



Compliance Testing, LLC
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FCC CFR47 Part 15.255 Test Report

Prepared for: Athena Wireless Communications

Model: A060-Mini

Description: 60GHz Millimeter-Wave System

To

Federal Communications Commission

Rule Part(s) 15.255

Date of Issue: May 23, 2011

On the behalf of the applicant:

Athena Wireless Communications
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Attention of:

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John Erhard
Project Test Engineer



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	5/23/11	J. Erhard	Original Document
2.0	6/30/11	J. Erhard	Additional Test Data Added



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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 in the table below

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

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 Use

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 marketed 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 part may employ other methods of ensuring that the special accessories are provided to the consumer, without 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	Humidity	Pressure
25.30	26.50	960.50

EUT Description

Wireless point to point Gigabit Ethernet communication system

EUT Operation during Tests

Operating on a test chassis allowing for direct conducted measurements



Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.255(e)	Peak Output Power	Pass	
15.255(f)	In band emissions	Pass	
15.225(c)	Spurious Emissions	Pass	
15.207	Powerline conducted Emissions	Pass	
RSS 210	99% Occupied Bandwidth	Pass	

15.203: Antenna Requirement:

- 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



Peak Output Power

Name of Test: Peak Output Power

Specification: 15.255(e)

Engineer: J. Erhard

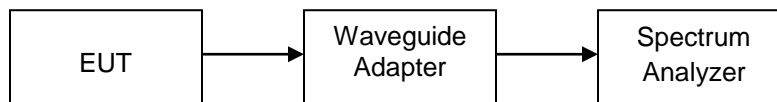
Test Equipment Utilized: i00029, i00394

Test date: 5/18/2011

Test Procedure

The EUT was connected to a spectrum analyzer utilizing an external mixer and waveguide adapter. All cable, waveguide, and mixer losses were input in to the spectrum analyzer as a reference level offset to ensure that accurate readings were obtained. The measurement was made in a CW mode of operation as it produces an accurate peak power reading.

