L.S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012
262-375-4400 Fax: 262-375-4248

COMPLIANCE TESTING OF: 2 Watt Repeater

PREPARED FOR: Audio Intelligence Devices, Inc.

TEST REPORT NUMBER: 303401, rev 2

TEST DATE(S): October, November, 2003; January, 2004

Table of Contents

1. L. S. Compliance In Review

L. S. Compliance, Inc. is located in Cedarburg, Wisconsin – United States.

We may be contacted by:

Mail: L. S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, Wisconsin 53012

Phone: 262-375-4400
Fax: 262-375-4248
E-mail: eng@lsr.com

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation
Accreditation based on ISO/IEC 17025 : 2003
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: **1255.01**

U. S. Conformity Assessment Body (CAB) Validation
Validated by the European Commission as a U. S. Conformity Assessment Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union EMC Directive 89/336/EEC, Article 10.2.
Date of Validation: **January 16, 2001**

Federal Communications Commission (FCC) – USA
Listing of 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
FCC Registration Number: **90756**

Listing of 3 and 10 meter OATS based on 47CFR 2.948
FCC Registration Number: **90757**

Industry Canada
On-file, 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
File Number: **IC 3088**

On-file 3 and 10 Meter OATS based on RSS-210
File Number: **IC 3088-A**

2. A2LA Certificate of Accreditation

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

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/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002 (1994).

Presented this 26th day of March 2003.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2005

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

3. A2LA Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

L.S. COMPLIANCE, INC.
W66 N220 Commerce Court
Cedarburg, WI 53012
James Blaha Phone: 262 375 4400

ELECTRICAL (EMC)

Valid to: January 31, 2005 Certificate Number: 1255-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

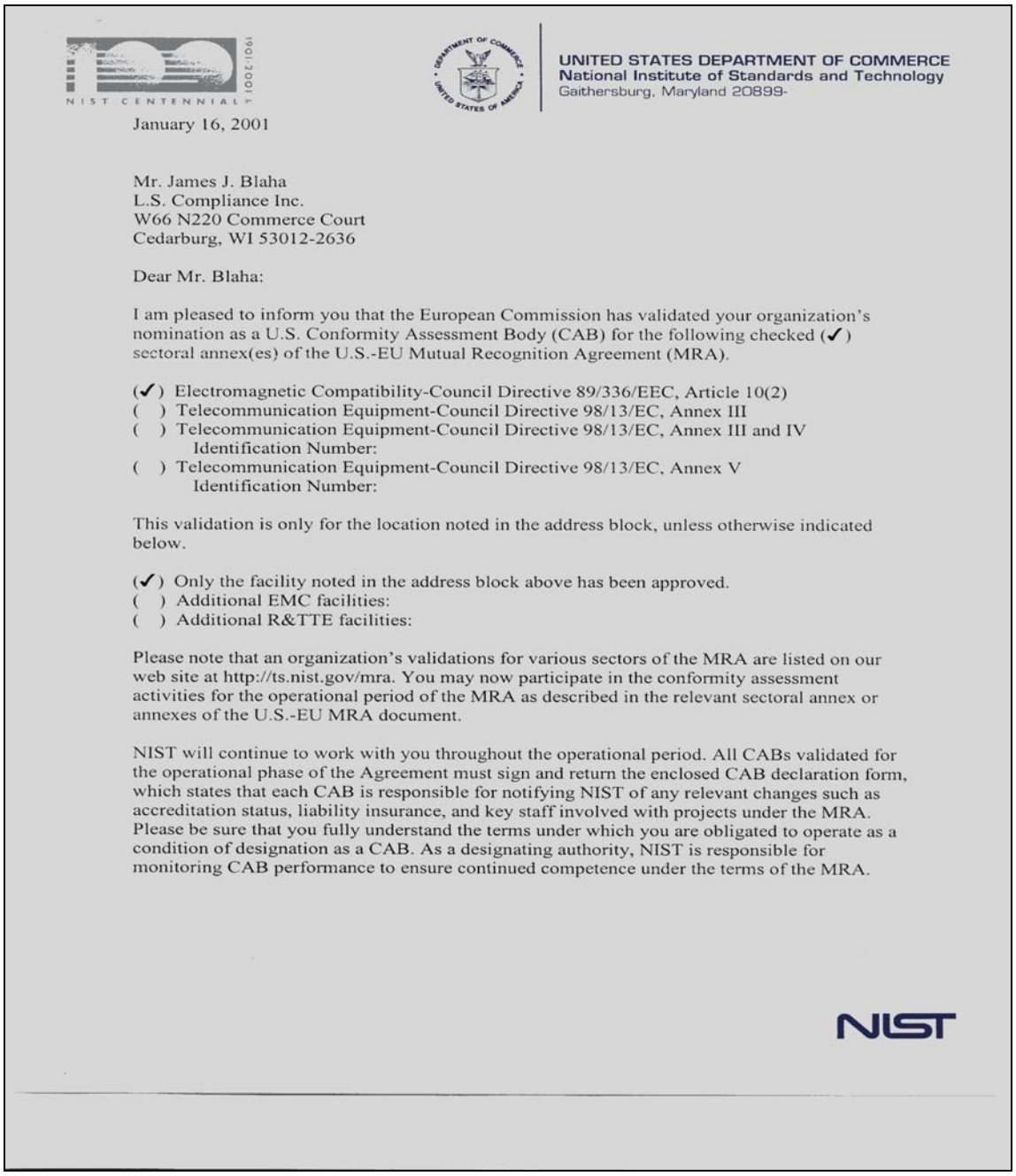
Test	Test Method(s)
Emissions	
Conducted	
Continuous/Discontinuous	Code of Federal Regulations (CFR) 47, FCC Method Parts 15, 18 using ANSI C63.4; EN: 55011, 55022, 50081-1, 50081-2; CISPR: 11, 12, 14-1, 22; CNS 13438
Radiated	Code of Federal Regulations (CFR) 47, FCC Method Parts 15, 18 using ANSI C63.4; EN: 55011, 55022, 50081-1, 50081-2; CISPR: 11, 12, 14-1, 22; CNS 13438
Current Harmonics	IEC 61000-3-2; EN 61000-3-2
Voltage Fluctuations & Flicker	IEC 61000-3-3; EN 61000-3-3
Immunity	EN: 50082-1, 50082-2 EN 61000-6-2 CISPR: 14-2, 24
Conducted Immunity	
Fast Transients/Burst	IEC 61000-4-4; EN 61000-4-4
Surge	IEC: 61000-4-5; ENV 50142; EN 61000-4-5
RF Fields	IEC: 61000-4-6; ENV 50141; EN 61000-4-6
Voltage Dips/Interruptions	IEC 61000-4-11; EN 61000-4-11

Roxanne M. Robinson

(A2LA Cert. No. 1255-01) 05/13/03 Page 1 of 2

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

4. Validation Letter – U.S. Competent Body for EMC Directive 89/336/EEC



UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

January 16, 2001

Mr. James J. Blaha
L.S. Compliance Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012-2636

Dear Mr. Blaha:

I am pleased to inform you that the European Commission has validated your organization's nomination as a U.S. Conformity Assessment Body (CAB) for the following checked (✓) sectoral annex(es) of the U.S.-EU Mutual Recognition Agreement (MRA).

(✓) Electromagnetic Compatibility-Council Directive 89/336/EEC, Article 10(2)
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III and IV
Identification Number:
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex V
Identification Number:

This validation is only for the location noted in the address block, unless otherwise indicated below.

(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

Please note that an organization's validations for various sectors of the MRA are listed on our web site at http://ts.nist.gov/mra. You may now participate in the conformity assessment activities for the operational period of the MRA as described in the relevant sectoral annex or annexes of the U.S.-EU MRA document.

NIST will continue to work with you throughout the operational period. All CABs validated for the operational phase of the Agreement must sign and return the enclosed CAB declaration form, which states that each CAB is responsible for notifying NIST of any relevant changes such as accreditation status, liability insurance, and key staff involved with projects under the MRA. Please be sure that you fully understand the terms under which you are obligated to operate as a condition of designation as a CAB. As a designating authority, NIST is responsible for monitoring CAB performance to ensure continued competence under the terms of the MRA.

NIST

5. Signature Page

Tested By:  **December 19, 2003**

Abtin Spantman, EMC Engineer **Date**

Tested By:
Prepared By:

Approved By:  **December 19, 2003 ; 1/13/04**

Kenneth L. Boston, EMC Lab Manager **Date**
PE #31926 Licensed Professional Engineer
Registered in the State of Wisconsin, United States

6. Product and General Information

Manufacturer:	Audio Intelligence Devices
Model No.:	PSR-2202A
Serial No.:	0329003, 0342004, 0344002
Description:	2 watt FM repeater

7. Product Description

The PSR-2202 is a fully synthesized, single-channel pair VHF-VHF tactical repeater. Channel assignments are programmed by a technician, and the total frequency range is 150-174 MHz. It is a small 2 watt output device, which operates from a 12.7 VDC supply, usually a battery or an automotive power buss. Over this range, the device can operate on one of two TX channels, and one of 16 RX channels.

8. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the Repeater system with limits contained in various provisions of Title 47 CFR, FCC Part 90 and part 2.

All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2001). Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference CISPR 16-1 (2002). Measurement technique guidelines found in EIA/TIA 603 were also consulted.

9. Summary of Test Report

DECLARATION OF CONFORMITY

The AID 2 watt repeater system was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 90 for a licensed mobile transmitter.

10 Introduction

During October and November of 2003, and January of 2004, a series of Radiated and Conducted Emission tests were performed on three samples of the AID 2 watt tactical mobile repeater, here forth referred to as the "*Equipment Under Test*" or "*EUT*". The three models tested all use the same RF transmitter topology and are used to retransmit a signal in the 150-174 MHz band. These tests were performed using the procedures outlined in ANSI C63.4-2001 for intentional radiators, and in accordance with the limits set forth in FCC Part 90. These tests were performed by Abtin Spantman, EMC Engineer, and Kenneth Boston, EMC Lab Manager of L.S. Compliance, Inc.

11 Purpose

All Radiated and Conducted Emission tests upon the EUT were performed to measure the emissions in the frequency bands described in title 47 CFR, FCC Part 90 to determine whether these emissions are below the limits expressed within the standards. These tests were performed in accordance with the procedure described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2001). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques CISPR 16-1, 2002. EIA/TIA 603 was also consulted for guidance for measurements of a 2 watt FM re-transmitter.

12. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CRF FCC Part 90 and ANSI C63.4-2001. Radiated tests were conducted on each of the three samples corresponding to a low, middle and high channel. The essential radio transceiver found in all models is the same, and therefore radiated tests are performed on all three to determining the worst case. Each EUT was placed on an 80cm high non-conductive table, centered on a flush mounted 2-meter diameter turntable inside the 3 Meter Semi-Anechoic, FCC listed Chamber located at L. S. Compliance, Inc., Cedarburg, Wisconsin. The EUTs were operated in continuous operation mode, using DC power as provided by a regulated supply. The applicable limits apply at a 3 meter distance. The calculations to determine the limits are detailed in the following pages. Please refer to Appendix A for a list of the test equipment. As these devices were repeaters, which have input and output on the same antenna port, (BNC) a directional coupler is used, along with a 5 watt dummy load for the radiated tests. The FWD (-40dB) port is fed with the appropriate input signal needed to energize and create the repeated output signal. The test samples were operated on one of three (3) standard channels:

Channel (low): 151.49 MHz
Channel (medium): 162.00 MHz
Channel (high): 173.52 MHz

Test Procedure

Radiated Emission measurements were performed on each EUT in the 3 Meter Semi-Anechoic, FCC listed Chamber, located at L. S. Compliance, Inc. in Cedarburg, Wisconsin. The frequency range from 30 MHz to 1800 MHz was scanned, and levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. All three samples were evaluated, with each EUT being placed on the non-conductive table (or pedestal) in the 3 Meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the test object. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double Ridged Waveguide Horn Antenna was used from 1 GHz to 2 GHz. The maximum radiated emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

A subsequent test was performed, with a signal generator feeding a tuned dipole which was positioned in the same location as the repeater sample, which was removed. The signal generator was tuned to each of the frequencies that were investigated previously, and was set to give the same radiated level as were recorded earlier. These signal generator readings were corrected for cable and balun losses, to achieve an equivalent level into a half-wave dipole. After correction, they were compared to the 90.210 limit in dBm.

The results are presented in the following pages.

Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The HP 8546A EMI Receiver was operated with a bandwidth of 120 kHz for measurements below 1 GHz, and a bandwidth of 1 MHz for measurements above 1 GHz. The Peak Detector functions were utilized.

