Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

M/A-COM, Inc.
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Lynchburg, VA 24501
Contact: Daryl Popowitch
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MODEL: M7100(IP) VHF 50W Mobile Radio

FCC ID: OWDTR-0035-E
IC: 3636B-0035

December 20, 2004

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 2003	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 2003	RADIO FREQUENCY DEVICES - §15.109: RADIATED EMISSIONS LIMITS
PART 22: 2003	PUBLIC MOBILE SERVICES
PART 74: 2002	EXPERIMENTAL RADIO, AUXILIARY SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES
PART 80: 1998	STATIONS IN MARITIME SERVICES
PART 90: 2003	PRIVATE LAND MOBILE RADIO SERVICES
ANSI C63.4-2003	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
ANSI/TIA/EIA603- 2002	LAND MOBILE FM OR PM COMMUNICATIONS EQUIPMENT MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA –102.CAAA; 2002	DIGITAL C4FM/CQPSK TRANSCEIVER MEASUREMENT METHODS
RSS-119; Issue 6; 2000	LAND MOBILE AND FIXED RADIO TRANSMITTERS AND RECEIVERS 27.41 TO 960.0 MHZ

Frequency Range	Maximum Measured Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
136-174 MHz	51.52	5.0	16K0F3E (Voice)
136-174 MHz	51.52	5.0	11K0F3E (Voice)
136-174 MHz	51.52	+/-2.0	14K2F1D (2 level WB)
136-174 MHz	51.52	+/-2.0	14K2F1E (2 level WB)
136-174 MHz	51.52	+/-2.0	9K9F1D (2 level NB 9600)
136-174 MHz	51.52	+/-2.0	9K9F1E (2 level NB 9600)
136-174 MHz	51.52	+/-2.0	7K1F1D (2 level NB 4800)
136-174 MHz	51.52	+/-2.0	7K1F1E (2 level NB 4800)
136-174 MHz	51.52	+/-2.0	8K4F1D (P25)
136-174 MHz	51.52	+/-2.0	8K4F1E (P25)

REPORT PREPARED BY TEST ENGINEER: DANIEL BIGGS

Document Number: 2004231/QRTL04-450

TABLE OF CONTENTS

Table of Tables

Table of Plots

Table of Figures

Table of Appendices

Table of Photographs

1 GENERAL INFORMATION

The following Type Certification Report is prepared on behalf of **M/A-COM, Inc**. in accordance with the Federal Communications Commission and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the **M7100(IP) VHF 50W Mobile Radio; FCC ID: OWDTR-0035-E**. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, Industry Canada RSS-119, and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 2003. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application report.

2 CONFORMANCE STATEMENT

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 2003	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 2003	RADIO FREQUENCY DEVICES - §15.109: RADIATED EMISSIONS LIMITS
PART 22: 2003	PUBLIC MOBILE SERVICES
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ANSI/TIA/EIA –102.CAAA; 2002	DIGITAL C4FM/CQPSK TRANSCEIVER MEASUREMENT METHODS
RSS-119; Issue 6; 2000	LAND MOBILE AND FIXED RADIO TRANSMITTERS AND RECEIVERS 27.41 TO 960.0 MHZ

Frequency Range	Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
136-174 MHz	51.52	5.0	16K0F3E (Voice)
136-174 MHz	51.52	5.0	11K0F3E (Voice)
136-174 MHz	51.52	+/-2.0	14K2F1D (2 level WB)
136-174 MHz	51.52	+/-2.0	14K2F1E (2 level WB)
136-174 MHz	51.52	+/-2.0	9K9F1D (2 level NB 9600)
136-174 MHz	51.52	+/-2.0	9K9F1E (2 level NB 9600)
136-174 MHz	51.52	+/-2.0	7K1F1D (2 level NB 4800)
136-174 MHz	51.52	+/-2.0	7K1F1E (2 level NB 4800)
136-174 MHz	51.52	+/-2.0	8K4F1D (P25)
136-174 MHz	51.52	+/-2.0	8K4F1E (P25)

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the above standards for Certification methodology.