Test Setup

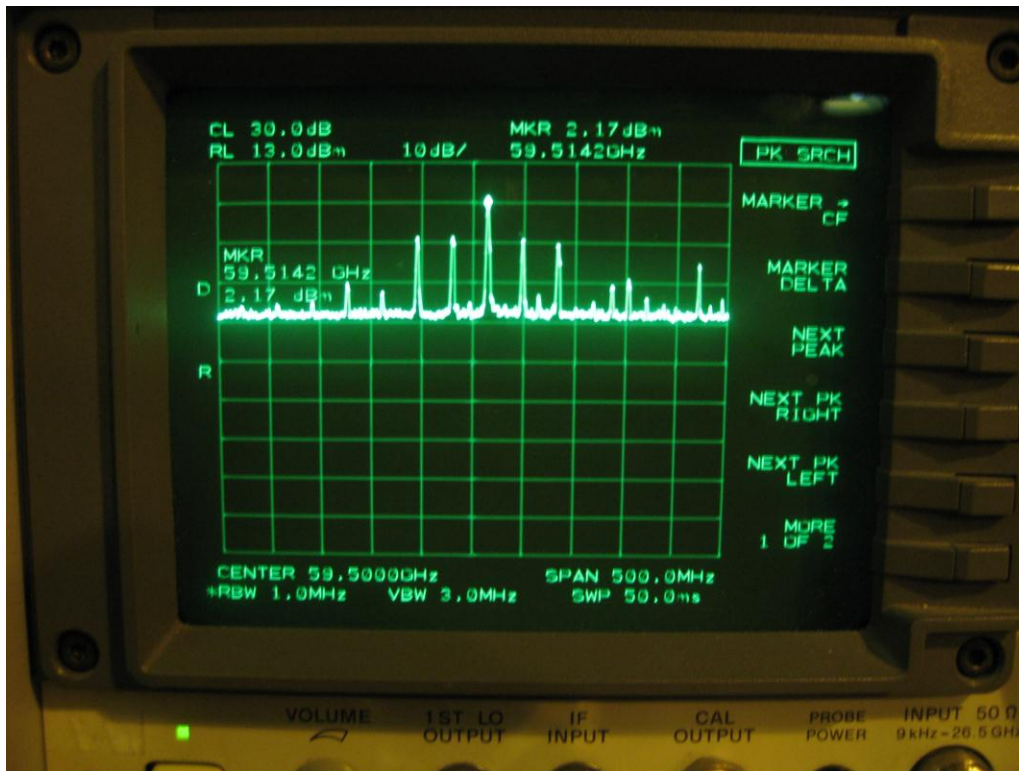


Peak Output Power

Frequency	Measured Level	Limit
59.5 GHz	2.17 dBm	27 dBm
62.0 GHz	9.54 dBm	27 dBm



Peak Power 59.5 GHz



Peak Power 62.0 GHz



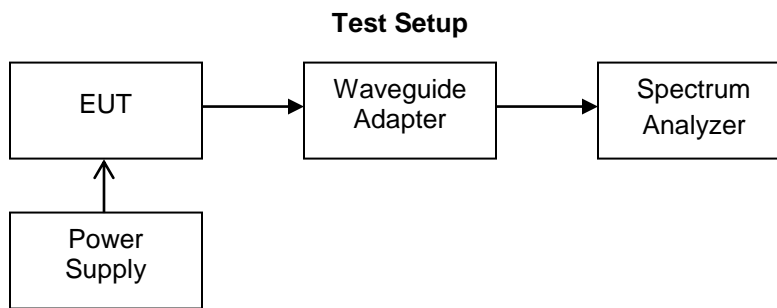


In Band Emissions

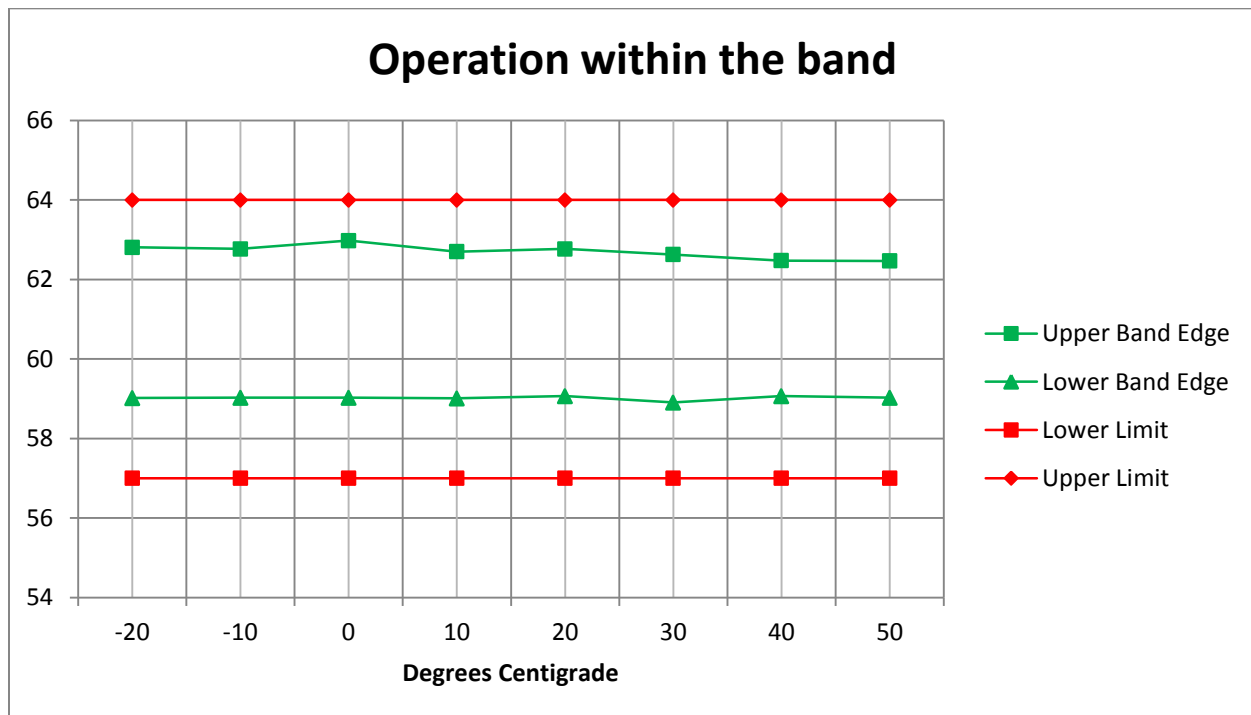
Name of Test: In Band Emissions
Specification: 15.255(f) **Engineer:** J. Erhard
Test Equipment Utilized: i00029, i00394, i00027, i00343 **Test Date:** 5/19/2011

Test Procedure

The EUT was placed in an environmental test chamber connected to a spectrum analyzer utilizing an external mixer and waveguide adapter. The temperature was varied from -20°C to +50°C in 10°C increments with the -20 dBc value being measured at every point. At 20°C the voltage was varied from 85% to 115% of the rated voltage. The following graph indicates the all emissions were contained in the band.