Test Results

The EUT was found to MEET the Radiated Emissions requirements of Title 47 CFR, FCC Part 90 for a Frequency Modulated mobile transmitter. The frequencies with significant signals were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS (for 90.210 and 2.1053 compliance)

FIELD STRENGTH OF PART 90 LIMIT: **AT R = 3 METERS DSTANCE**

FROM THE STANDARD REFERENCE FORMULA FOR POWER TRANSMITTED VERSUS ELECTRIC FIELD:

$$Pt = (R^{**}) \times |E|^{**} / 30$$

Then to convert to dB:

$$Pt = 20\log|E| + 20\log(R) - 10\log(30)$$

Insert additional terms to convert watts to milli-watts (in dB) and volts to micro-volts (in dBuV):

$$Pt = 20\log|Euv| - 20\log(1{,}000{,}000) + 10\log(1000) + 20\log(3) - 10\log(30)$$

$$Pt = 20\log|Euv| - 120 + 30 + 9.54 - 14.77$$

$$Pt = 20\log|Euv| - 95.23$$

OR; $20\log|Euv| = Pt \text{ (in dBm)} + 95.23$

$|E|$ (in dBuV) = -20 dBm + 95.23 = 75.23 dBuV/m , at 3 meters

This limit can be increased by 2.14 dB to correct for the gain of an ideal half-wave dipole antenna, as specified in TIA/EIA 603 clause 2.2.12

75.23 + 2.14 = 77.37 dBuV/m at 3 meters

The -20 DBM limit is found in 90.210d. (see page 24)

Note: Limits are rounded to the nearest tenth of a dB.

Measurement of Electromagnetic Radiated Emissions Within the 3 Meter FCC Listed Chamber

Manufacturer: Audio Intelligence Devices, Inc.
Date of Test: 28,29 October, 11 November, 2003
Model Nos.: PSR-2202A
Serial No.: 0329003, 0342004, 0344002

Test Requirements: FCC 90.210, 2.1053; TIA/EIA 603 clause 2.2.12

Distance: 3 Meters,	**Frequency Range Inspected:** 30 to 1800 MHz per 2.1057
Configuration: Continuous Transmit,	

Test Equipment Used:

EMI Measurement Instrument: HP 8546A and Agilent E4407B	Biconical Antenna: EMCO 93110B
Double-Ridged Wave Guide/Horn Antenna: EMCO 3115	Log Periodic Antenna: EMCO 43146A

Detector(s) Used:	√	Peak		Quasi-Peak	√	Average

The following table depicts the level of significant radiated emissions found

Frequency (MHz)	Antenna Polarity	Channel #	Antenna Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBμV/m)	90.210Limit (dBμV/m)	Margin (dB)
303.00	H	Low	1.2	0	55.7	77.4	21.7
454.5	H	Low	1.0	250	63.9	77.4	13.5
1060.0	V	Low	1.0	175	57.1	77.4	20.3
324.0	H	Middle	1.0	185	59.2	77.4	18.2
486.0	V	Middle	1.0	110	66.9	77.4	10.5

Notes: A-Peak Detector was used in measurements below 1 GHz, and both an Average and a Peak Detector were used in measurements above 1 GHz. All other Radiated Spurious Emissions seen were found to be greater than 20 dB below the limits, or below the noise floor of the instrumentation.

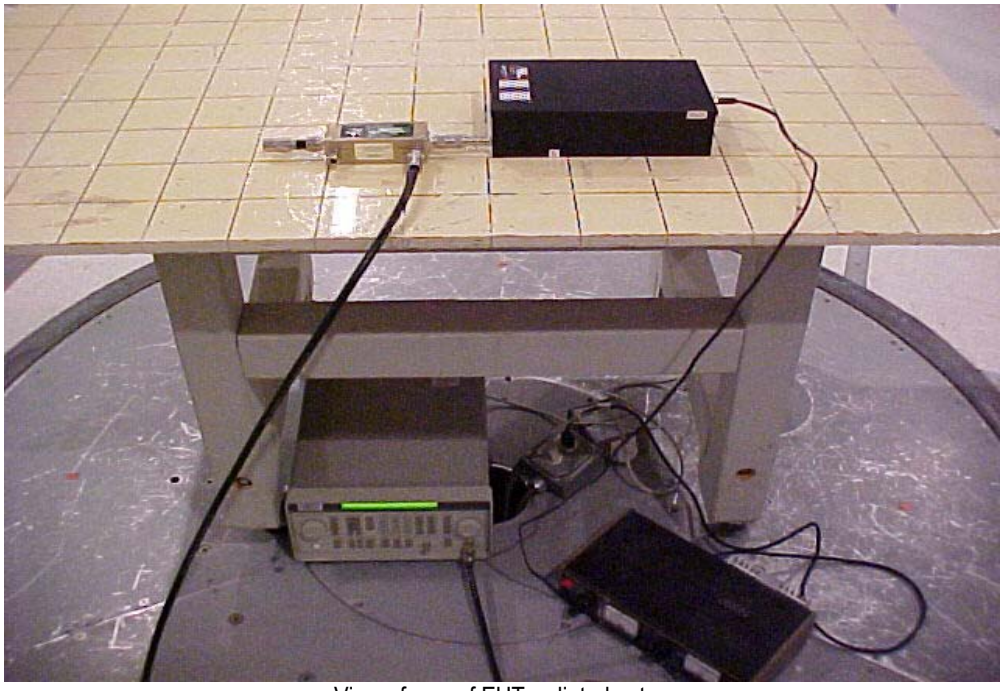
The table below depicts the radiated emission equivalent signal generator levels derived via the substitution method

Frequency (MHz)	Antenna Polarity	Antenna Height (meters)	Signal Generator (dBm)	Cable/ Balun correction	Corrected generator signal	90.210Limit (dbm)	Margin (dB)
303.00	H	1.0	-44.2	-0.2	-44.4	-20.0	24.4
454.5	H	1.7	-35.8	-0.7	-36.5	-20.0	16.5
1060.0	V	1.0	-39.1	-3.5	-42.6	-20.0	22.6
324.0	H	1.0	-41.8	-0.4	-42.2	-20.0	22.2
486.0	V	1.0	-32.9	-0.7	-33.6	-20.0	13.6

Photos Taken During Radiated Emission Testing

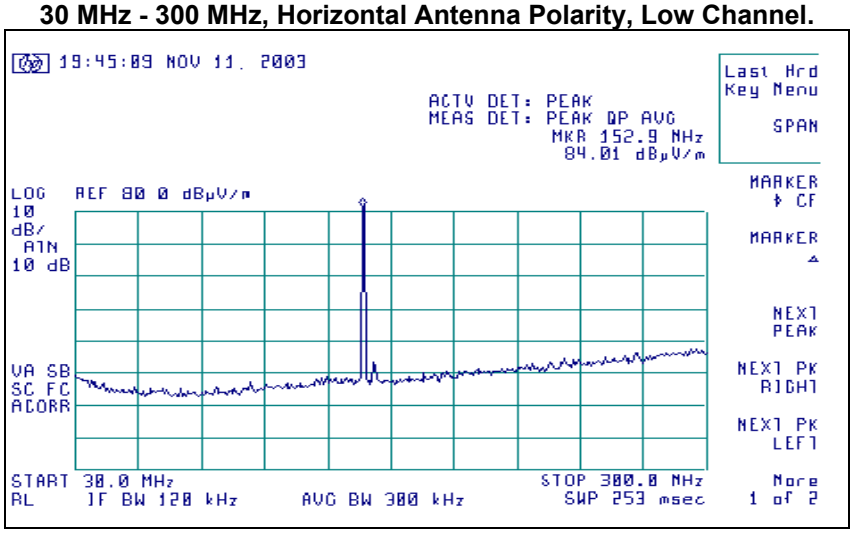
Setup of Radiated Emissions Test. (w/ signal generator injection, TXing into load)

Front view of the EUT radiated setup

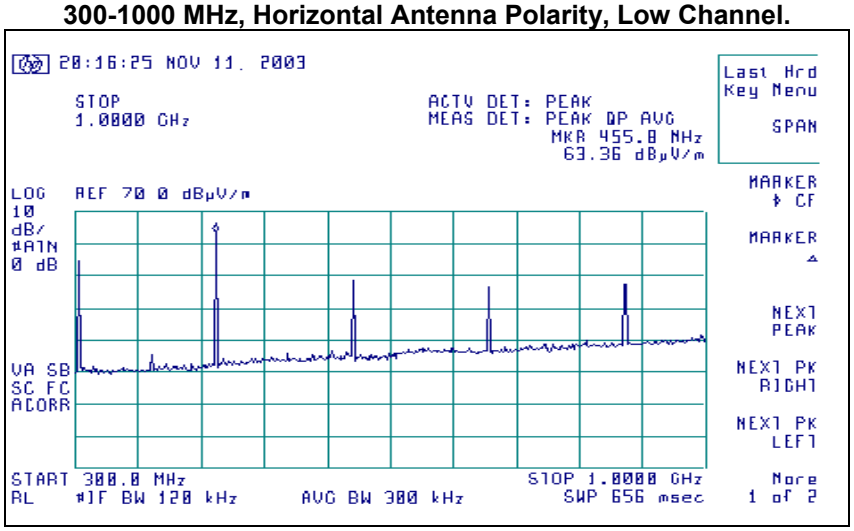


View of rear of EUT radiated setup

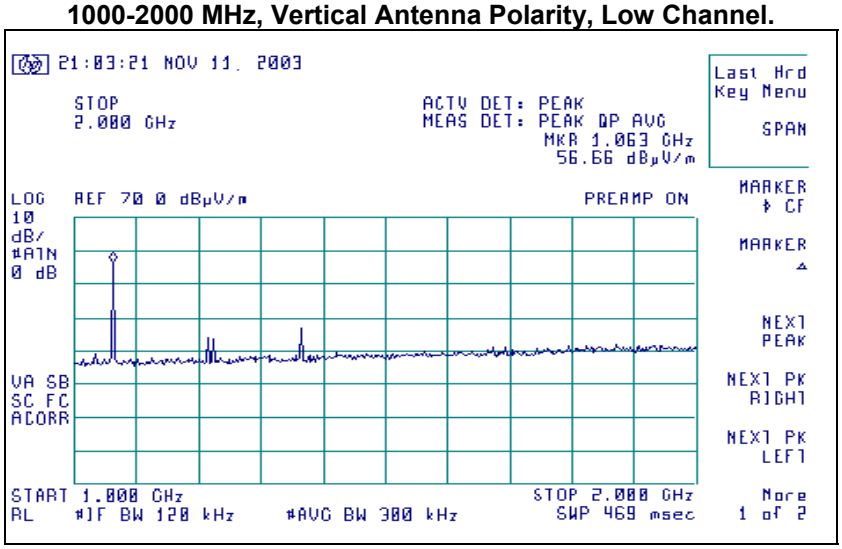
30 MHz - 300 MHz, Horizontal Antenna Polarity, Low Channel.



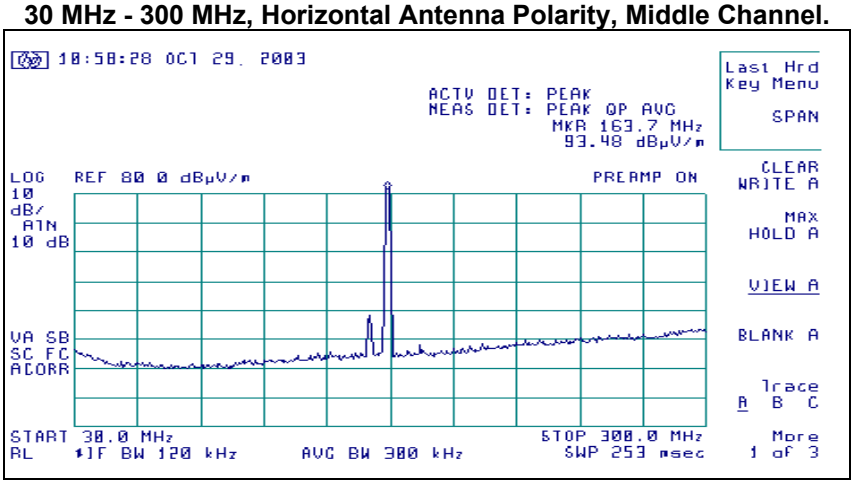
300-1000 MHz, Horizontal Antenna Polarity, Low Channel.



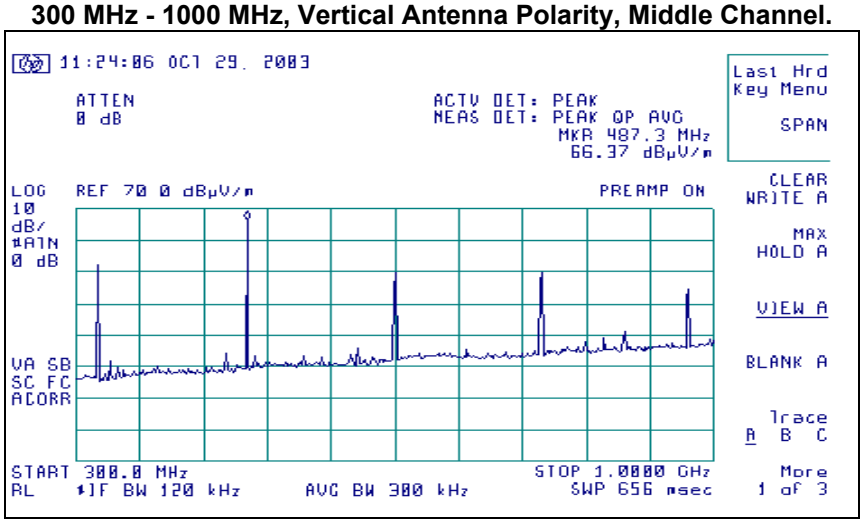
1000-2000 MHz, Vertical Antenna Polarity, Low Channel.



