Compliance Testing, LLC
Previously Flom Test Lab
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268
fax: (480) 926-3598
http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Space Data Corporation

Model: SK8-900

Description: SkySite Voice Repeater (LMR Repeater/Extender)

To

FCC Rule Part 24D

Date of Issue: February 8, 2012

On the behalf of the applicant:	**Space Data Corporation** **2535 W. Fairview St.** **Suite 101** **Chandler, AZ 85224**
Attention of:	**Jerry Knoblach, Chairman/CEO** **Ph: (480)722-2100** **Fax: (480) 403-0021** **E-Mail: knoblach@spacedata.net**

Prepared by
Compliance Testing, LLC
3356 N San Marcos Pl, Suite 107
Chandler, AZ 85225-7176
(866) 311-3268 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1220002

John Erhard

Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	February 8, 2012	John Erhard	Original Document
2.0	March 5, 2012	John Erhard	Correct typographical error in environmental conditions during testing.

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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.

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 the 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 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 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.

Sub-part
2.1033(c)(14): **Test and Measurement Data**

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II, Part 2, Sub-part J, Sections 2.947, 2.1033(c), and the FCC *AMPLIFIER, BOOSTER, AND REPEATER - BASIC ITEMS* Measurement Guide

Standard Test Conditions and Engineering Practices

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

In accordance with ANSI/C63.4-2009, 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.

Environmental Conditions		
Temperature (deg C)	**Humidity (%)**	**Pressure (mbar)**
25.00	**27.90**	**971.300**

Accessories:

Qty	Desc	Mfg	Model	S/N
1	Active GPS Antenna System	N/A	N/A	N/A
1	Laptop with System Control Software	N/A	N/A	N/A
1	System Control Transmitter	Space Data	FCC ID: RY9GST900	N/A

Cables: Standard RF cables as necessary

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

Test Result Summary

Test Name	Pass, Fail, N/A	Comments
Radiated Spurious Emissions	Pass	
Conducted Spurious Emissions	Pass	
Intermodulation	Pass	
Occupied Bandwidth	Pass	
Output power	Pass	
Out of Band Rejection	Pass	
Frequency Stability	Pass	

Radiated Spurious Emissions

Name of Test:	Radiated Spurious Emissions	**Engineer:** John Erhard
Test Equipment Utilized:	i00103, i00331, i00348, i00091	**Test Date:** 2/6/2012

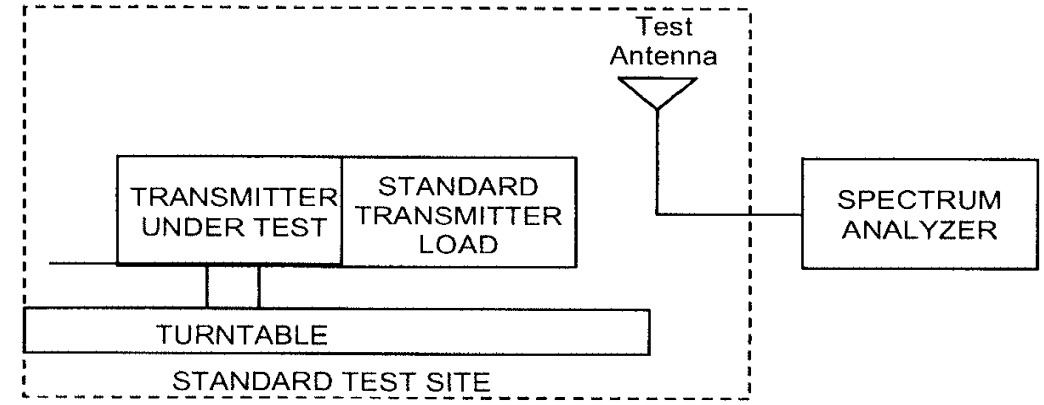
Test Procedure

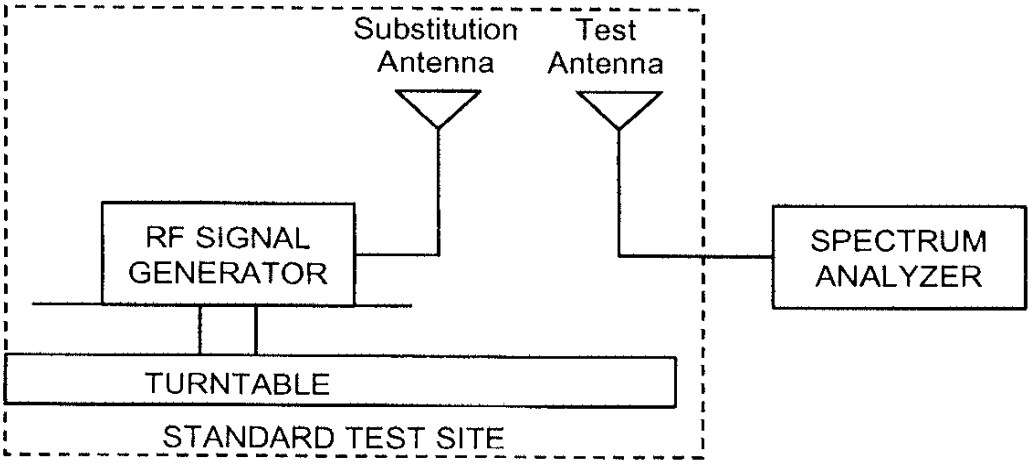
A) Connect the equipment as illustrated
B) Adjust the spectrum analyzer for the following settings:
   1) Resolution Bandwidth 100 kHz (< 1 GHZ), 1 MHZ (> 1GHz) unless otherwise specified.
   2) Video Bandwidth ≥ 3 times Resolution Bandwidth
   3) Sweep Speed ≤2000 Hz/second
   4) Detector Mode = Average
C) Place the transmitter to be tested on the turntable in the standard test site. Transmitters without antennas were transmitting into a non-radiated load. The RF cable to this load should be of minimum length. Transmitters with antennas were transmitting into the manufacturer's supplied antenna.
D) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth (see section 1.3.4.4).
E) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
F) Repeat step E) for each spurious frequency with the test antenna polarized vertically.
G) Reconnect the equipment as illustrated.
H) Keep the spectrum analyzer adjusted as in step B).
I) Remove the transmitter and replace it with a substitution antenna (the antenna should be half wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.
J) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
K) Repeat step J) with both antennas vertically polarized for each spurious frequency.
L) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps J) and K) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.
M) The levels recorded in step L) are absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

Radiated spurious emissions dB = $10\log_{10}$ (TX power in watts/0.001) – the levels in step I)

NOTE: It is permissible that the other antennas provided can be referenced to a dipole.

Test Setup


Test
Antenna
TRANSMITTER
UNDER TEST
STANDARD
TRANSMITTER
LOAD
SPECTRUM
ANALYZER
TURNTABLE
STANDARD TEST SITE


Substitution
Antenna
Test
Antenna
RF SIGNAL
GENERATOR
SPECTRUM
ANALYZER
TURNTABLE
STANDARD TEST SITE

930.5 MHz Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1861.005	-46.85	-13	Pass
2791.505	-37.90	-13	Pass
3722.005	-37.41	-13	Pass
4652.505	-37.61	-13	Pass

940.5 MHz Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1881.000	-44.10	-13	Pass
2821.500	-37.72	-13	Pass
3762.000	-37.02	-13	Pass
4702.500	-36.14	-13	Pass

No other emissions were detected. All emissions were greater than -20 dBc and no emissions were above the limit.