Test Results





Spurious Emissions

Name of Test: Spurious Emissions

Specification: 15.225(c)

Engineer: J. Erhard

Test Equipment Utilized: i00029, i00394

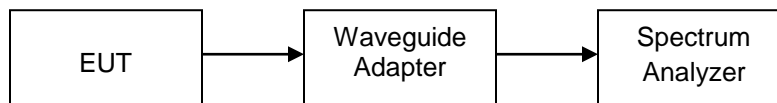
Test Date: 5/18/2011

Test Procedure

The EUT was connected to a spectrum analyzer utilizing an external mixer and waveguide adapter. All cable, waveguide, and mixer losses were input in to the spectrum analyzer as a reference level offset to ensure that accurate readings were obtained.

Note the first plot for each TX frequency appears to have detectable spurious emissions however these are intermodulation products commonly observed when using an external mixing system with an analog spectrum analyzer. They are not true spurious emissions.

Test Setup

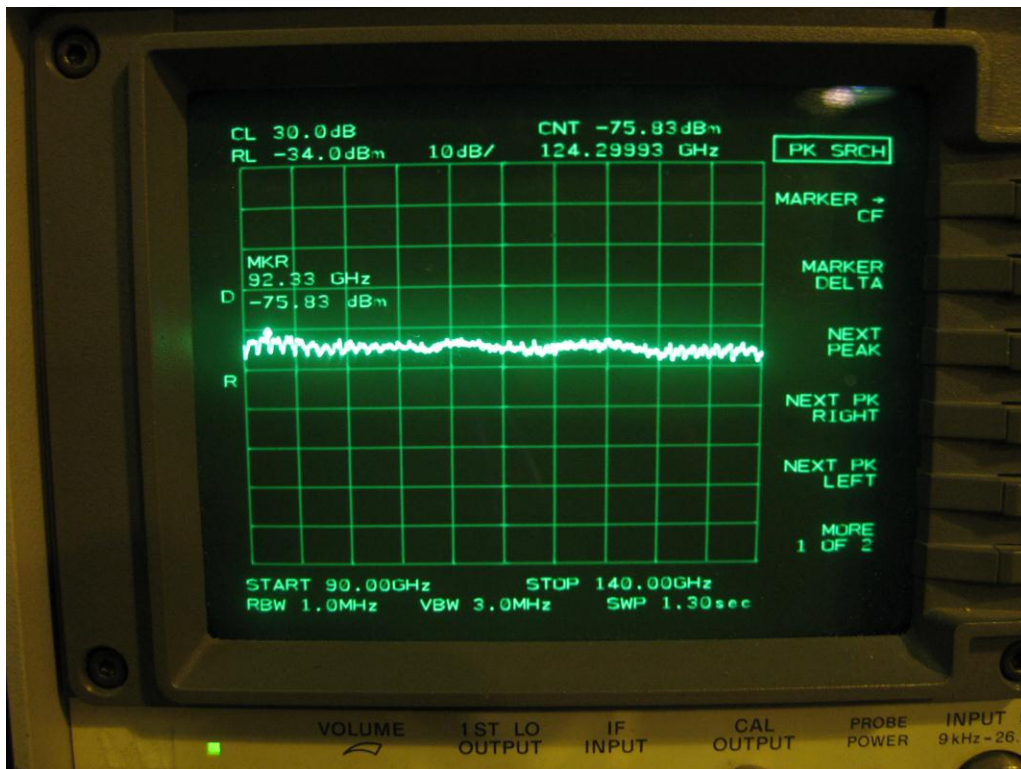
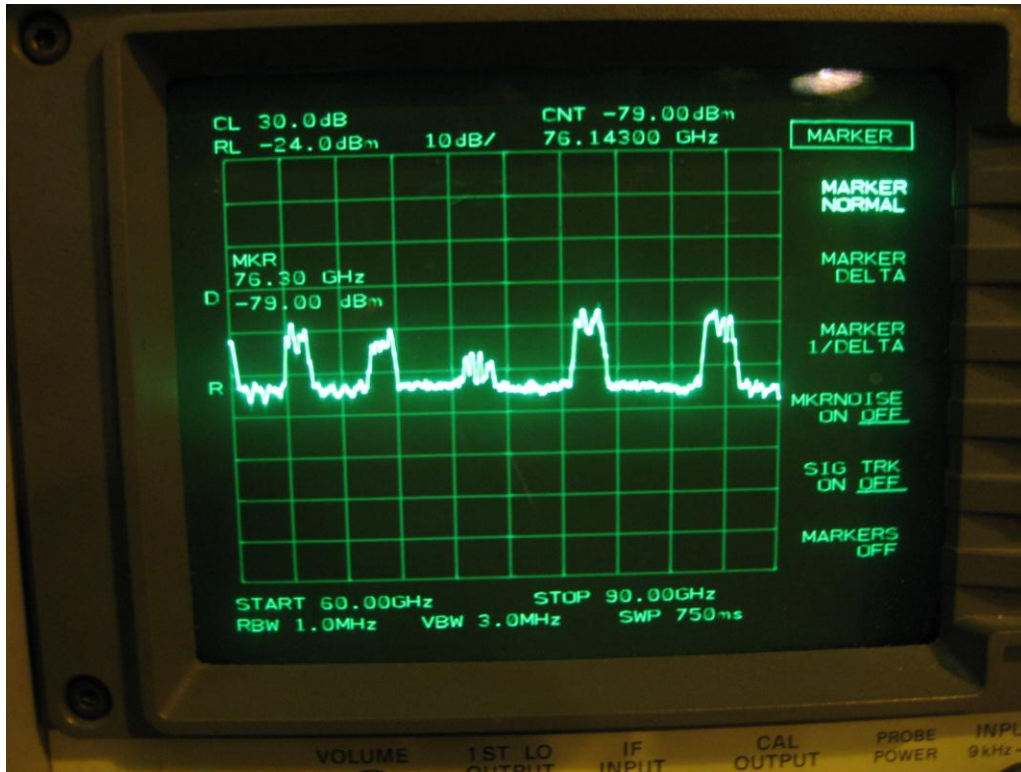