Signature: Richard B. Mc Murray _____ Date: December 20, 2004

Typed/Printed Name: Rick McMurray Position: Vice President of Operations

Signature: Daniel Biggs _____ Date: December 20, 2004

Typed/Printed Name: Daniel W. Biggs Position: Test Engineer

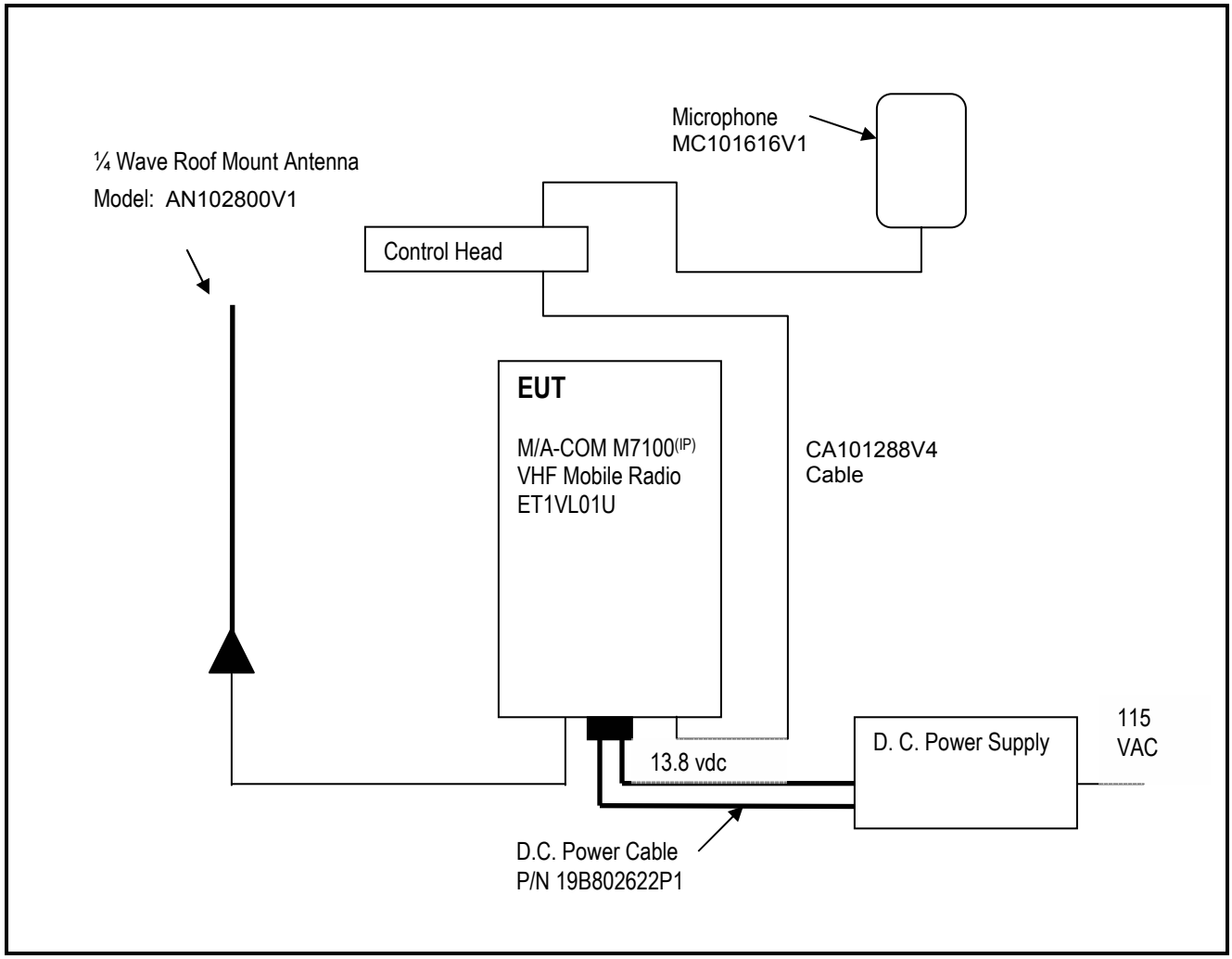
3 TESTED SYSTEM DETAILS

The test sample was received on December 13, 2004. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