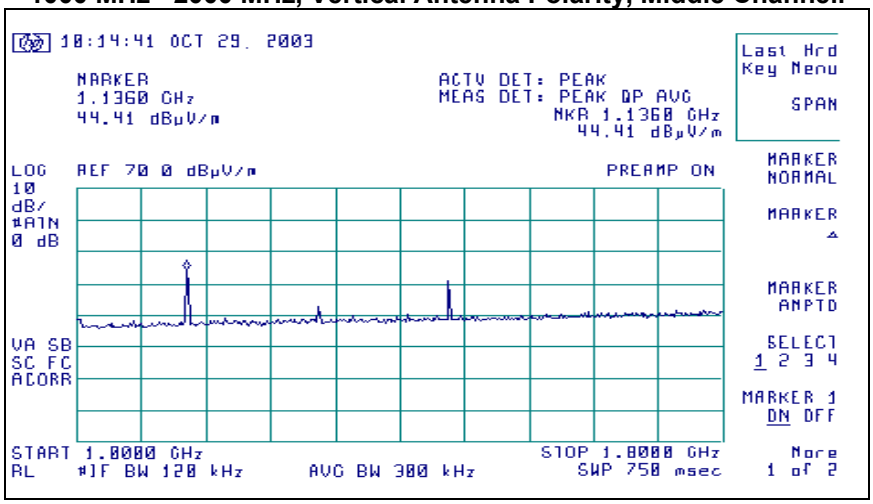
30 MHz - 300 MHz, Horizontal Antenna Polarity, Middle Channel.



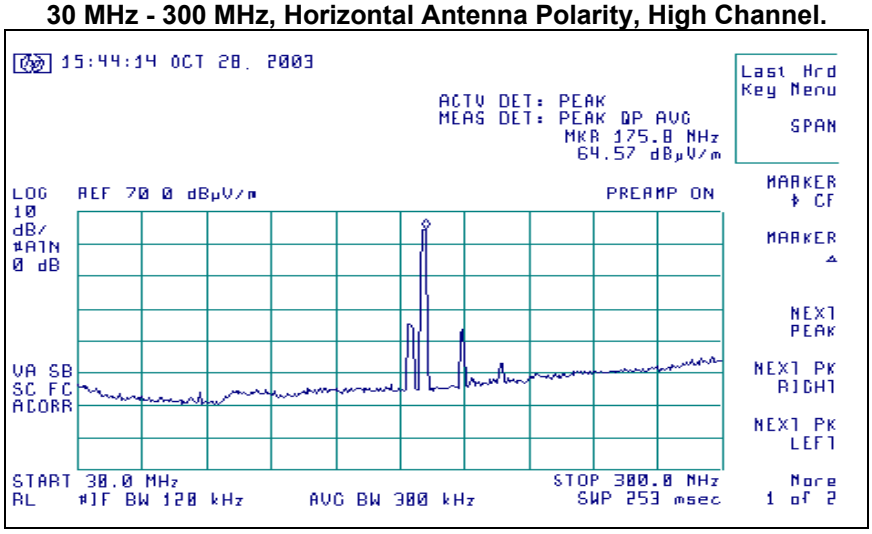
300 MHz - 1000 MHz, Vertical Antenna Polarity, Middle Channel.



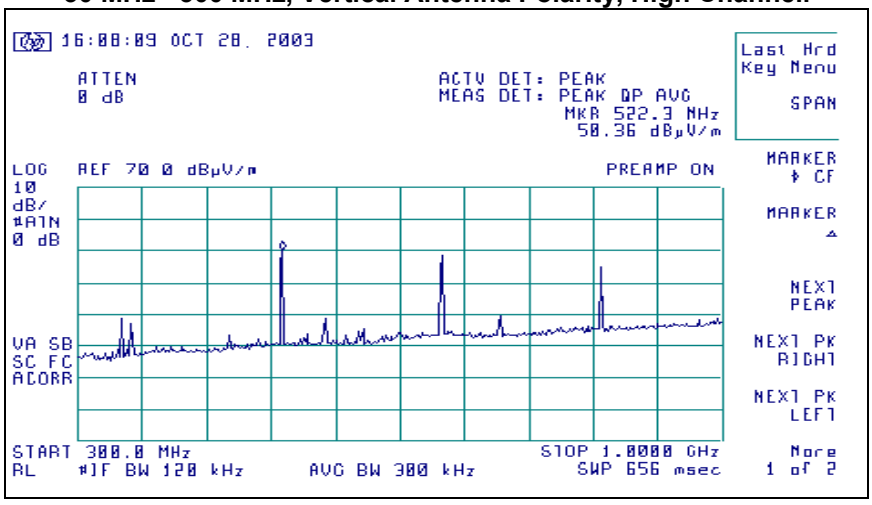
1000 MHz - 2000 MHz, Vertical Antenna Polarity, Middle Channel.



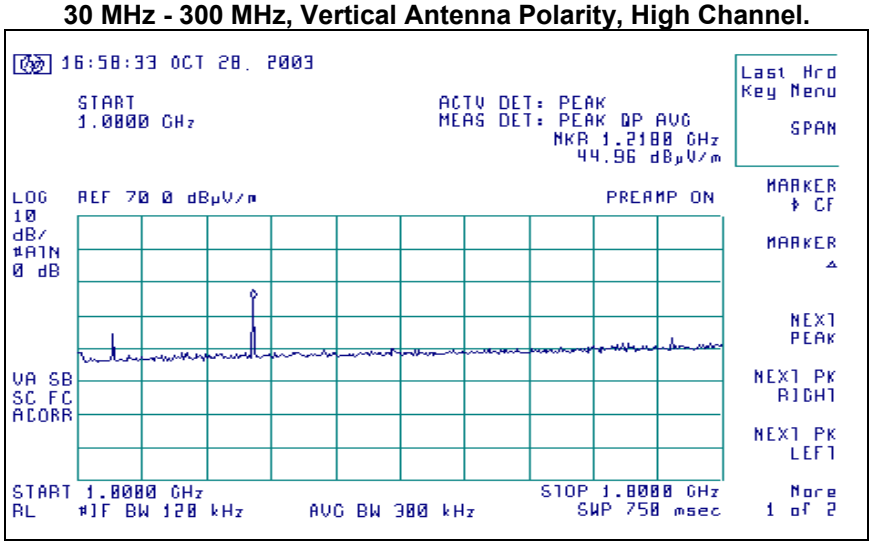
30 MHz - 300 MHz, Horizontal Antenna Polarity, High Channel.



30 MHz - 300 MHz, Vertical Antenna Polarity, High Channel.



30 MHz - 300 MHz, Vertical Antenna Polarity, High Channel.

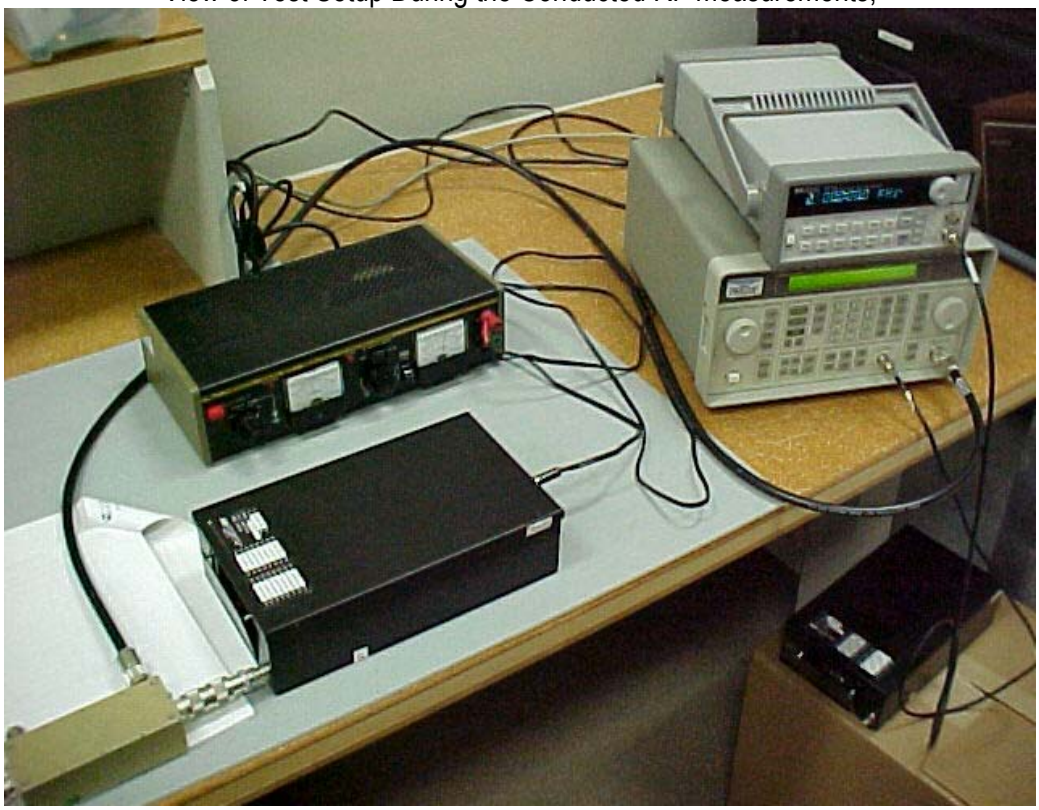


14. Power Output 47 CFR 2.1046

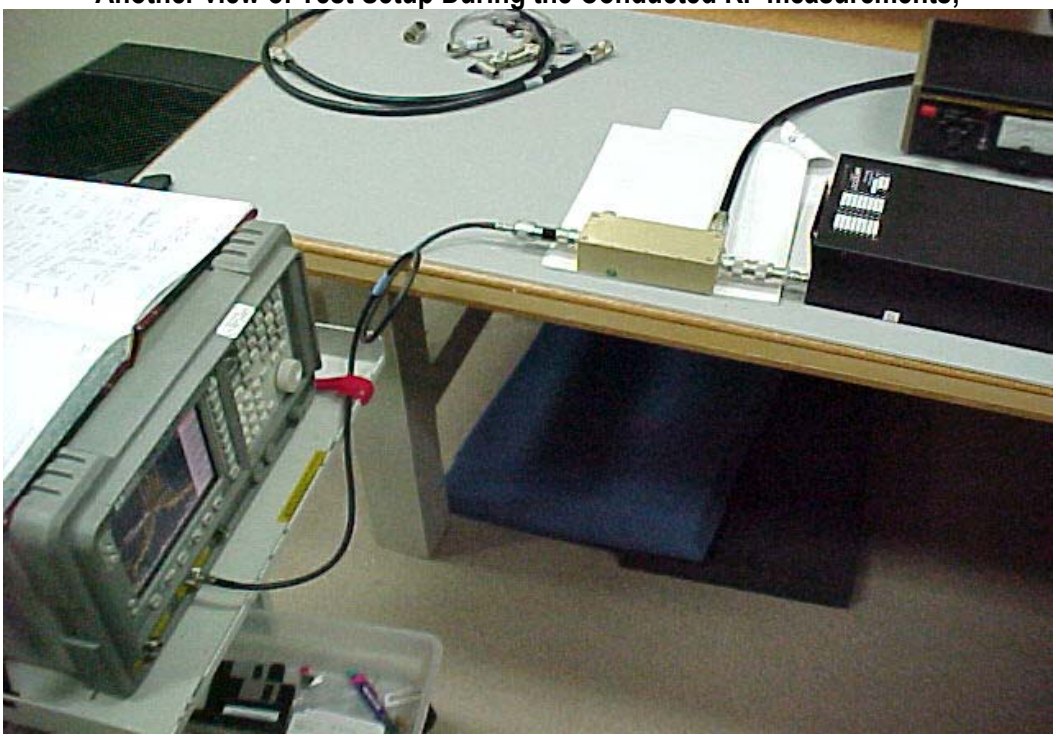
For the FCC Part 2.1046 measurement, the output of the selected sample was connected via a short jumper cable from the directional coupler, through a 40 dB Attenuator to the input of the HP E4407B Spectrum Analyzer. The unit was configured to run in a normal continuous transmit mode, while being supplied with an FM modulated signal (2.5 KHz at 3 KHz deviation) as a modulation source. The input signal was set for an input frequency of about 3 MHz above or below the channel output signal, as programmed into each of the three samples. The HP receiver was set to a 3 MHz Bandwidth, and the resultant signal was then stored, with the peak signal level stored. This power level was collected for three channels and can be seen in the chart presented below.

CHANNEL	CENTER FREQ (MHz)	MEASURED POWER (dBm)
Low	151.49	33.1
Middle	162.00	32.3
High	173.52	32.9

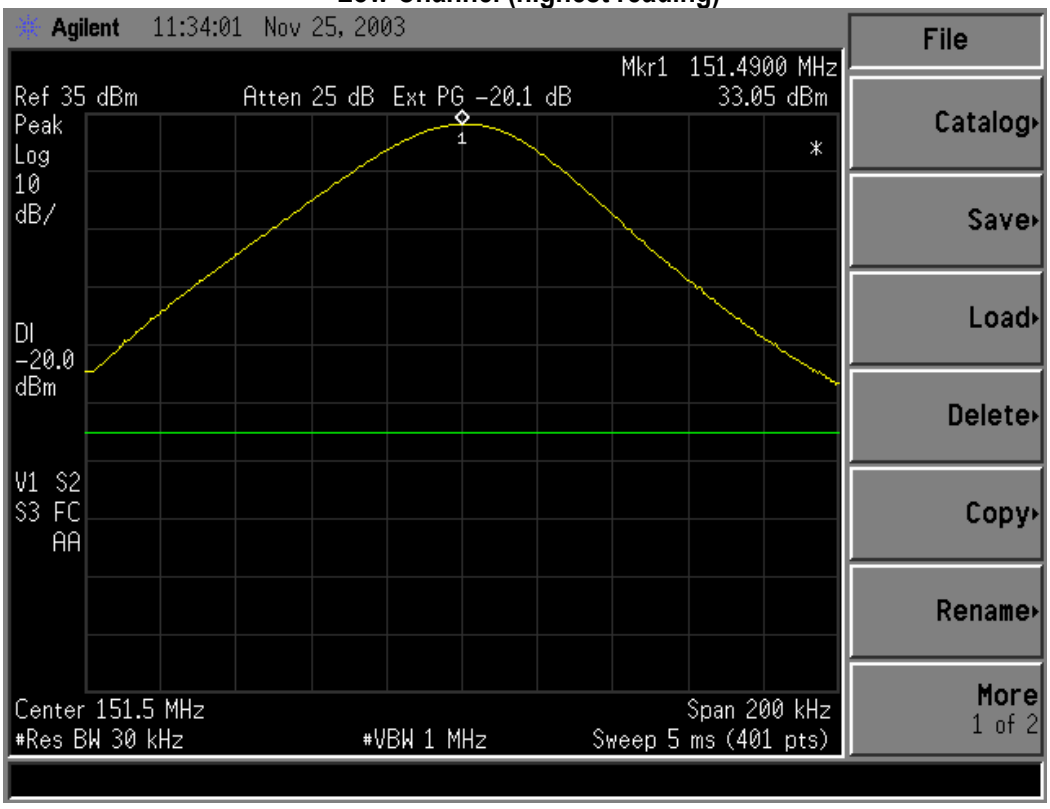
View of Test Setup During the Conducted RF measurements;



Another view of Test Setup During the Conducted RF measurements;



Signature Scan of Conducted RF Power measurements,
Low Channel (highest reading)

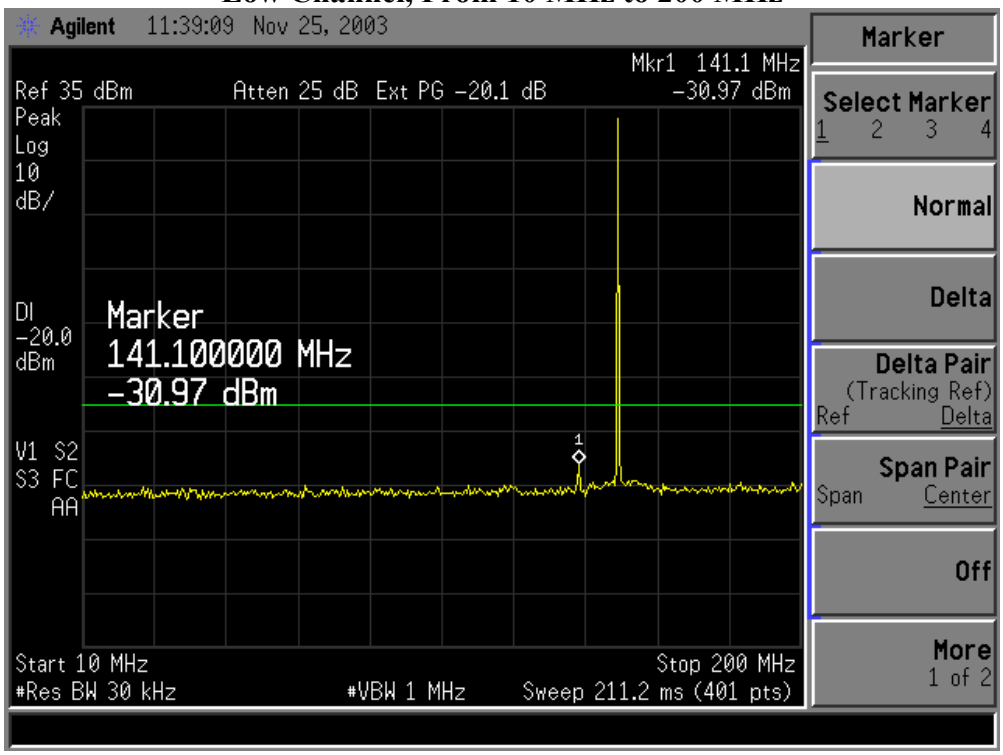


15. Conducted Spurious Emissions: 47 CFR 2.1051

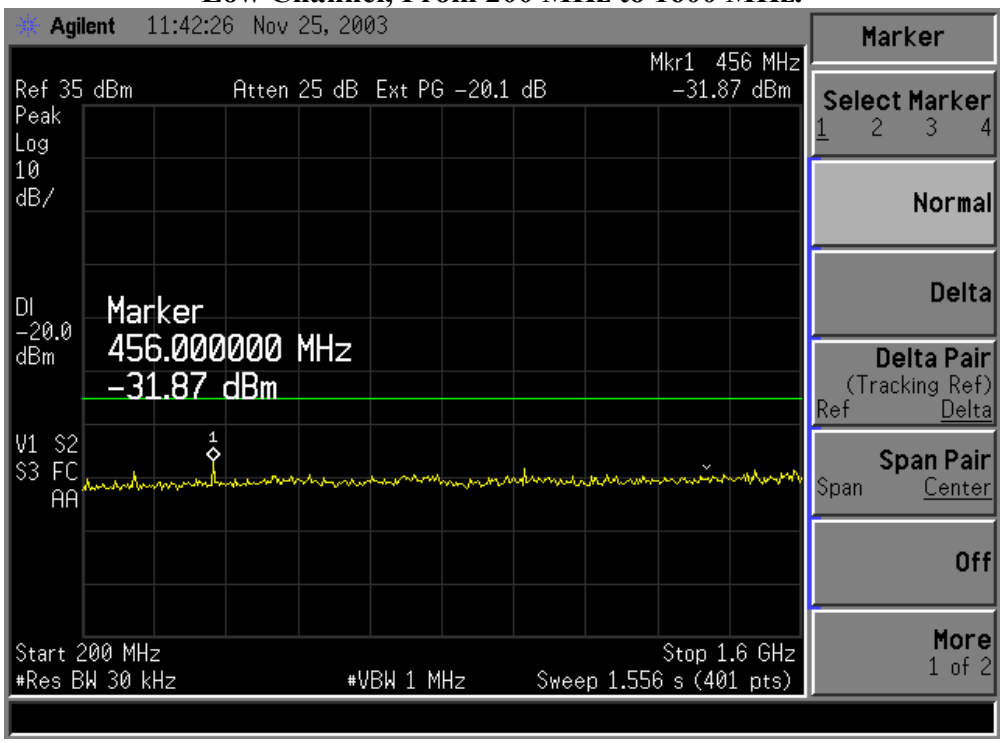
FCC Part 2.1051 requires an antenna conducted measurement of conducted harmonic and spurious levels, as reference to the carrier frequency in a 30 kHz bandwidth. For this test, the repeater TX out was passed through a 40 dB directional coupler and directly connected to the HP E4407B Spectrum Analyzer, through a very short Coaxial Cable and a 40 DB Attenuator. An HP 8648C signal generator was fed into the FWD port of the coupler to supply the input signal for the repeater to operate. Plots were then taken, with any noticeable spurious or harmonic signals identified. The highest spurious signal seen was at347.04 MHz (high), which was measured at -31.6 dBm in a 30 kHz bandwidth, which is about 11.6 dB below the -20.0 dBm limit.

Frequency (MHz)	Channel #	EMI Meter Reading (dBm)	90.210Limit (dBm)	Margin (dB)
140.8	Low	-31.6	-20.0	11.6
302.98	Low	-39.0	-20.0	19.0
454.47	Low	-33.1	-20.0	13.1
151.3	Middle	-33.5	-20.0	13.5
324.0	Middle	-33.3	-20.0	13.3
486.0	Middle	-38.2	-20.0	18.2
162.82	High	-34.2	-20.0	14.2
347.04	High	-31.6	-20.0	11.6
520.56	High	-40.7	-20.0	20.7

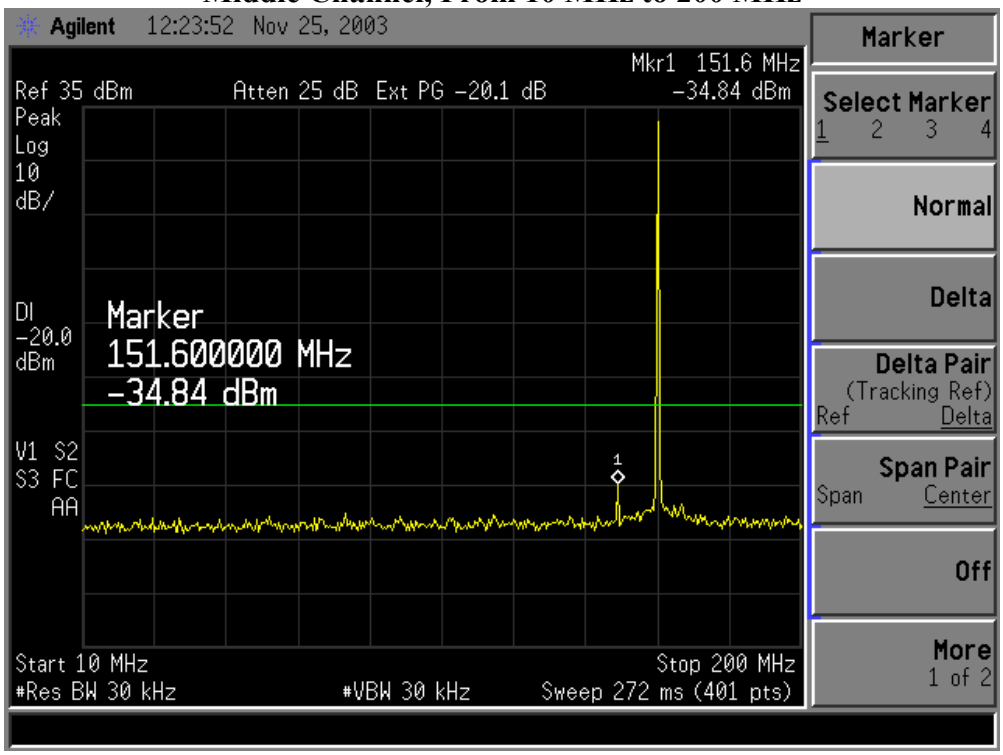
Signature Scan of Conducted Spurious measurements,
Low Channel, From 10 MHz to 200 MHz



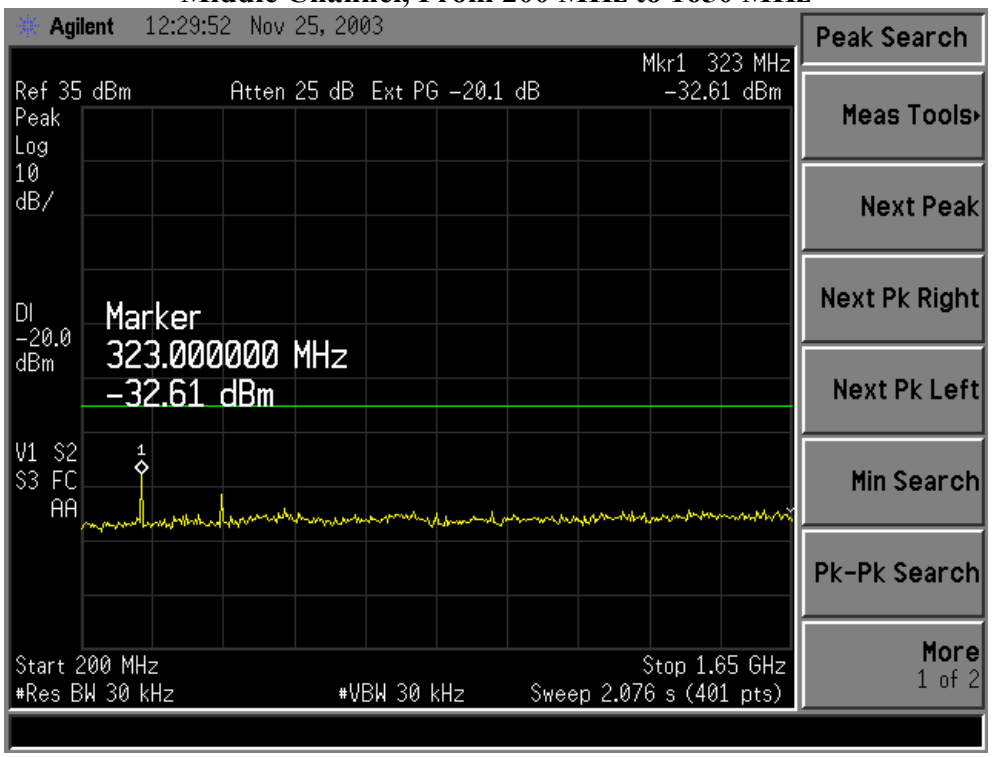
Signature Scan of Conducted Spurious measurements,
Low Channel, From 200 MHz to 1600 MHz.



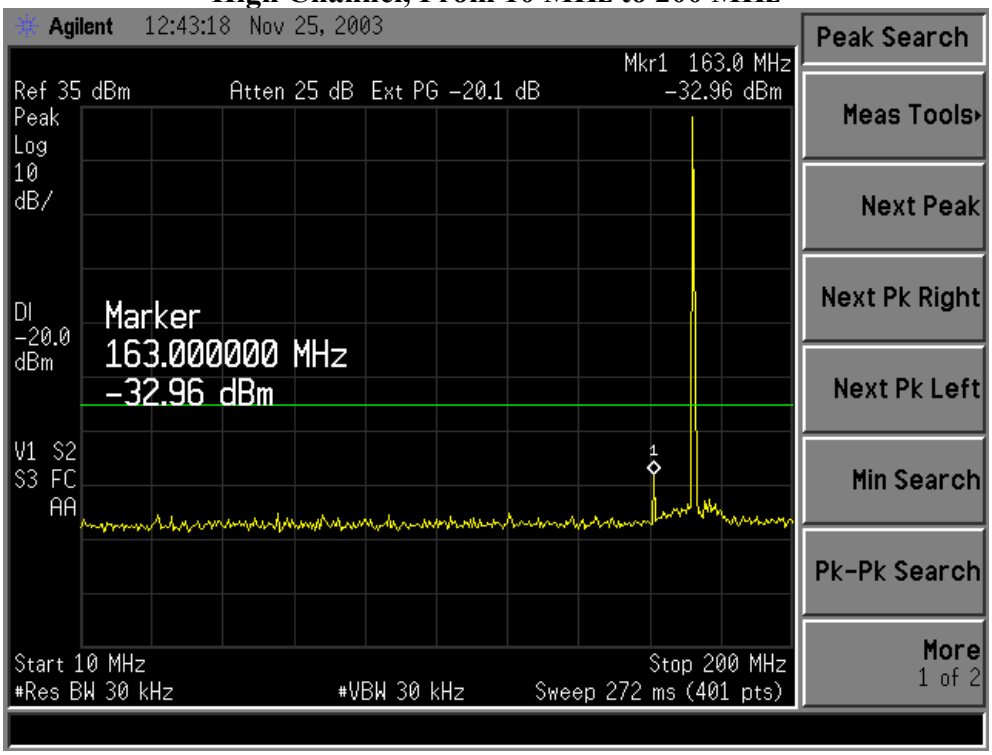
Signature Scan of Conducted Spurious measurements,
Middle Channel, From 10 MHz to 200 MHz



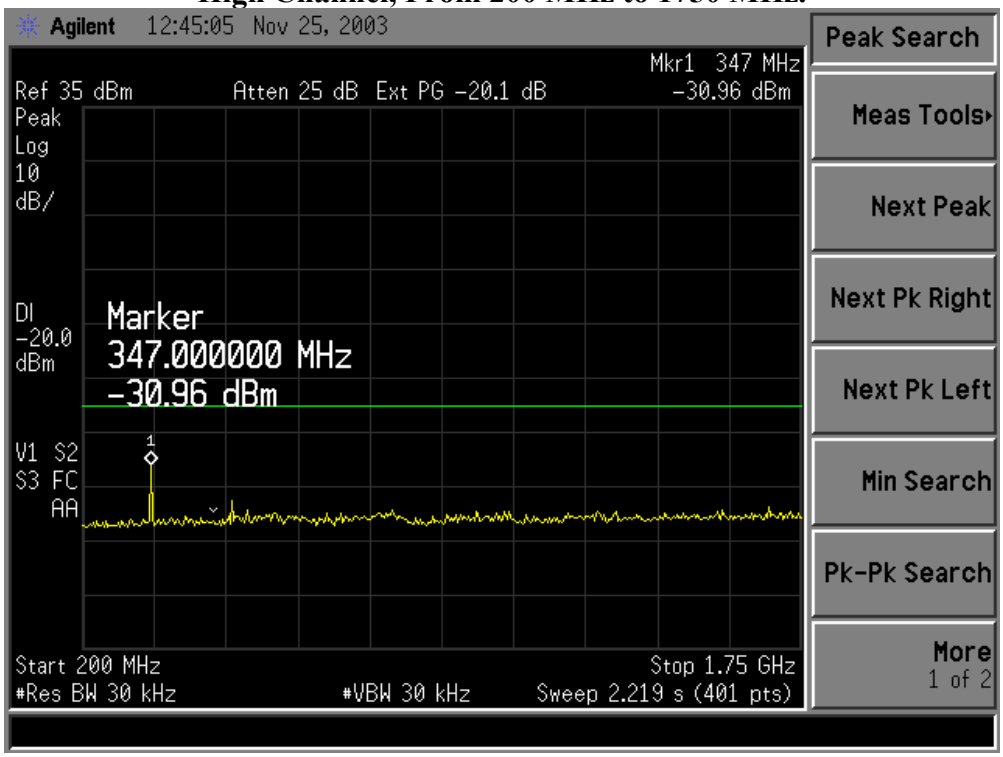
Signature Scan of Conducted Spurious measurements,
Middle Channel, From 200 MHz to 1650 MHz



Signature Scan of Conducted Spurious measurements,
High Channel, From 10 MHz to 200 MHz



Signature Scan of Conducted Spurious measurements,
High Channel, From 200 MHz to 1750 MHz.



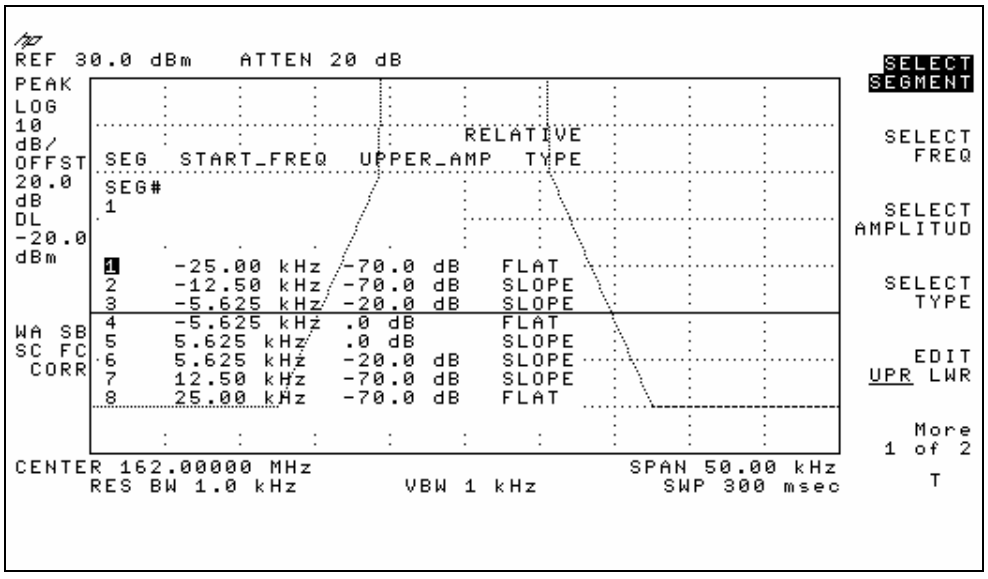
16. Bandwidth Measurements 47 CFR 2.1049

Direct measurement of the transmitted signal, via a cabled connection to the HP E4407B Analyzer, was then used to determine the signal bandwidth. The repeaters were injected with an input signal modulated with a 2.5 kHz tone, at 16 dB above 50% deviation. (7,875 kHz) For each of the representative channels, refer to the graphs found on the following pages.

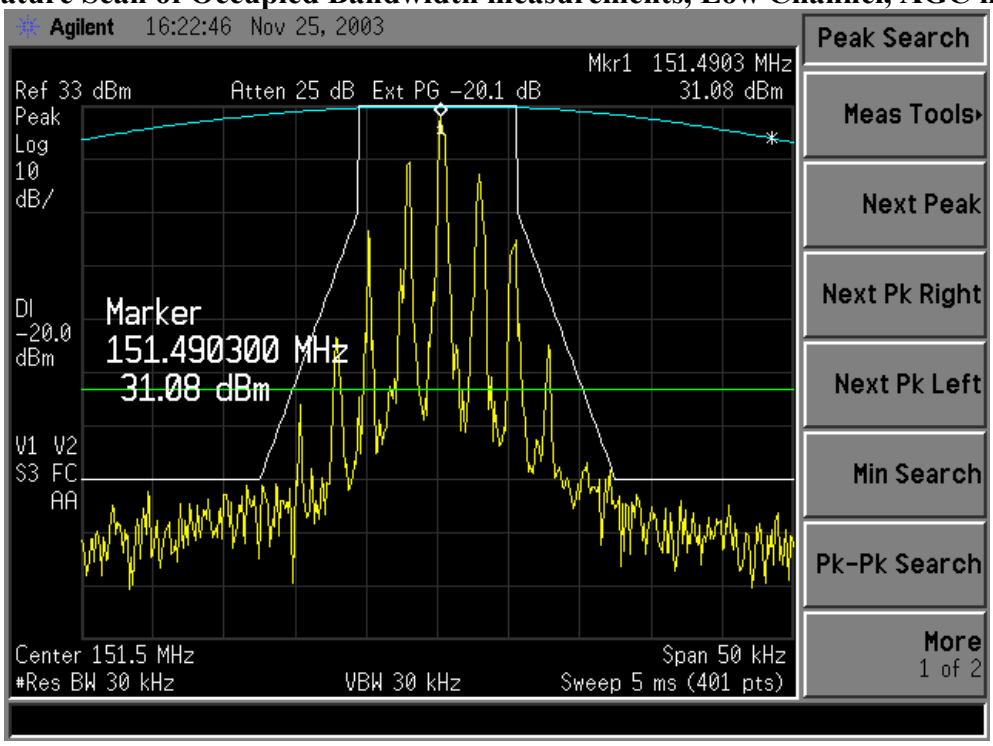
Calculation of 90.210 d emission mask:

(1) On any frequency from the center of the authorized bandwidth f_o to 5.625 kHz removed from f_o: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d -2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized band by a displacement frequency (f_d in kHz) of more than 12.5 kHz : At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.
The test condition is presented in Tabular form below. The definition of the spectrum mask as indicated on the spectrum analyzer is also presented, where the display line set to –20 dBm applies to $|f_m|$ > 12.5 kHz.

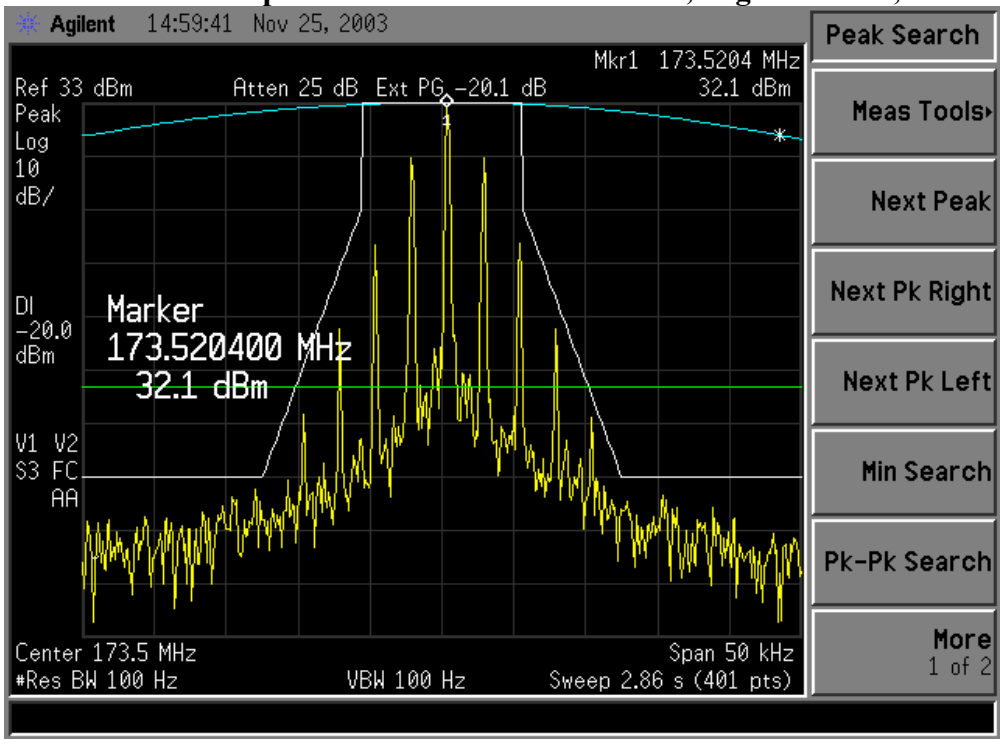
90.210 (d)	*Absolute Frequency Offset Range: $\|f_m\|$*	*Attenuation relative to Carrier power (P).*
(1)	*0 to 5.625 kHz*	*0 dB*
(2)	*5.625 kHz to 12.5 kHz*	*7.27($\|f_m\|$ -2.88) dB*
(3)	*> 12.5 kHz*	*Min (50 + 10 log $_{10}$(P) dB ,70 dB) = -20 dBm*



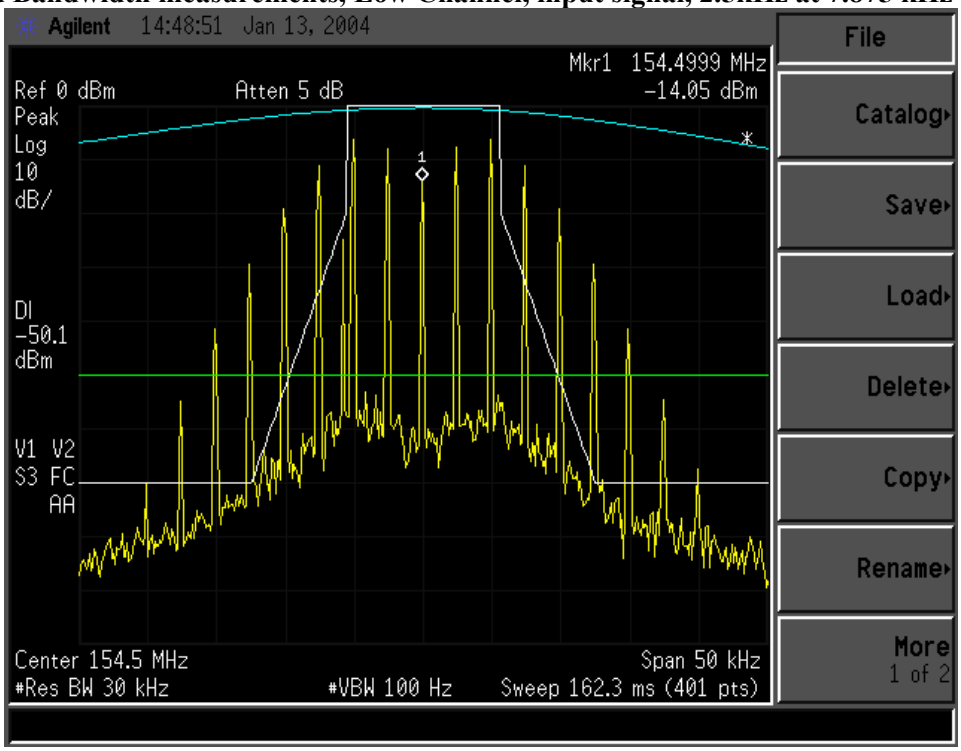
Signature Scan of Occupied Bandwidth measurements, Low Channel, AGC mode



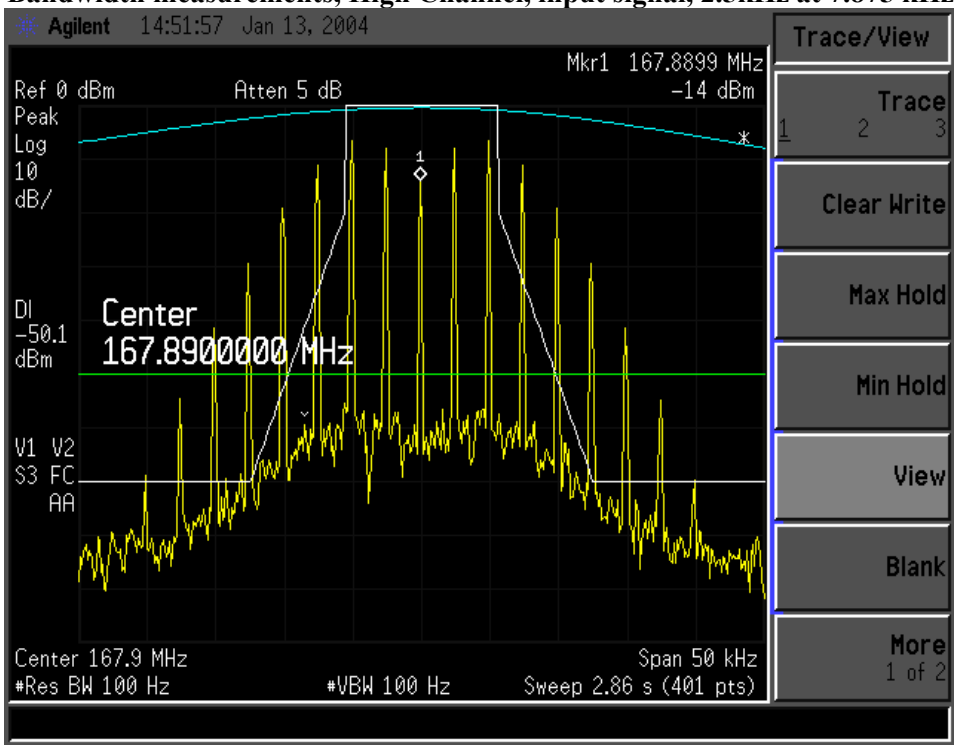
Signature Scan of Occupied Bandwidth measurements, High Channel, AGC mode



Occupied Bandwidth measurements, Low Channel, input signal, 2.5kHz at 7.875 kHz deviation



Occupied Bandwidth measurements, High Channel, input signal, 2.5kHz at 7.875 kHz deviation



17. Frequency stability (47 CFR 2.1055; 90.213a)

Mobile stations below 2W output power must have an absolute frequency stability of **5 ppm** when operating with a 12.5 kHz bandwidth.

Test in accordance to conditions called out in Part 2.995 (a) (1): Frequency stability must be measured from **–30 to 50 degrees centigrade for (b) steps of 10 degrees** Allowing for thermal equilibrium, the measurement was performed after the desired temperature was maintained for 30 minutes. One EUT was set to repeat on the middle channel, and operated within a Thermotron model S-8C.

Temperature (degree C)	Frequency (Mhz)	Frequency Delta (hz)	Frequency Delta (PPM)
-30	161.9999854	-14.6	-0.09
-20	161.9999993	-0.7	-0.01
-10	162.0000090	+9.0	+0.06
0	161.9999955	-4.5	-0.03
10	161.9999771	-22.9	-0.14
20	161.9999612	-38.8	-0.24
25	161.9999555	-44.5	-0.27
30	161.9999534	-46.6	-0.29
40	162.0000072	+7.2	+0.04
50	162.0000351	+35.1	+0.22

18. Transient Frequency behavior. (47 CFR 90.214)

Transmitters designed to operate within the 150 to 174 MHz bands must maintain transient frequencies within the maximum frequency difference during the time intervals indicated in the table below. This EUT is designed to operate on 12.5 kHz channel bandwidth.

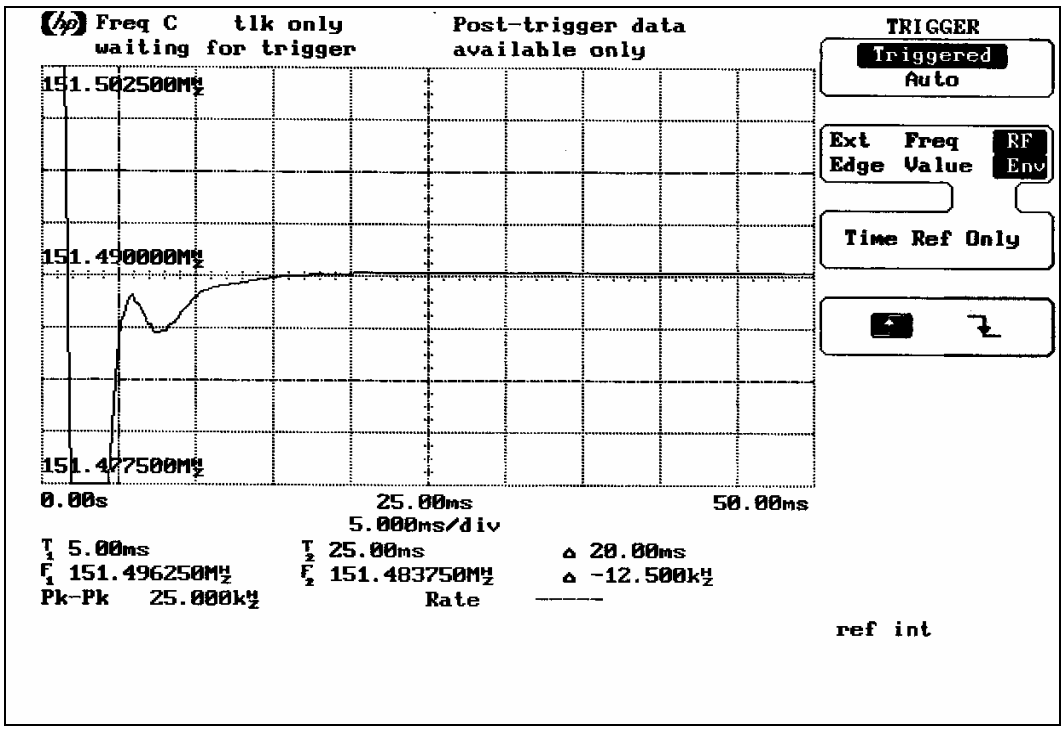
The time,t_{on} ,is defined when the transmitter power exceeds –25 dBm at the transmitter output. The modulation domain analyzer (HP 53310A) is triggered on the envelope of the RF power and the zero time indication is referenced to this trigger level. The time, t_{off} , is defined when the transmitter is turned off and the power level falls below –25 dBm. The output of the EUT is fed through a coupler, and a 40 dB attenuator, and into the HP 53310A, which is set to trigger on the carrier signal. Triggering was manual, when the input signal was keyed on or off.

Time Interval	Transient Frequency Limit	Settling Time
t_1	±12.5 kHz (*)	5.0 ms
t_2	±6.25 kHz	25.0 ms
t_3	±12.5 kHz (*)	5.0 ms

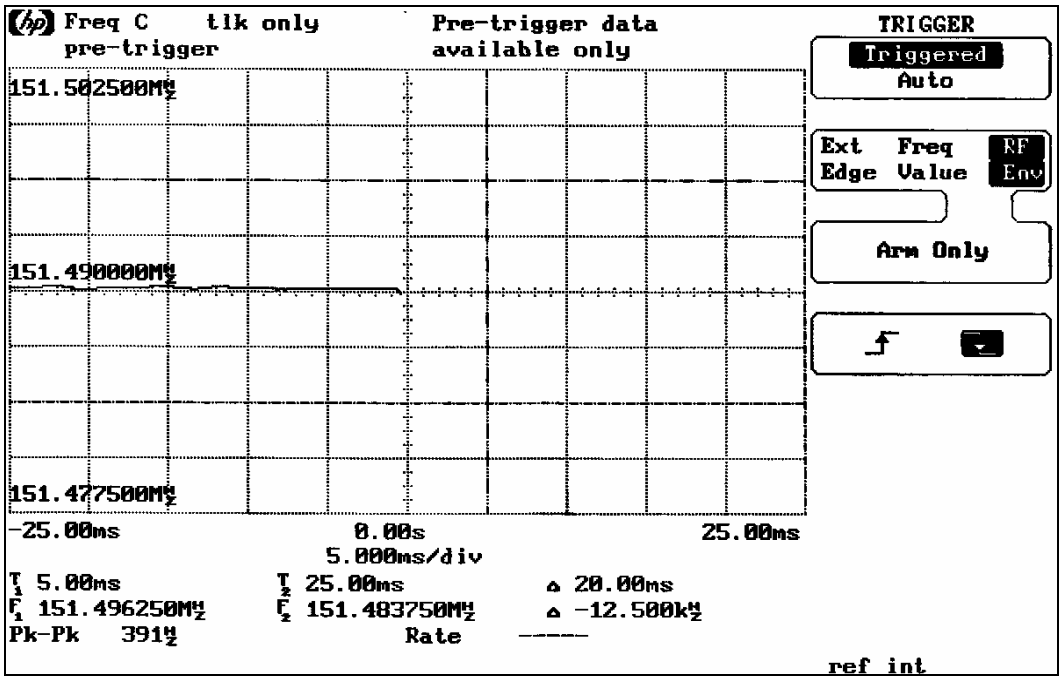
The output power of the device is less than 6 Watts, therefore the transient frequency can exceed the 12.5 kHz limit for the time intervals t_{on} to t_1 and t_{off} to t_3. (*)

View of setup for Transient Behavior:

Transient Frequency Behavior, Low Channel (152.49 MHz)

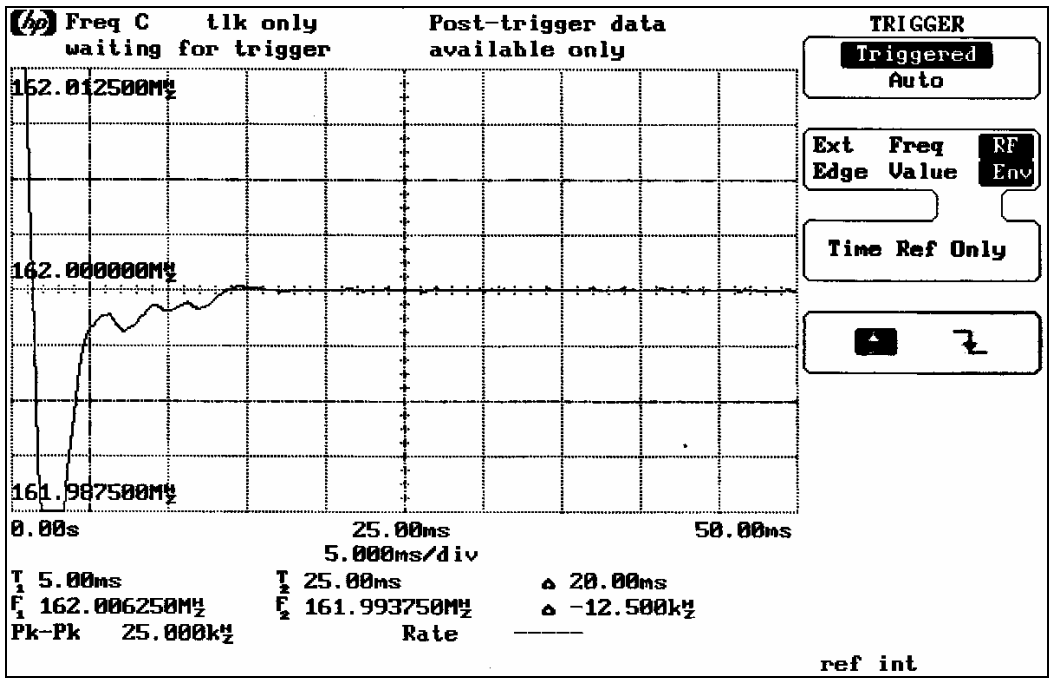


Attack Behavior

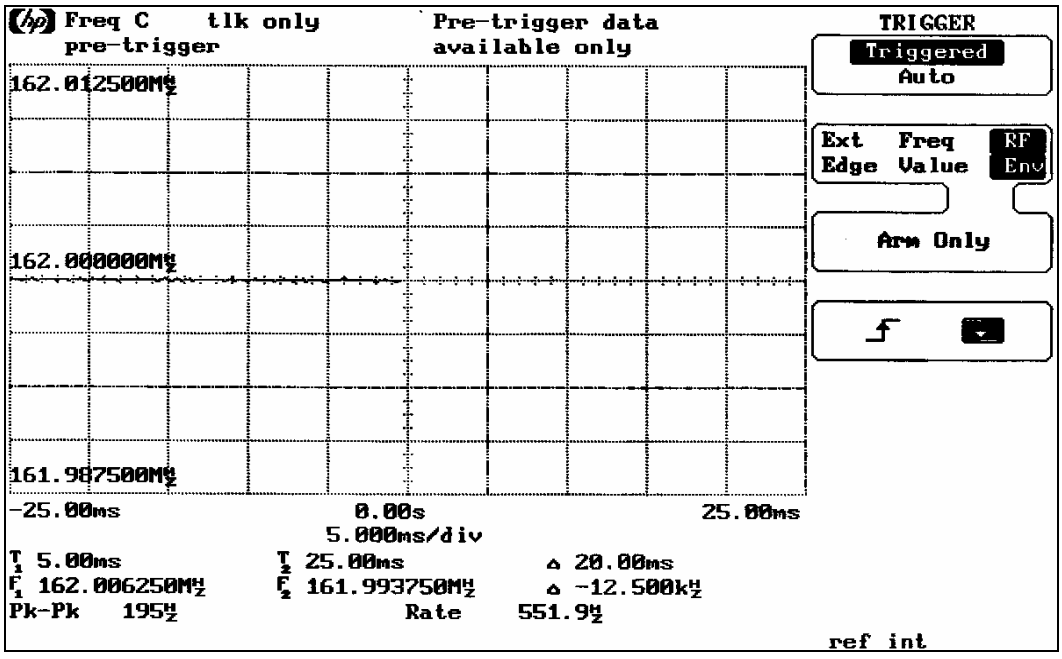


Release Behavior

Transient frequency Behavior, Middle Channel (162.00 MHz)

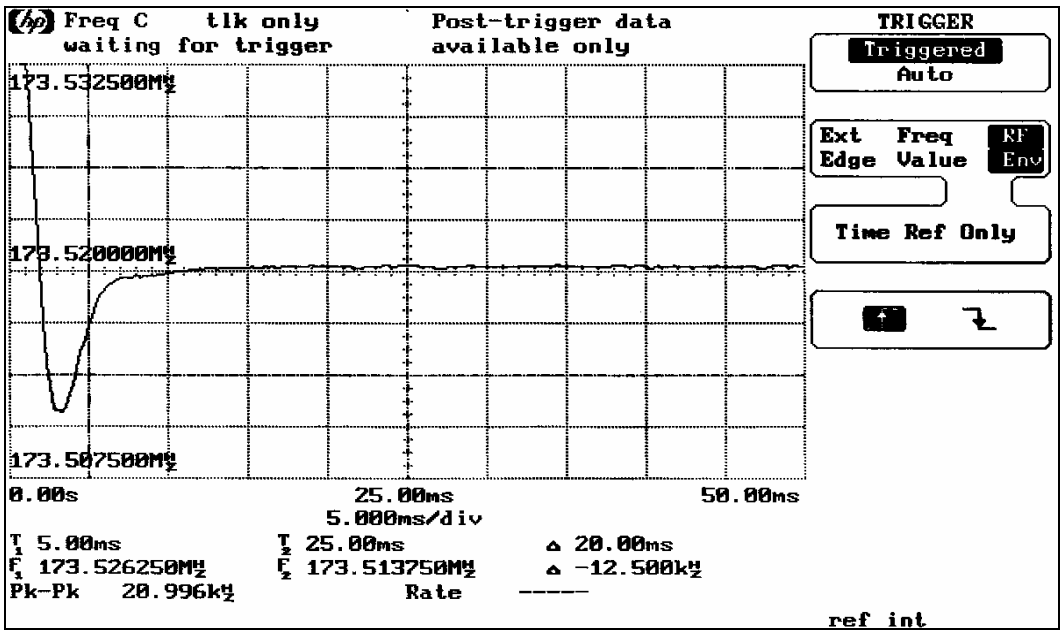


Attack Behavior

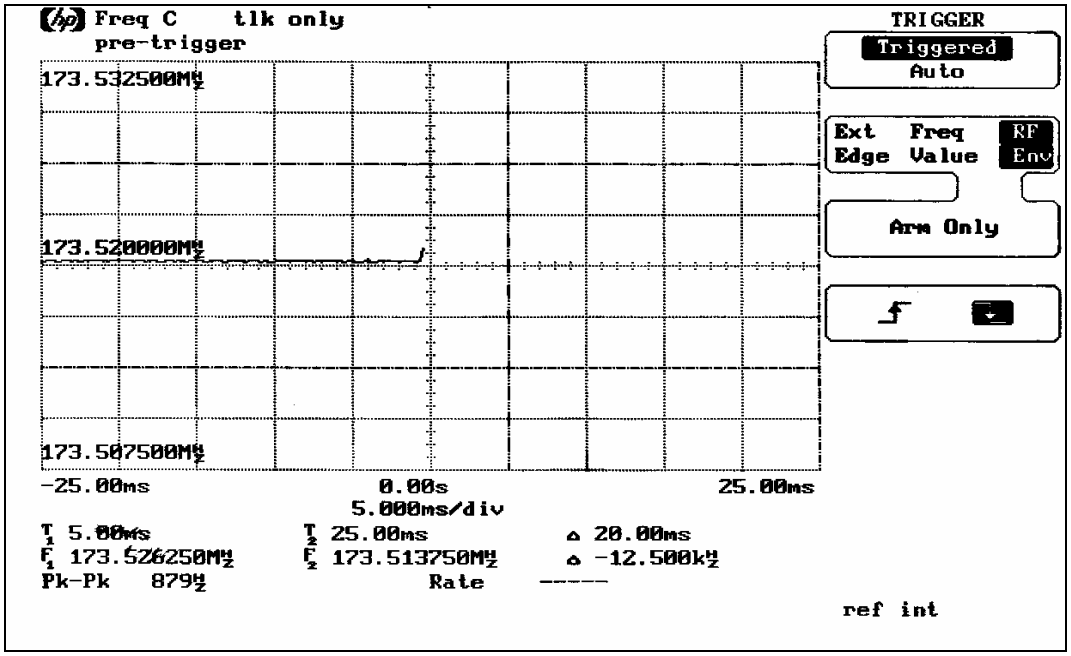


Release Behavior

Transient frequency behavior, High Channel (173.52 MHz)



Attack Behavior

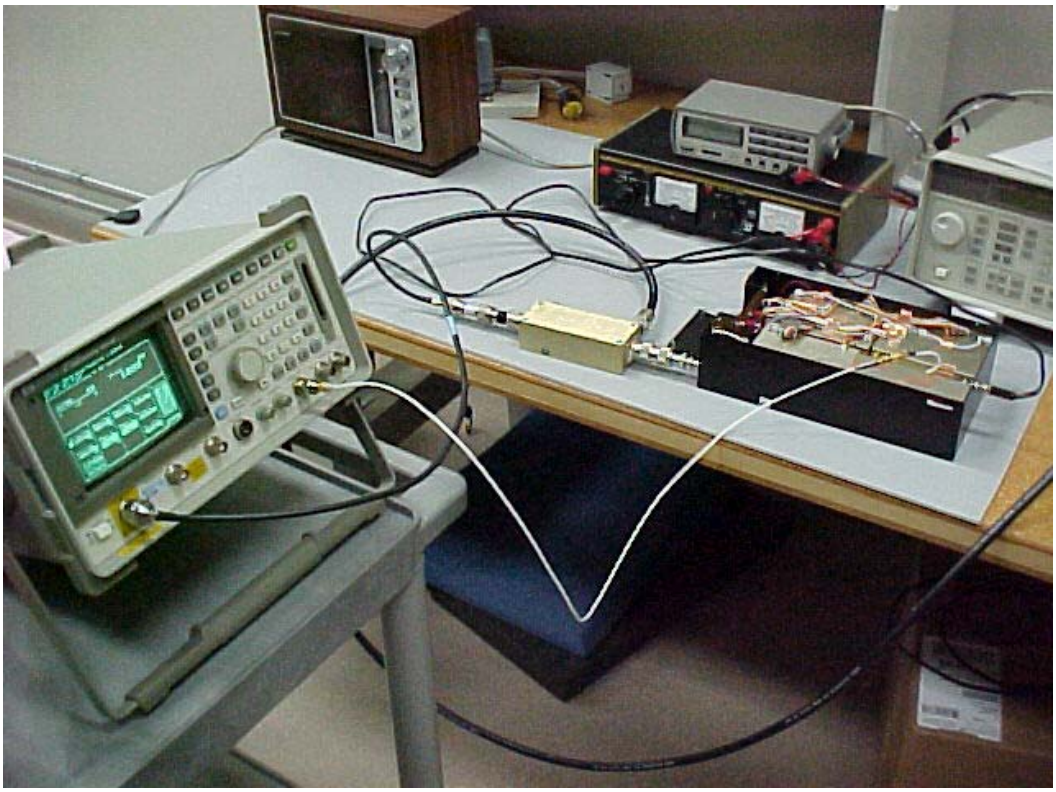


Release Behavior

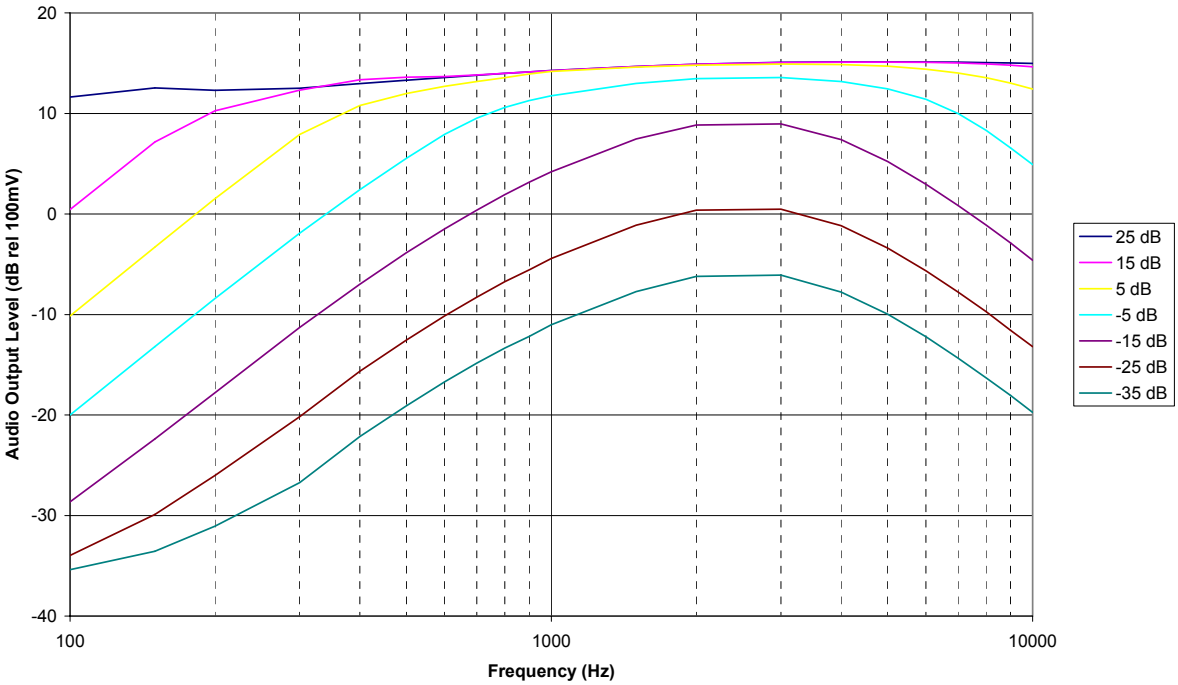
19. Modulation characteristics. (47 CFR 2.1047 a,b)

For a voice modulated transmitter a frequency response curve of the audio processor between the microphone and modulator must be submitted. Also, a curve of frequency deviation versus level must be made across the range of input audio frequencies.

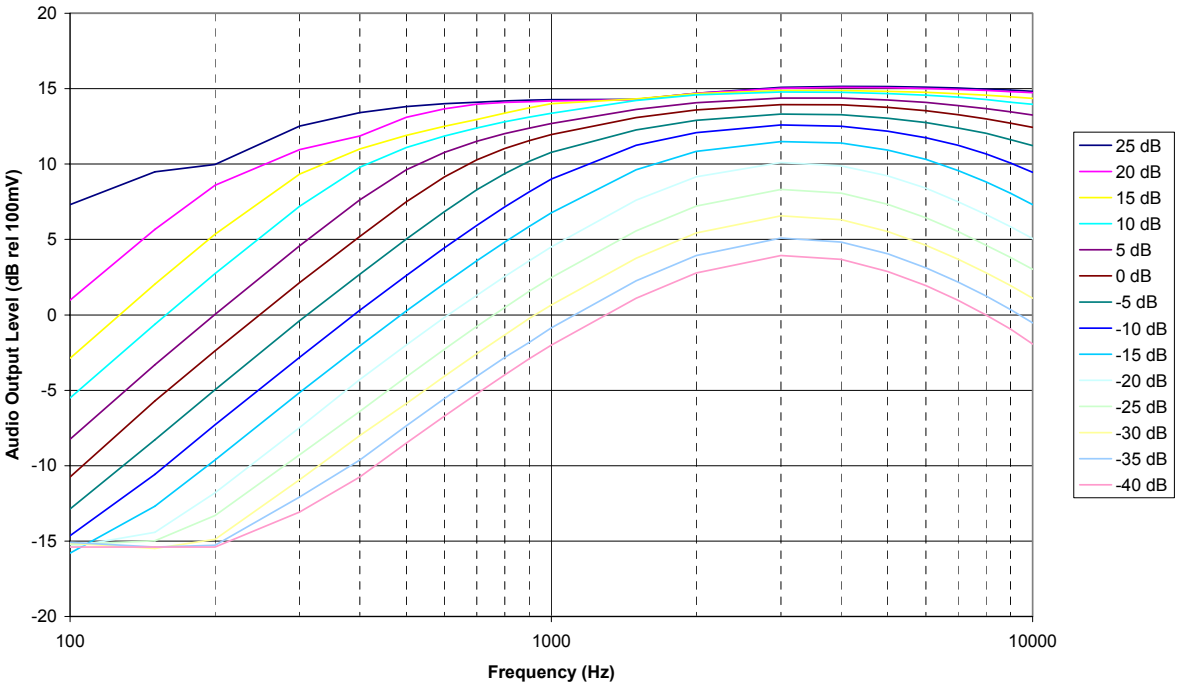
This test is configured with the audio path in the repeater broken between the receiver output and the transmitter input. The HP 8920 FM signal monitor's audio generator signal is fed into the EUT at this point, and the Repeater output, attenuated by a 40 dB pad is fed into the HP signal monitor, where the resultant deviation and recovered audio level is recorded.



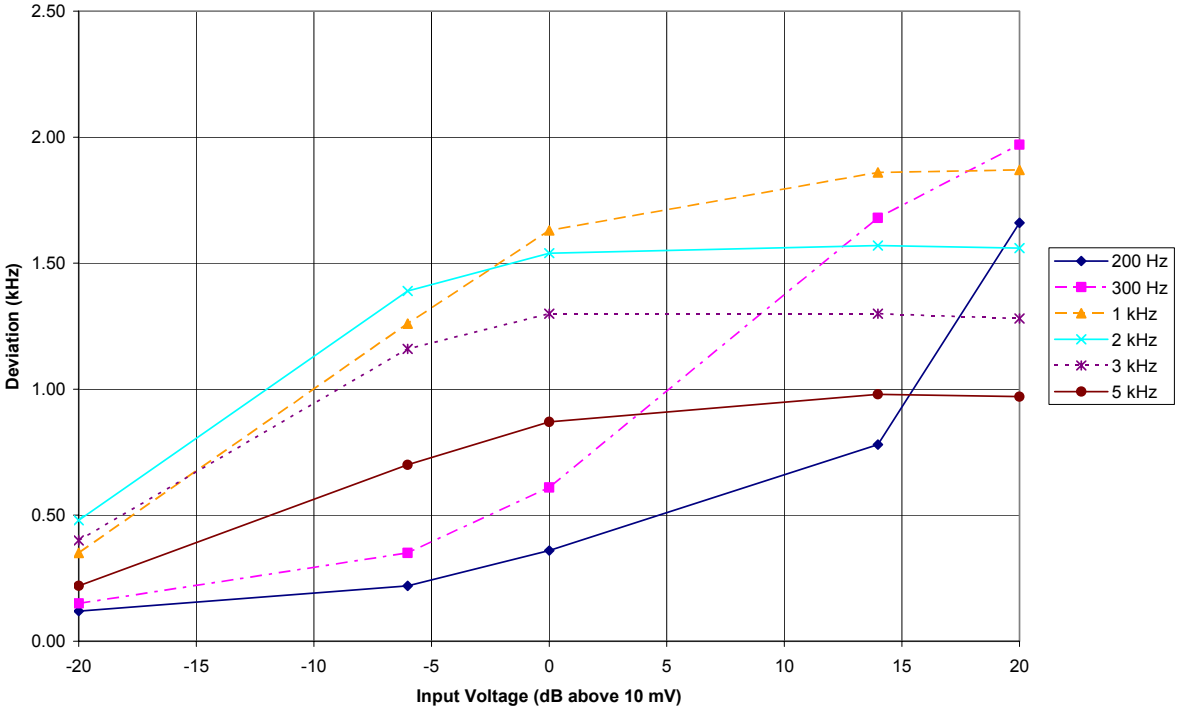
Pass Through Mode Frequency Response vs Input Level
[0 dB rel 100 mV at 1kHz at Pre-emphasis input]



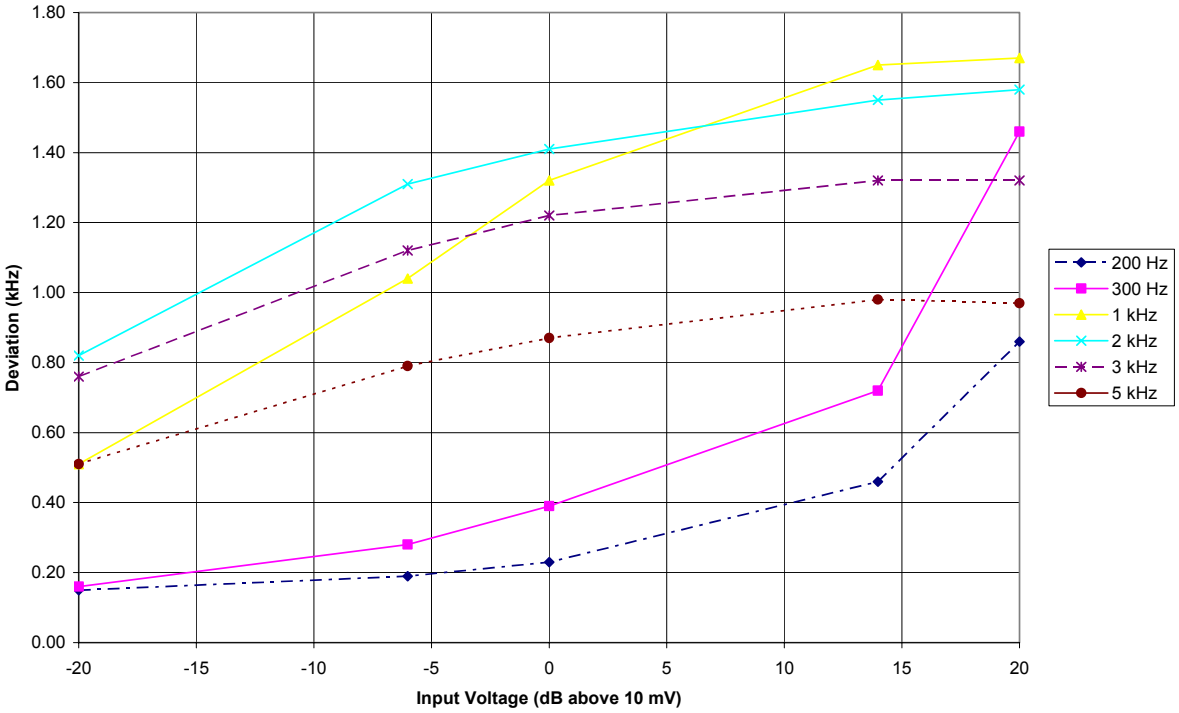
Compressed Mode Frequency Response vs Input Level
[0 dB rel 100mV at 1kHz at Compressor input]



Pass Through Mode Modulation Characteristics



Compression Mode Modulation Characteristics



APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	09/03/03	09/03/04
AA960031	HP	119474A	3107A01708	Transient Limiter	09/07/03	09/07/04
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	09/02/03	09/02/04
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	09/02/03	09.02.04
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	02/03/03	02/03/04
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	11/04/03	11/04/04
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	09/09/03	09/09/04
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	09/09/03	09/09/04
CC00223C	HP	8920B	US36492280	Signal Monitor	N/A	N/A
CC00124C	HP	53310A	3121A01379	Modulation Domain Analyzer	N/A	N/A
EE960067	HP	8648A	3636A02735	RF signal Generator	9/30/03	9/30/04
AA960026	Werlatone	C3948	5147	40 dB directional coupler	I/O	I/O
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	09/0703	09/07/04
N/A	LSC	Cable	0038	1 Meter RG 214 Cable	09/07/03	09/07/04
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	09/07/03	09/07/04
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	09/07/03	09/07/04

Note 1 - Equipment calibrated within a traceable system.*

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V