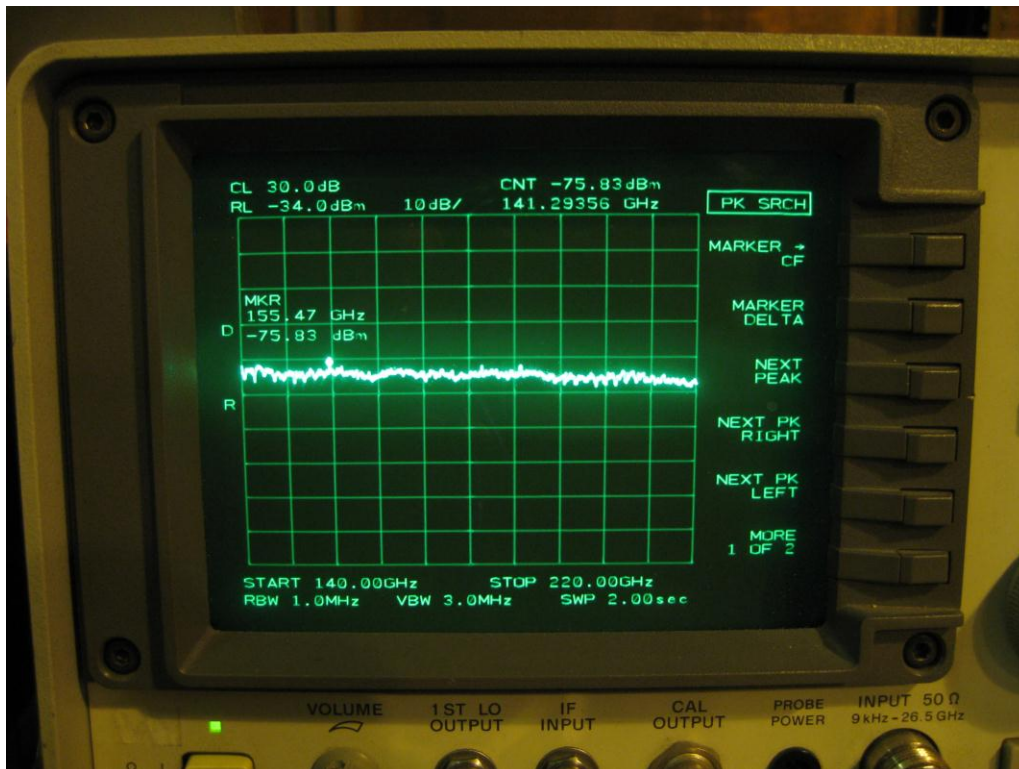
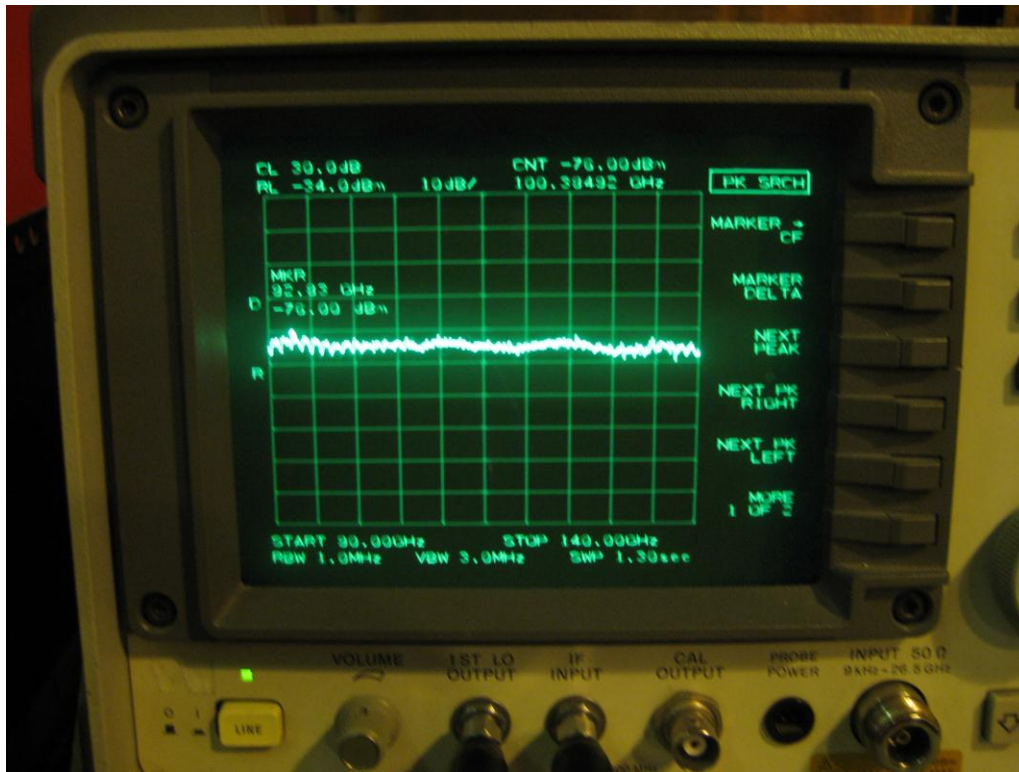
Peak Output Power