TABLE 3-1: EQUIPMENT UNDER TEST (EUT)

Part	Manufacturer	Model	PN/Serial Number	FCC ID
VHF 50W Mobile Radio	M/A-COM, Inc.	M7100(IP)	ET1VL01U	OWDTR-0035-E
Control Head	M/A-COM, Inc.	N/A	KRY1011632/14	N/A
Microphone	M/A-COM, Inc.	N/A	MC101616V1	N/A
Power Cable	M/A-COM, Inc.	N/A	19B802622P1	N/A
Cable	M/A-COM, Inc.	N/A	CA101288V4	N/A
¼ Wave Roof Mount Antenna	M/A-COM, Inc.	N/A	AN102800V1	N/A

FIGURE 3-1: CONFIGURATION OF TESTED SYSTEM



4 FCC RULES AND REGULATIONS PART 2 §2.1033(C)(8) VOLTAGES AND CURRENTS THROUGH THE FINAL AMPLIFYING STAGE

Nominal DC Voltage: 13.8 VDC
Current: 10.5 amps

5 FCC RULES AND REGULATIONS PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED; RSS-119 §6.2: OUTPUT POWER TEST

5.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50Ω load impedance.

5.2 TEST DATA

The following channels (in MHz) were tested: 136.0, 156.0, and 174.0

TABLE 5-1: RF POWER OUTPUT: CARRIER OUTPUT POWER (UNMODULATED)

Channel	Frequency (MHz)	RF Power Measured (Watt)*
1 (High Power)	136.0	50.12
2 (High Power)	156.0	51.52
3 (High Power)	174.0	51.17
4 (Low Power)	136.0	9.89
5 (Low Power)	156.0	10.74
6 (Low Power)	174.0	9.98

* Measurement accuracy: +/- .02 dB (logarithmic mode)

TABLE 5-2: RF POWER OUTPUT (RATED POWER)

Rated Power (W)
50

TABLE 5-3: TEST EQUIPMENT USED FOR TESTING RF POWER OUTPUT - CONDUCTED

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184/901186	Agilent	E4416A/E9323A	Power Meter / Sensor	GB41050573/US420.52510380	08/02/05

TEST PERSONNEL:

DANIEL BIGGS	Daniel Biggs	DECEMBER 13, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

6 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS; RSS-119 §6.3: UNWANTED EMISSIONS

6.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, Section 2.2.13

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.
The transmitter is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1,000 Hz.

Digital Modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps

6.2 TEST DATA

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: Mask D (dBm): P(dBm) – (50+10xLOG P(W))

The following channels (in MHz) were investigated: 136.0, 156.0, and 174.0. The worse case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 6-1: CONDUCTED SPURIOUS EMISSIONS CHANNEL 1 – 136.0 MHZ

(136.0 MHz); 12.5 kHz channel spacing; Mask D; Conducted power = 49.89W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
272	86.35	66.98	-19.37
408	105.41	66.98	-38.43
544	124.93	66.98	-57.95
680	122.37	66.98	-55.39
816	118.04	66.98	-51.06
952	109.27	66.98	-42.29
1088	116.14	66.98	-49.16
1224	122.32	66.98	-55.34
1360	99.59	66.98	-32.61
1496	86.35	66.98	-19.37

