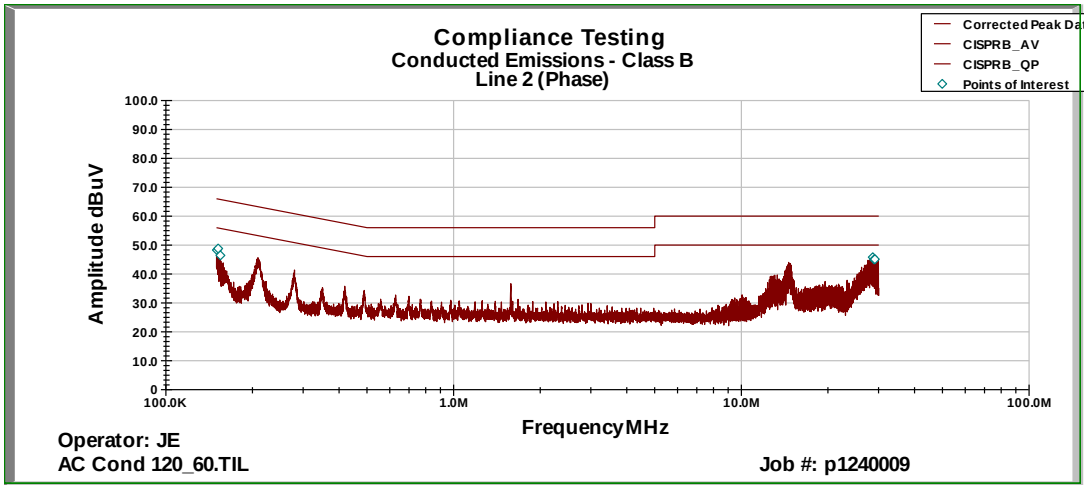


Conducted Emissions Test Results

Line 1 Peak Plot



Line 2 Peak Plot



All peak readings are below the quasi peak and average limits.

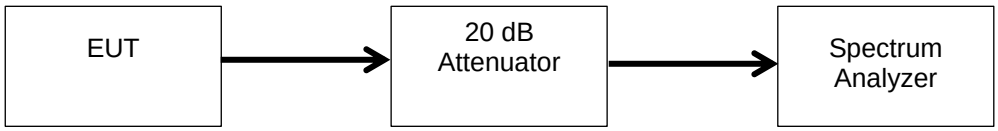
Receiver Spurious Emissions

Name of Test: Receiver Spurious Emissions
Specification: RSS-Gen 6.2 **Engineer:** John Erhard
Test Equipment Utilized: i00331 **Test Date:** 6/1/2012

Test Procedure

The EUT was connected directly to a spectrum analyzer.
The receiver spurious emissions were measured from 30 MHz to greater than 3 times the highest tunable frequency.