Frequency	Measured Level
59.5 GHz	-75.67 dBm
62.0 GHz	-75.83 dBm



Spurious Emissions 59.5 GHz







Power Density

Name of Test: Power Density

Specification: 15.225(b)(c)

Engineer: J. Erhard

Test Equipment Utilized: i00379, i00394

Test Date: 5/18/2011

Test Procedure

The EUT was tested on a R&D test site at a distance of 200m. The guaranteed near field limit on the antenna is 100m so a distance extrapolation of 6 dB is applied to the peak reading. All readings were converted to w/m with the resultant value compared to the limits of the indicated test sections.

Note it is impossible to make measurements at the prescribed 3m distance as defined by the standard as it is inside the near field of the antenna at a location which does not produce any RF energy. Additionally the gain of the antenna is undefined at other distances within the near field so a distance other than 3m was utilized per FCC guidance in CFR 47 subpart 15.31, in this case extrapolating from the measurement distance to the guaranteed far field distance.

Test Setup



Peak Power Density within the Band

Frequency	Measured Value	Limit
59.5 GHz	5.0 μ W	9 μ W
62.0 GHz	2.2 μ W	9 μ W

Peak Power Density outside the Band

Frequency	Measured Value	Limit
59.5 GHz	12.5 pW	90 pW
62.0 GHz	15.0 pW	90 pW

The peak power density values were below the average power density limits therefore no additional testing is required.