TABLE 6-2: CONDUCTED SPURIOUS EMISSIONS CHANNEL 2 – 156.0 MHZ

(156.0 MHz); 12.5 kHz channel spacing; Mask D; Conducted power = 51.52W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
312	85.05	67.20	-17.85
468	109.68	67.20	-42.48
624	117.42	67.20	-50.22
780	117.54	67.20	-50.34
936	121.81	67.20	-54.61
1092	100.31	67.20	-33.11
1248	123.51	67.20	-56.31
1404	118.58	67.20	-51.38
1560	120.04	67.20	-52.84

TABLE 6-3: CONDUCTED SPURIOUS EMISSIONS CHANNEL 3 – 174.0 MHZ

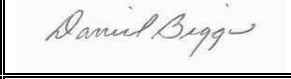
(174.0 MHz); 12.5 kHz channel spacing; Mask D; Conducted power = 51.17 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
348	90.91	67.20	-23.82
522	109.33	67.20	-42.24
696	122.81	67.20	-55.72
870	109.71	67.20	-42.62
1044	118.45	67.20	-51.36
1218	119.17	67.20	-52.08
1392	107.50	67.20	-40.41
1566	110.77	67.20	-43.68
1740	102.24	67.20	-35.15

TABLE 6-4: TEST EQUIPMENT USED FOR TESTING CONDUCTED SPURIOUS EMISSIONS

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz-12.8 GHz)	3826A00144	09/08/05
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

DANIEL BIGGS		DECEMBER 13, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

7 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION; RSS-119 §6.3: UNWANTED EMISSIONS

7.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.12

Analog Modulation: The transmitter is terminated with a 50 Ω load and is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1,000 Hz.

Digital Modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps

The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator and the gain of the antenna was further corrected to a half wave dipole.

7.2 TEST DATA

7.2.1 CFR 47 PART 90.210 REQUIREMENTS

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 7-1: FIELD STRENGTH OF SPURIOUS RADIATION CHANNEL 2 – 156.0 MHZ; NARROWBAND; HIGH POWER

Limit = 50 + 10 Log P = 67.2 dBc
Conducted Power = 47.12 dBm = 51.52 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
312	60.5	-53.5	0.05	-1.2	101.8	-34.6
468	57.5	-52.5	0.16	2.9	96.9	-29.7
624	55.4	-50.2	0.41	4.8	93.0	-25.8
780	59	-44.4	0.54	5.0	87.1	-19.9
936	47.5	-51.2	0.45	5.4	93.3	-26.1
1092	44.7	-56.5	0.41	0.6	103.4	-36.2
1248	38.9	-59.2	0.55	2.8	104.1	-36.9
1404	34	-58.1	0.67	3.8	102.1	-34.9
1560	41.3	-52.1	0.97	4.7	95.5	-28.3

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 7-2: FIELD STRENGTH OF SPURIOUS RADIATION CHANNEL 2 – 156.0 MHZ; NARROWBAND; LOW POWER

Limit = 50 + 10 Log P = 60.31 dBc
Conducted Power = 40.31 dBm = 10.74W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Margin (dB)
312	58.8	-55.2	0.05	-1.2	96.7	-36.4
468	48.9	-61.1	0.16	2.9	98.7	-38.4
624	54.7	-50.9	0.41	4.8	86.9	-26.6
780	59.4	-44.0	0.54	5.0	79.9	-19.6
936	54.8	-43.9	0.45	5.4	79.2	-18.9
1092	44.6	-56.6	0.41	0.6	96.7	-36.4
1248	36.5	-61.6	0.55	2.8	99.7	-39.3
1404	36.4	-55.7	0.67	3.8	92.9	-32.6
1560	36.1	-57.3	0.97	4.7	93.9	-33.6

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 7-3: TEST EQUIPMENT USED FOR TESTING FIELD STRENGTH OF SPURIOUS RADIATION

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	09/20/05
900154	Compliance Design Inc	Roberts Dipole	Adjustable Elements Dipole Antenna (30 – 1000 MHz)	N/A	10/6/05
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridge Guide Antenna (1 - 18 GHz)	2310	2/17/06
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	N/A
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	08/11/05
900917	Hewlett Packard	8648C	Synthesized Signal Generator (9 kHz - 3200 MHz)	3537A01741	07/06/05
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 - 20 GHz)	3610A00866	09/05/05