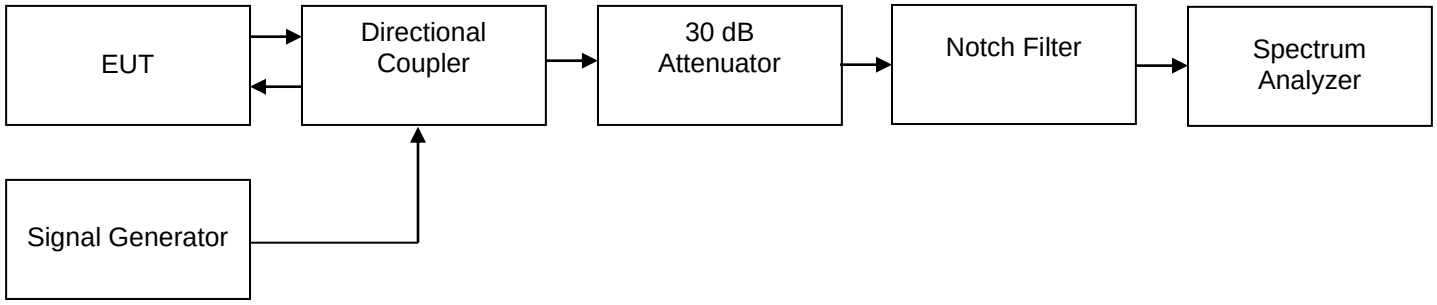
Conducted Spurious Emissions

Name of Test:	Conducted Spurious Emissions	**Engineer:** John Erhard
Test Equipment Utilized:	i00331, i00348, i00364 Narda 3116	**Test Date:** 2/6/2012

Test Procedure

The EUT was connected to a spectrum analyzer through a directional coupler and a 30 dB attenuator to verify that the UUT met the requirements for spurious emissions. The RBW was set to 100 KHz which is greater than 3 times the occupied bandwidth while still providing enough dynamic range for accurate measurements. The peak emission for each tunable frequency was examined. A tunable notch filter was used to provide additional suppression of the fundamental and to ensure that the spectrum analyzer was not in compression while making this measurement. The signal generator is used to provide the received signal which is then translated to the new output frequency.

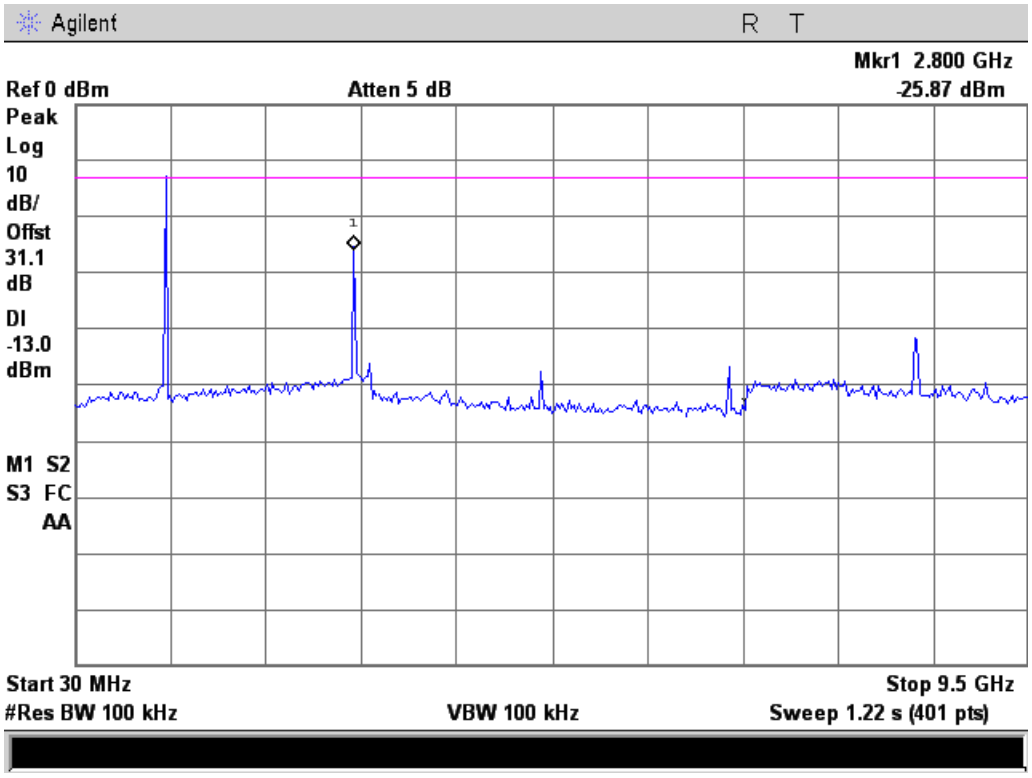
Test Setup



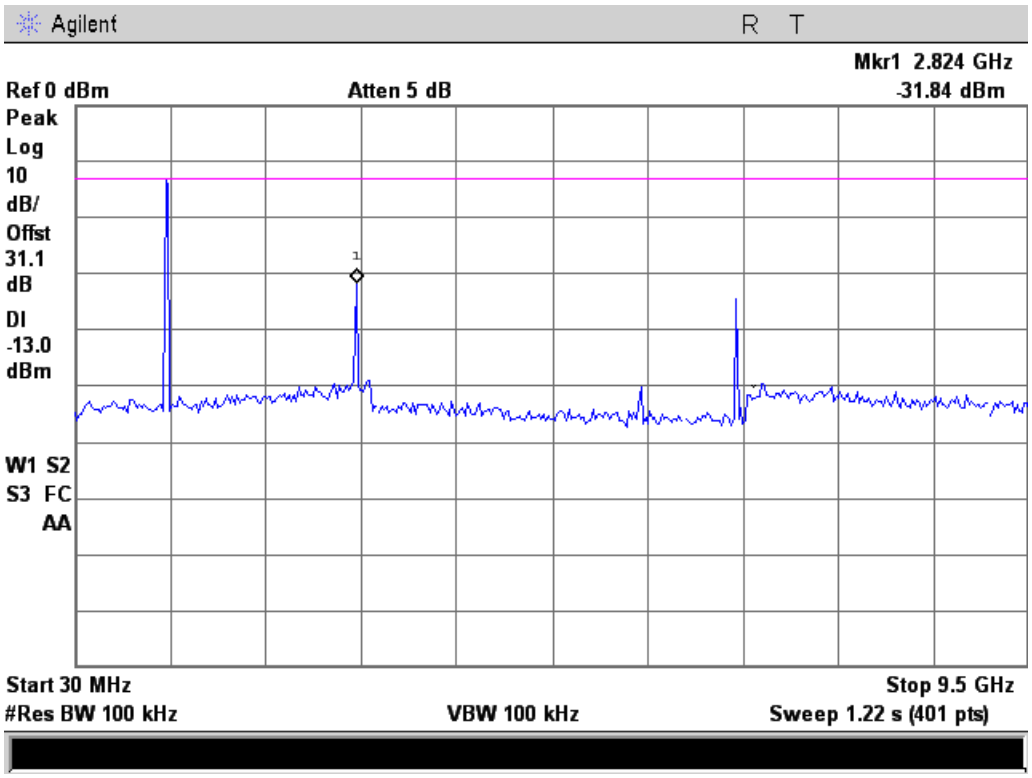
Test Results

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
930.5	2800.0	-25.87	-13	Pass
940.5	2824.0	-31.84	-13	Pass

930.5 MHz Test Results



940.5 MHz Test Results



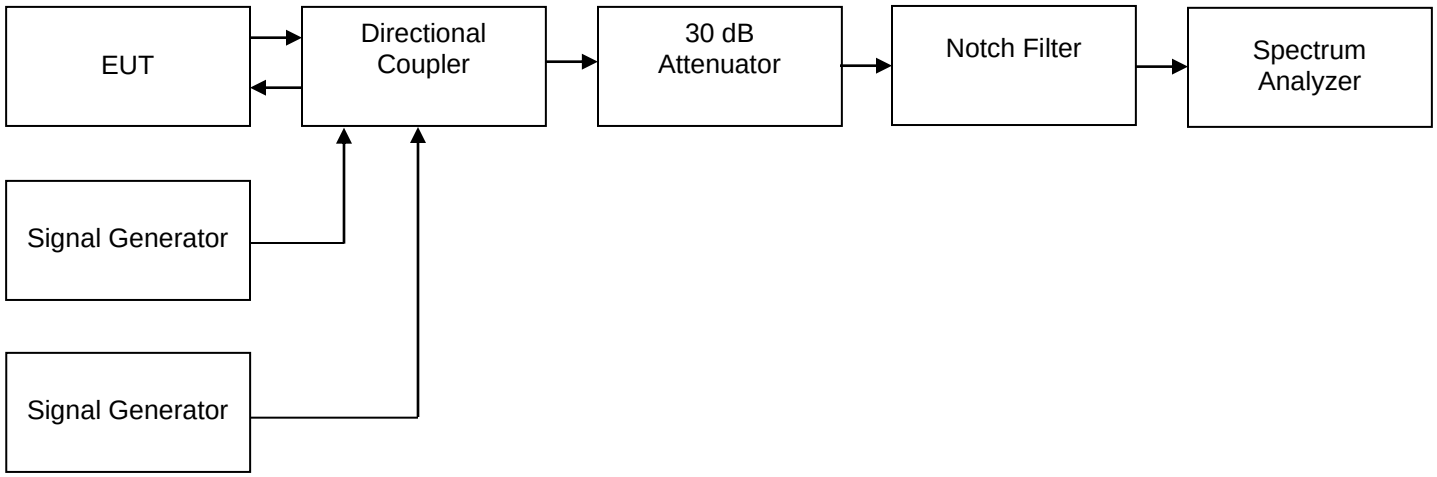
Intermodulation

Name of Test:	Intermodulation	**Engineer:** John Erhard
Test Equipment Utilized:	i00331, i00348, i00363, i00364 Narda 3116	**Test Date:** 2/6/2012

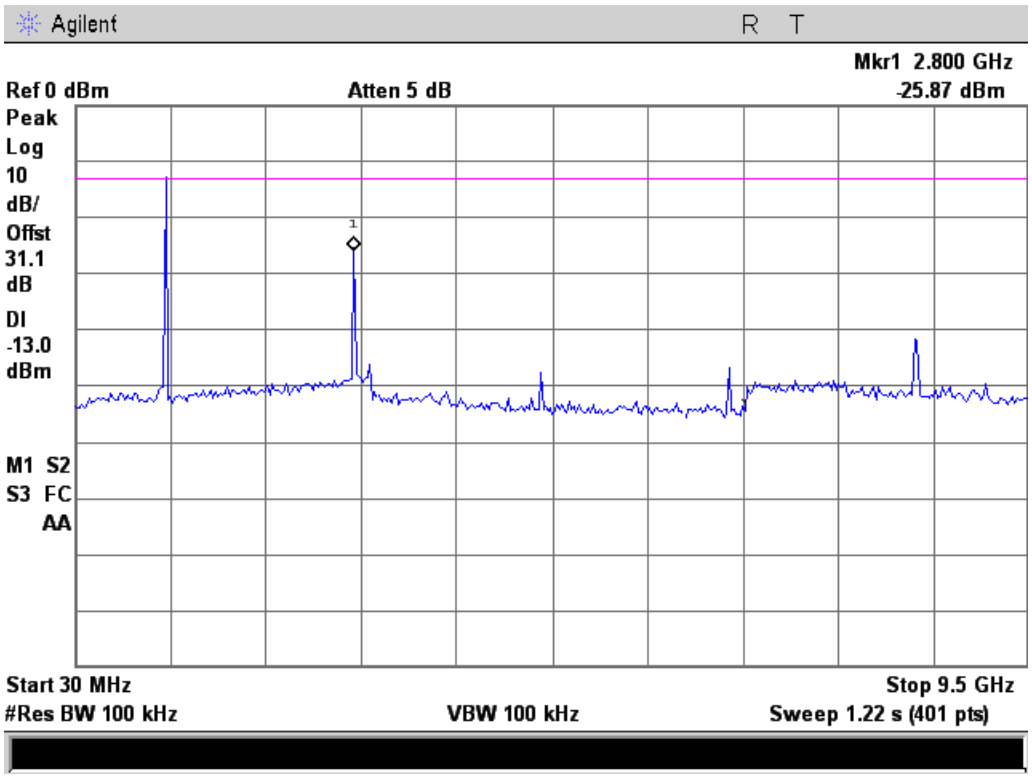
Test Procedure

The EUT was connected to a spectrum analyzer through a directional coupler and a 30 dB attenuator to verify that the UUT met the requirements for intermodulation. The RBW was set to 100 KHz which is greater than 3 times the occupied bandwidth while still providing enough dynamic range for accurate measurements. A second signal generator tuned to a different operational channel was utilized to verify that there were no intermodulation products. The peak emission for each tunable frequency was examined. A tunable notch filter was used to provide additional suppression of the fundamental to ensure that the spectrum analyzer was not in compression while making this measurement. The signal generator is used to provide the received signal which is then translated to the new output frequency.

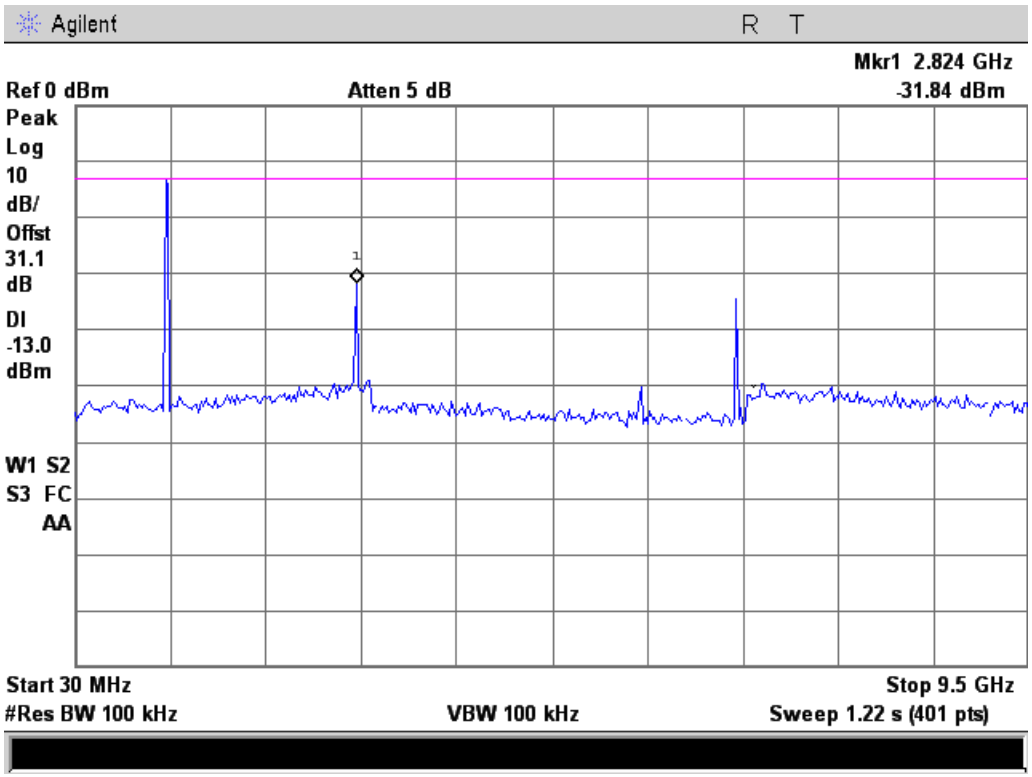
Test Setup



930.5 MHz Test Results



940.5 MHz Test Results



Only harmonic products of the fundamental signal are detectable. There are no intermodulation products.

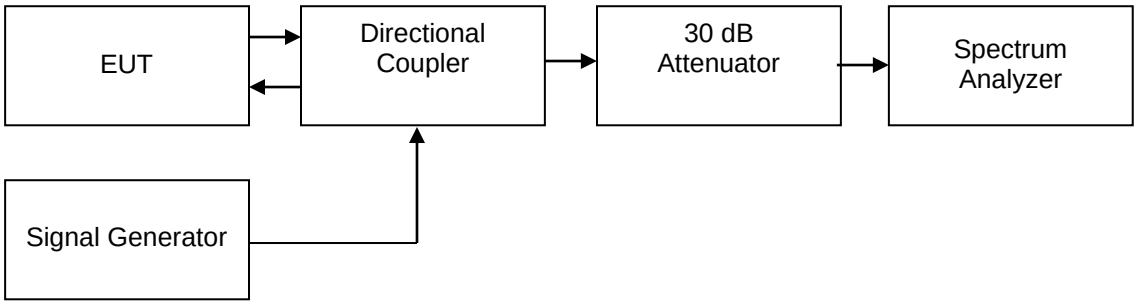
Occupied Bandwidth

Name of Test:	Occupied Bandwidth	**Engineer:** John Erhard
Test Equipment Utilized:	i00331, i00348 Narda 3116	**Test Date:** 2/6/2012

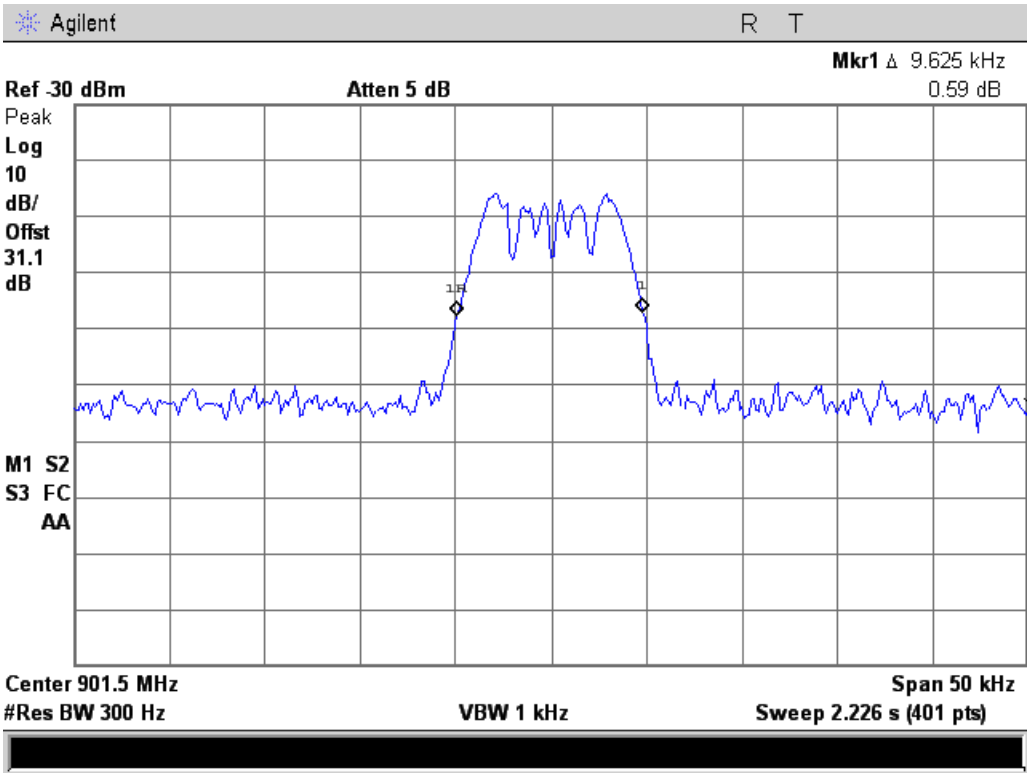
Test Procedure

The EUT was connected to a spectrum analyzer through a directional coupler and a 30 dB attenuator to verify that the UUT met the requirements for occupied bandwidth. The RBW was set to 300 Hz per the FCC measurement guide recommendation. The occupied bandwidth of the input signal was measured as a reference. The signal generator is used to provide the received signal which is then translated to the new output frequency.

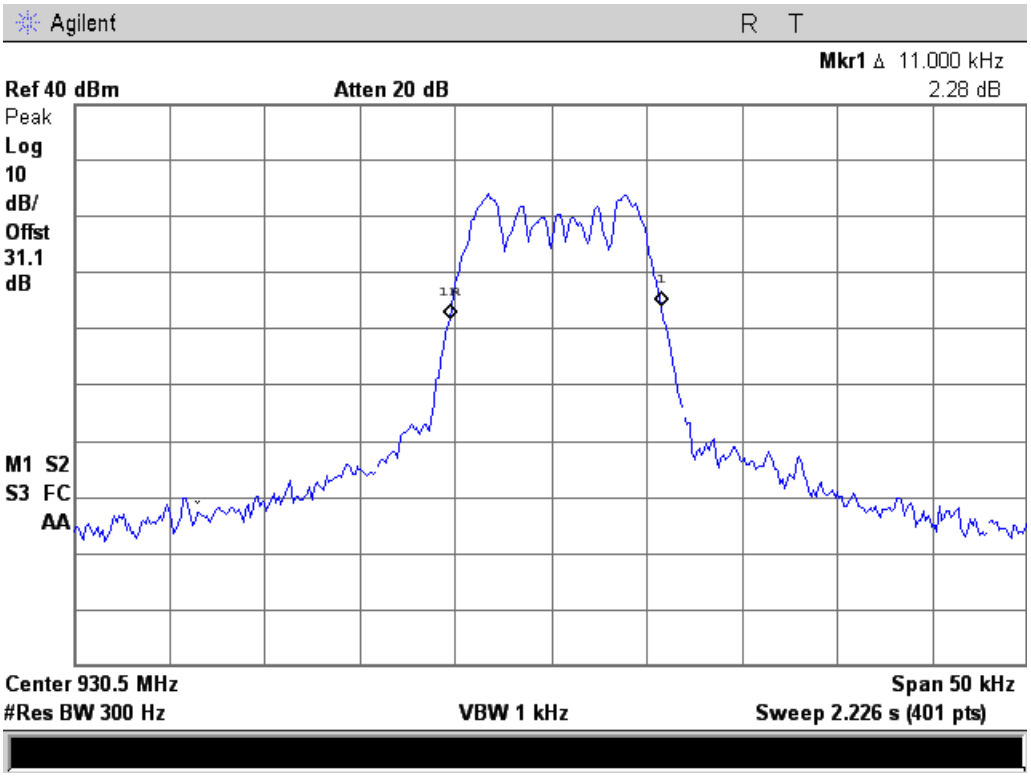
Test Setup



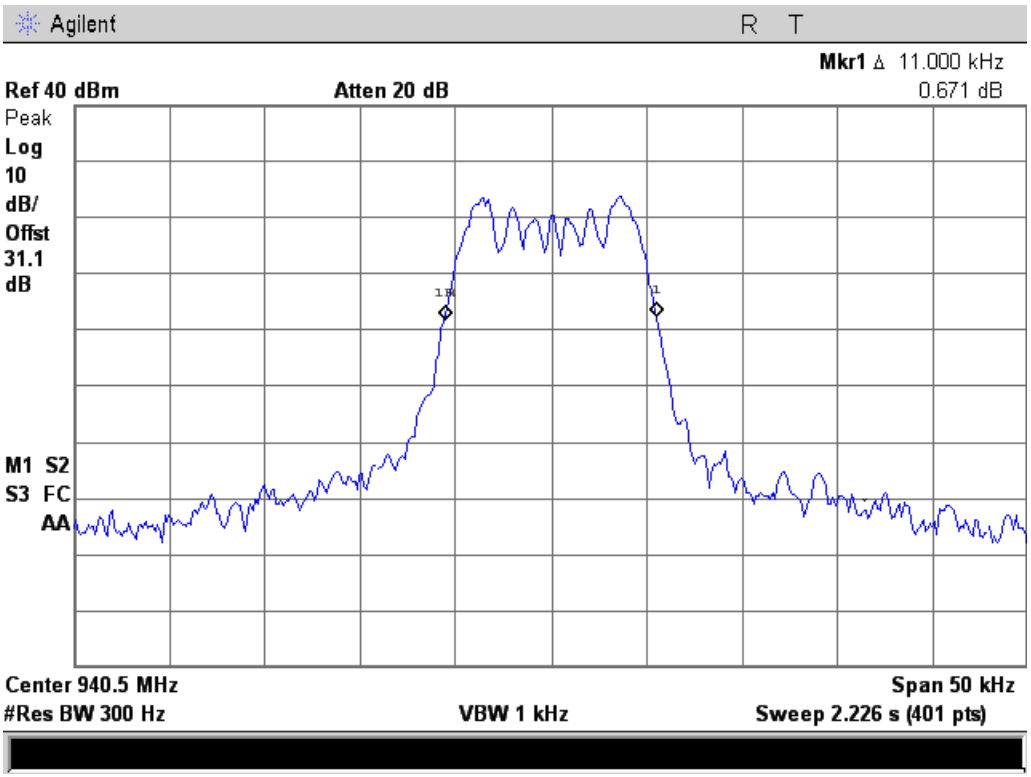
Reference Plot



930.5 MHz Test Results



940.5 MHz Test Results



The occupied bandwidth of both operational bands was similar in shape and bandwidth to the input signal.

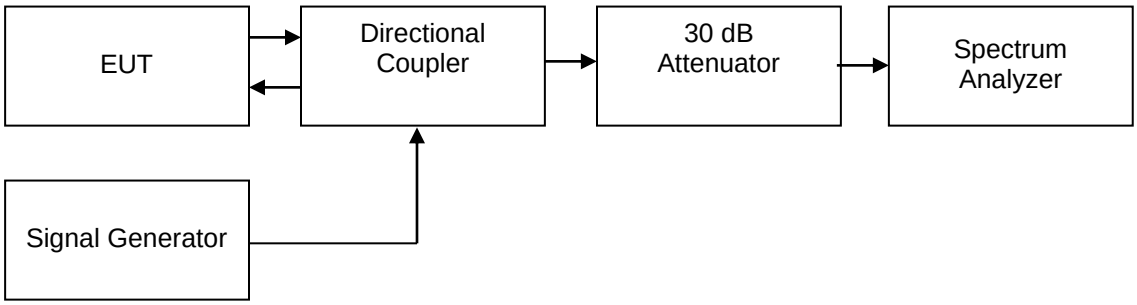
Output Power

Name of Test:	Output Power	**Engineer:** John Erhard
Test Equipment Utilized:	i00331, i00348 Narda 3116	**Test Date:** 2/6/2012

Test Procedure

The EUT was connected to a spectrum analyzer through a directional coupler and a 30 dB attenuator to verify that the UUT met the requirements for output power. The RBW was set to 100 KHz which is greater than 3 times the occupied bandwidth. The power of the input signal was set above the maximum recommended operational input power and the output power was measured to ensure it was not greater than allowed. The signal generator is used to provide the received signal which is then translated to the new output frequency.

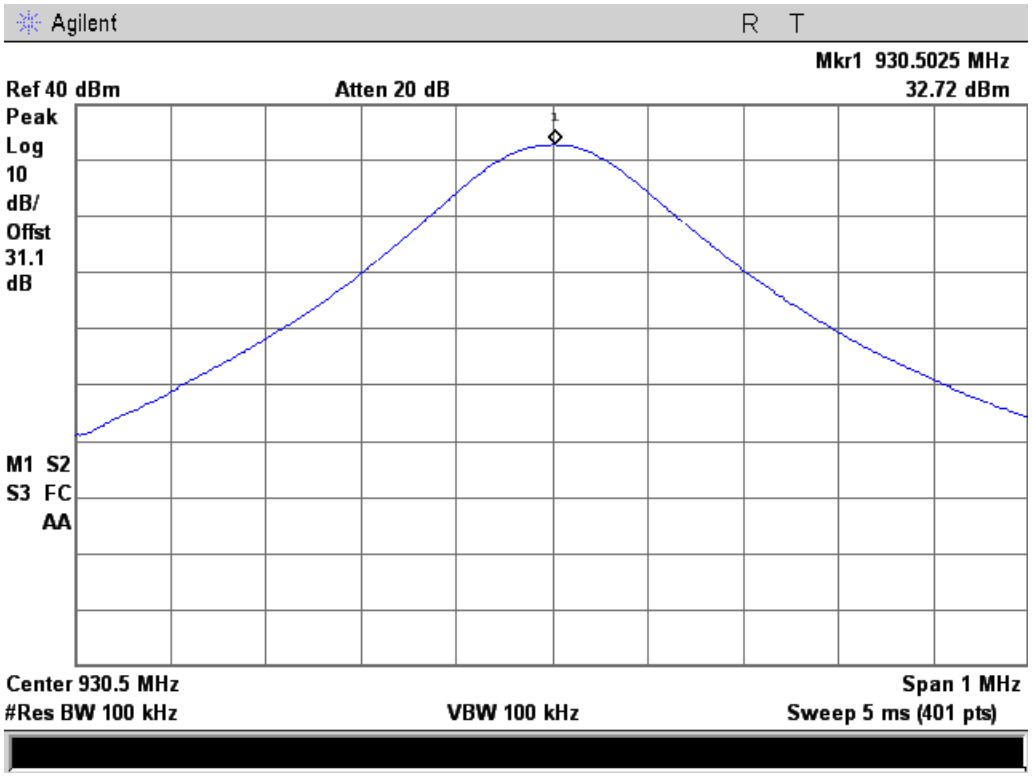
Test Setup



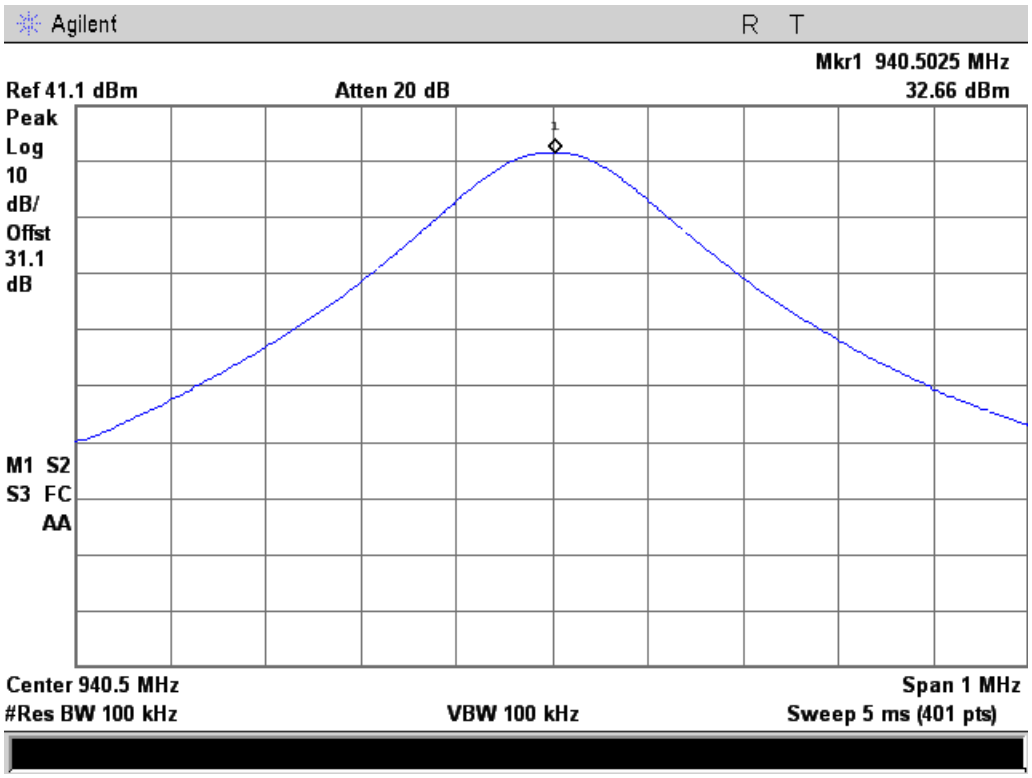
Test Results

Tuned Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
930.5	32.72	33	Pass
940.5	32.66	33	Pass

930.5 MHz Test Results



940.5 MHz Test Results



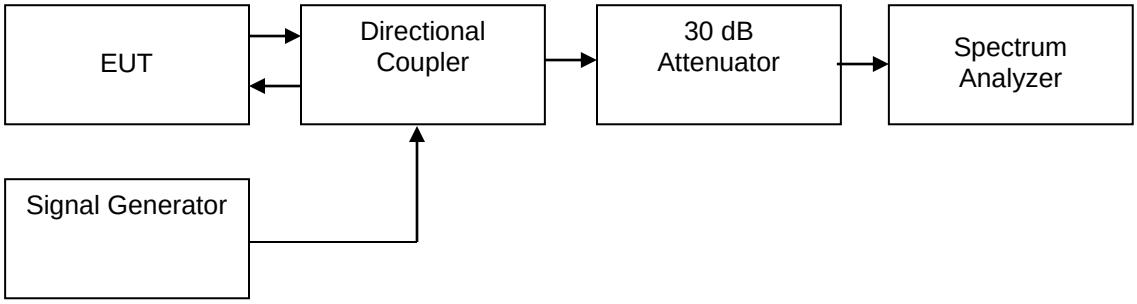
Out of Band Rejection

Name of Tests:	Out of Band Rejection	**Engineer:** John Erhard
Test Equipment Utilized:	i00331, i00348 Narda 3116	**Test Date:** 2/6/2012

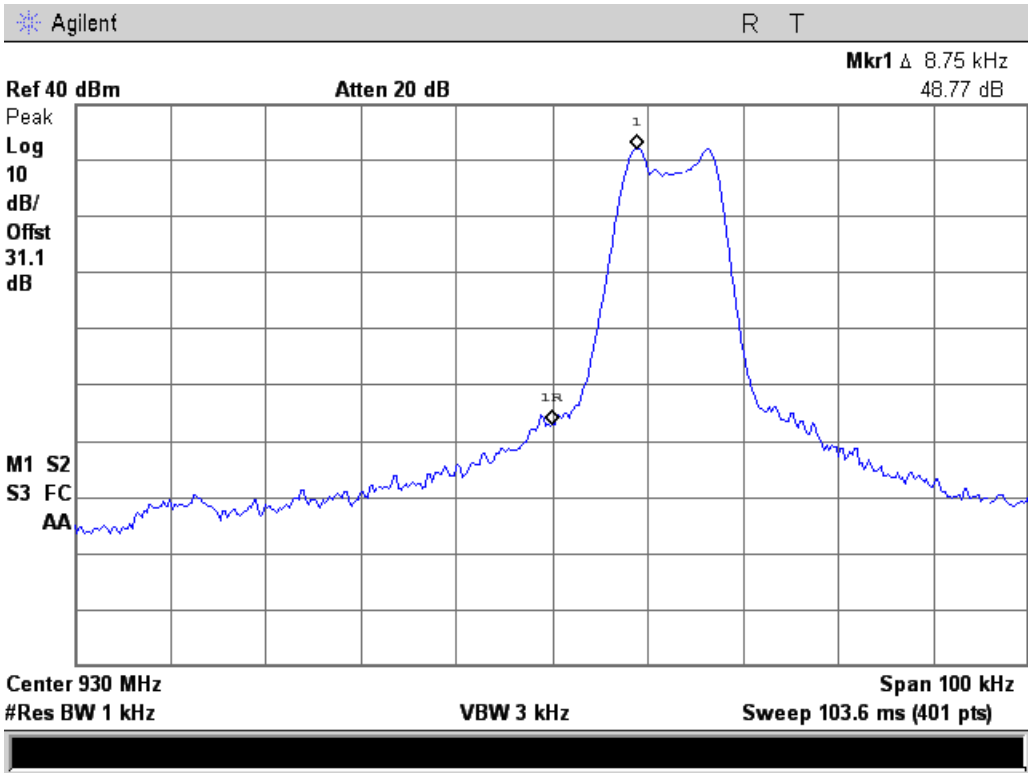
Test Procedure

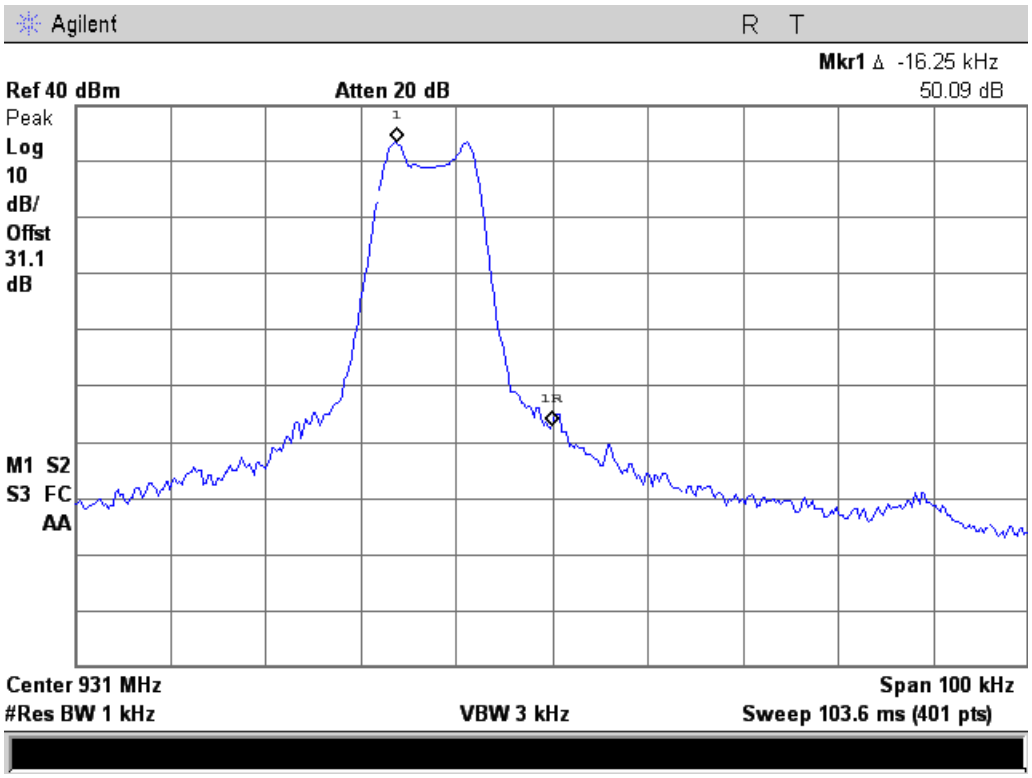
The EUT was connected to a spectrum analyzer through a directional coupler and a 30 dB attenuator to verify that the UUT met the requirements for out of band rejection. The RBW was set to 1 KHz to allow for an accurately measurable narrowband single while preventing signal suppression. The band edge for the lowest and highest tunable channels were measured showing the band edges. As the EUT will only provide an output if a signal on a specified input channel is detected an out of band signal cannot be passed through the EUT. The signal generator is used to provide the received signal which is then translated to the new output frequency.

Test Setup

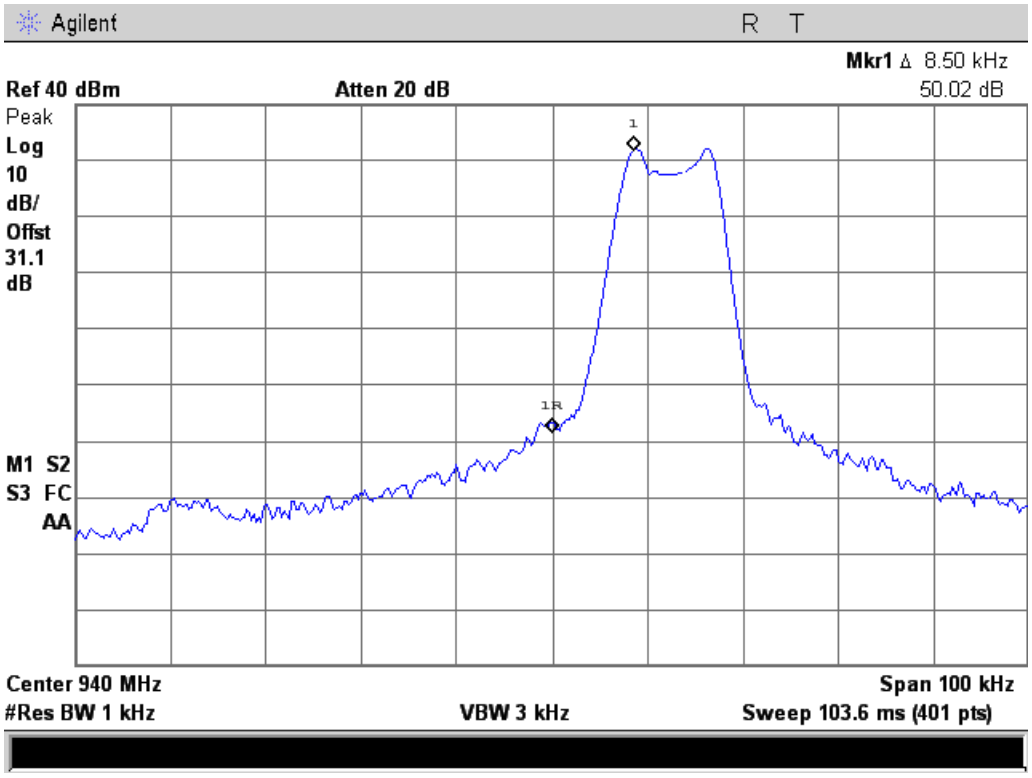


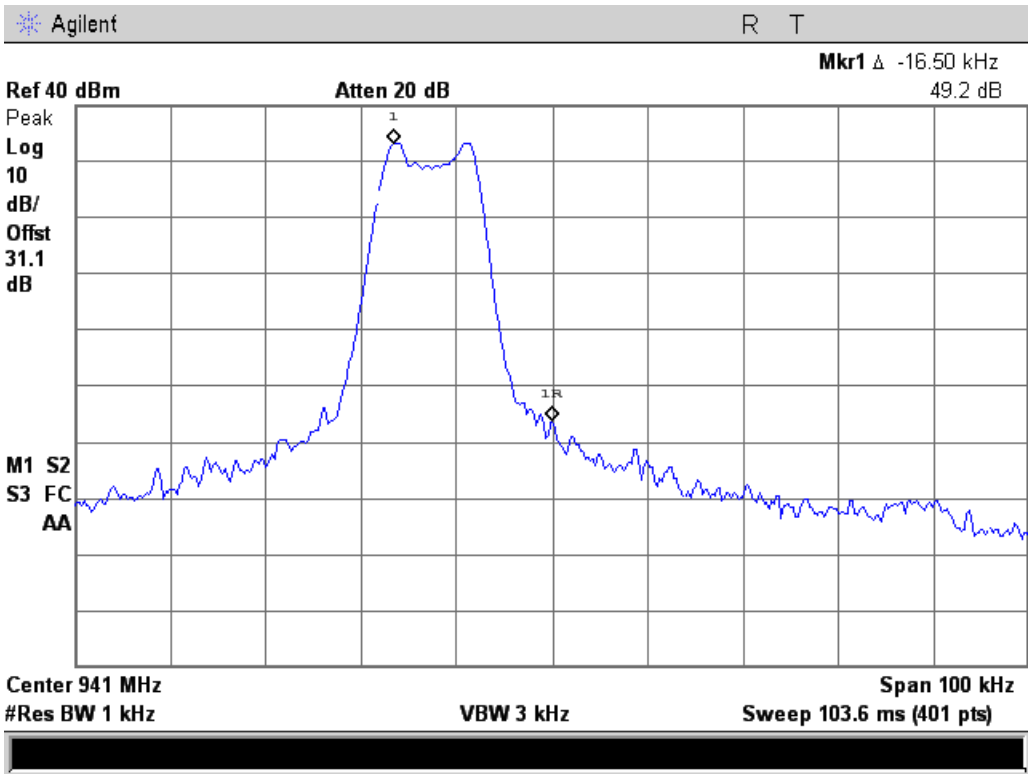
930.5 MHz Test Results





940.5 MHz Test Results





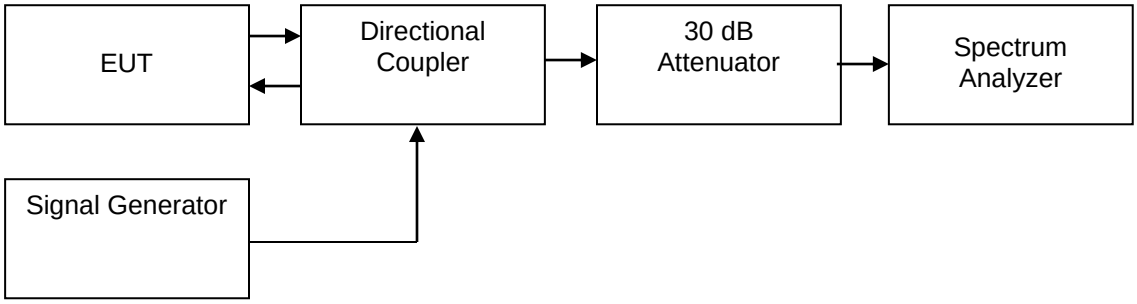
Frequency Stability

Name of Test:	Frequency Stability	**Engineer:** John Erhard
Test Equipment Utilized:	i00287, i00320, i00331, i00343, i00348 Narda 3116	**Test Date:** 2/7/2012

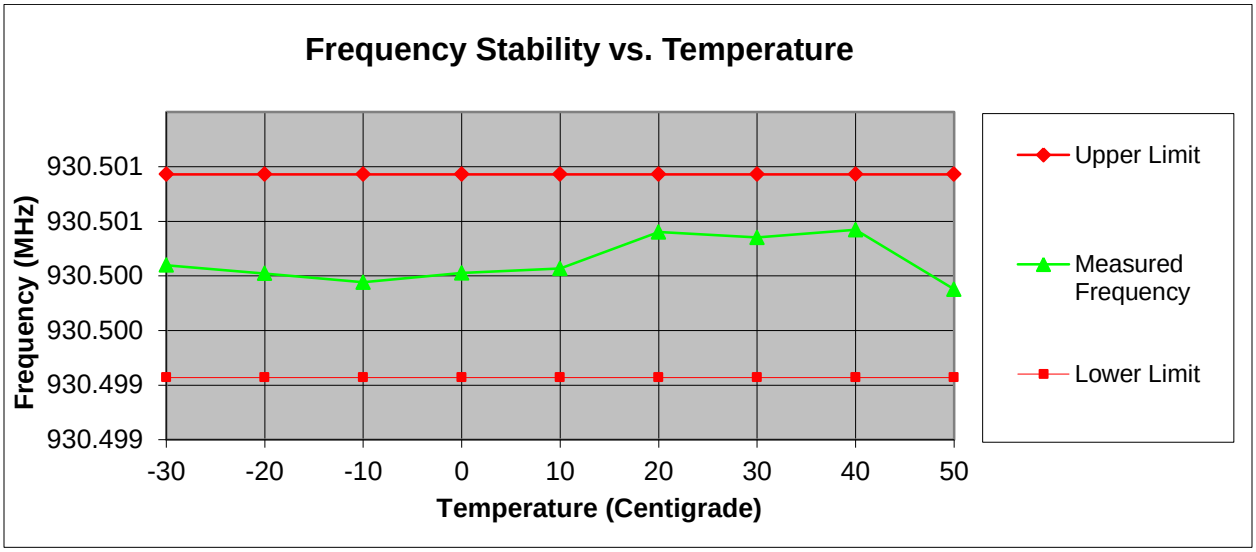
Test Procedure

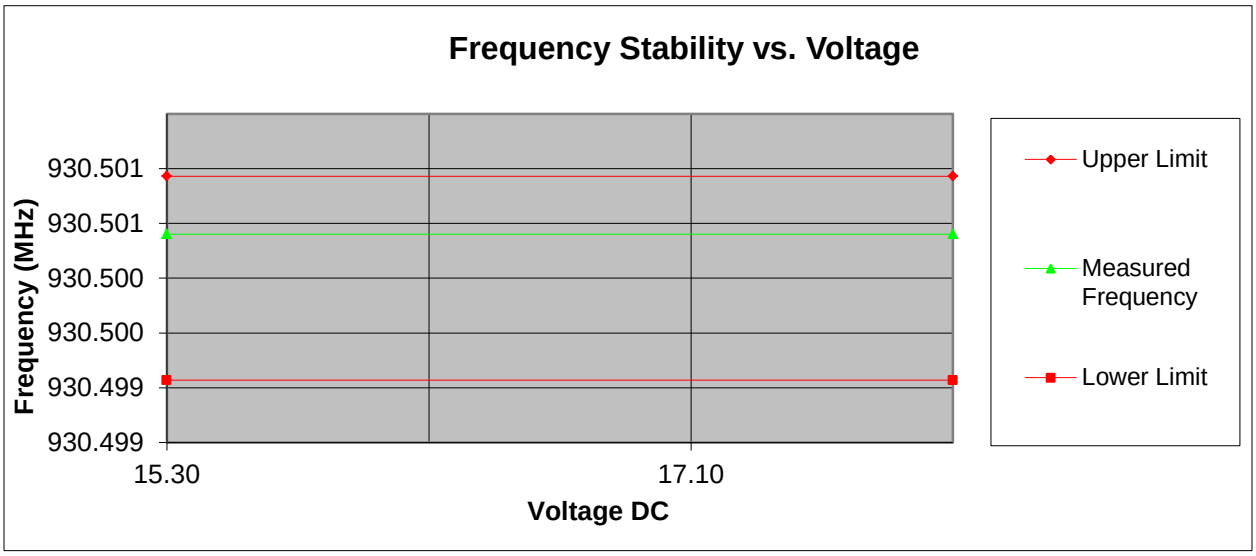
The EUT was placed in an environmental test chamber and the RF output was connected to a spectrum analyzer through a directional coupler and a 30 dB attenuator. The temperature was varied from -30°C to 50°C in 10°C increments. After a sufficient time for temperature stabilization the RF output frequency was measured. At 20°C the voltage was varied -15% to ensure that a low battery condition does not change the frequency stability. Over voltage was not tested as this device only operated from battery power. The signal generator is used to provide the received signal which is then translated to the new output frequency.

Test Setup



Measurement Results





Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Temperature Chamber	Tenney	Tenney II Benchmaster	i00287	Verified on: 2/7/12	
Horn Antenna	EMCO	3115	i00103	11/5/10	11/5/12
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	11/5/11	11/5/12
Voltmeter	Fluke	75III	i00320	1/10/12	1/10/13
Spectrum Analyzer	Agilent	E4407B	i00331	5/24/11	5/24/12
Data Logger	Fluke	Hydra Data Bucket	i00343	12/15/11	12/15/12
Humidity / Temp Meter	Control Company	4189CC	i00355	1/11/12	1/11/13
Signal Generator	Agilent	E4438C	i00348	9/27/11	9/27/12
Signal Generator	Rhode & Schwartz	SME-02	i00363	12/22/11	12/22/12
Horn Antenna	Aprel	AH118	i00091	Verified on: 2/6/12	
Tunable Notch Filter	Eagle	TNF240MFMF	i00364	Verified on: 2/6/12	

Customer Supplied Test Equipment Utilized

Description	Manufacturer	Model Number	Last Cal Date	Cal Due Date
Directional Coupler	Narda	3166	Verified on: 2/6/12	

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