A/C Powerline Conducted Emissions

Name of Test: A/C Poweline Conducted Emissions

Specification: 15.207

Engineer: J. Erhard

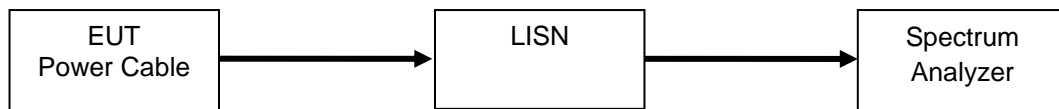
Test Equipment Utilized: i00379, i00270

Test Date: 5/6/2011

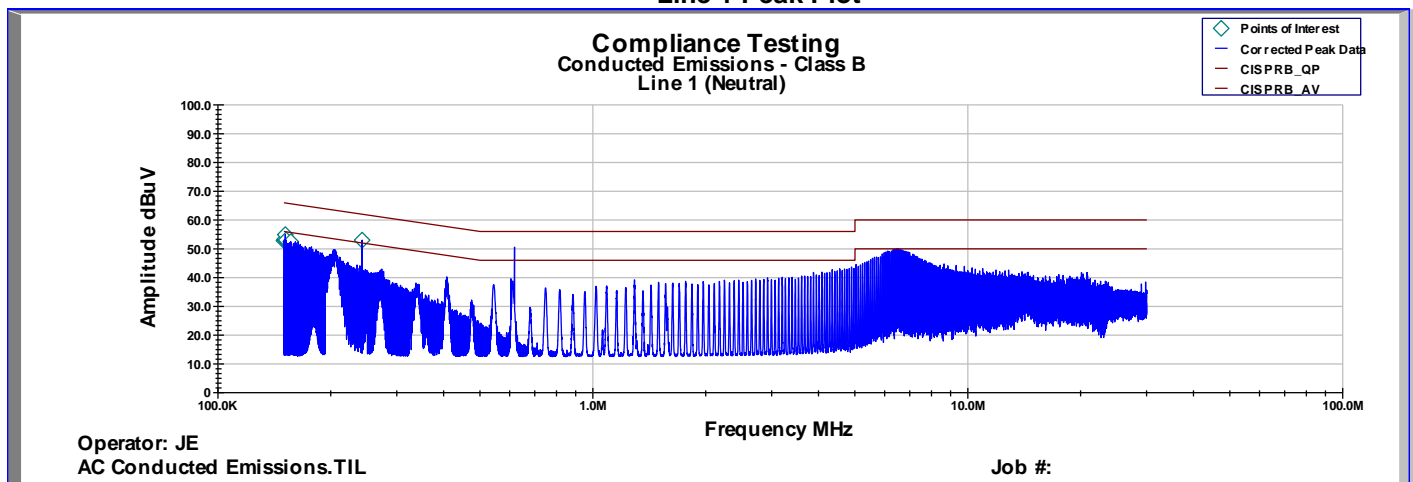
Test Procedure

The EUT power cable was connected through a LISN and the monitored output was connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were monitored and compared to the specification limits.

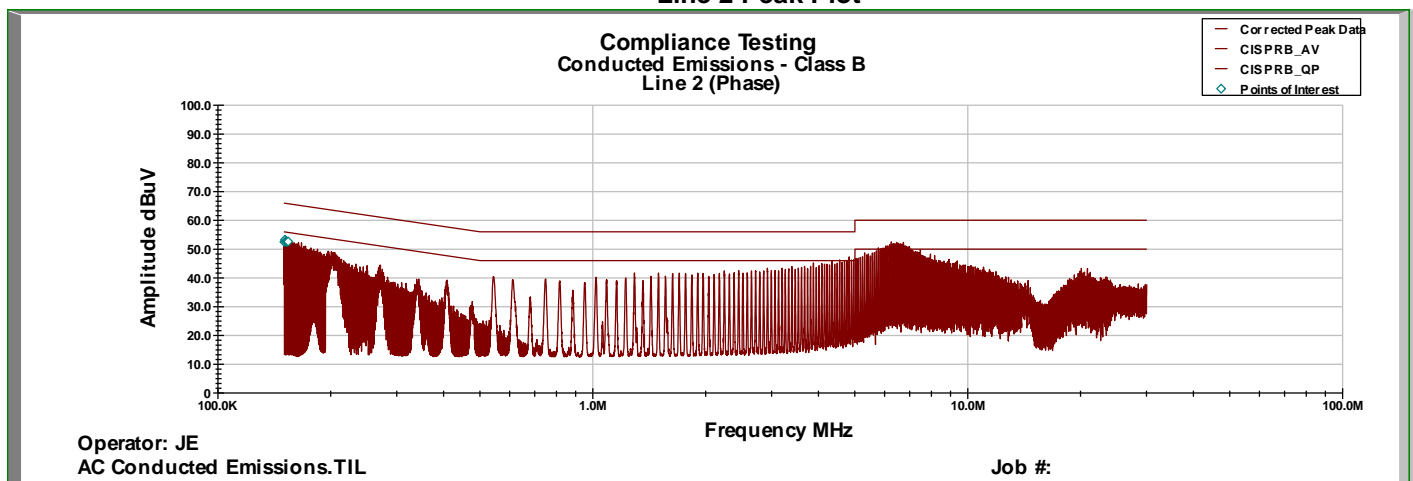
Test Setup



Conducted Emissions Test Results Line 1 Peak Plot



Line 2 Peak Plot





Line 1 Neutral AVG Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L1 Final Data (dBuV)	CISPR/FCC Limit (dBuV)	AVG Margin (dB)
229.4 KHz	-1.10	0.19	0.067	10.000	9.149	53.731	-44.582
151.24 KHz	9.09	0.29	0.043	10.000	19.421	55.964	-36.544
150.87 KHz	9.10	0.29	0.043	10.000	19.437	55.975	-36.538
150.83 KHz	9.52	0.29	0.042	10.000	19.850	55.976	-36.126
150.26 KHz	9.82	0.30	0.038	10.000	20.152	55.992	-35.841
150.01 KHz	10.12	0.30	0.043	10.000	20.463	56.000	-35.536