TEST PERSONNEL:

DANIEL BIGGS		DECEMBER 14, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

8 FCC RULES AND REGULATIONS PART 2 §2.1049(C)(1): OCCUPIED BANDWIDTH; RSS-119 §6.4: EMISSIONS MASKS

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

8.1 TEST PROCEDURE

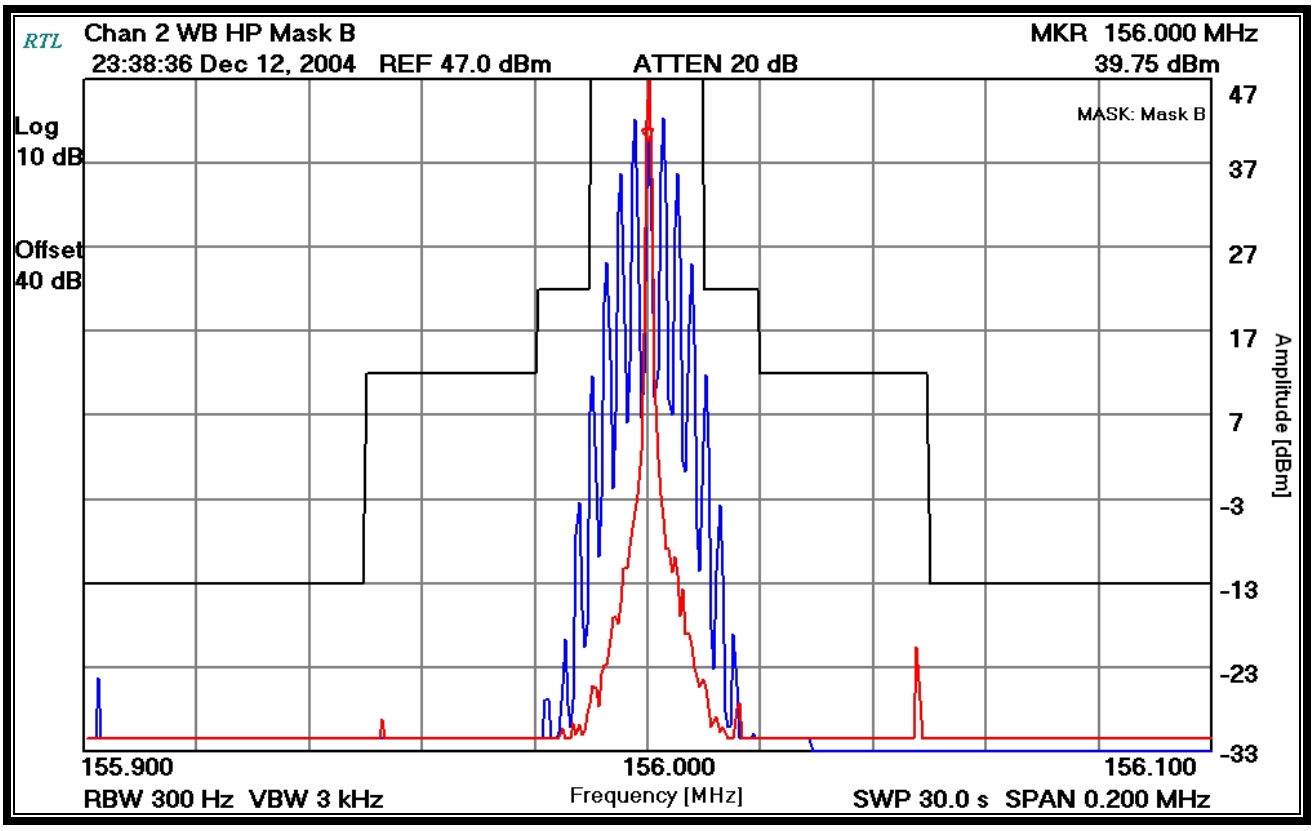
ANSI/TIA/EIA-603-2002, section 2.2.11 and TIA/EIA-102.CAAA-2002 section 2.2.5

Device with audio modulation: Transmitter was modulated with a 2,500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1,000 Hz.

