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

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fax: (480) 926-3598
http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Kenwood USA Corporation

Model: NX-420-K / -K3

Description: 800MHz Digital Transceiver

To

FCC Part 90

Date of Issue: January 18, 2013

On the behalf of the applicant:

Kenwood USA Corporation
Communications Division
3970 Johns Creek Court
Suwanee, GA 30024

Attention of:

Joel Berger, Research and Development
Ph: (678)474-4722
E-Mail: jberger@kenwoodusa.com

Prepared By
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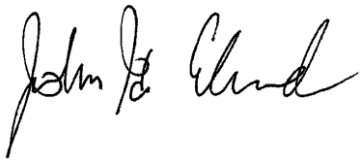
Project No: p12b0023



John Erhard
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	January 18, 2013	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.

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

Testing Certificate Number: **2152.01**

ACCREDITED
TESTING CERT
#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.

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

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), 2.1041, 2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057, and the following individual Parts: 90.

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		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
16.3 - 20.8	22.9 - 26.8	974.2 - 979.8

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

EUT Description

Model: NX-420-K / -K3
Description: The EUT is an 800 MHz push to talk radio
Firmware: N/A
Software: N/A

Additional Information: None

EUT Operation during Tests: The EUT was in a normal operating condition.

Accessories: None

Cables: None

Modifications: None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
2.1046	Carrier Output Power (Conducted)	Pass	
2.1051	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1053	Field Strength of Spurious Radiation	Pass	
90.210	Emission Masks (Occupied Bandwidth)	Pass	
2.1047	Audio Low Pass Filter (Voice Input)	Pass	
2.1047	Audio Frequency Response	Pass	
2.1047(a)	Modulation Limiting	Pass	
90.213	Frequency Stability (Temperature Variation)	Pass	
90.213	Frequency Stability (Voltage Variation)	Pass	
90.214	Transient Frequency Behavior	N/A	The EUT operates at a frequency above 512 MHz
RSS-Gen	Receiver Spurious Emissions	Pass	
2.202	Necessary Bandwidth Calculation	Pass	

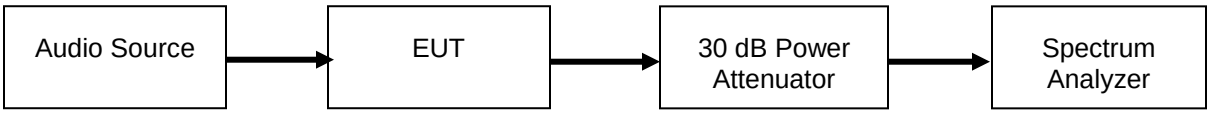
Carrier Output Power (Conducted)

Name of Test:	Carrier Output Power (Conducted)	**Engineer:** John Erhard
Test Equipment Utilized:	i00118, i00331	**Test Date:** 1/17/2013

Test Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB power attenuator. The RBW was set at least 3X wider than the occupied bandwidth of the operating signal and the VBW was set 3X the RBW. An audio source was used to ensure that a modulated signal was generated. The peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Recorded Measurement (Watts)	Result
806.05	34.49	2.8	Pass
815.05	34.78	3.0	Pass
823.95	34.78	3.0	Pass
851.05	34.74	3.0	Pass
860.05	34.64	2.9	Pass
868.95	34.75	3.0	Pass

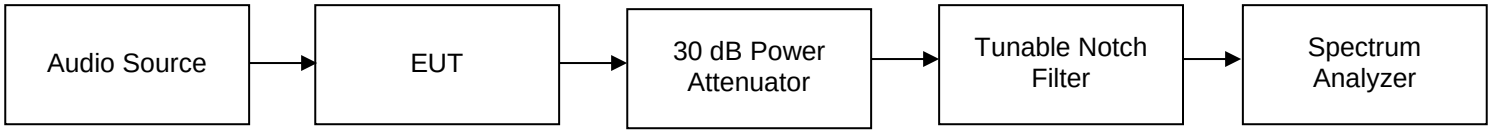
Conducted Spurious Emissions

Name of Test:	Conducted Spurious Emissions	**Engineer:** John Erhard
Test Equipment Utilized:	i00118, i00331	**Test Date:** 1/17/2013

Test Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB power attenuator. The RBW was set at least 3X wider that the occupied bandwidth of the operating signal and the VBW was set 3X the RBW. An audio source was used to ensure that a modulated signal was generated. A tunable notch filter was utilized to ensure that the spectrum analyzer was not in compression. The peak readings were taken and the result was then compared to the limit.

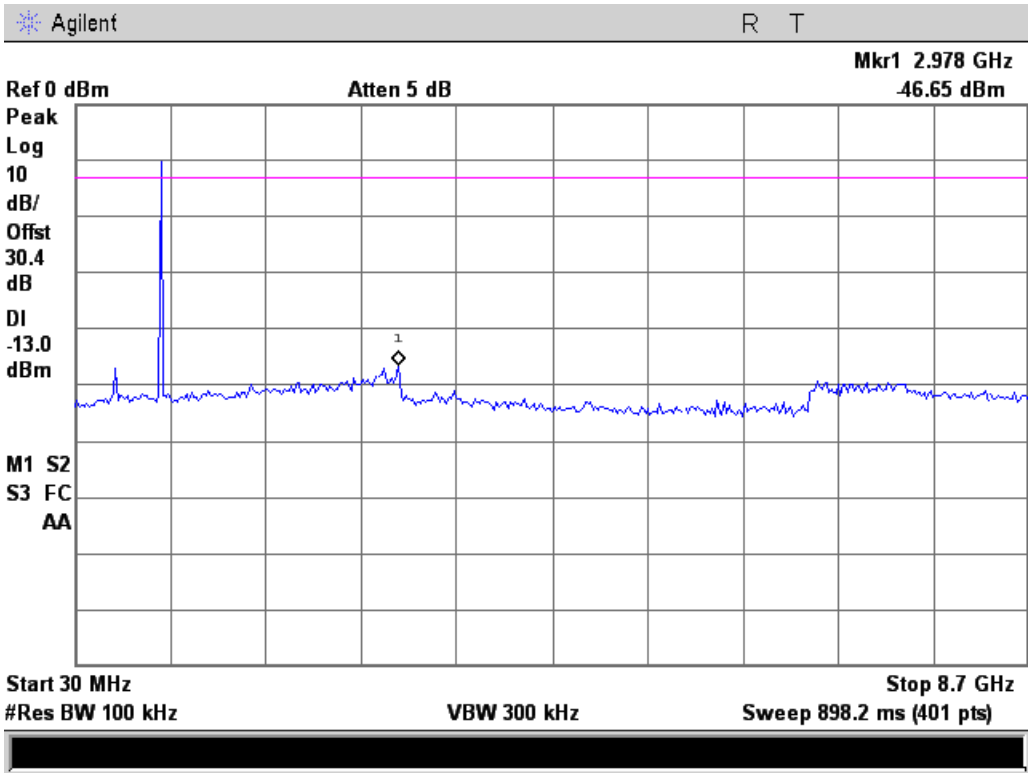
Test Setup



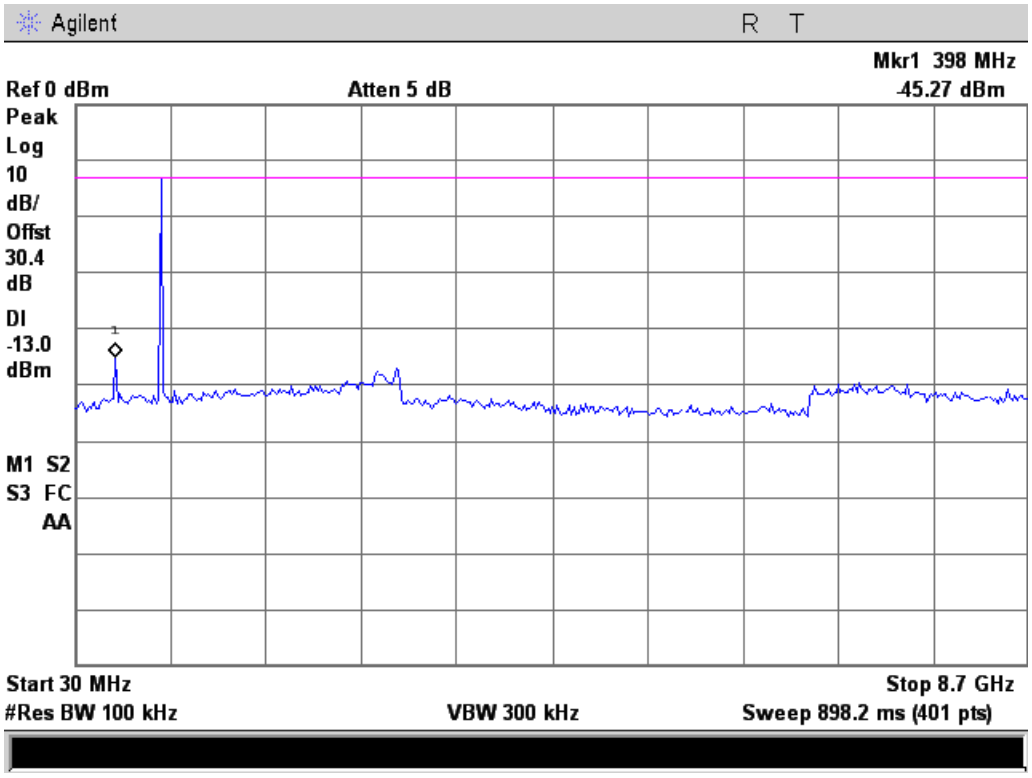
Conducted Spurious Emissions Summary Test Table

Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
806.05	2978	-46.65	-13	Pass
815.05	398	-45.27	-13	Pass
823.95	420	-45.91	-13	Pass
851.05	2826	-47.41	-13	Pass
860.05	2956	-46.92	-13	Pass
868.95	442	-46.90	-13	Pass

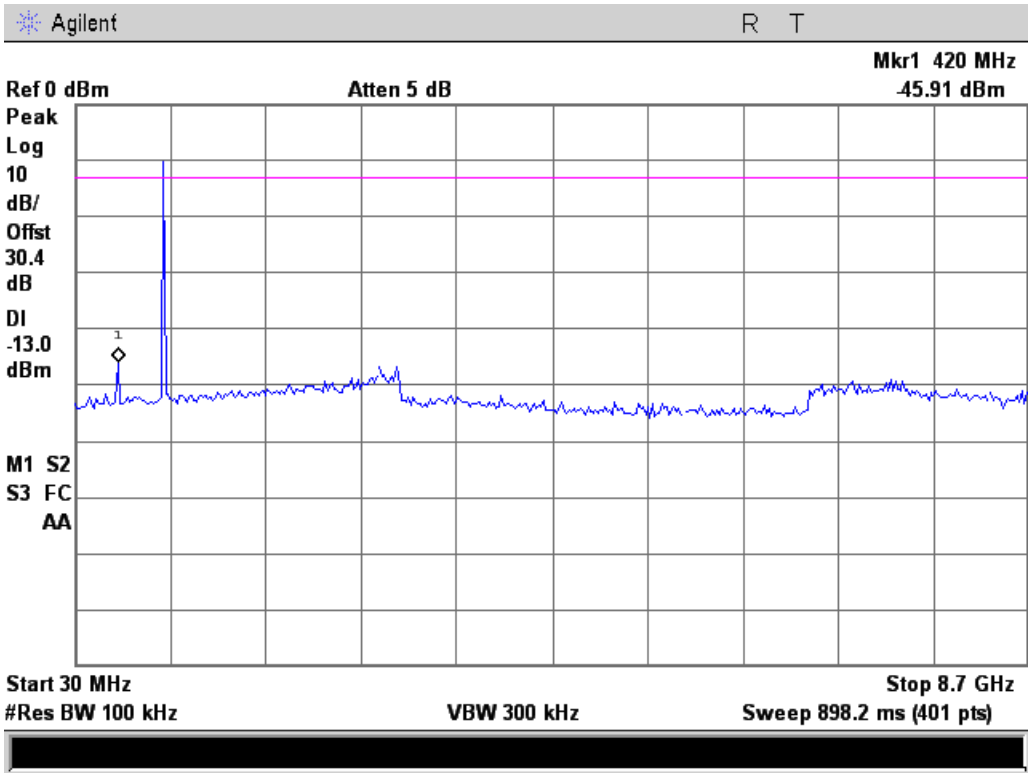
806.05 MHz



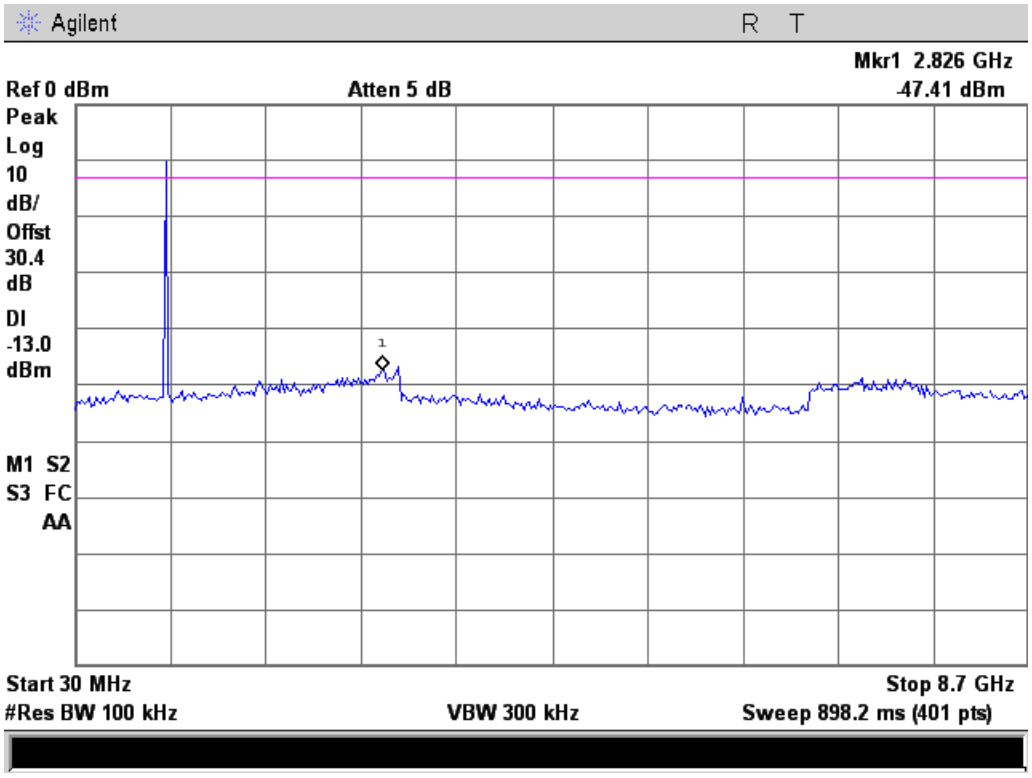
815.05 MHz



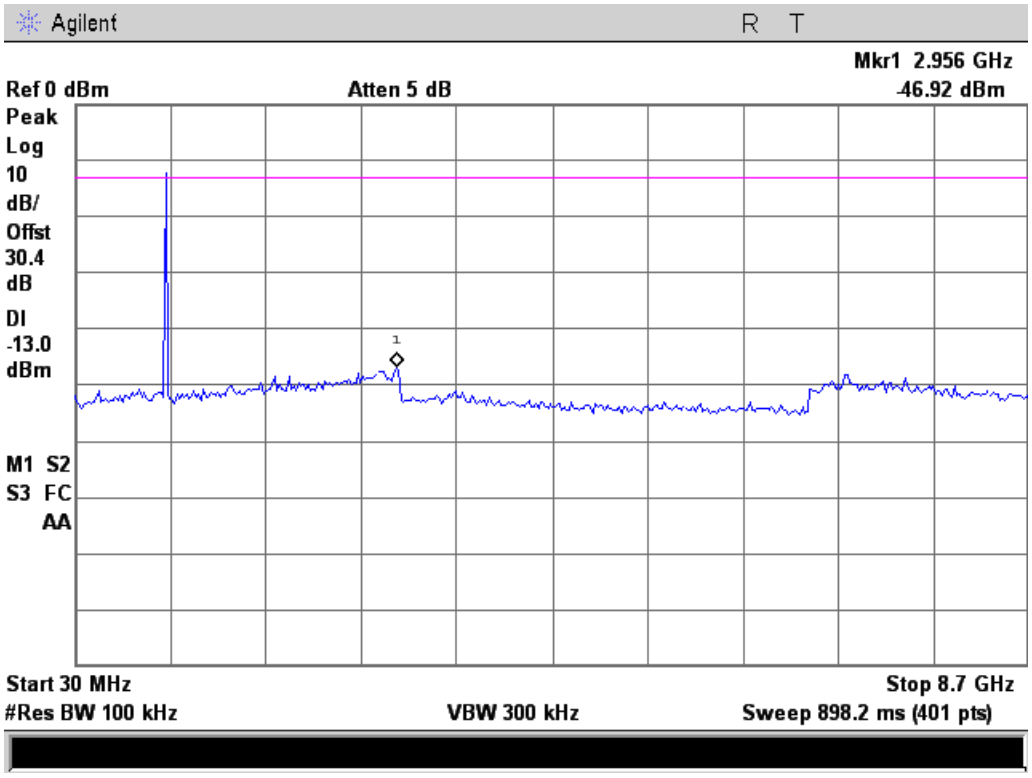
823.95 MHz



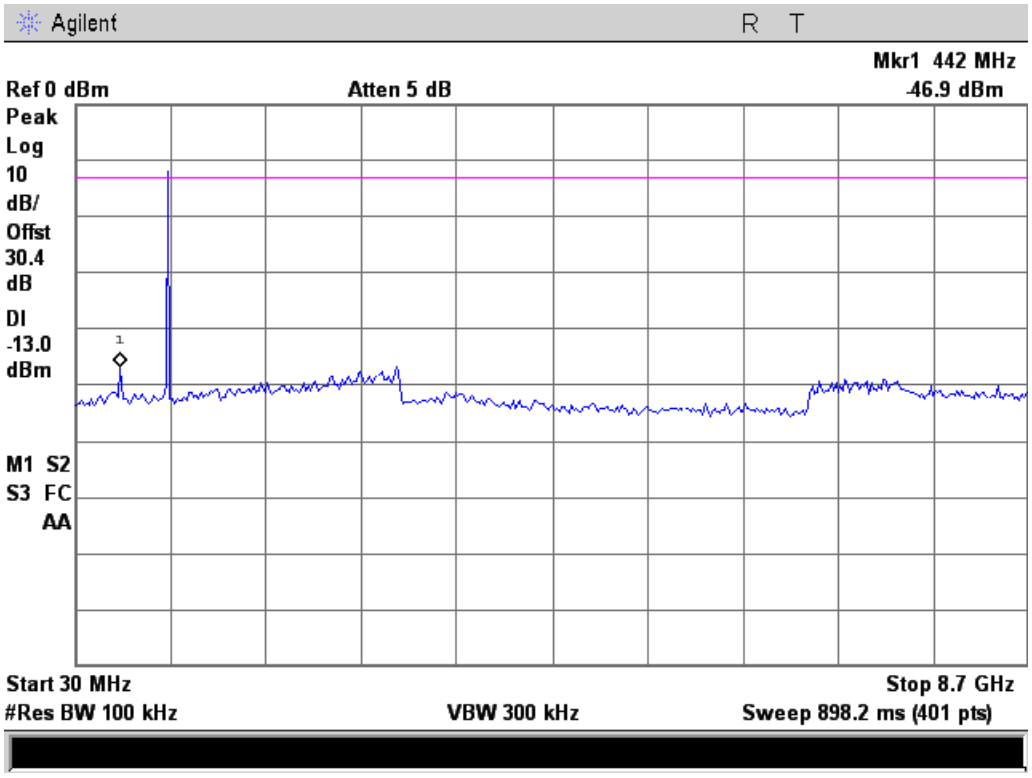
851.05 MHz



860.05 MHz



868.95 MHz



Field Strength of Spurious Radiation

Name of Test:	Field Strength of Spurious Radiation	**Engineer:**	John Erhard
Test Equipment Utilized:	i00271, i00331	**Test Date:**	1/20/2013

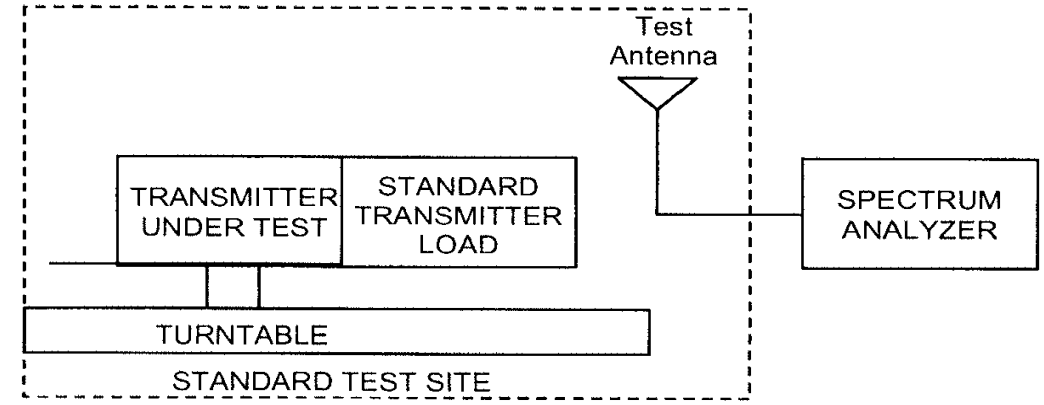
Test Procedure

A) Connect the equipment as illustrated below.
B) Adjust the spectrum analyzer to the following settings:
    1) Resolution Bandwidth 100 kHz (< 1 GHZ), 1 MHZ (> 1GHz)
    2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz
    3) Sweep Speed ≤2000 Hz/second
    4) Detector Mode = Mean or Average Power
C) Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non- radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.
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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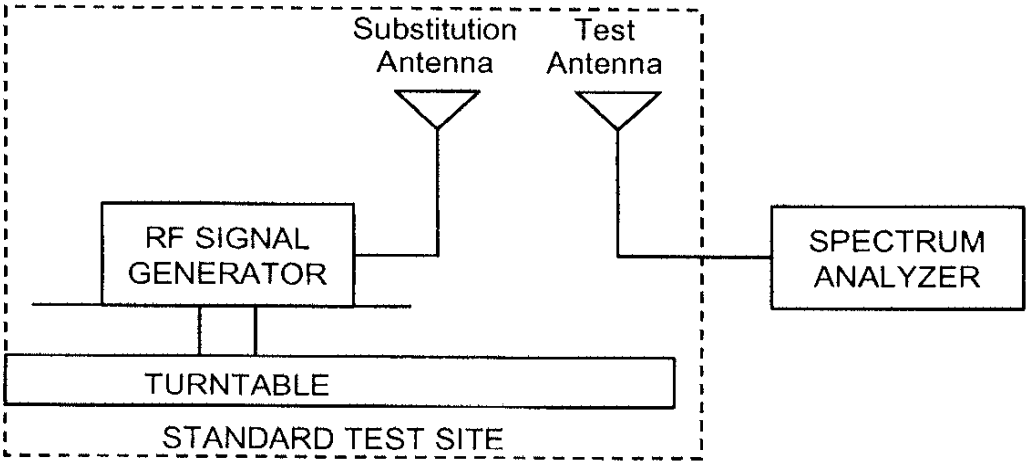
Antenna
TRANSMITTER
UNDER TEST
STANDARD
TRANSMITTER
LOAD
SPECTRUM
ANALYZER
TURNTABLE
STANDARD TEST SITE


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

806.05 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1612.1	-60.39	-13	Pass
2418.15	-72.24	-13	Pass
3224.2	-69.83	-13	Pass

815.05 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1630.1	-57.08	-13	Pass
2445.15	-63.49	-13	Pass
3260.2	-73.37	-13	Pass

823.95 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1647.9	-54.62	-13	Pass
2471.85	-62.55	-13	Pass
3295.8	-74.15	-13	Pass

851.05 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1702.1	-48.47	-13	Pass
2553.15	-59.07	-13	Pass
3404.2	-71.43	-13	Pass

860.05 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1720.1	-44.61	-13	Pass
2580.15	-51.37	-13	Pass
3440.2	-66.21	-13	Pass

868.95 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1737.9	-47.65	-13	Pass
2606.85	-53.13	-13	Pass
3475.8	-65.31	-13	Pass

No other emissions were detected. All emissions were less than –13 dBm.

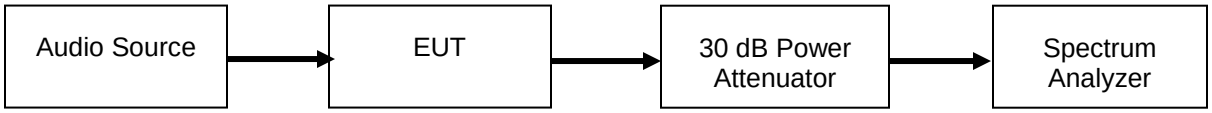
Emission Masks (Occupied Bandwidth)

Name of Test:	Emission Masks (Occupied Bandwidth)	**Engineer:**	John Erhard
Test Equipment Utilized:	i00118, i00331	**Test Date:**	1/17/2013

Test Procedure

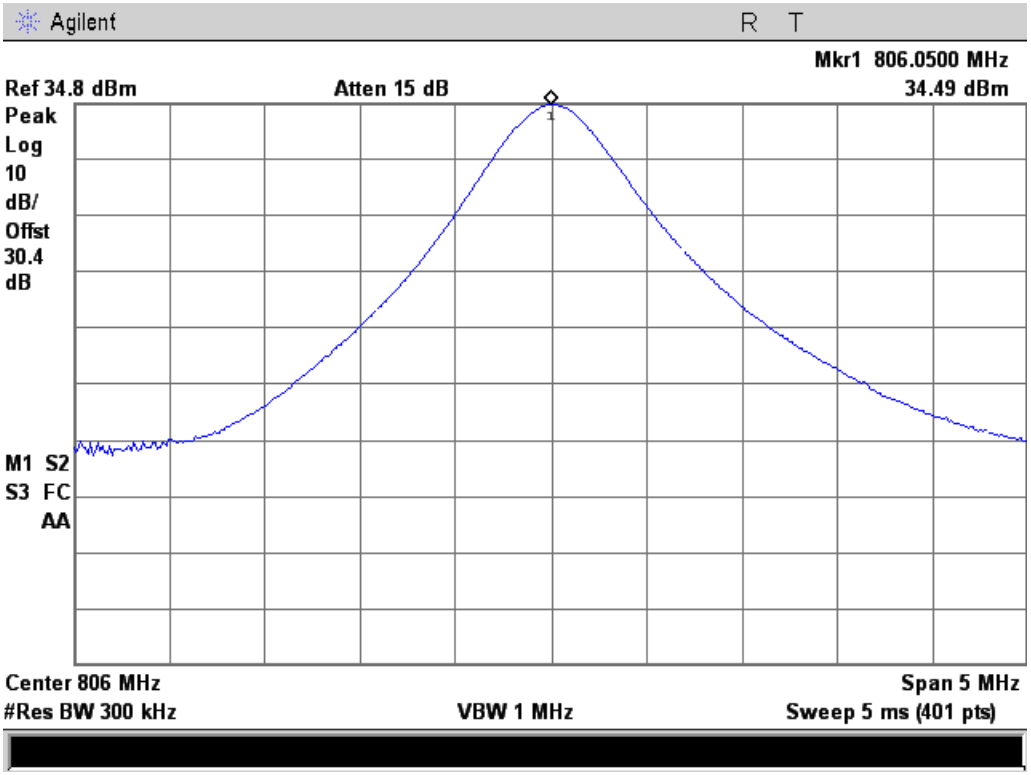
The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask. A reference level plot is provided to verify that the peak power was established prior to testing the mask. A modulation frequency of 2.5 kHz at a level of 500 mVPP was input into the EUT for the analog tests and an internal test pattern was utilized for the digital input.

Test Setup

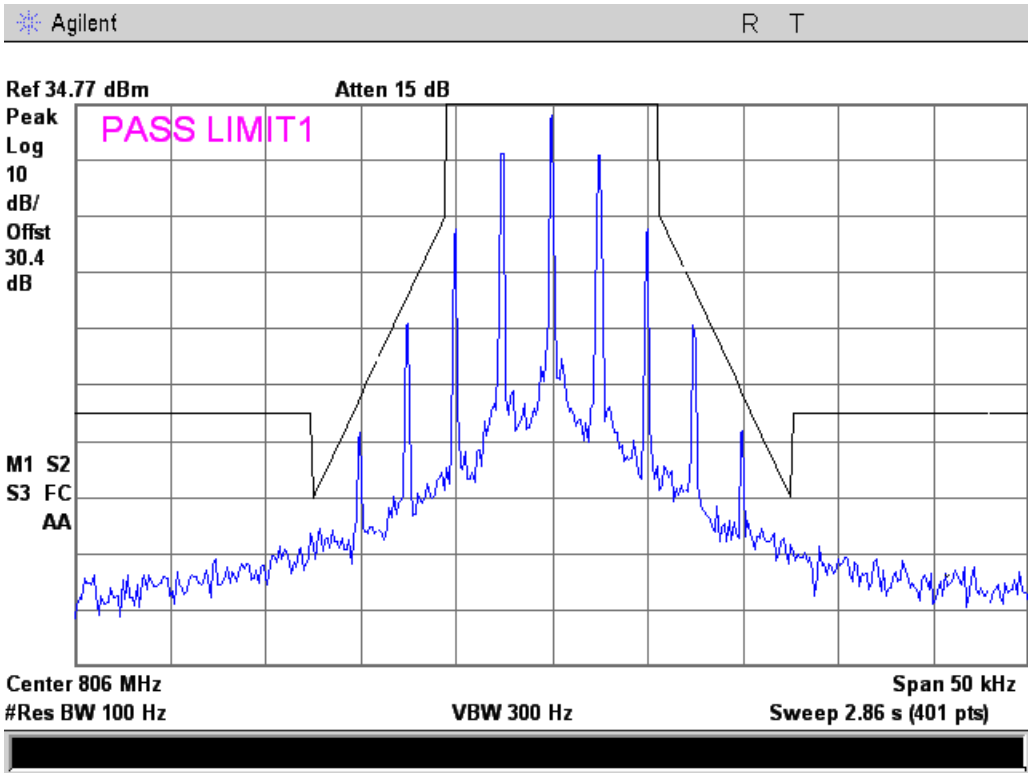


805.05 MHz

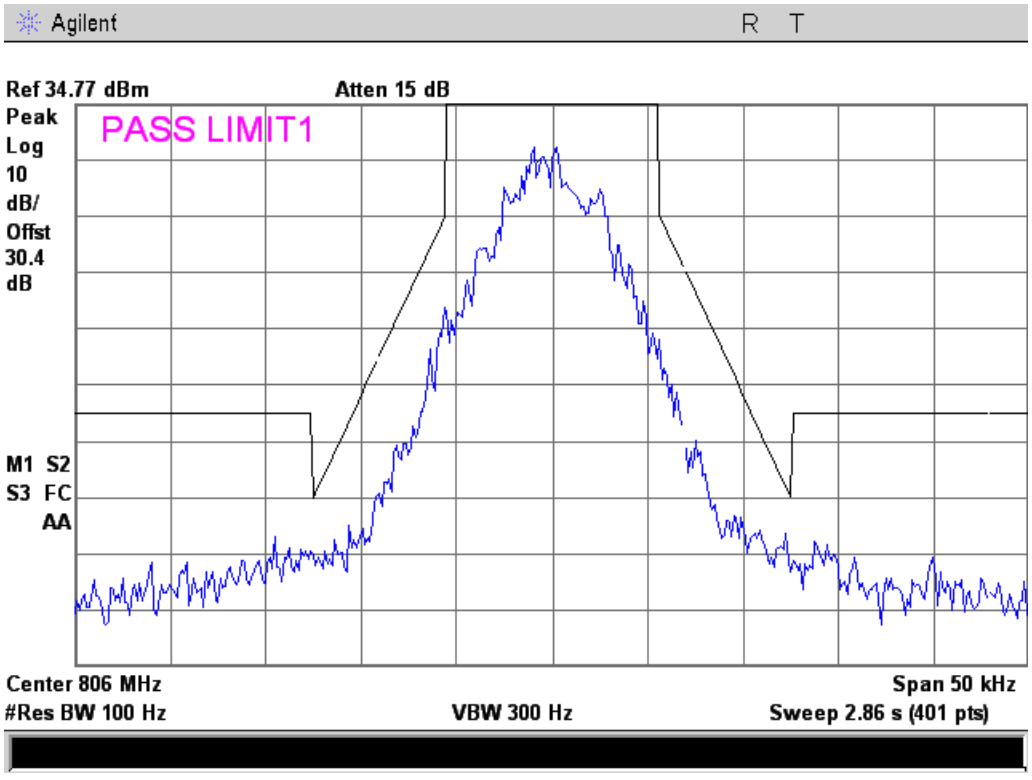
Reference



11K0F3E

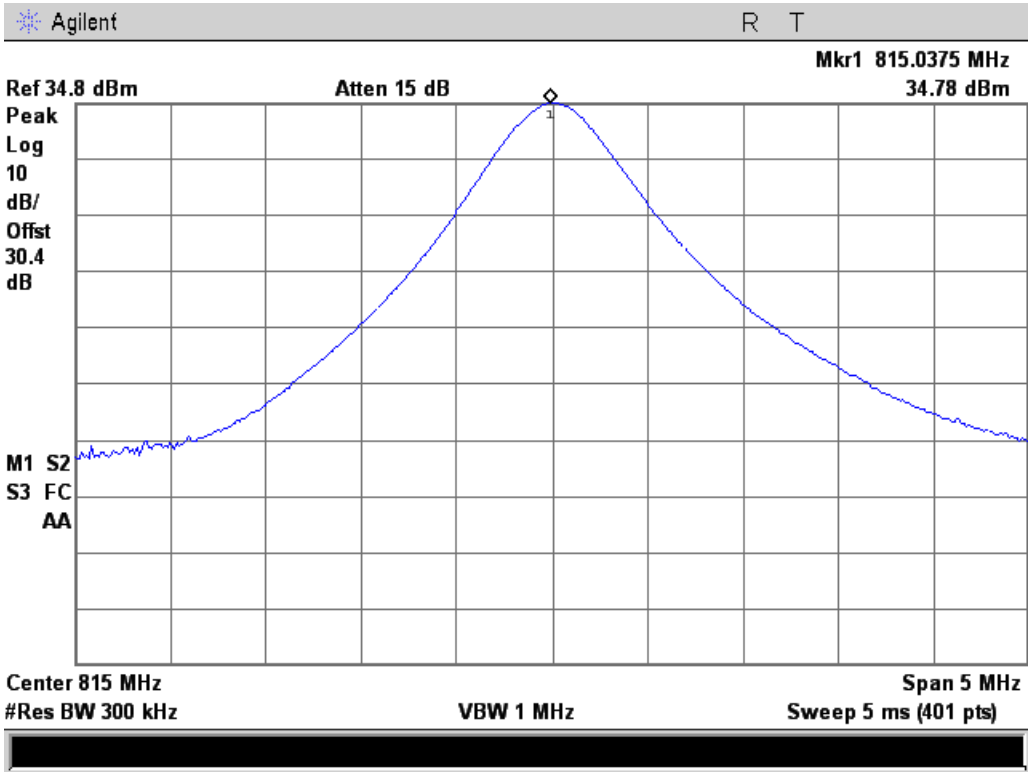


8K30F1D



815.05 MHz

Reference



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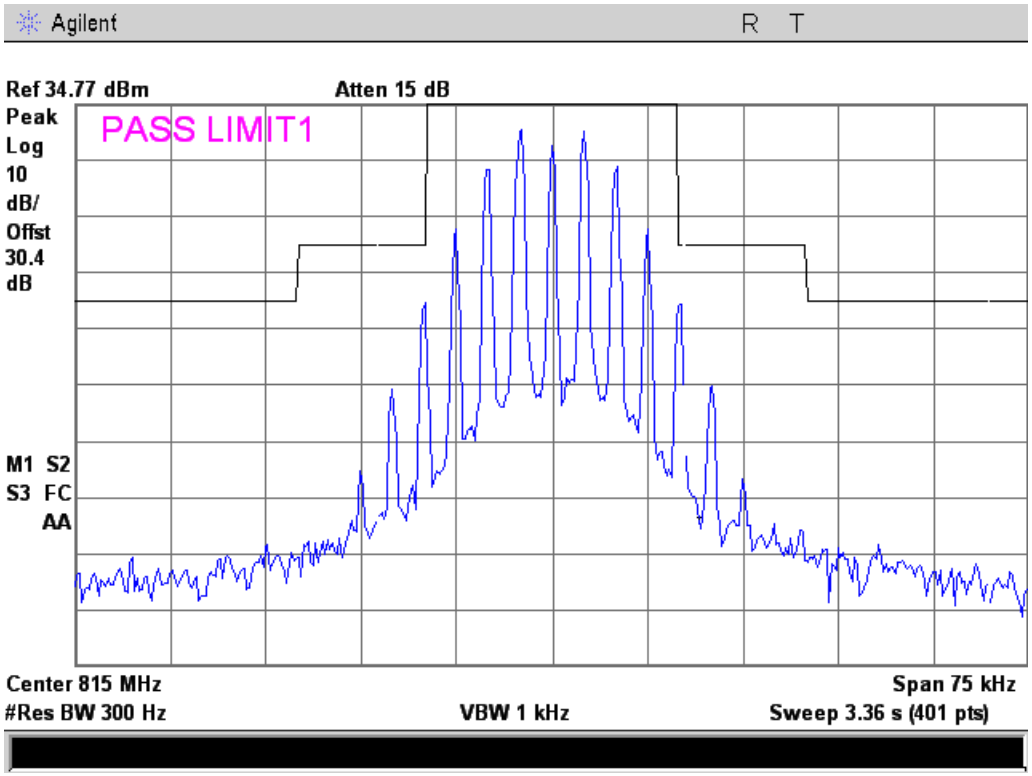
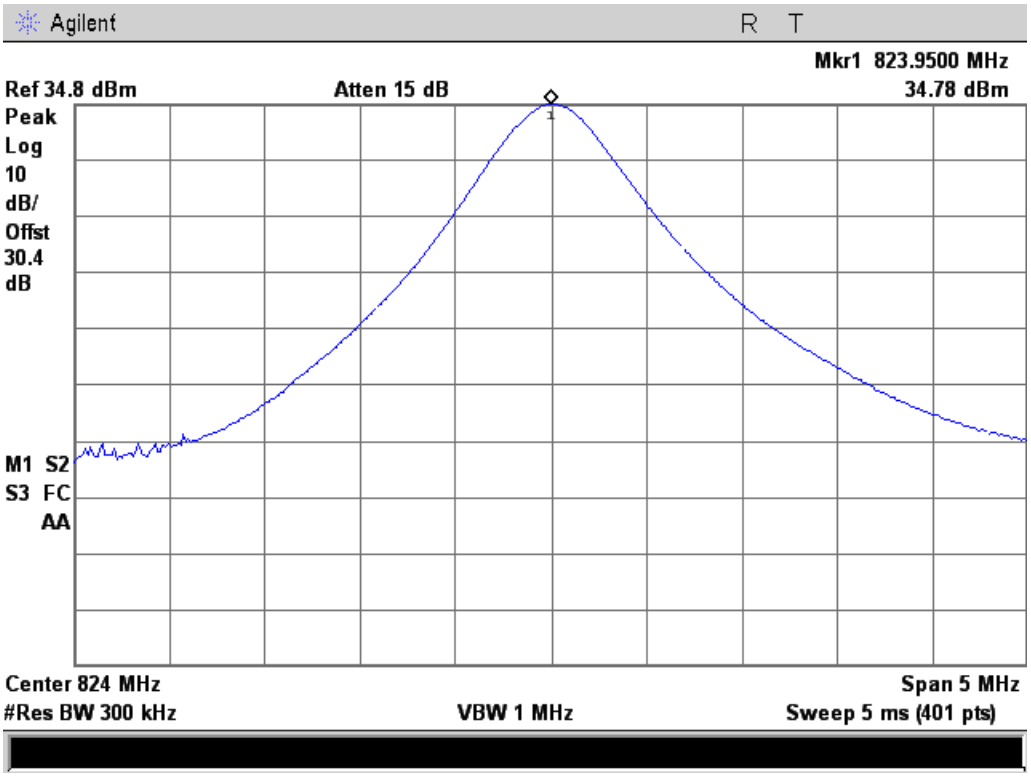


823.95 MHz

Reference



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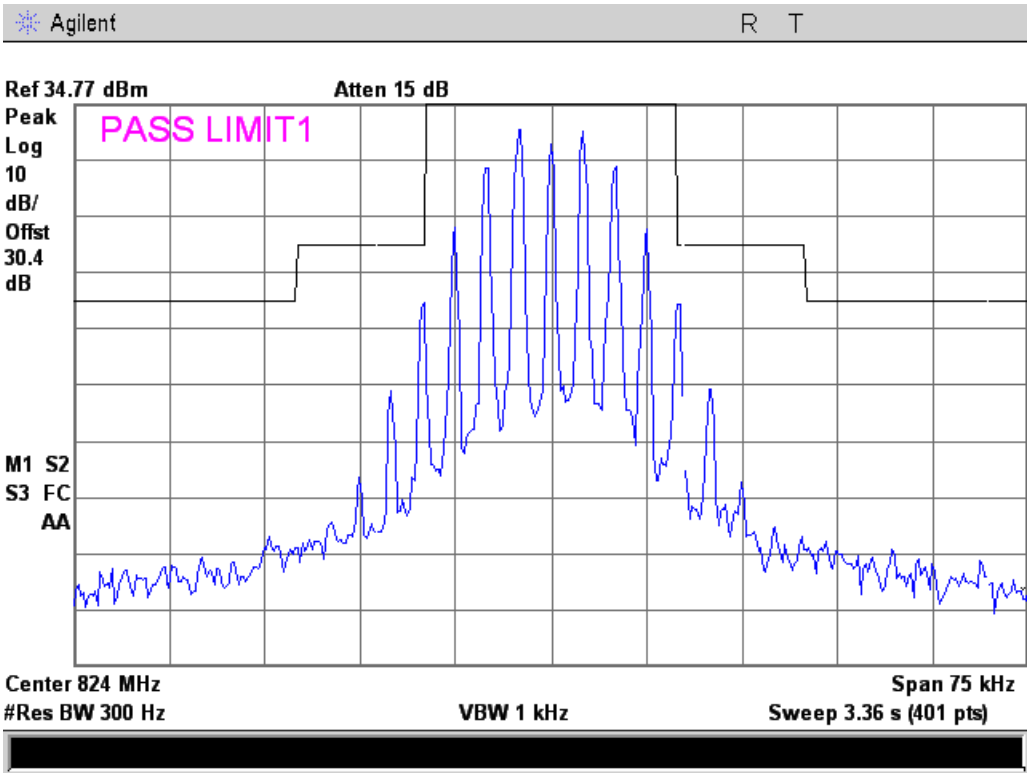
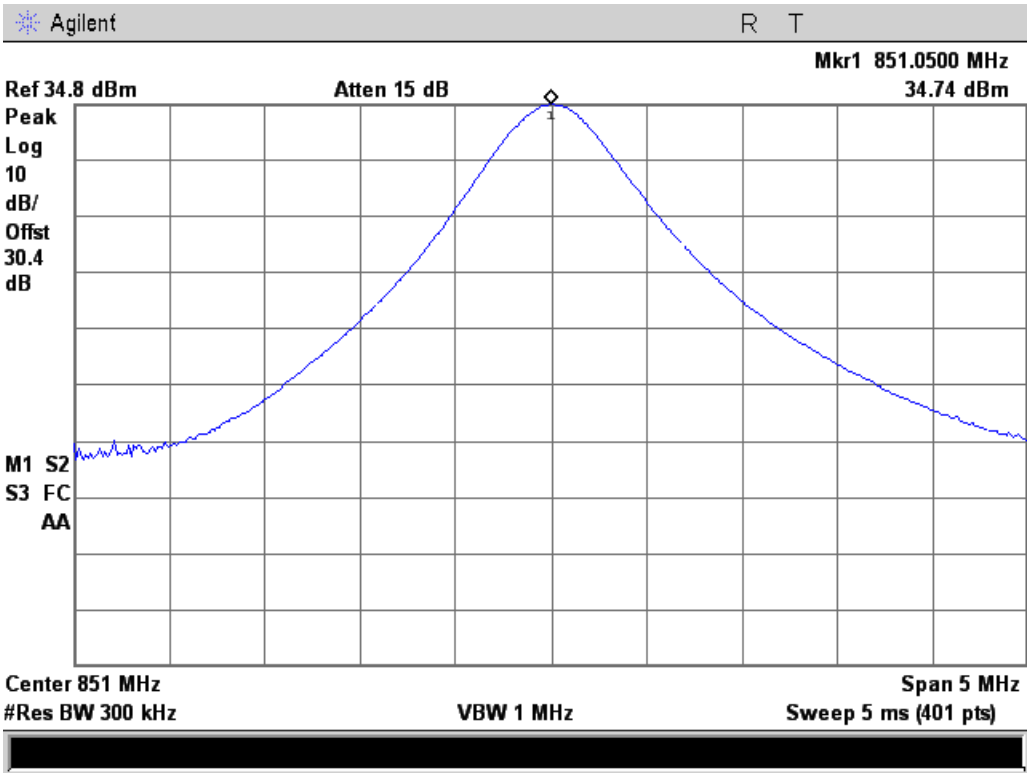


851.05 MHz

Reference



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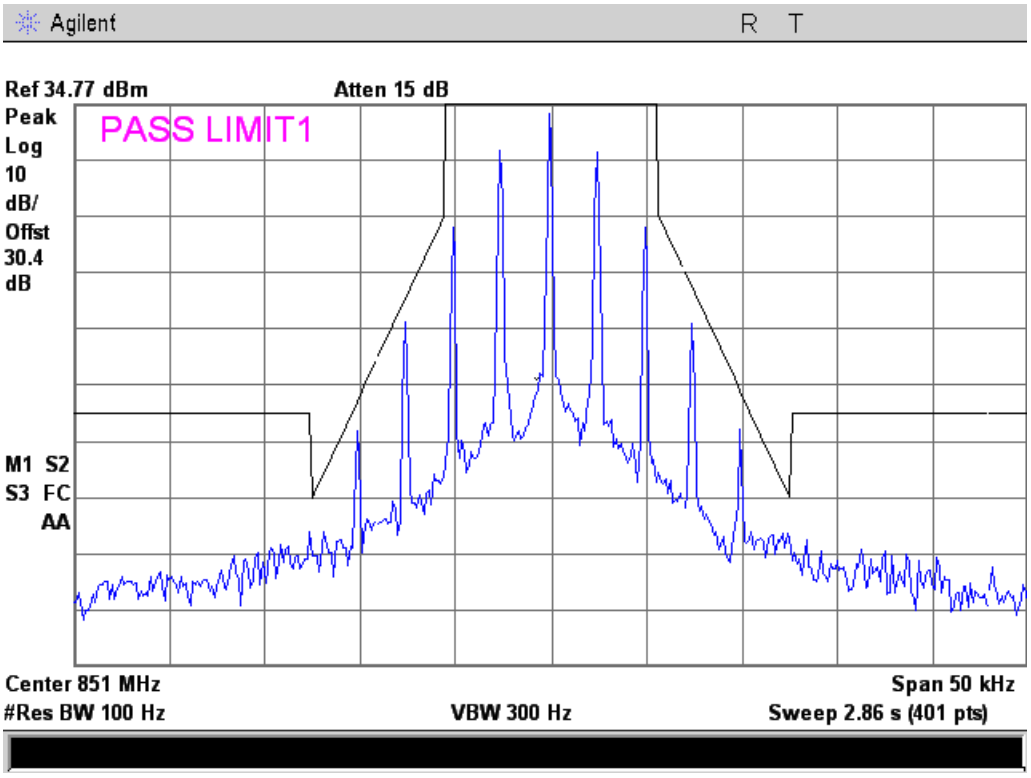
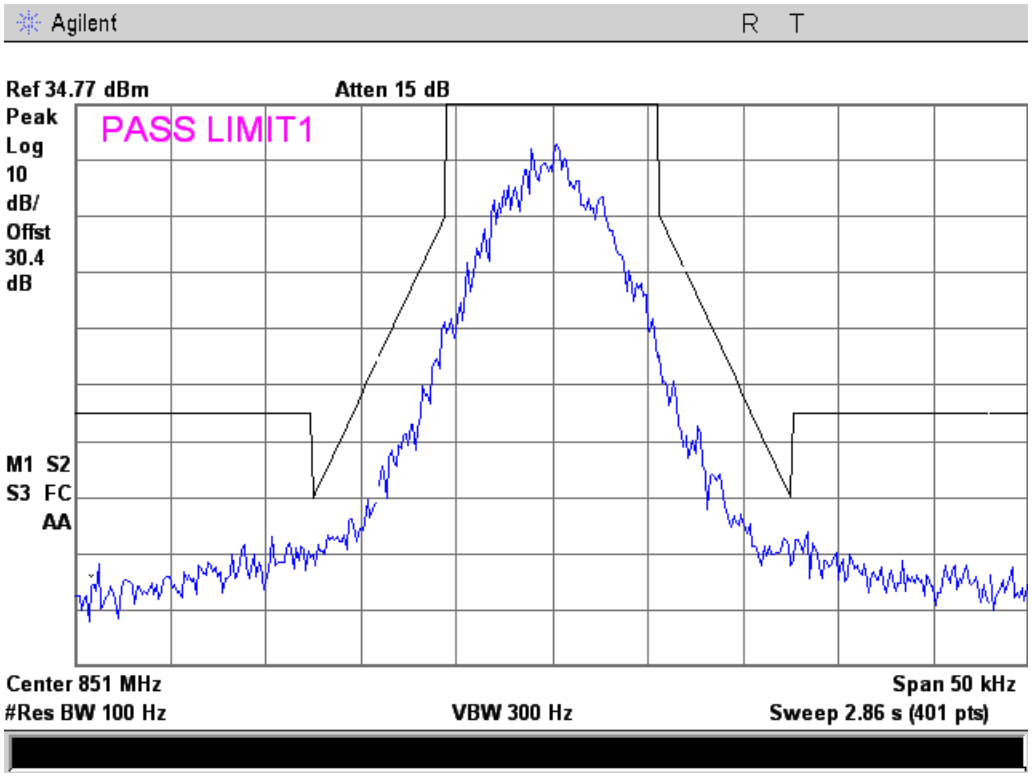
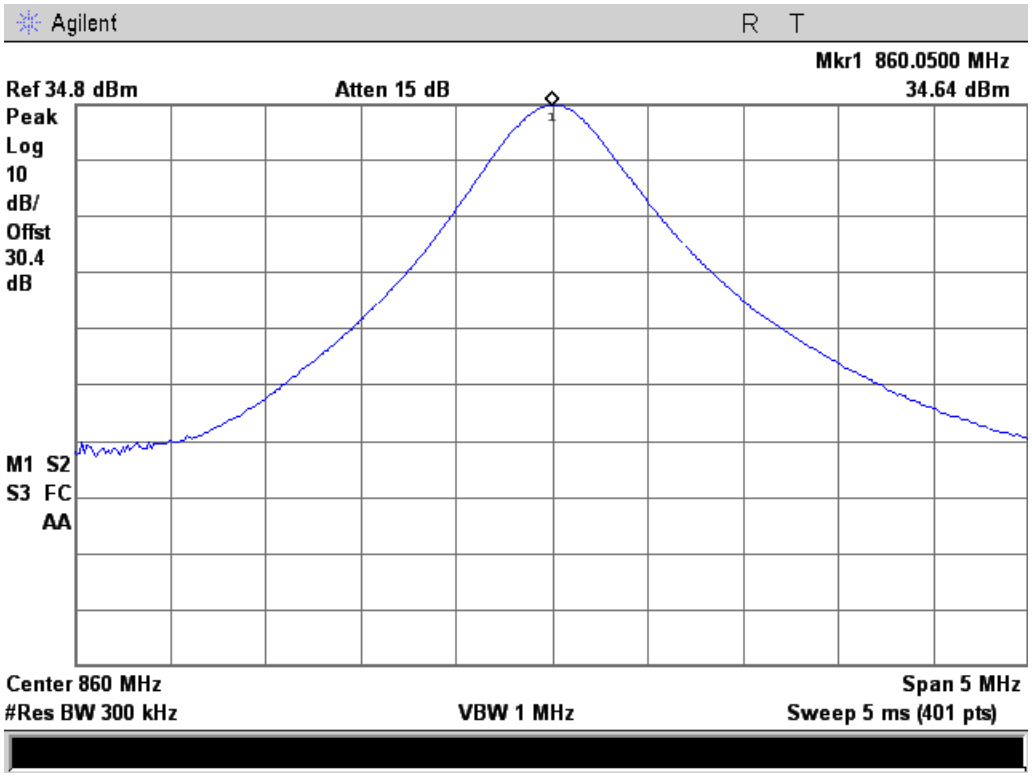


8K30F1D



860.05 MHz

Reference



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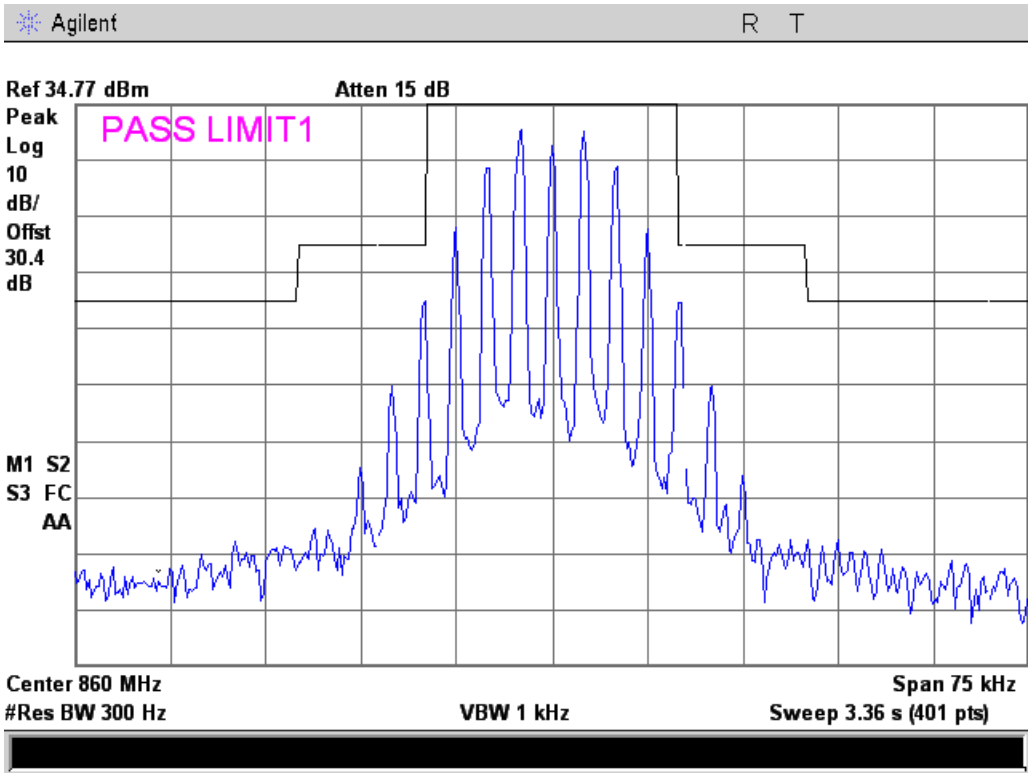
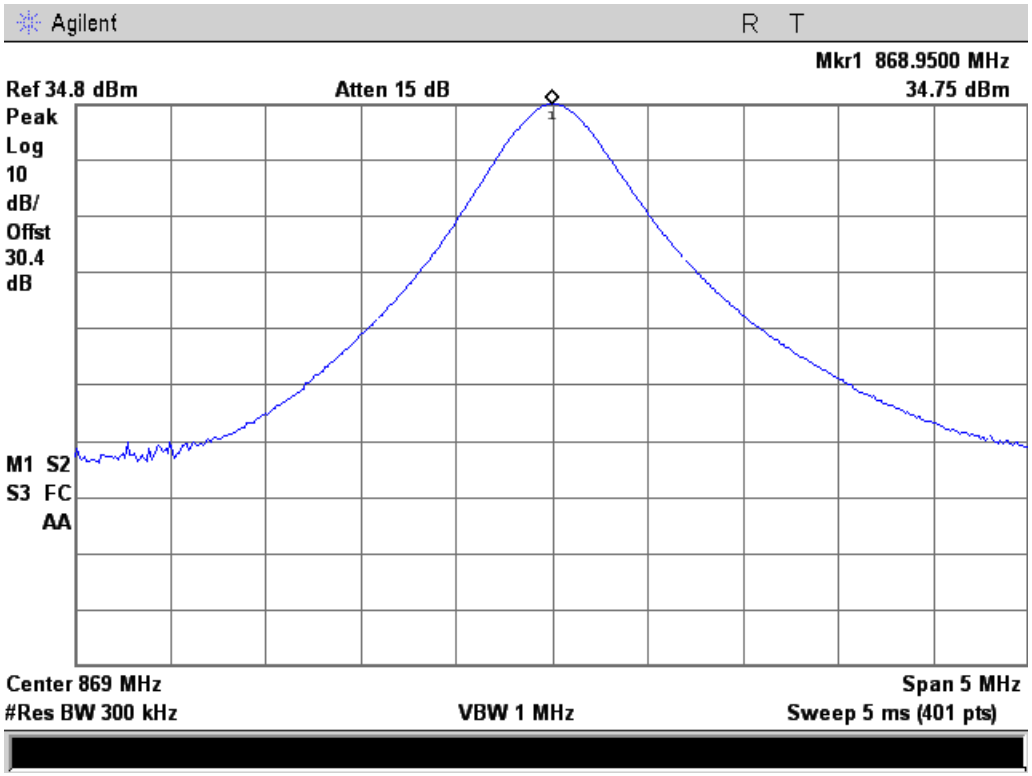


868.95 MHz

Reference



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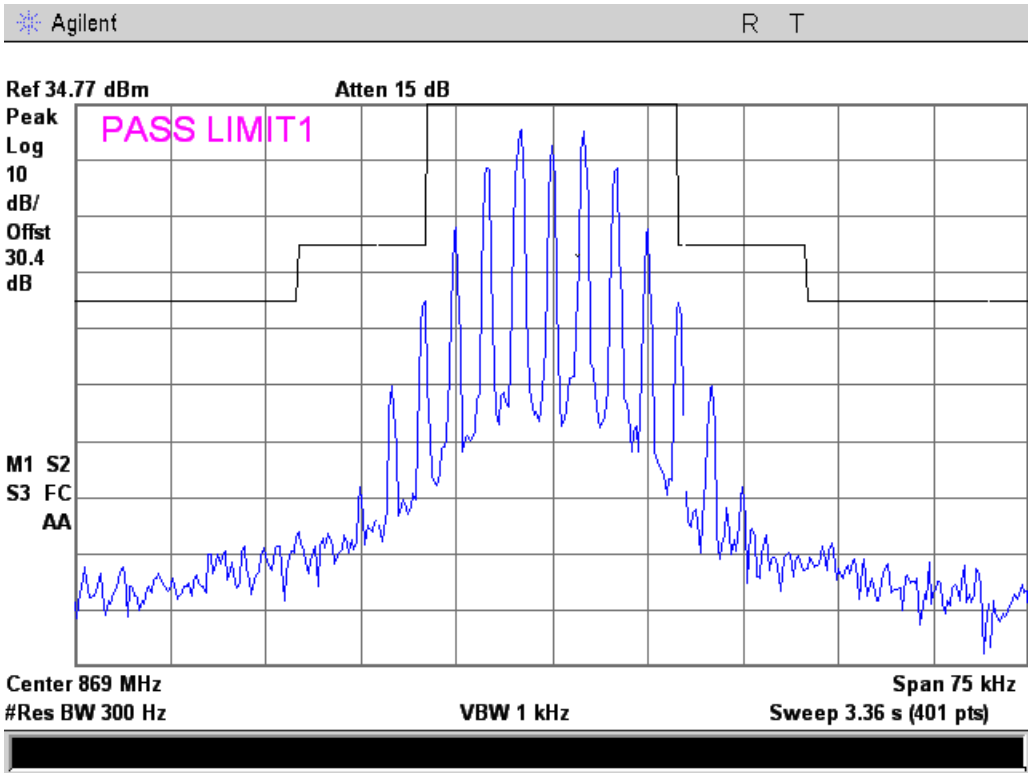

Agilent
R T
Ref 34.77 dBm
Atten 15 dB
Peak
Log
10
dB/
Offst
30.4
dB
PASS LIMIT1
M1 S2
S3 FC
AA
Center 869 MHz
#Res BW 300 Hz
VBW 1 kHz
Span 75 kHz
Sweep 3.36 s (401 pts)

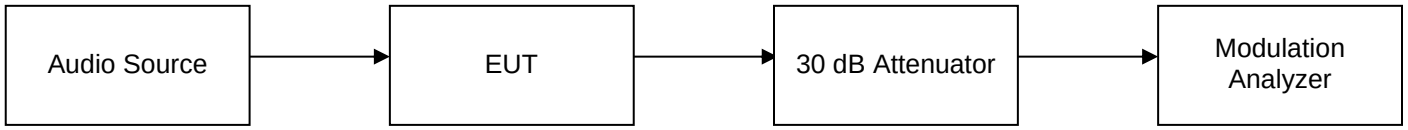
Audio Low Pass Filter (Voice Input)

Name of Test:	Audio Low Pass Filter (Voice Input)	**Engineer:** John Erhard
Test Equipment Utilized:	i00118, i00345	**Test Date:** 1/18/2013

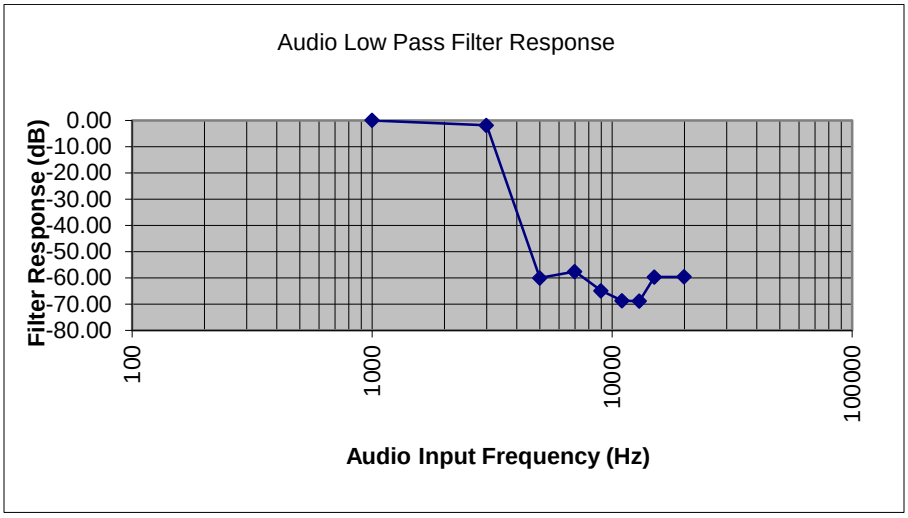
Test Procedure

The EUT was connected directly to a modulation analyzer through an attenuator. The audio source was tuned across the required audio frequency range and the audio low pass filter response was measured and plotted. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.

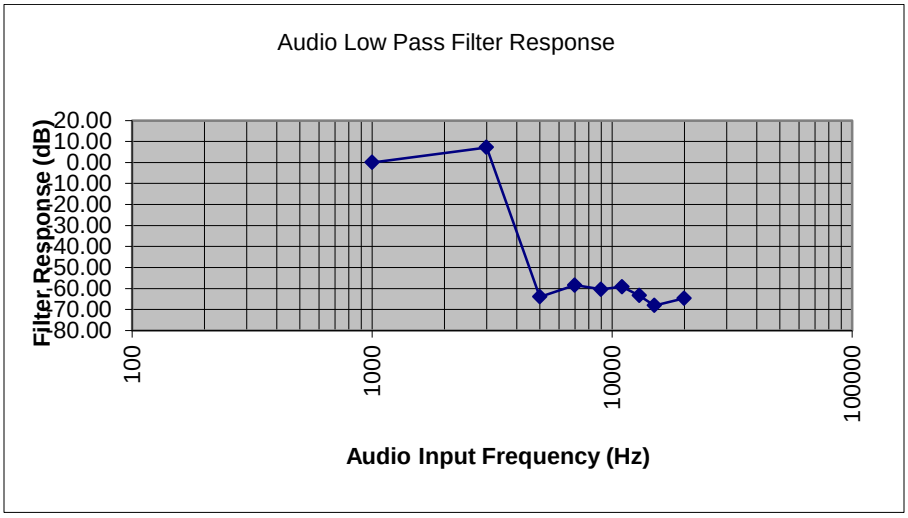
Test Setup



11K0F3E Test Results



16K0F3E Test Results



This unit is a digital radio and the roll-off for the filter is very linear in the operational band and sharp out of band.

Audio Frequency Response

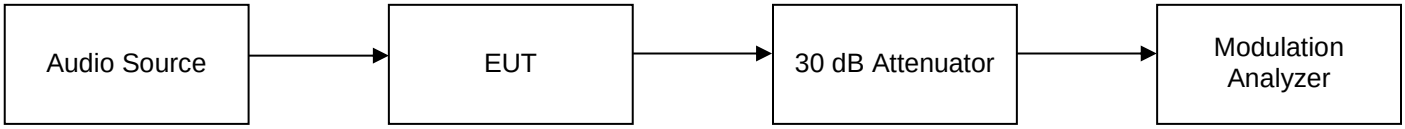
Name of Tests: Audio Frequency Response **Engineer:** John Erhard

Test Equipment Utilized: i00118, i00345 **Test Date:** 1/18/2013

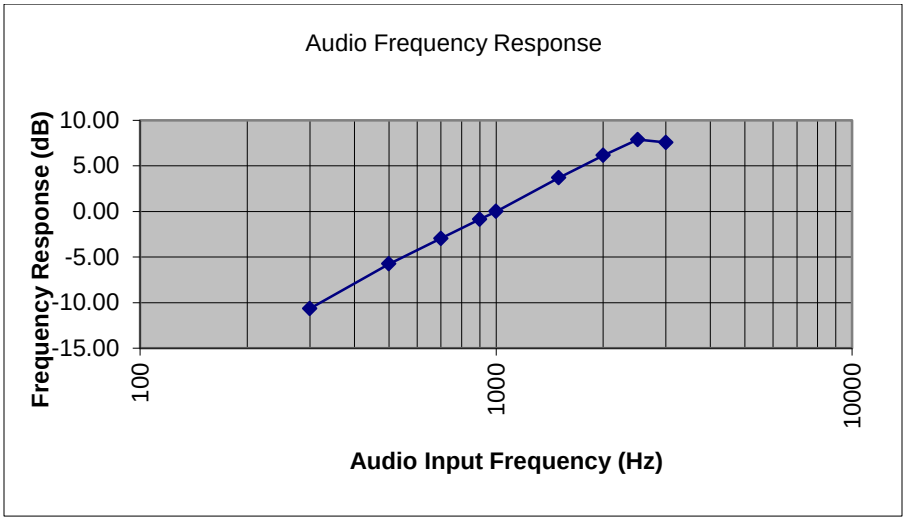
Test Procedure

The EUT was connected directly to a modulation analyzer through an attenuator. The audio source was tuned across the required audio frequency range and the audio frequency response was measured and plotted. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.

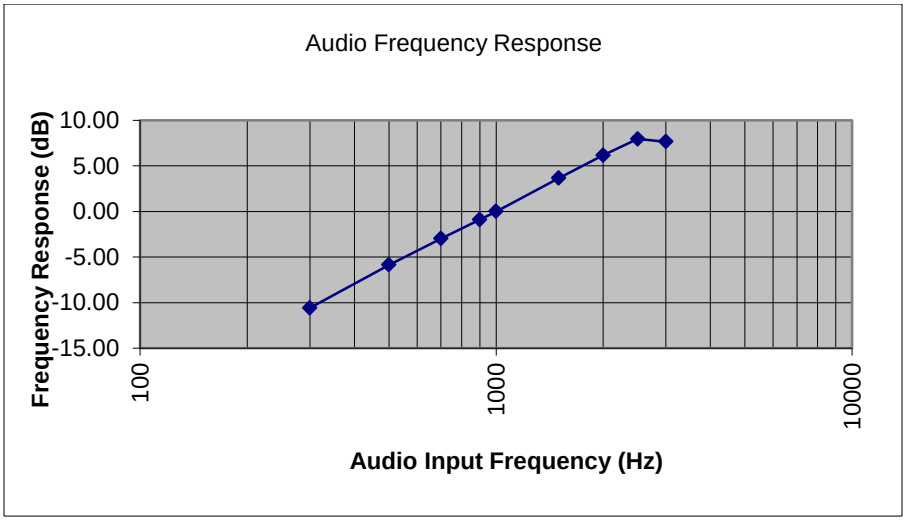
Test Setup



11K0F3E Test Results



16K0F3E Test Results



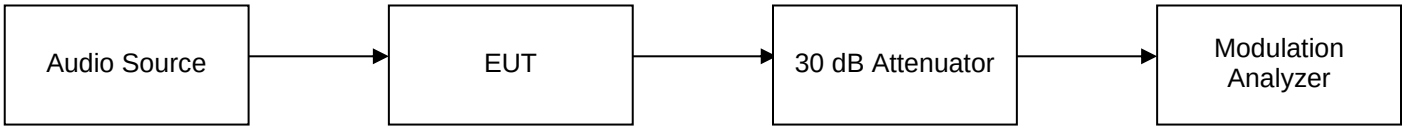
Modulation Limiting

Name of Test: Modulation Limiting
Engineer: John Erhard
Test Equipment Utilized: i00118, i00345
Test Date: 1/18/2013

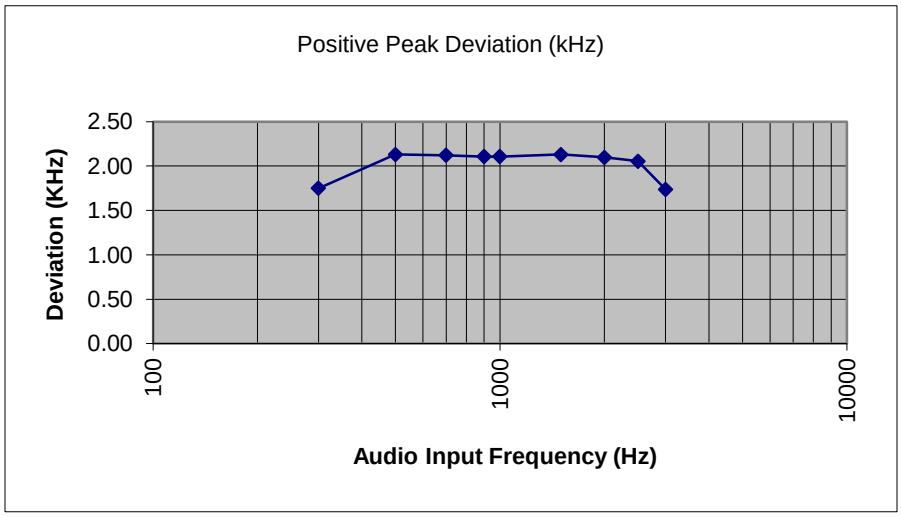
Test Procedure

The EUT was connected directly to a modulation analyzer through an attenuator. The audio source was tuned across the required audio frequency range and the modulation limiting response was measured and plotted. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.

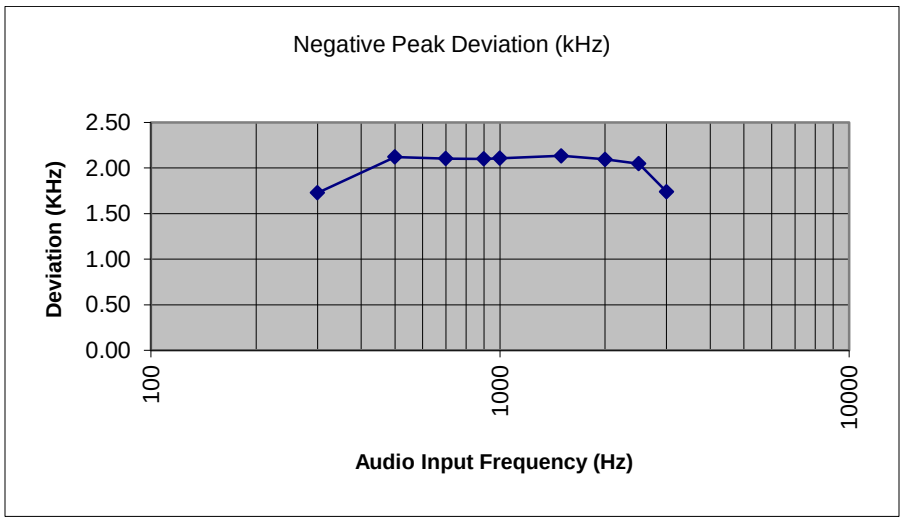
Test Setup



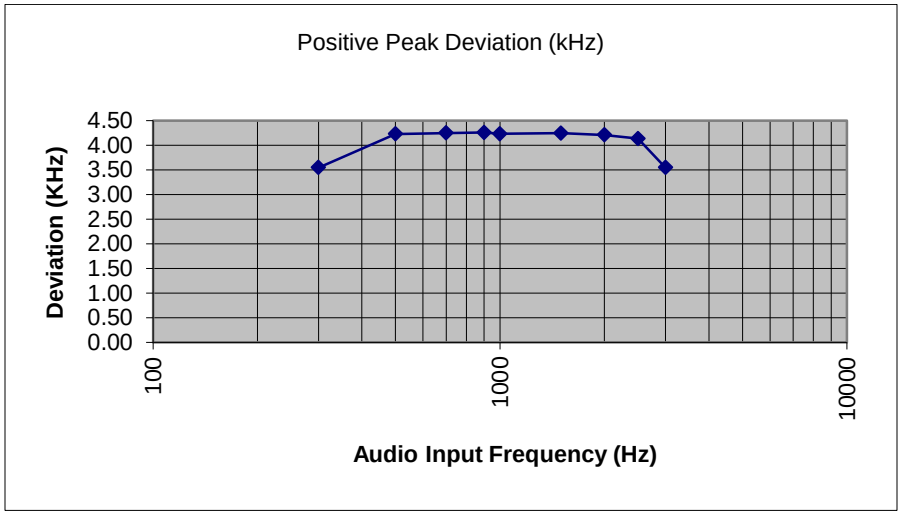
11K0F3E Positive Peaks



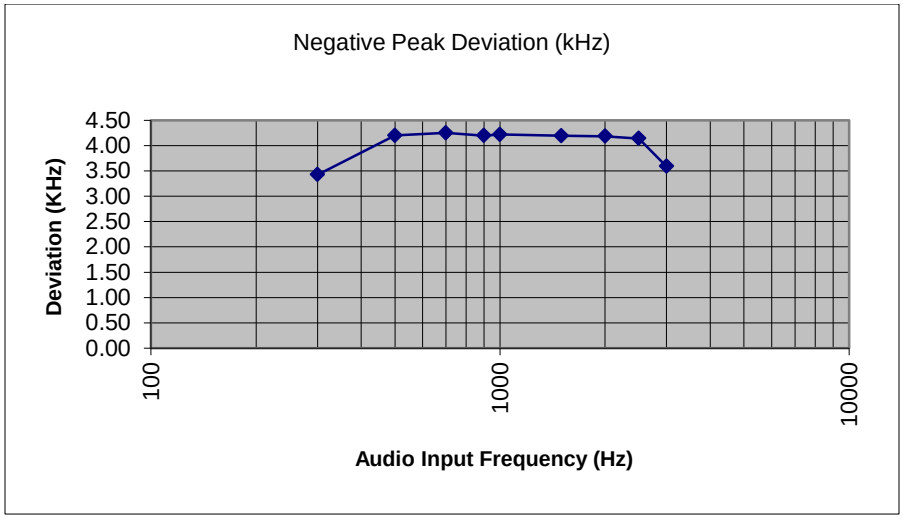
11K0F3E Negative Peaks



16K0F3E Positive Peaks



16K0F3E Negative Peaks



Frequency Stability (Temperature Variation)

Name of Test:	Frequency Stability (Temperature Variation)	**Engineer:** John Erhard
Test Equipment Utilized:	i00008, i00019, i00027, i00320, i00343	**Test Date:** 1/17/2013

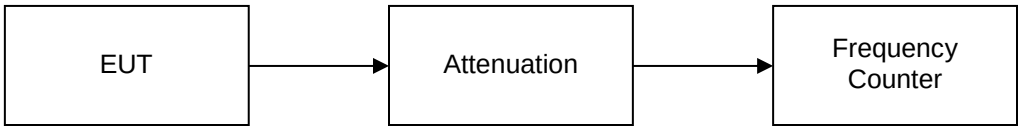
Test Procedure

The EUT was placed in an environmental test chamber and the RF output was connected directly to a frequency counter. 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. Two frequencies were evaluated.

Tuned frequency 1 = 815.05 MHz
Limit = 1 PPM
Upper Limit = 815.050815
Lower Limit = 815.049185

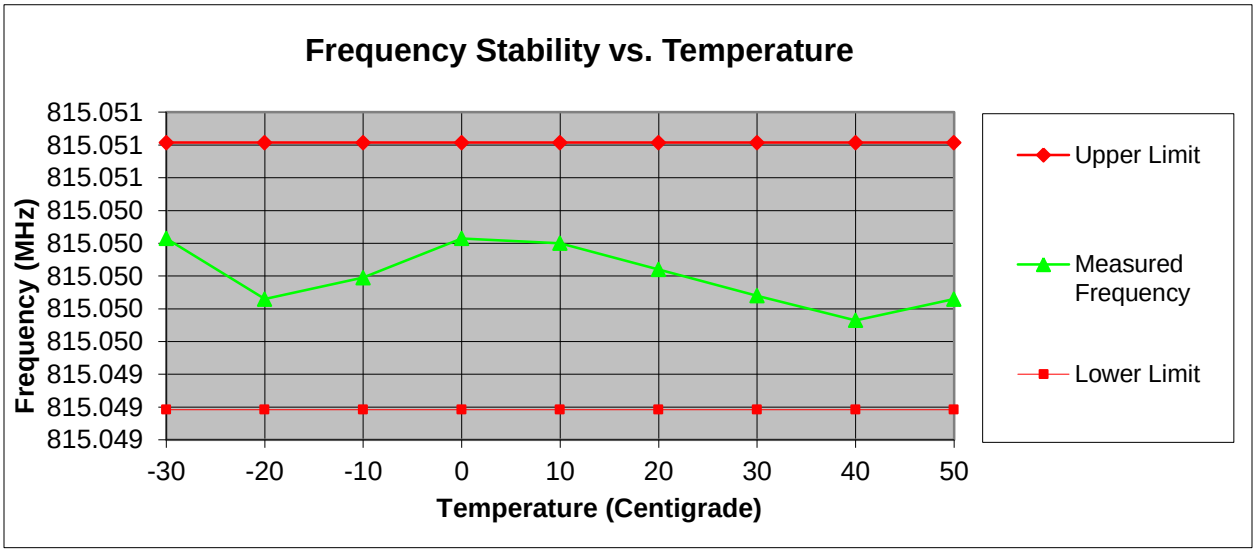
Tuned frequency 2 = 860.05 MHz
Limit = 1 PPM
Upper Limit = 860.050860
Lower Limit = 860.049140

Test Setup

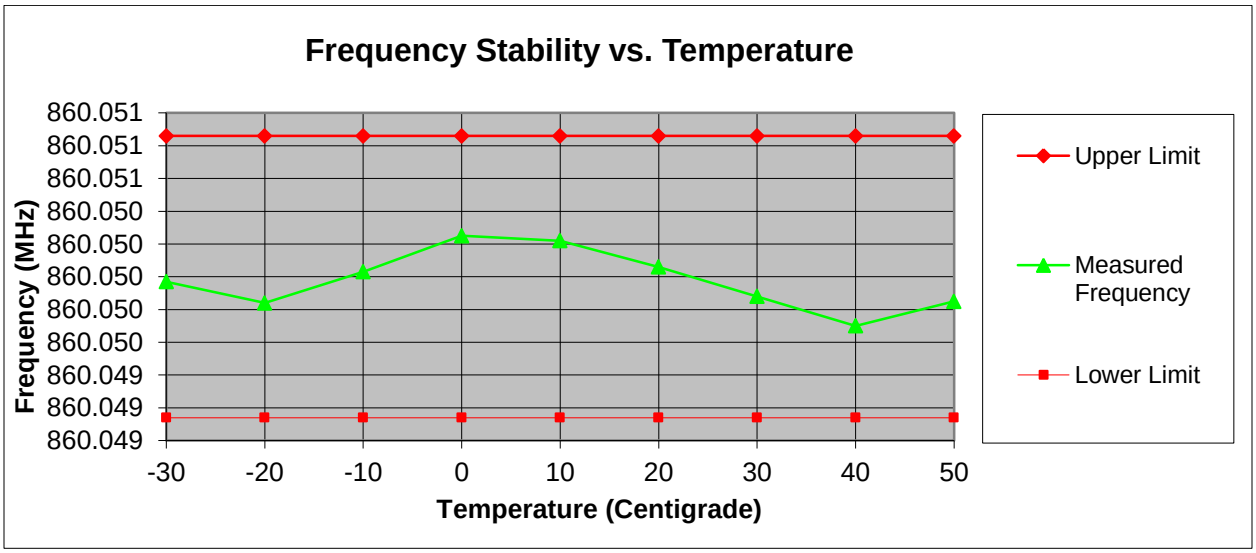


Test Results

815.05 MHz



860.05 MHz



Frequency Stability (Voltage Variation)

Name of Test:	Frequency Stability (Voltage Variation)	**Engineer:** John Erhard
Test Equipment Utilized:	i00008, i00019, i00027, i00320, i00343	**Test Date:** 1/17/2012

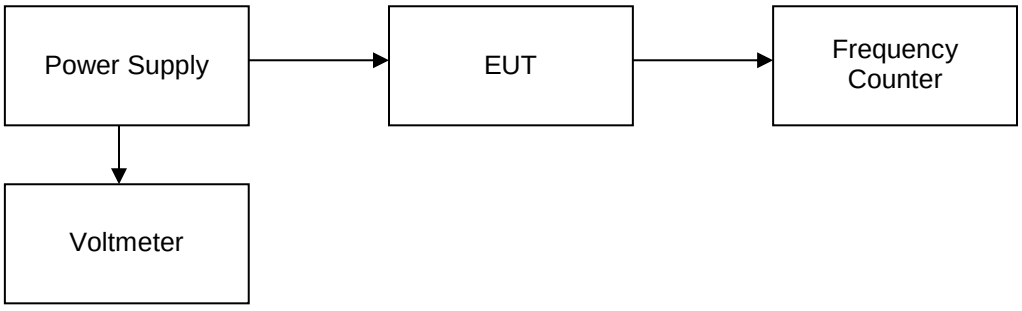
Test Procedure

The EUT was placed in a temperature chamber at 25±5°C and connected directly to a frequency counter and variable power supply. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output frequency was measured. Two frequencies were evaluated.

Tuned frequency 1 = 815.05 MHz
Limit = 1 PPM
Upper Limit = 815.050815
Lower Limit = 815.049185

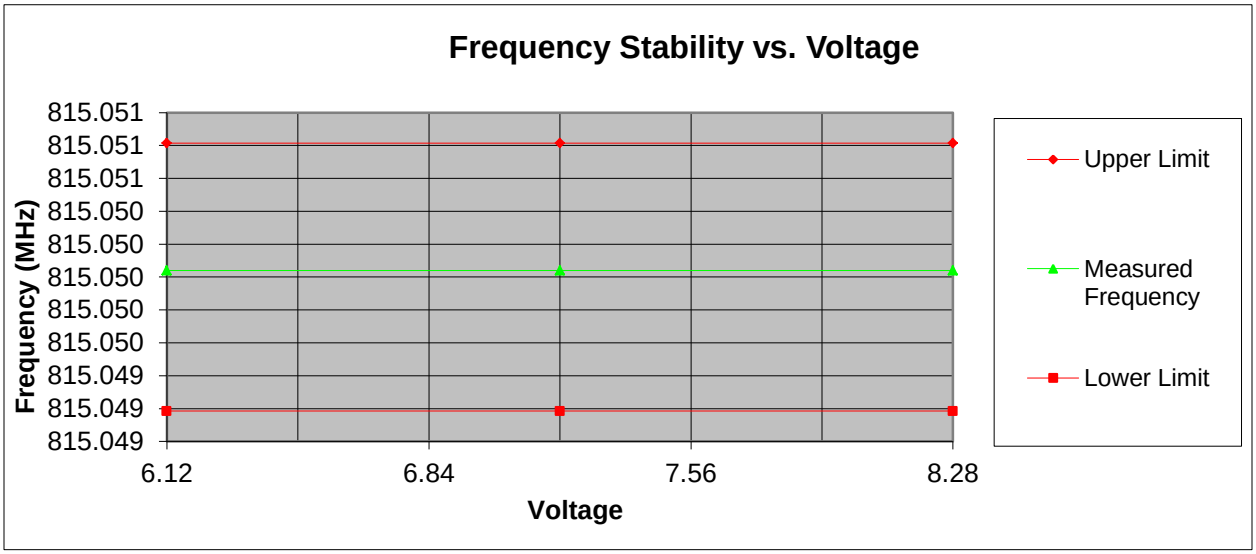
Tuned frequency 2 = 860.05 MHz
Limit = 1 PPM
Upper Limit = 860.050860
Lower Limit = 860.049140

Test Setup

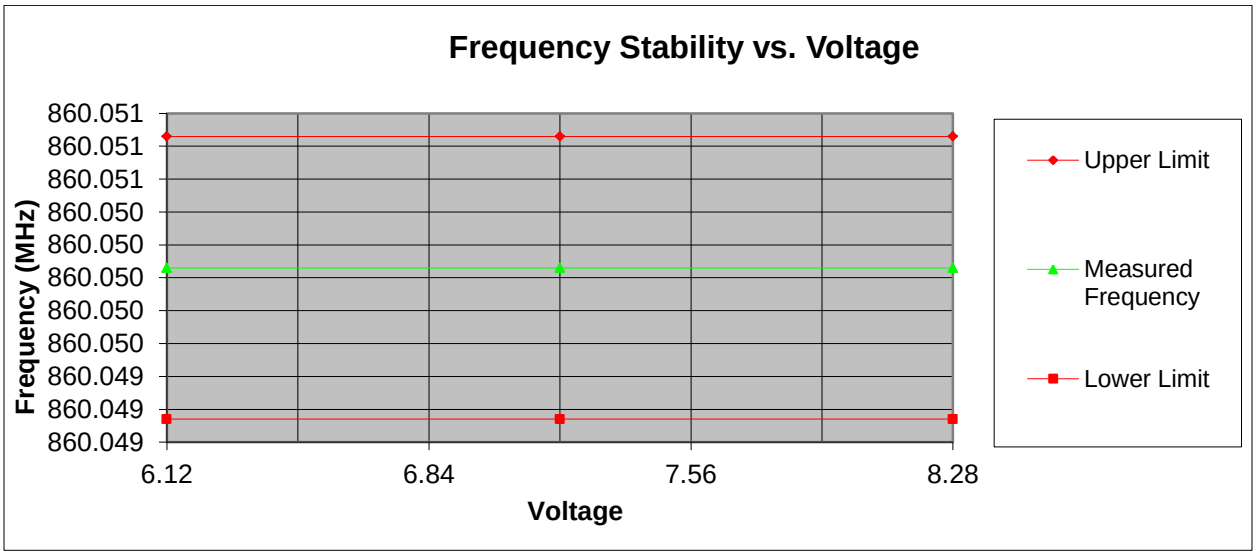


Test Results

815.05 MHz



860.05 MHz



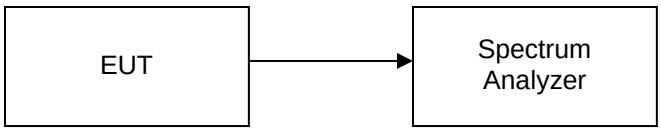
Receiver Spurious Emissions

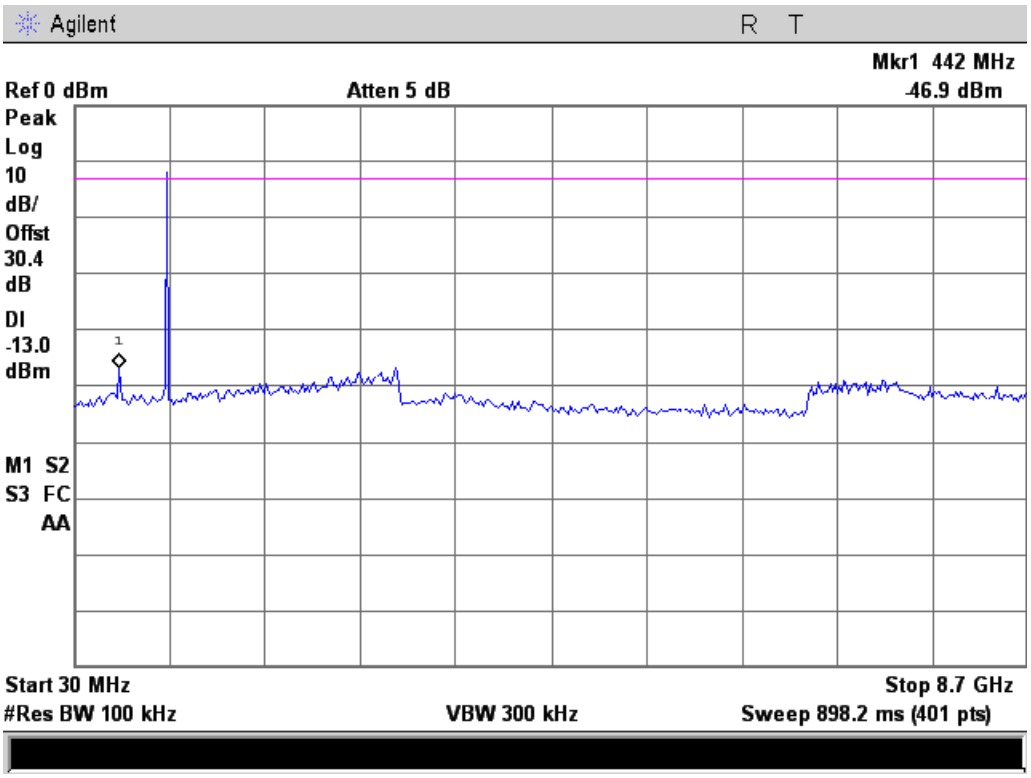
Name of Test:	Receiver Spurious Emissions	**Engineer:**	John Erhard
Test Equipment Utilized:	i00331	**Test Date:**	1/17/2013

Test Procedure

The EUT was connected directly to a spectrum analyzer. The cable loss was input into the analyzer as a reference level offset to ensure accurate readings.

Test Setup





Necessary Bandwidth Calculations

Name of Test: Necessary Bandwidth Calculations **Engineer:** John Erhard
Test Specification: 2.202 **Test Date:** 1/21/2013

Modulation = 16K0F3E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M) kHz	=	3
Maximum Deviation (D), kHz	=	5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	16.0

Modulation = 14K0F3E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M) kHz	=	3
Maximum Deviation (D), kHz	=	4
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	14.0

Modulation = 11K0F3E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	3
Maximum Deviation (D), kHz	=	2.5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	11.0

Modulation = 8K30F1E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	1.65
Maximum Deviation (D), kHz	=	2.5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	8.3

Modulation = 8K30F1D		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	2.3
Maximum Deviation (D), kHz	=	2.5
Necessary Bandwidth (B_N), kHz	=	2.4D+1.0R
	=	8.3

Modulation = 8K30F7W		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	3.973
Maximum Deviation (D), kHz	=	2.5
Signaling States	=	4
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	($R/\log_2 S$)+2DK
	=	8.3

Modulation =4K00F1E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	.75
Maximum Deviation (D), kHz	=	1.25
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	4.0

Modulation =4K00F1D		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	1.0
Maximum Deviation (D), kHz	=	1.25
Necessary Bandwidth (B_N), kHz	=	2.4D+1.0R
	=	4.0

Modulation =4K00F7W		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	1.806
Maximum Deviation (D), kHz	=	1.25
Signaling States	=	4
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	($R/\log_2 S$)+2DK
	=	8.3

Modulation =4K00F2D		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	1.0
Maximum Deviation (D), kHz	=	1.25
Necessary Bandwidth (B_N), kHz	=	2.4D+1.0R
	=	4.0

Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Power Supply	Kenwood	PR18-3A	i00008	Verified on: 1/17/13	
Frequency Counter	HP	5334B	i00019	1/10/12	1/10/13***
Temperature Chamber	Tenney	Tenney Jr	i00027	Verified on: 1/17/13	
Function Generator	HP	33120A	i00118	Verified on: 1/17/13	
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	12/4/12	12/4/13
Voltmeter	Fluke	75III	i00320	1/10/12	1/10/13***
Spectrum Analyzer	Agilent	E4407B	i00331	4/20/12	4/20/13
Data Logger	Fluke	Hydra Data Bucket	i00343	12/19/12	12/19/13
Spectrum Analyzer	Tektronix	RSA3308A	i00345	10/16/12	10/16/13
Tunable Notch Filter	Eagle	TNF-240MFMF	i00364	Verified on: 1/17/13	

*** 30-day calibration extension.

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