Line 2 Phase AVG Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L2 Final Data (dBuV)	CISPR/FCC Limit (dBuV)	AVG Margin (dB)
156.41 KHz	7.28	0.24	0.037	10.000	17.557	55.817	-38.260
153.82 KHz	17.95	0.26	0.038	10.000	28.247	55.891	-27.644
152.55 KHz	8.08	0.27	0.042	10.000	18.399	55.927	-37.528
151.09 KHz	9.52	0.29	0.040	10.000	19.846	55.969	-36.123
150.91 KHz	9.44	0.29	0.042	10.000	19.773	55.974	-36.201
150.02 KHz	18.35	0.30	0.043	10.000	28.690	55.999	-27.310

Line 1 Neutral QP Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L1 Final Data (dBuV)	CISPR/FCC Limit (dBuV)	QP Margin (dB)
229.4 KHz	27.830	0.185	0.067	10.000	38.083	63.731	-25.649
151.24 KHz	36.480	0.288	0.043	10.000	46.811	65.964	-19.154
150.87 KHz	36.610	0.291	0.043	10.000	46.944	65.975	-19.031
150.83 KHz	36.400	0.292	0.042	10.000	46.733	65.976	-19.243
150.26 KHz	36.360	0.297	0.038	10.000	46.695	65.992	-19.297
150.01 KHz	36.700	0.300	0.043	10.000	47.043	66.000	-18.956

Line 2 Phase QP Detector

Frequency	Measured Data (dBuV)	LISN Corr Fact (dB)	Cable Loss (dB)	Attenuator (dB)	L2 Final Data (dBuV)	CISPR/FCC Limit (dBuV)	QP Margin (dB)
156.41 KHz	36.28	0.24	0.037	10.000	46.553	65.817	-19.264
153.82 KHz	35.94	0.26	0.038	10.000	46.240	65.891	-19.651
152.55 KHz	36.11	0.27	0.042	10.000	46.426	65.927	-19.501
151.09 KHz	36.67	0.29	0.040	10.000	46.999	65.969	-18.969
150.91 KHz	36.02	0.29	0.042	10.000	46.353	65.974	-19.621
150.02 KHz	36.78	0.30	0.043	10.000	47.123	65.999	-18.876



99% Occupied Bandwidth

Name of Test: 99% Occupied Bandwidth

Specification: RSS 210

Engineer: J. Erhard

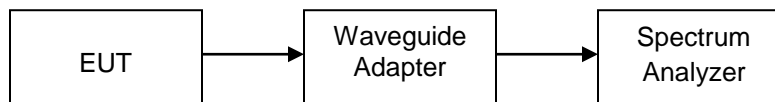
Test Equipment Utilized: i00029, i00394

Test Date: 5/18/2011

Test Procedure

The EUT was connected to a spectrum analyzer utilizing an external mixer and waveguide adapter. All cable, waveguide, and mixer losses were input in to the spectrum analyzer as a reference level offset to ensure that accurate readings were obtained. As the external mixing system results in a mirror image of the modulated spectrum only one side of the bandwidth is measured as referenced to the peak emission. This result is then multiplied to obtain an accurate reading.

Test Setup

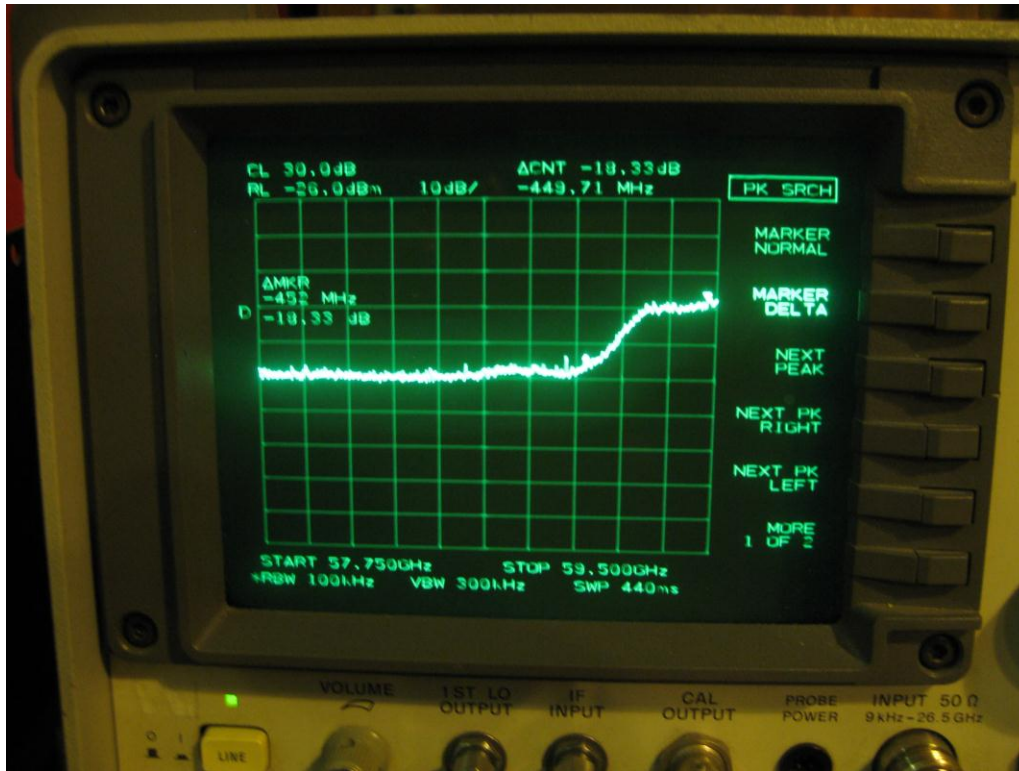


Peak Output Power

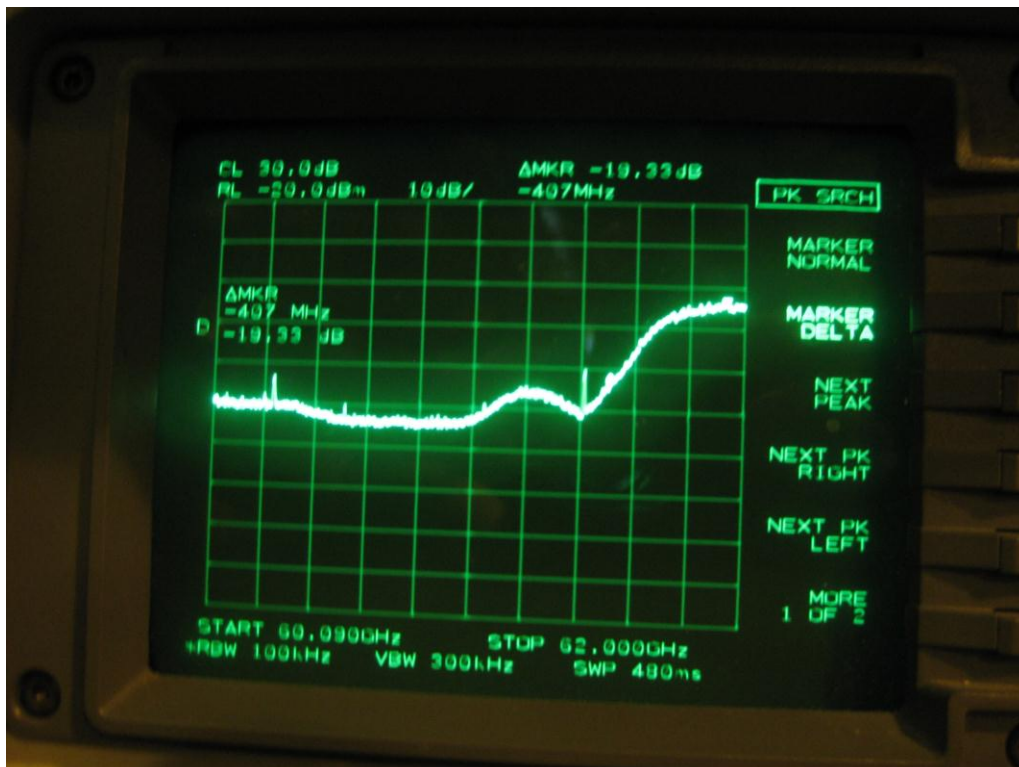
Frequency	Measured Bandwidth
59.5 GHz	899.42 MHz
62.0 GHz	814.00 MHz



99% Bandwidth 59.5 GHz



99% Bandwidth 62.0 GHz





Test Equipment Utilized

Description	MFG	Model Number	CT Asset Number	Last Cal Date	Cal Due Date
Spectrum Analyzer	HP	8563E	i00029	10/17/10	10/17/11
Temperature Chamber	Tenney	Tenney Jr	i00027	NCR	NCR
Data Logger	Fluke	Hydra	i00343	11/10/10	11/10/11
Microwave Horn / Mixer Test Set	Pacific Millimeter Products	EM, FM, UM, GM	i00394	NCR	NCR
LISN	FCC	FCC-LISN-50-32-2-01	i00270	9/30/2010	9/30/2012
Spectrum Analyzer	Agilent	E7405A	i00379	11/22/2010	11/22/2011

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