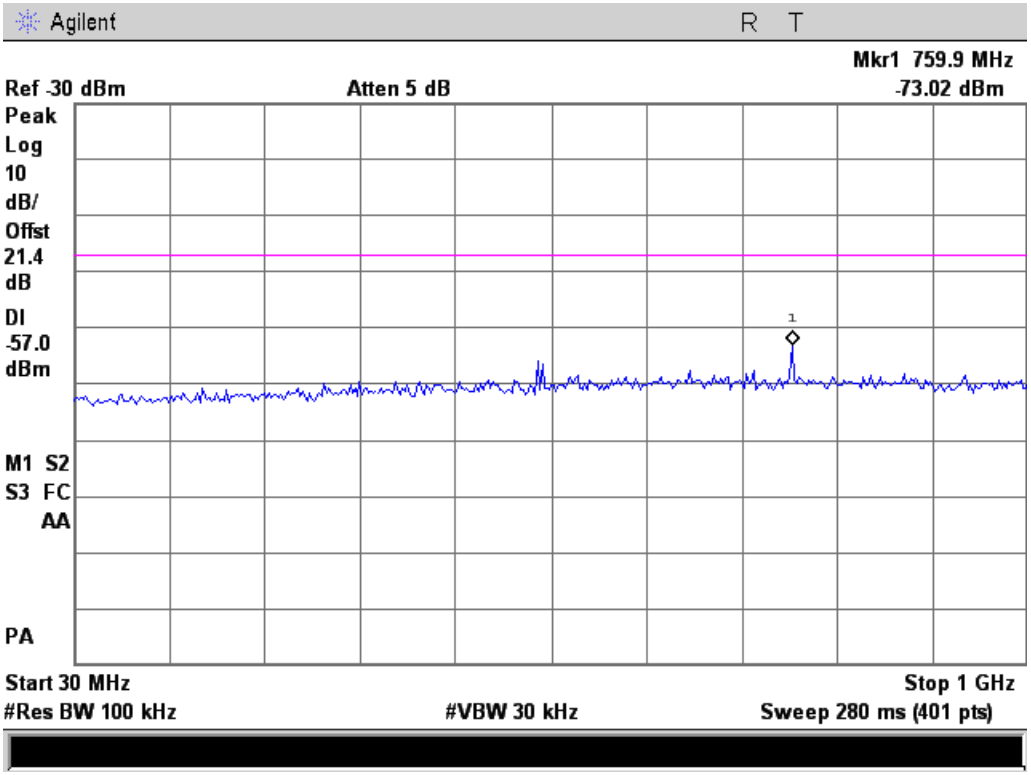
Test Setup



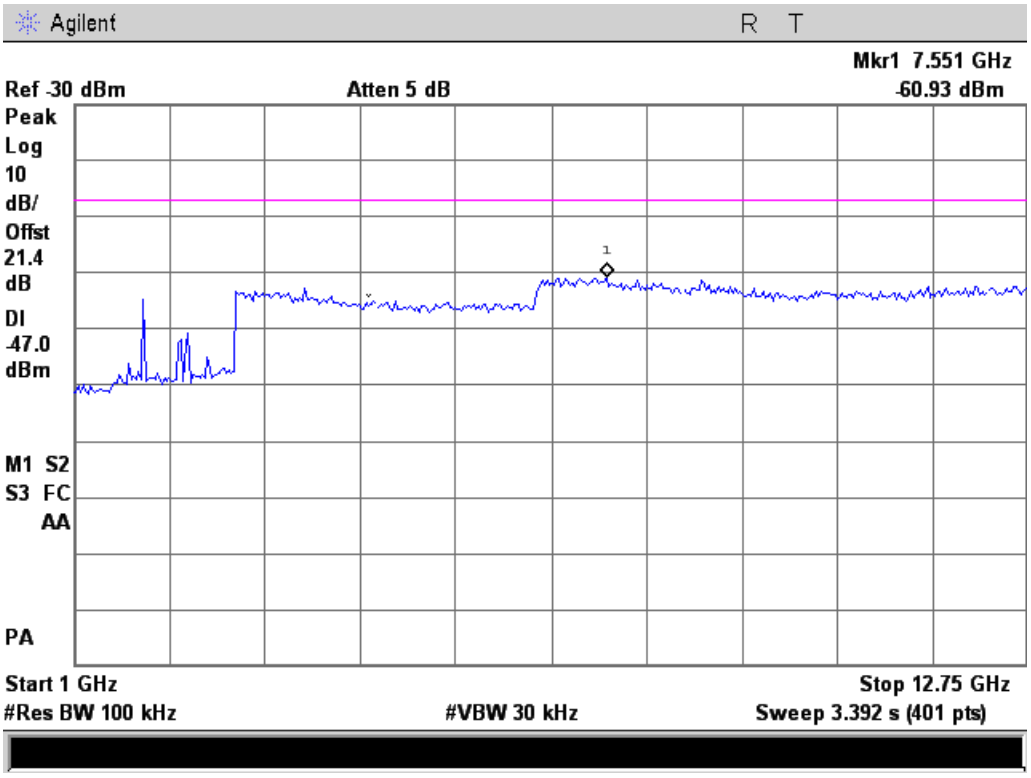
Receiver Spurious Emissions Summary

Frequency Range (MHz)	Recorded Measurement (dBm)	Specification Limit	Result
30 – 1000	-73.02	-57 dBm	Pass
1000 - 8000	-60.93	-53 dBm	Pass

Receiver Spurious Emissions 30 MHz – 1 GHz



Receiver Spurious Emissions 1 GHz – 12.75 GHz



Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	12/2/11	12/22/12
Horn Antenna	EMCO	3115	i00103	11/5/10	11/5/12
Bi-Log Antenna	Schaffner	CBL611C	i00267	12/19/2011	12/19/2013
LISN	FCC	FCC-LISN-50-32-2-01	i00270	9/30/10	9/30/12
Horn Antenna	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	11/5/11	11/5/12
Spectrum Analyzer	Agilent	E4407B	i00331	4/20/12	4/20/13
Humidity / Temp Meter	Control Company	4189CC	i00355	1/11/12	1/11/13
AC Power Source	Behlman	BL 6000	i00362	Verified on:5/9/2012	
Spectrum Analyzer	Agilent	E7405A	i00379	12/14/2011	12/14/2012
Transient Limiter	Com-Power	LIT-930	i00123	Verified on:5/9/2012	

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT