



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

Date: September 30, 2010

Applicant: Kenwood USA Corporation
Communications Division
3970 Johns Creek Court, Suite 100
Suwanee, GA 30024

Attention of: Joel E. Berger, Research & Development
Ph: (678) 474-4722
Fax: (687) 474 -4731
E-mail: JBerger@kenwoodusa.com

Equipment: TK-3000-2
FCC ID: ALH437301
FCC Rules: Part 90

Enclosed please find your copy of the Engineering Test Report for which you are subject to the restrictions as listed on the attached summary. Please retain a copy of this report for your archival purposes.

This report may not be reproduced, except in full, without written permission from Compliance Testing, LLC.

Once a Telecommunication Certification Body (TCB) issues a Grant the Federal Communication Commission (FCC) has 30 days to review the application and request added information. It is your decision whether or not to market the equipment subject to a possible recall before the end of the 30 days.

If your equipment is still retained by us, it will be returned to you 30 days after approval is achieved. Our invoice for services has been directed to your Accounts Payable Department.

For any additional information please contact us.

Sincerely,

Compliance Testing



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Test Report

for

FCC ID: ALH437301

Model: TK-3000-2

Description: UHF FM Transceiver

to

Federal Communications Commission

Rule Part(s) 90

Date of Report: September 30, 2010

On the Behalf of the Applicant:

Kenwood USA Corporation

At the Request of:

Kenwood USA Corporation
Communications Division
3970 Johns Creek Court, Suite 100
Suwanee, GA 30024

Attention of:

Joel E. Berger, Research & Development
Ph: (678) 474-4722
Fax: (687) 474 -4731
E-mail: JBerger@kenwoodusa.com

By

Compliance Testing, LLC
3356 N. San Marcos Place, Suite 107
Chandler, Arizona 85225-7176
(866) 311-3268 phone, (480) 926-3598 fax



Test Report Revision History

Revision	Date	Revised By	Reason for revision
1.0	September 30, 2010	J. Erhard	Original Document



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 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.



Testimonial and Statement of Certification

This is to Certify:

1. That the application was prepared either by, or under the direct supervision of, the undersigned.
2. That the technical data supplied with the application was taken under my direction and supervision.
3. That the data was obtained on representative units, randomly selected.
4. That, the facts set forth in the application and accompanying technical data is true and correct to the best of my knowledge and belief.

A handwritten signature in black ink, appearing to read "John D. Erhard".

Certifying Engineer:

J. Erhard: Engineering Manager



Table of Contents

<u>Rule</u>	<u>Description</u>	<u>Page</u>
2.1033(c)(14)	Rule Summary	6
	Standard Test Conditions and Engineering Practices	7
2.1033(c)	General Information Required	9
	Test Results Summary	11
2.1046	Carrier Output Power (Conducted)	12
2.1051	Conducted Spurious Emissions	13
2.1053	Field Strength of Spurious Radiation	17
90.210	Emission Masks (Occupied Bandwidth)	20
90.214	Transient Frequency Behavior	25
2.1047	Audio Low Pass Filter (Voice Input)	28
2.1047	Audio Frequency Response	29
2.1047	Modulation Limiting	30
90.213	Frequency Stability (Temperature Variation)	33
90.213	Frequency Stability (Voltage Variation)	34
	Test Equipment Utilized	35



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), 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		
Temperature	Humidity	Pressure
78 F	36 %	30.1 in

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



Compliance Testing, LLC
Previously Flom Test Lab

A2LA

"A2LA has accredited Compliance Testing, LLC, in Chandler, AZ for technical competence in the field of Electrical testing. The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO 17025:2005 'General Requirements for the Competence of Testing and Calibration Laboratories' and any additional program requirements in the identified field of testing."

Please refer to www.a2la.org for current scope of accreditation.

Certificate number: 2152.01



TESTING CERT# 2152.01

FCC OATS Reg. #933597

IC Reg. # 2044A-1



List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,
Volume II, Part 2 and to Part 90

Sub-part 2.1033

(c)(1):

Name and Address of Applicant: Kenwood USA Corporation
Communications Division
3970 Johns Creek Court, Suite 100
Suwanee, GA 30024

Manufacturer: Kenwood Corporation
2967-3, Ishikawa-machi,
Hachioji-shi, Tokyo 192-8525
Japan

(c)(2): **FCC ID:** ALH437301

Model Number: TK-3000-2

(c)(3): **Instruction Manual(s):**

Please see attached exhibits

(c)(4): **Type of Emission:** FM

(c)(5): **Frequency Range, MHz:** 406.1 – 430

(c)(6): **Power Rating, Watts:** 4

_____ Switchable

 X Variable

_____ N/A

FCC Grant Note:

(c)(7): **Maximum Allowable Power, Watts:** 5

DUT Results: Passes X Fails _____



Subpart 2.1033 (continued)

(c)(8): **Voltages & currents in all elements in final RF stage, including final transistor or solid-state device:**

Collector Current, A	=	0.54
Collector Voltage, Vdc	=	7.4
Supply Voltage, Vdc	=	7.4

(c)(9): **Tune-Up Procedure:**

Please see attached exhibits

(c)(10): **Circuit Diagram/Circuit Description:**

Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.

Please see attached exhibits

(c)(11): **Label Information:**

Please see attached exhibits

(c)(12): **Photographs:**

Please see attached exhibits

(c)(13): **Digital Modulation Description:**

 Attached Exhibits
 X N/A

(c)(14): **Test and Measurement Data:**

Follows



Test Results 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	Modulation Limiting	Pass	
90.213	Frequency Stability (Temperature Variation)	Pass	
90.213	Frequency Stability (Voltage Variation)	Pass	



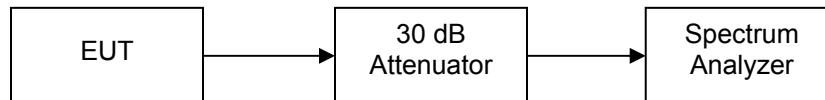
Name of Test: Carrier Output Power (Conducted)
Specification: 2.1046
Test Equipment Utilized: i00331, i00347

Engineer: J. Erhard
Test Date: 9/21/2010

Measurement Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB attenuator. All cable and attenuator losses were summed and input as a reference level offset to ensure accurate measurements. The peak readings were taken and the result was then compared to the limit.

Test Setup



High Power Transmitter Peak Output Power

Tuned Frequency MHz	Recorded Measurement dBm	Power (Watts)	Result
406.15	36.02	4.0	Pass
418.05	36.02	4.0	Pass
429.95	36.02	4.0	Pass



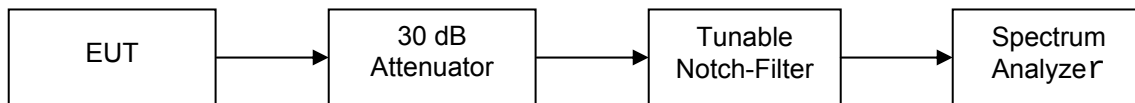
Name of Test: Conducted Spurious Emissions
Specification: 2.1051
Test Equipment Utilized: i00124, i00331, i00347

Engineer: J. Erhard
Test Date: 9/21/2010

Test Procedure

The EUT was connected to a spectrum analyzer through a 30 dB attenuator and to verify that the UUT met the requirements for spurious emissions. A tunable notch filter was utilized to ensure the fundamental did not put the spectrum analyzer into compression. The reference level was adjusted to ensure the system had sufficient dynamic range to measure spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed and plotted.

Test Setup

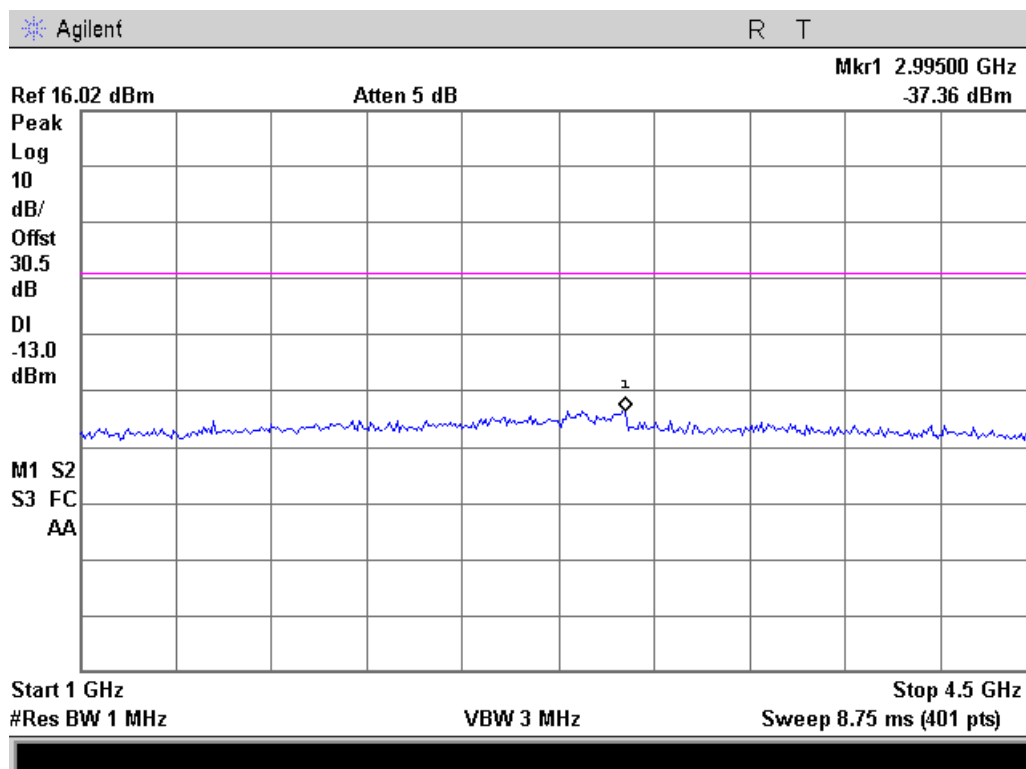
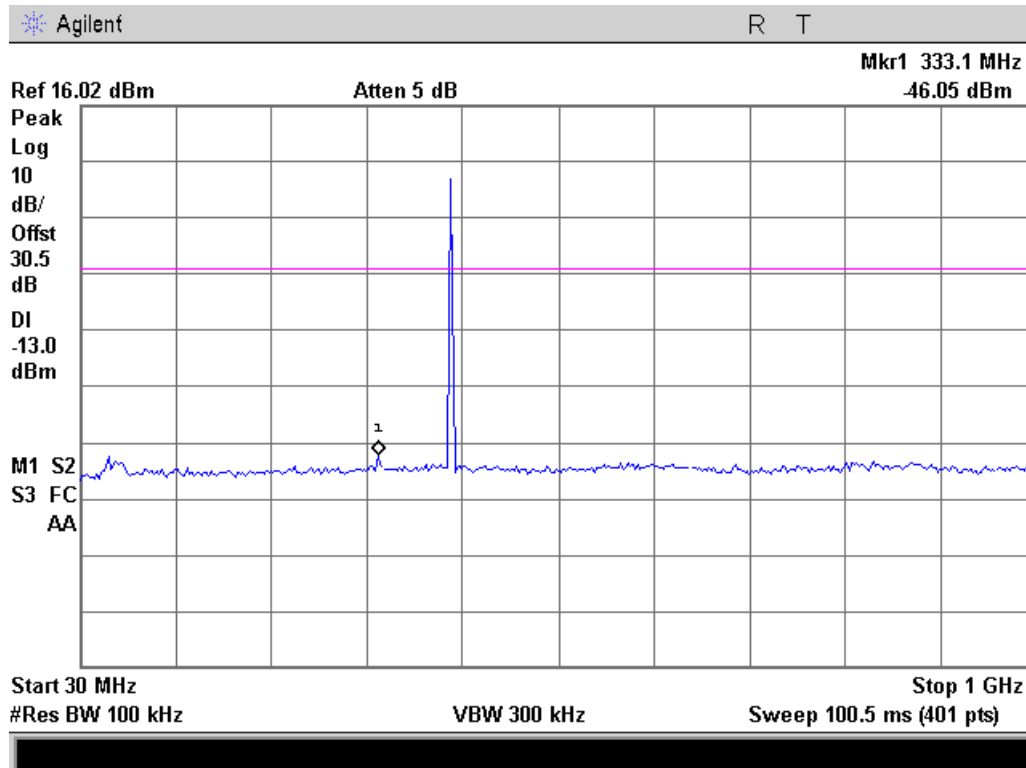


High Power Conducted Spurious Emissions Summary Test Table

Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
406.15	2995.0	-37.36	-13	Pass
418.05	2977.5	-36.32	-13	Pass
429.95	2995.0	-36.73	-13	Pass

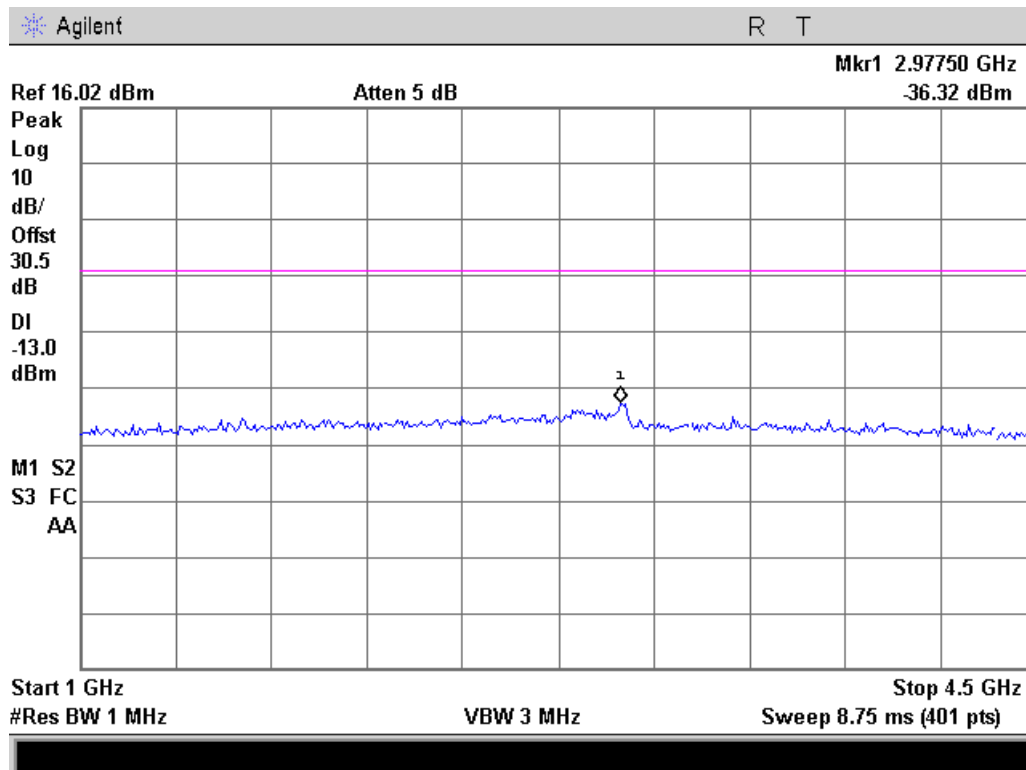
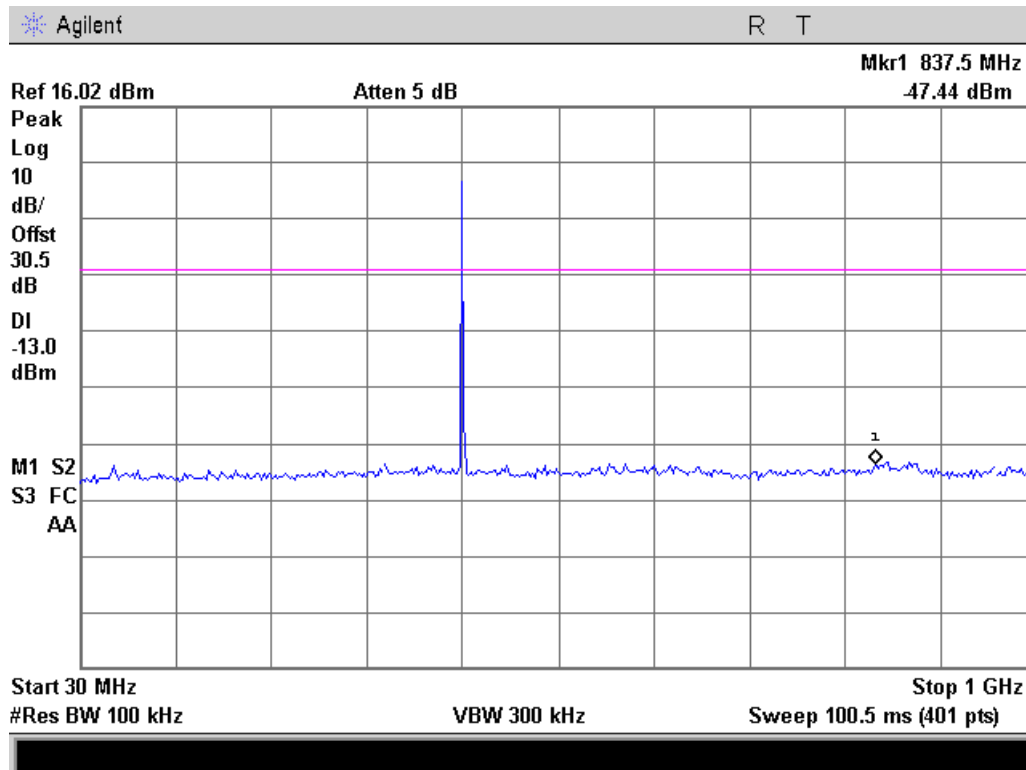


406.15 Test Plots



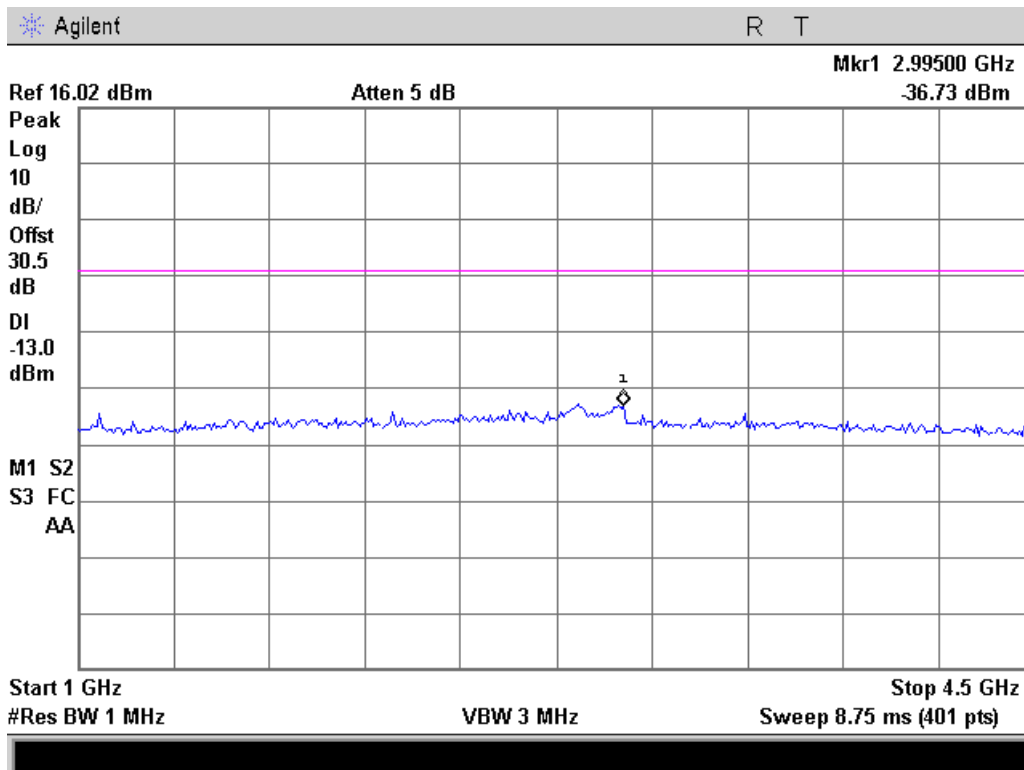
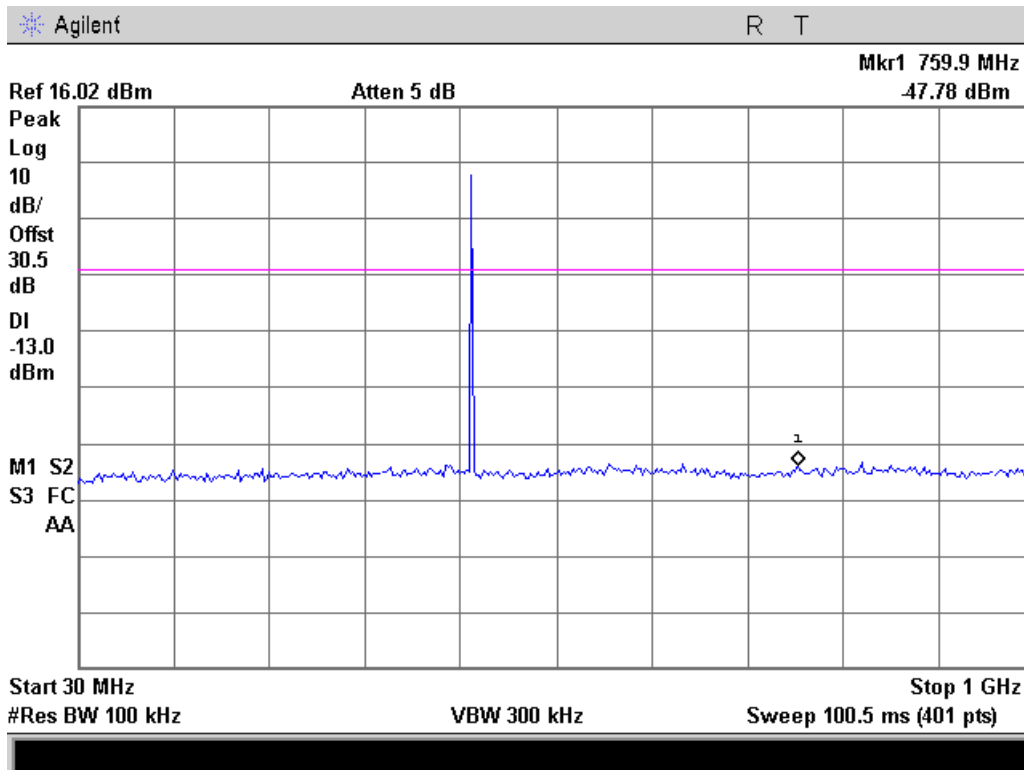


418.05 Test Plots





429.95 Test Plots





Name of Test: Field Strength of Spurious Radiation
Specification: 2.1053
Test Equipment Utilized: i00033, i00103, i00124, i00267

Engineer: J. Erhard
Test Date: 9/30/2010

Test Procedure

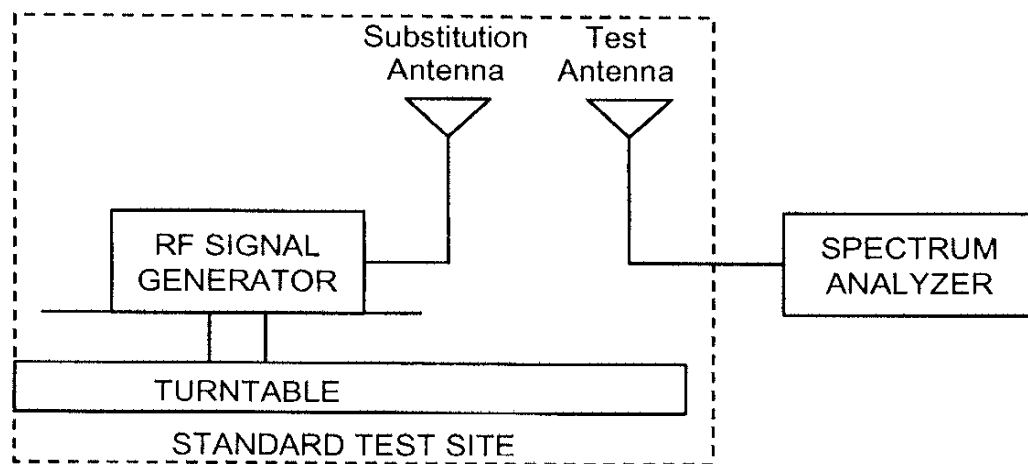
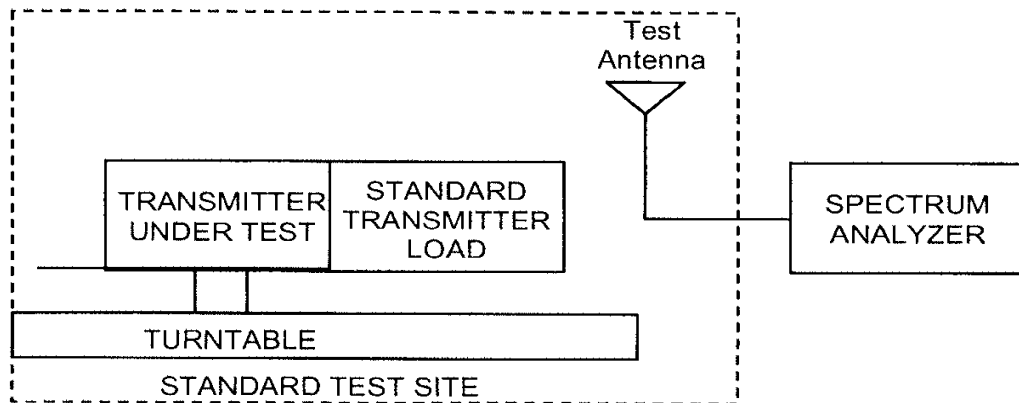
- A) Connect the equipment as illustrated
- B) Adjust the spectrum analyzer for the following settings:
 - 1) Resolution Bandwidth 100 kHz (<1 GHz), 1 MHz (> 1GHz).
 - 2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz
 - 3) Sweep Speed ≤ 2000 Hz/second
 - 4) Detector Mode = Mean or Average 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 $\pm$ 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 = $10\log_{10}(\text{TX power in watts}/0.001)$ – the levels in step I)

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



Test Setup





Peak Radiated Power Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Correction Factor (dB)	Corrected Value (dBm)
406.15	15.9	19.4	35.3
418.05	17.1	19.5	36.6
429.95	16.8	19.5	36.3

406.15 Radiated Spurious Emissions Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Correction Factor (dB)	Corrected Value (dBm)	Limit (dBm) ERP/EIRP	Result
812.30	-72.5	24.5	-48	-13	Pass
1218.45	-71.5	27.8	-43.7	-13	Pass
1624.60	-70.6	29.6	-41	-13	Pass

418.05 Radiated Spurious Emissions Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Correction Factor (dB)	Corrected Value (dBm)	Limit (dBm) ERP/EIRP	Result
836.1	-73.6	24.7	-48.9	-13	Pass
1254.15	-71	28	-43	-13	Pass
1672.2	-68.5	29.9	-38.6	-13	Pass

429.95 Radiated Spurious Emissions Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Correction Factor (dB)	Corrected Value (dBm)	Limit (dBm) ERP/EIRP	Result
859.9	-69.5	25.1	-44.4	-13	Pass
1289.85	-67.4	28	-39.4	-13	Pass
1719.8	-66.6	30.2	-36.4	-13	Pass

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

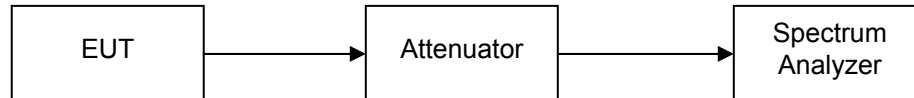


Name of Test: Emission Masks (Occupied Bandwidth)
Specification: 90.210
Test Equipment Utilized: i00331, i00347

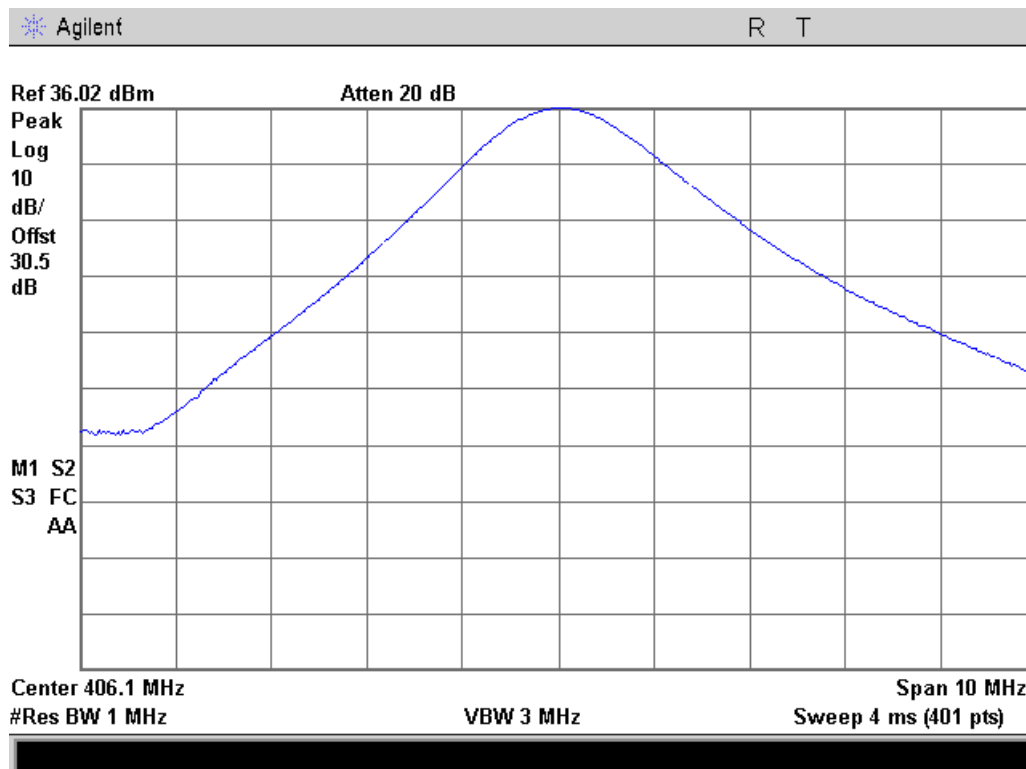
Engineer: J. Erhard
Test Date: 9/30/2010

The EUT was connected directly to a spectrum analyzer through a 30 dB attenuator to verify that the EUT meets the required emissions mask. All cable and attenuator losses were input as a reference level offset to ensure accurate measurements. A reference level plot is provided to verify that the peak power was established prior to testing the mask. An audio frequency of 2.5 kHz at a level of 100 mVPP was input into the EUT.

Test Setup

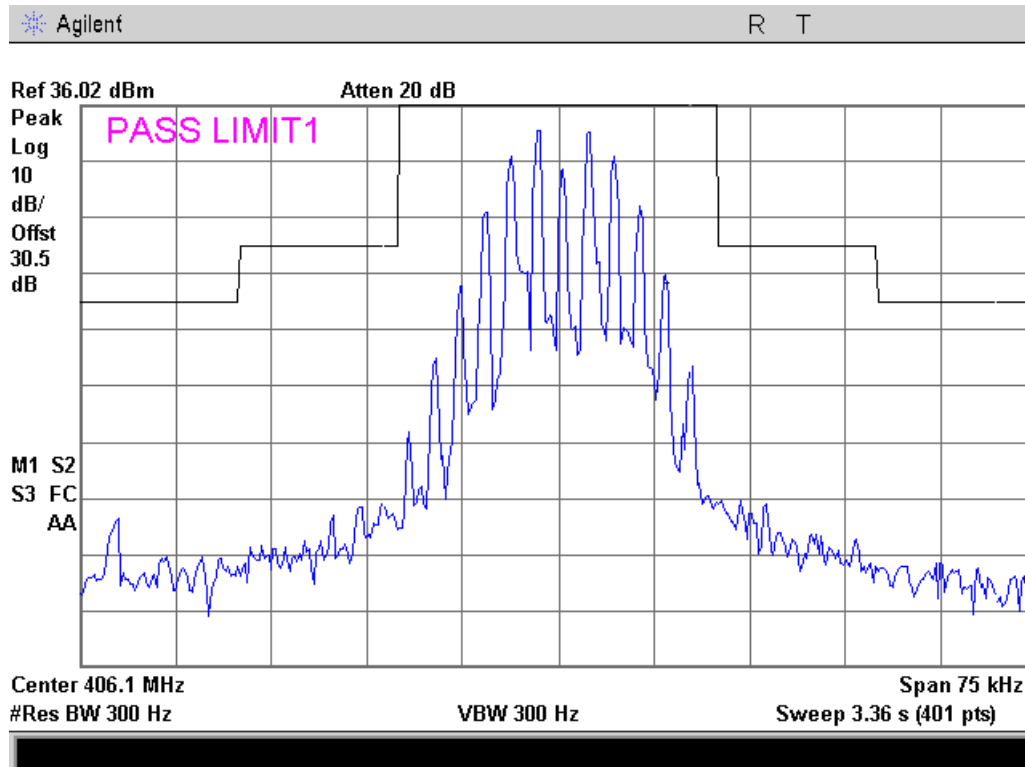


406.15 MHz Reference

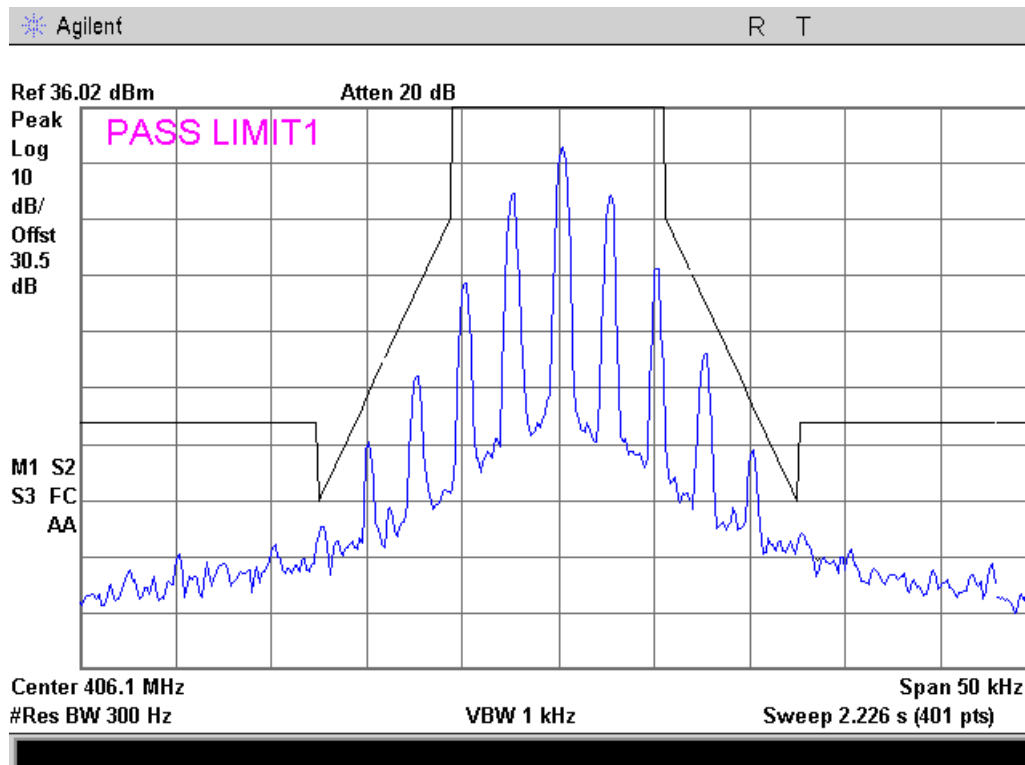




406.15 MHz Mask 25 kHz

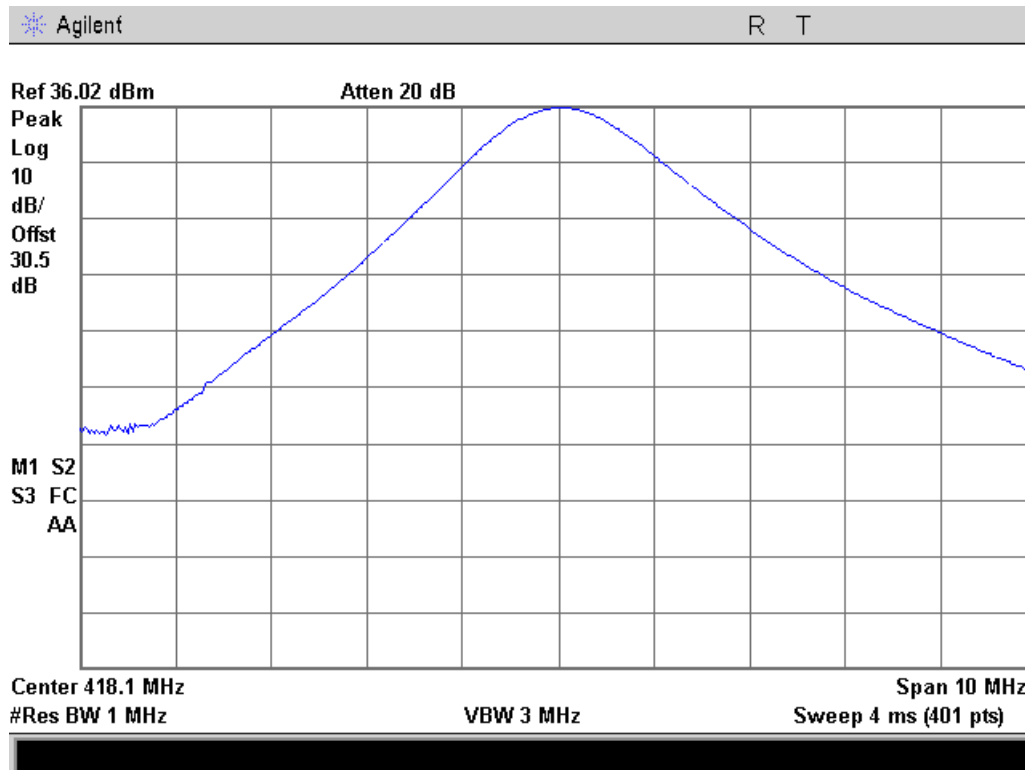


406.15 MHz Mask 12.5 kHz

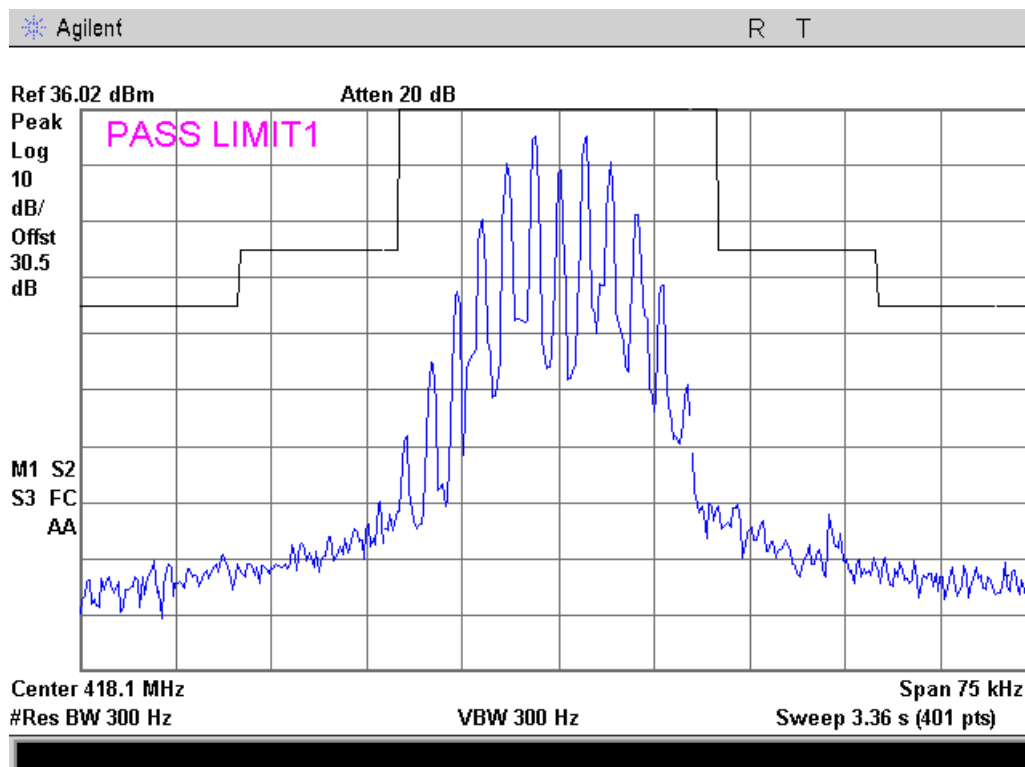




418.05 MHz Reference

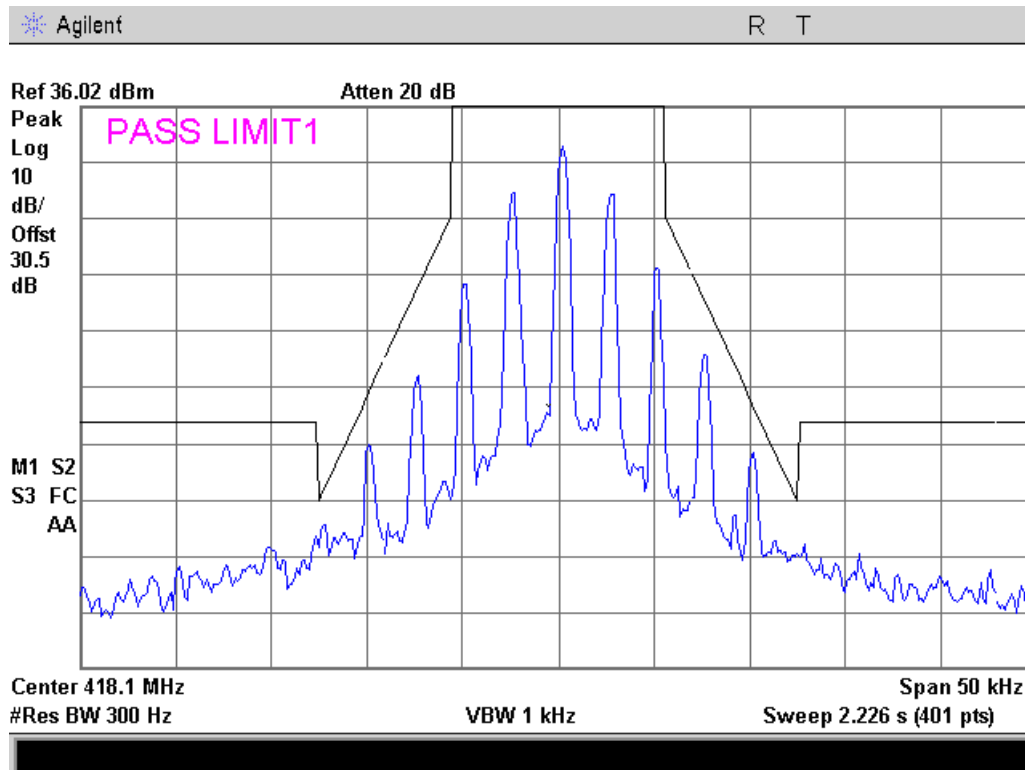


418.05 MHz Mask 25 kHz

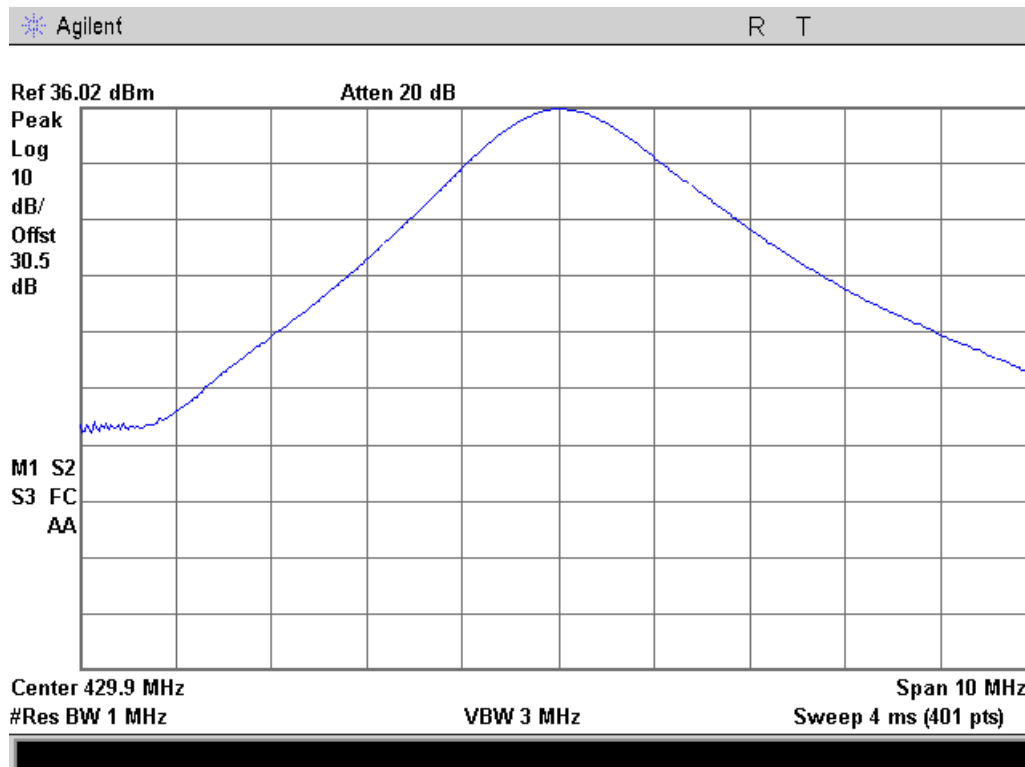




418.05 MHz Mask 12.5 kHz

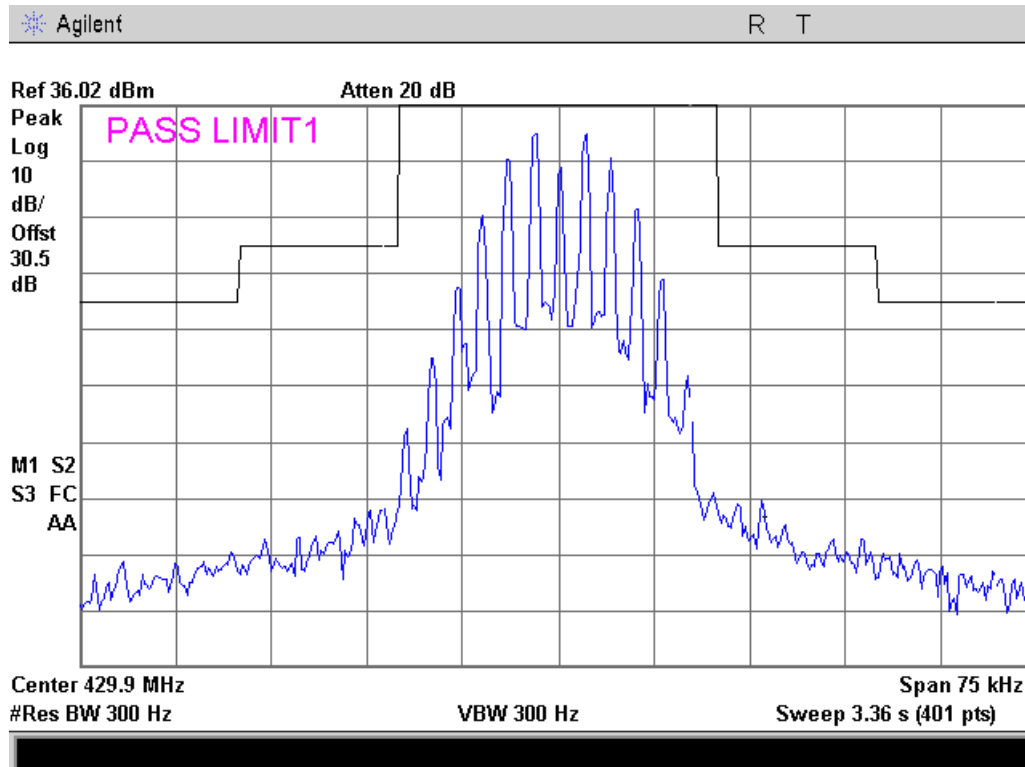


429.95 MHz Reference

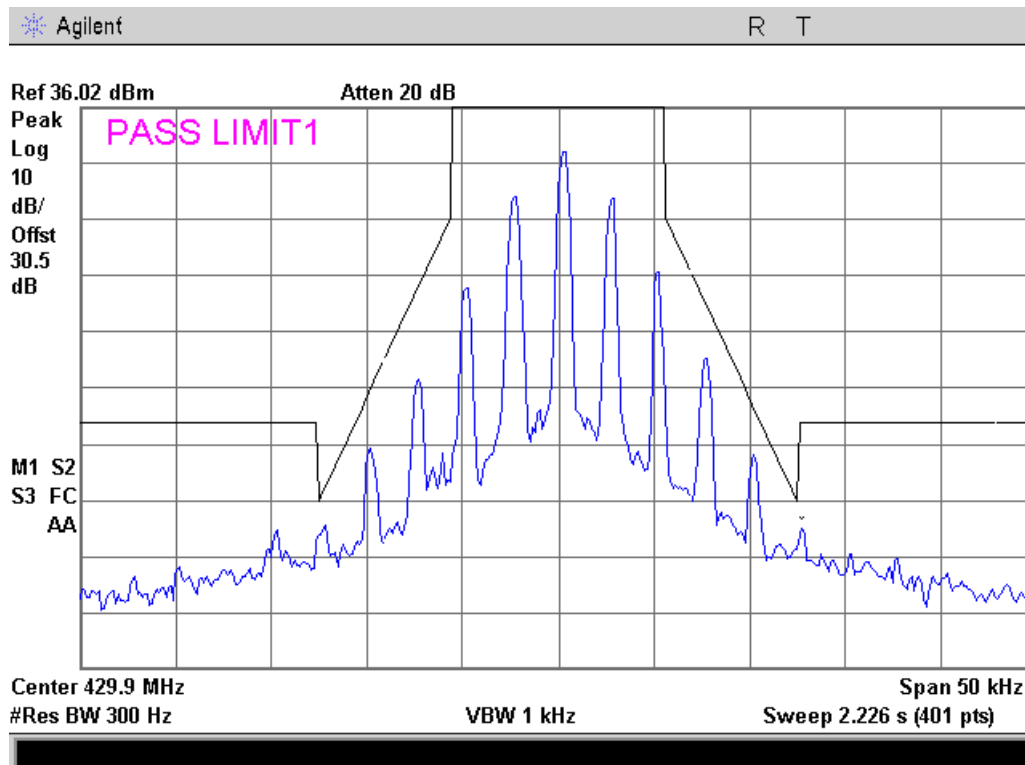




429.95 MHz Mask 25 kHz



429.95 MHz Mask 12.5 kHz





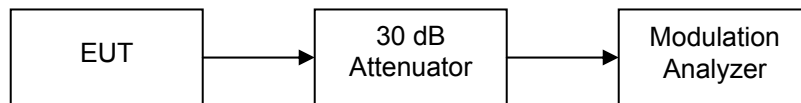
Name of Test: Transient Frequency Behavior
Specification: 90.214
Test Equipment Utilized: i00345, i00347, i00348

Engineer: J. Erhard
Test Date: 9/30/2010

Measurement Procedure

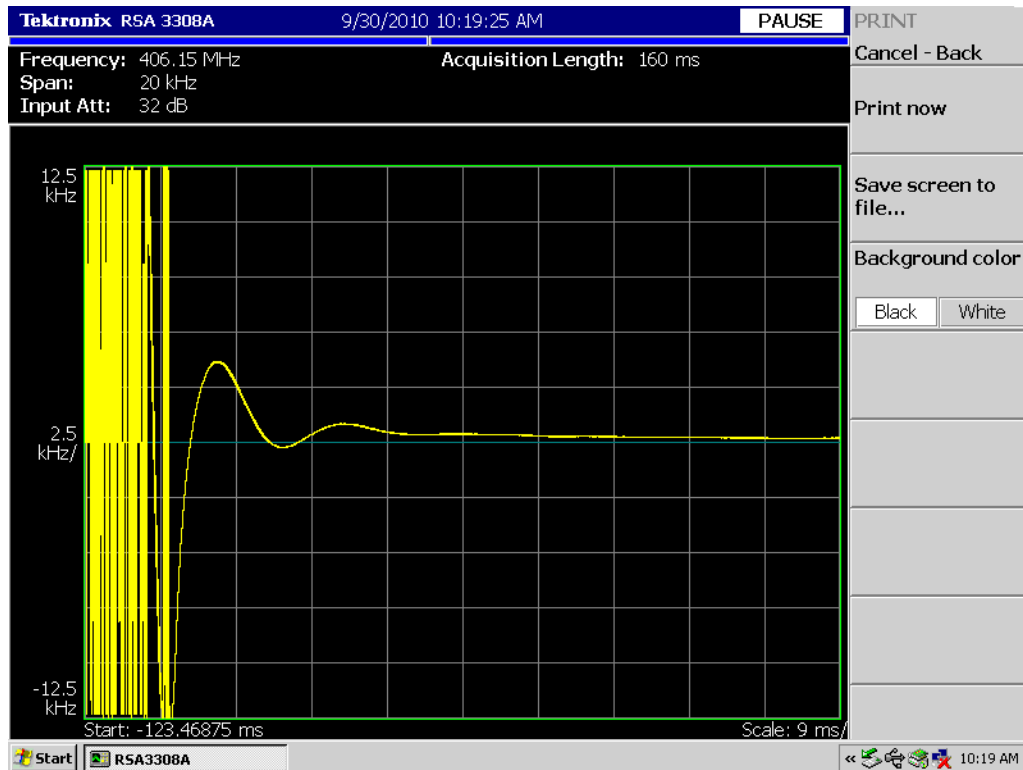
The EUT was connected directly to a Modulation analyzer through a 30 dB attenuator to verify that the EUT meets the required emissions mask. All cable and attenuator losses were input as a reference level offset to ensure accurate measurements. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis. The turn on and turn off transient timing was measured and plotted.

Test Setup

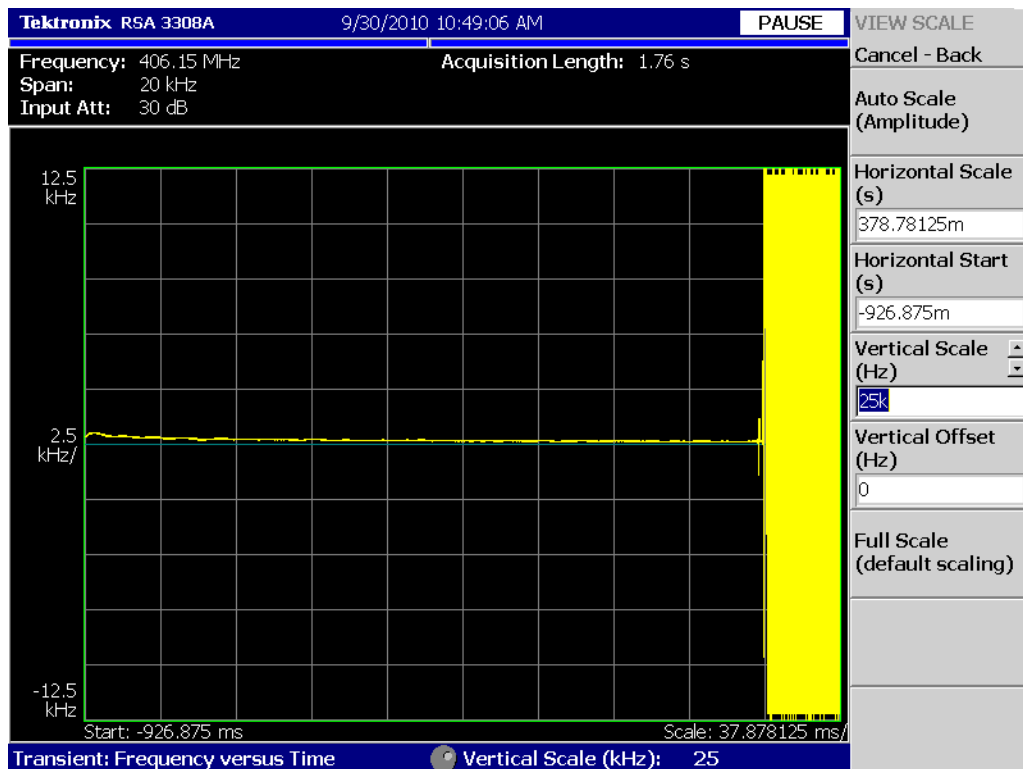




25 kHz On Time

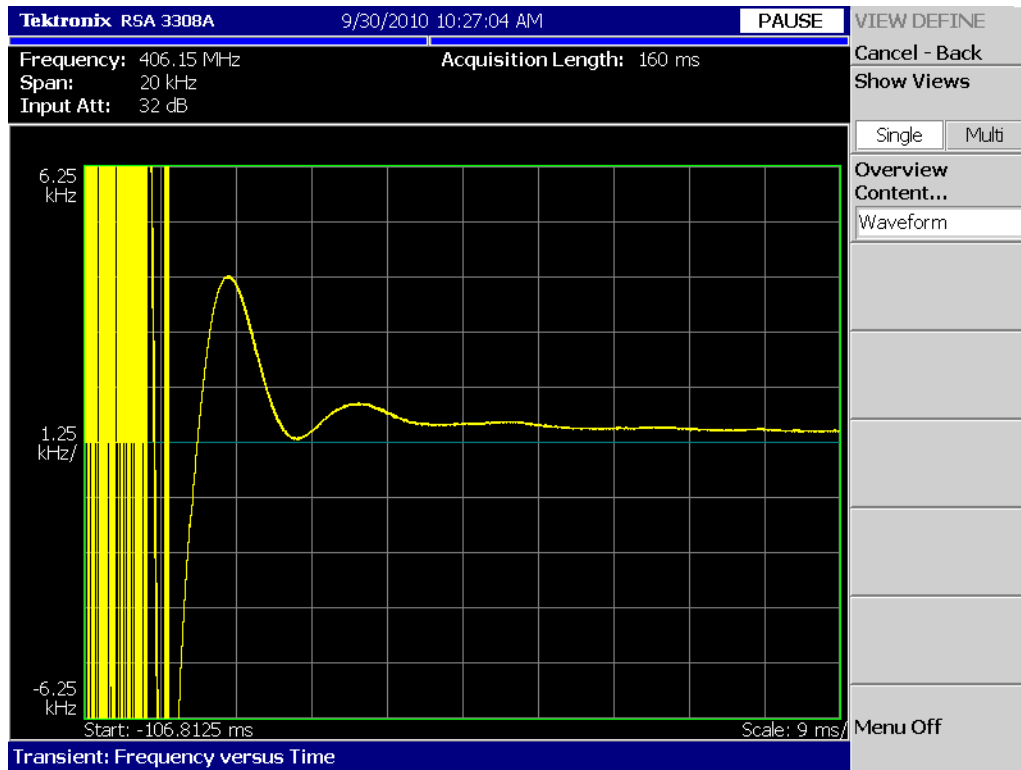


25 kHz Off Time

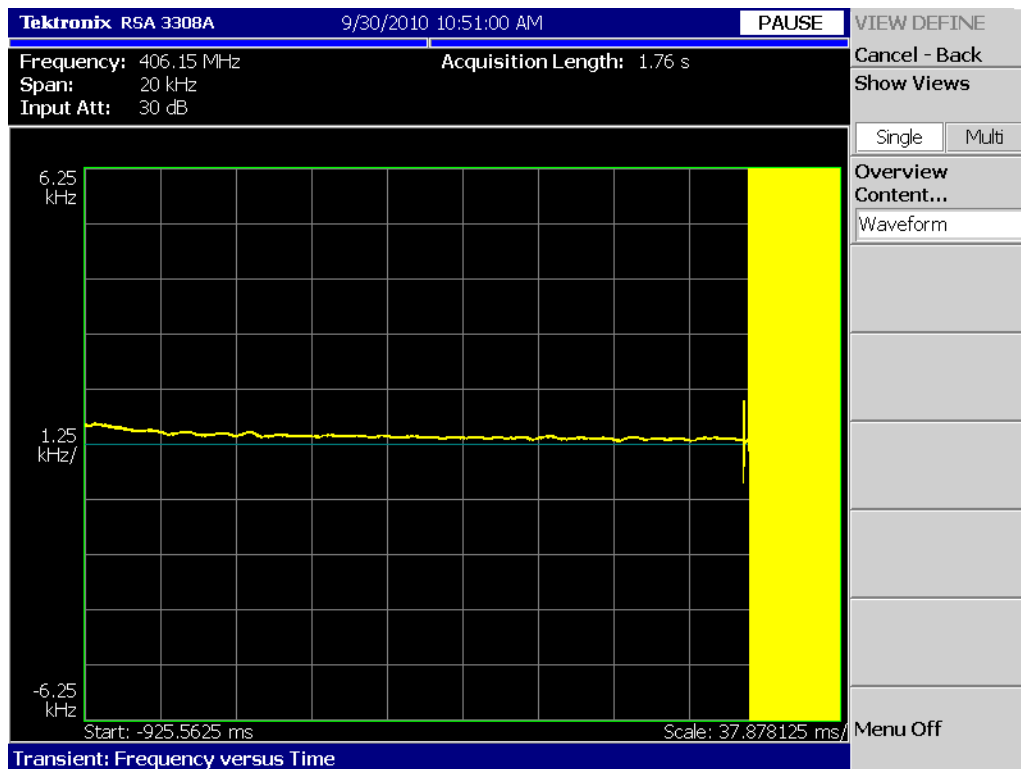




12.5 kHz On Time



12.5 kHz Off Time





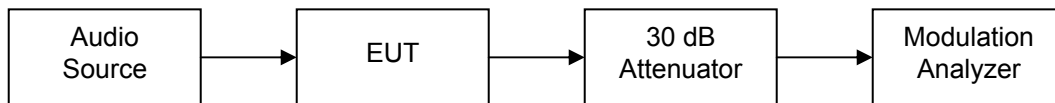
Name of Test: Audio Low Pass Filter (Voice Input)
Specification: 2.1047
Test Equipment Utilized: i00345, i00347, i00348

Engineer: J. Erhard
Test Date: 9/30/2010

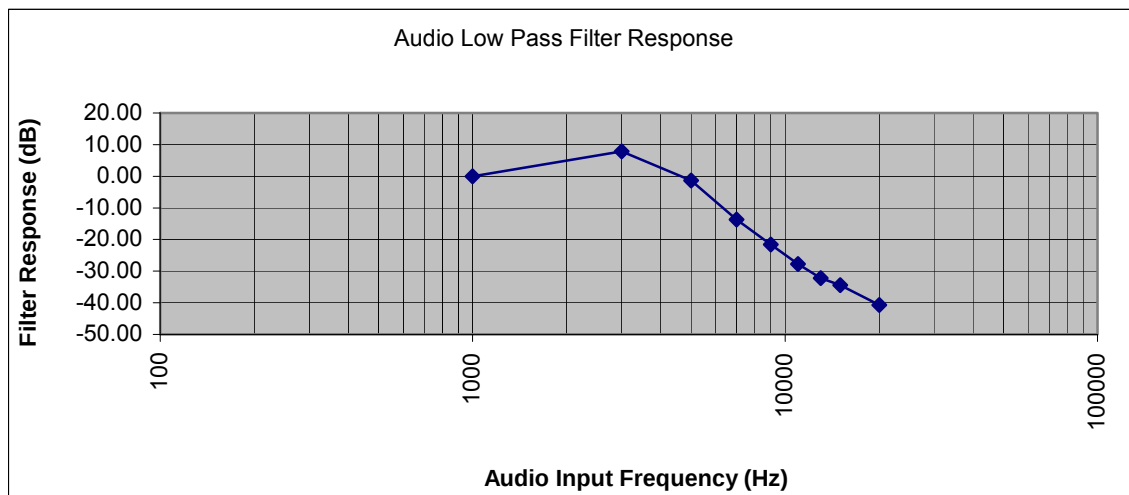
Measurement Procedure

The EUT was connected directly to a Modulation analyzer through a 30 dB attenuator to verify that the EUT meets the required emissions mask. All cable and attenuator losses were input as a reference level offset to ensure accurate measurements. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis. The audio low pass filter response was measured and plotted.

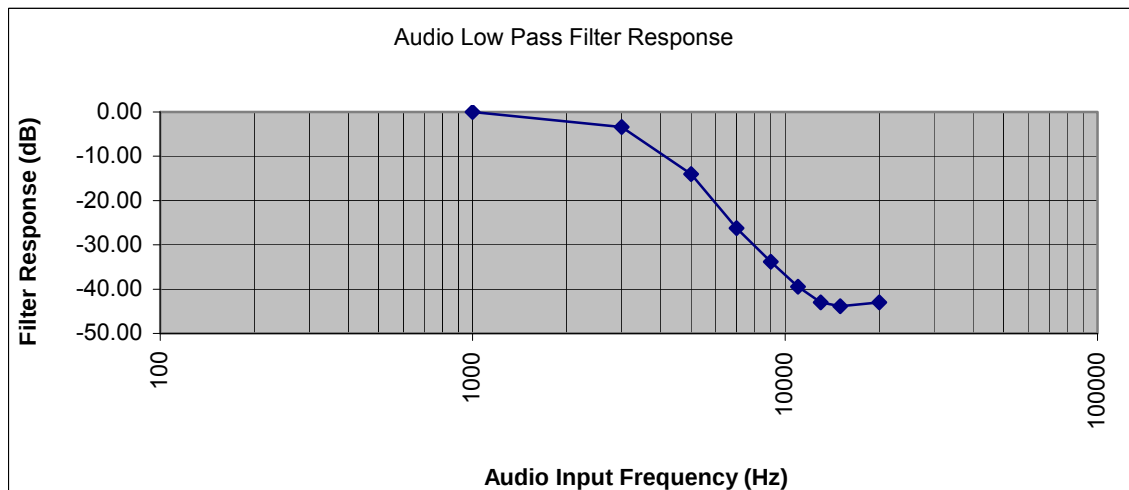
Transmitter Test Set-Up



Measurement Results 25 kHz



Measurement Results 12.5 kHz





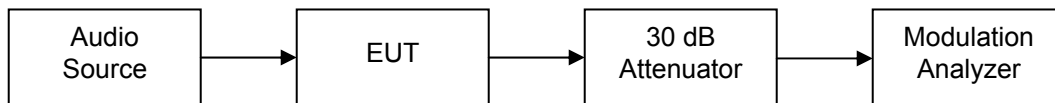
Name of Test: Audio Frequency Response
Specification: 2.1047
Test Equipment Utilized: i00345, i00347, i00348

Engineer: J. Erhard
Test Date: 9/30/2010

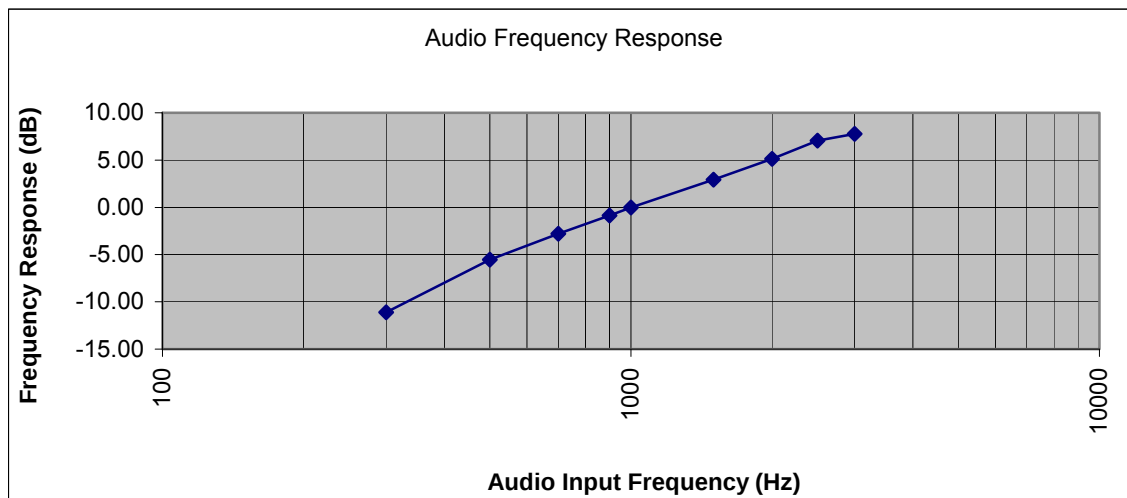
Measurement Procedure

The EUT was connected directly to a Modulation analyzer through a 30 dB attenuator to verify that the EUT meets the required emissions mask. All cable and attenuator losses were input as a reference level offset to ensure accurate measurements. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis. The audio frequency response was measured and plotted.

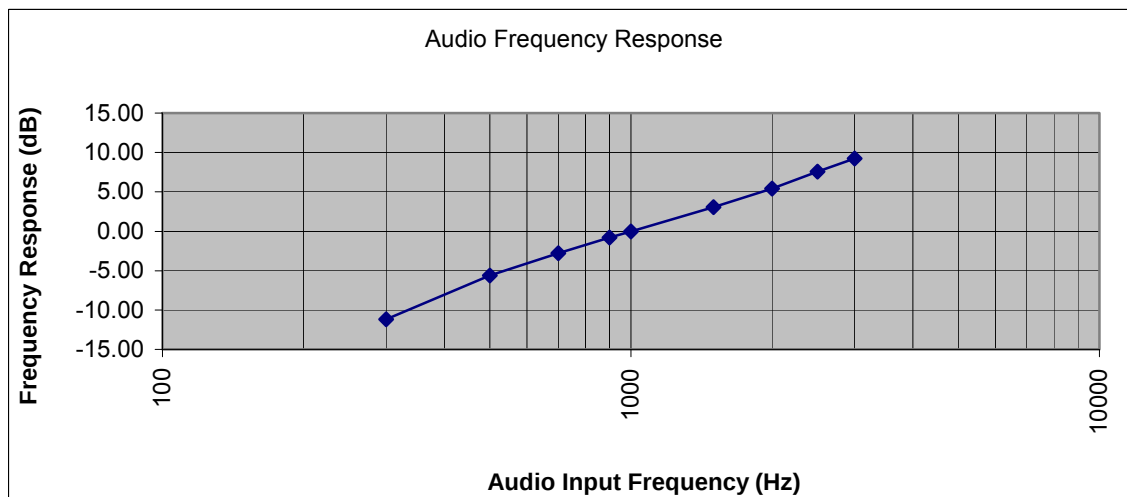
Test Setup



Measurement Results 25 kHz



Measurement Results 12.5 kHz





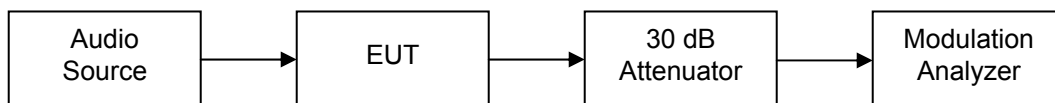
Name of Test: Modulation Limiting
Specification: 2.1047(a)
Test Equipment Utilized: i00345, i00347, i00348

Engineer: J. Erhard
Test Date: 9/30/2010

Measurement Procedure

The EUT was connected directly to a Modulation analyzer through a 30 dB attenuator to verify that the EUT meets the required emissions mask. All cable and attenuator losses were input as a reference level offset to ensure accurate measurements. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis. The swept frequency modulation limiting was measured and plotted.

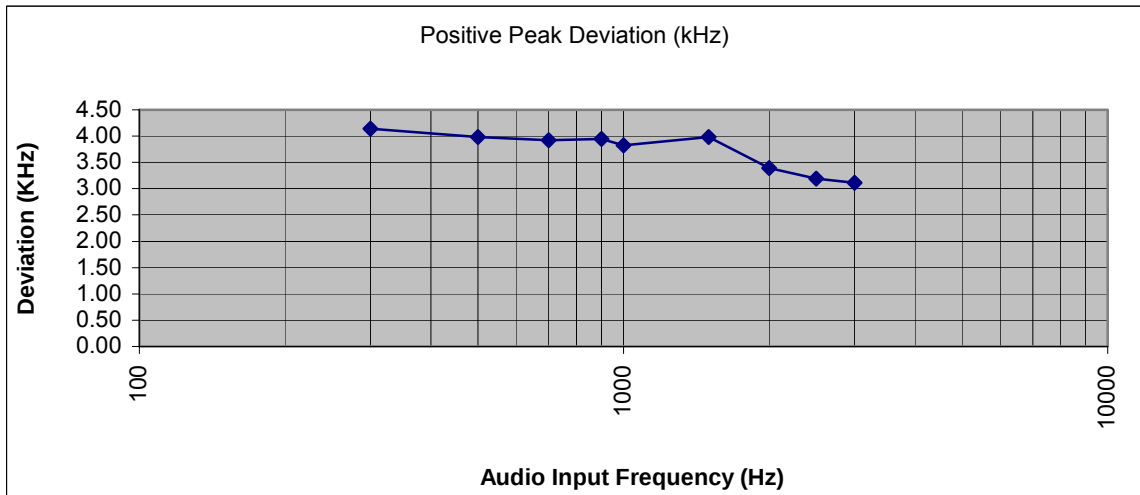
Test Setup



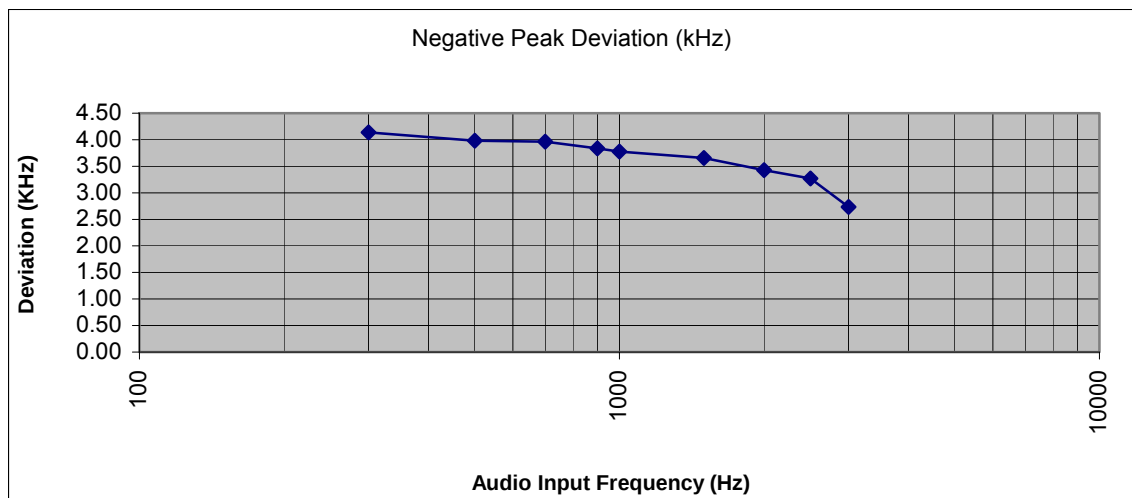


25 kHz Swept Frequency

Results Positive Peaks



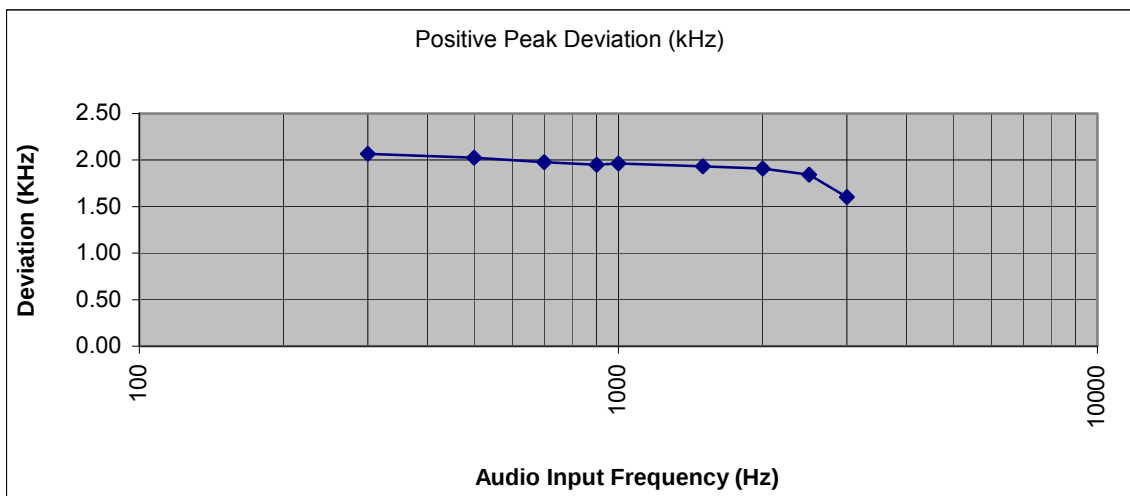
Test Results Negative Peaks



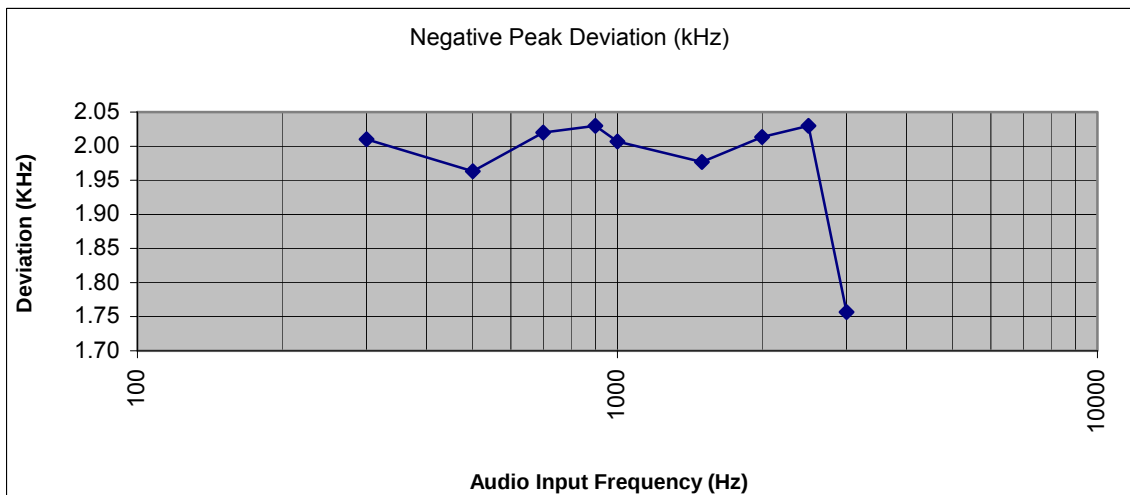


12.5 kHz Swept Frequency

Test Results Positive Peaks



Test Results Negative Peaks





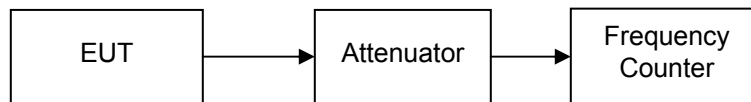
Name of Test: Frequency Stability (Temperature Variation)
Specification: 90.213
Test Equipment Utilized: i00019, i00027, i00350

Engineer: J. Erhard
Test Date: 9/21/2010

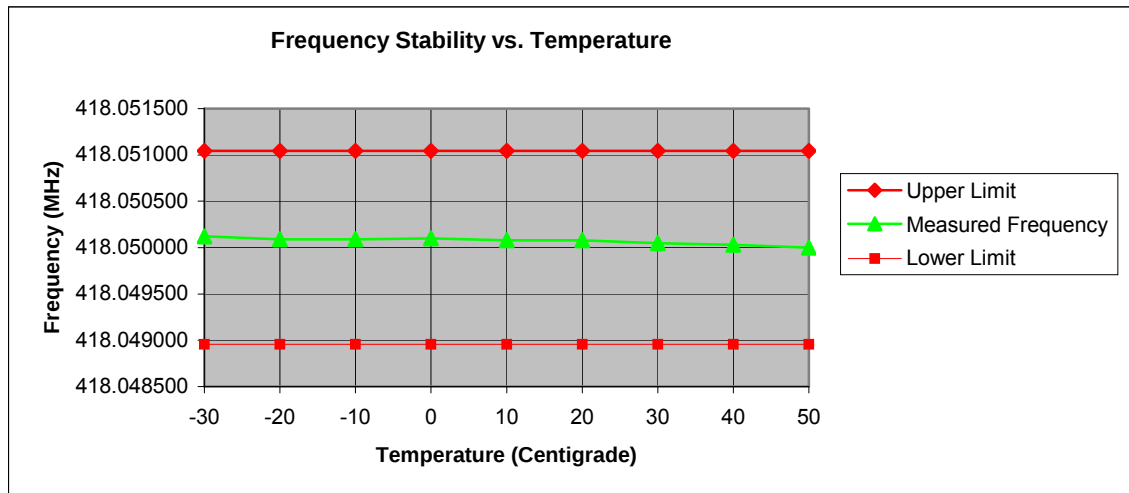
Measurement Procedure

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.

Measurement Setup



Measurement Results





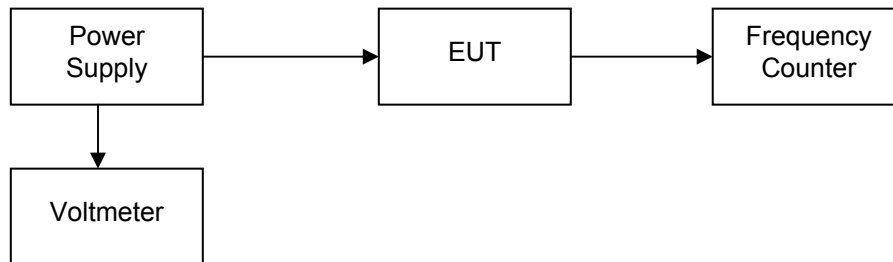
Name of Test: Frequency Stability (Voltage Variation)
Specification: 90.213
Test Equipment Utilized: i00019, i00027, i00319, i00350

Engineer: J. Erhard
Test Date: 9/21/2010

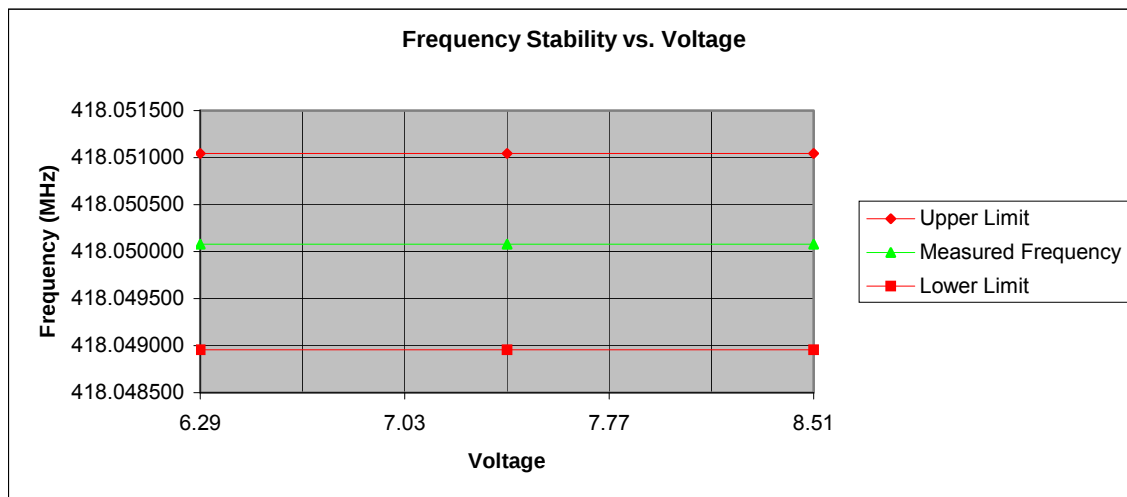
Measurement Procedure

The EUT was placed in a temperature chamber at $20\pm5^{\circ}\text{C}$ 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 was measured.

Measurement Setup



Measurement Results





Test Equipment Utilized

Description	MFG	Model Number	CT Asset Number	Last Cal Date	Cal Due Date
Frequency Counter	HP	5334B	i00019	2/15/2010	2/15/2011
Temperature Chamber	Tenney	Tenney Jr.	i00027	12/18/2009	12/18/2010
Emi Receiver	HP	8546A	i00033	11/4/2009	11/4/2010
Horn Antenna	EMCO	3115	i00103	11/25/2008	11/25/2010
Tunable Notch Filter	Eagle	TNF-1	i00124	NCR	NCR
Bilog Antenna	Schaffner	CBL6111C	i00267	11/21/2009	11/21/2010
DMM	Fluke	87 III	i00319	7/9/2010	7/9/2011
Spectrum Analyzer	Agilent	E4407B	i00331	11/3/2009	11/3/2010
Real Time Spectrum Analyzer	Tektronix	RSA3308A	i00345	9/21/2010	9/21/2011
30dB 150W attenuator	Narda	769-30	i00347	NCR	NCR
Vector Signal Generator	Agilent	E4438C	i00348	3/26/2010	3/26/2011
Power Supply	HP	6654A	i00350	NCR	NCR

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