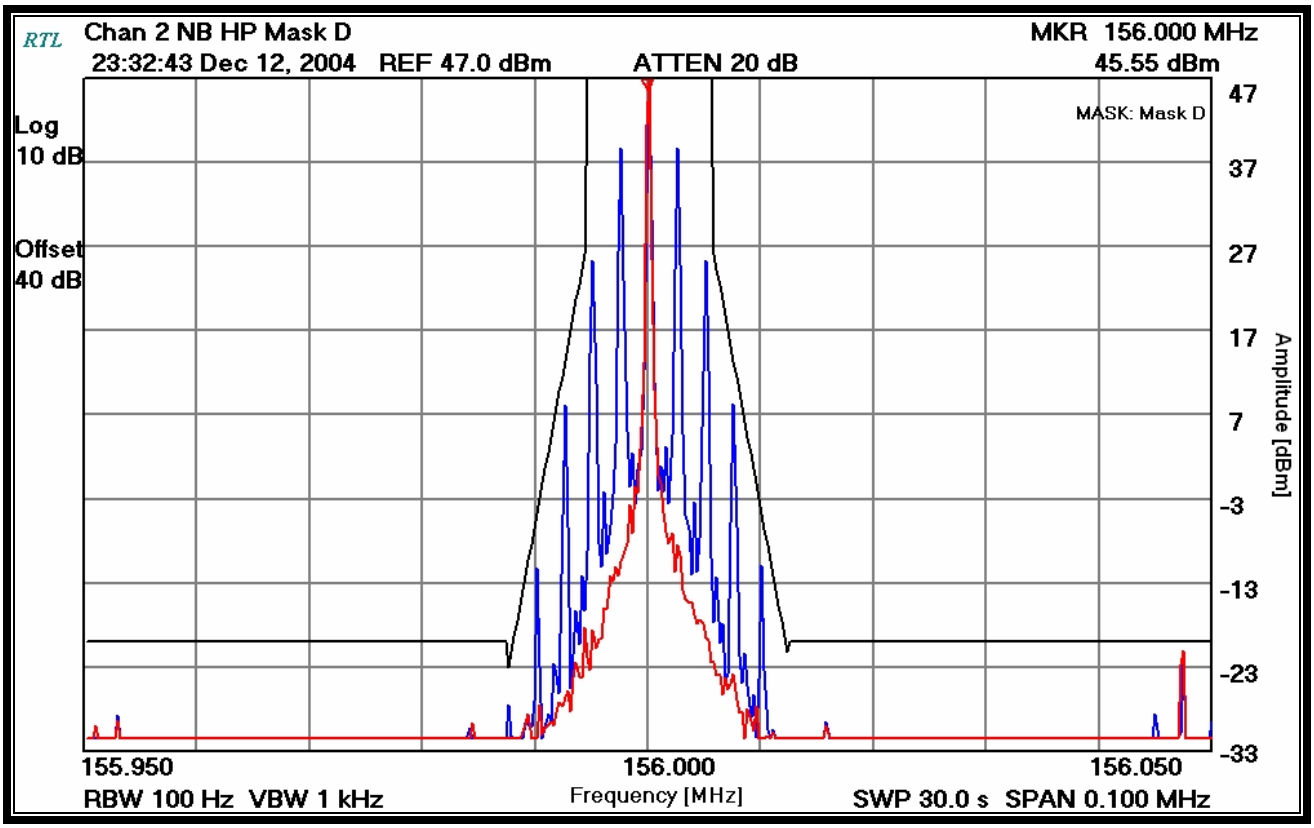
Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps

8.2 TEST DATA

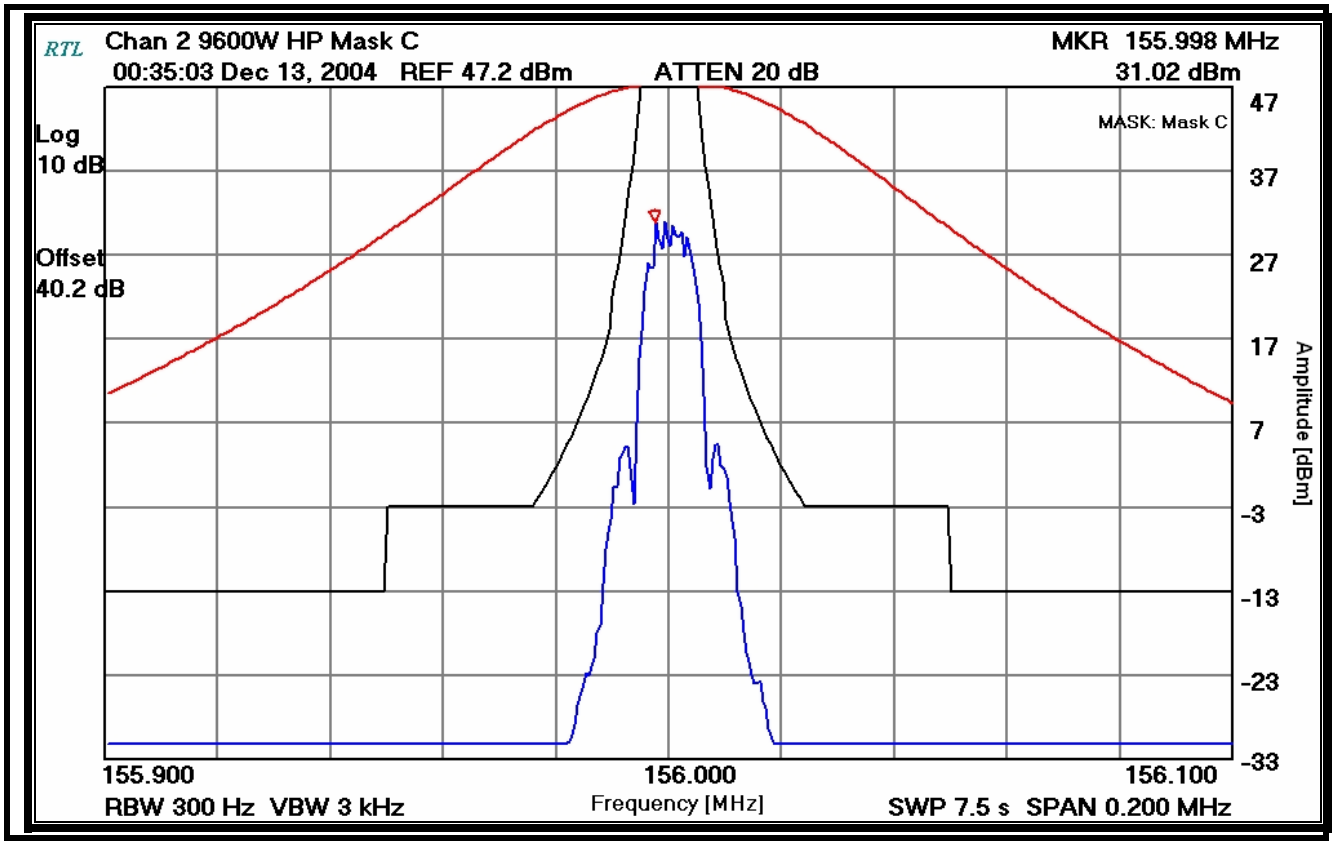
PLOT 8-1: OCCUPIED BANDWIDTH; WIDEBAND; ANALOG MODULATION: 2,500 HZ



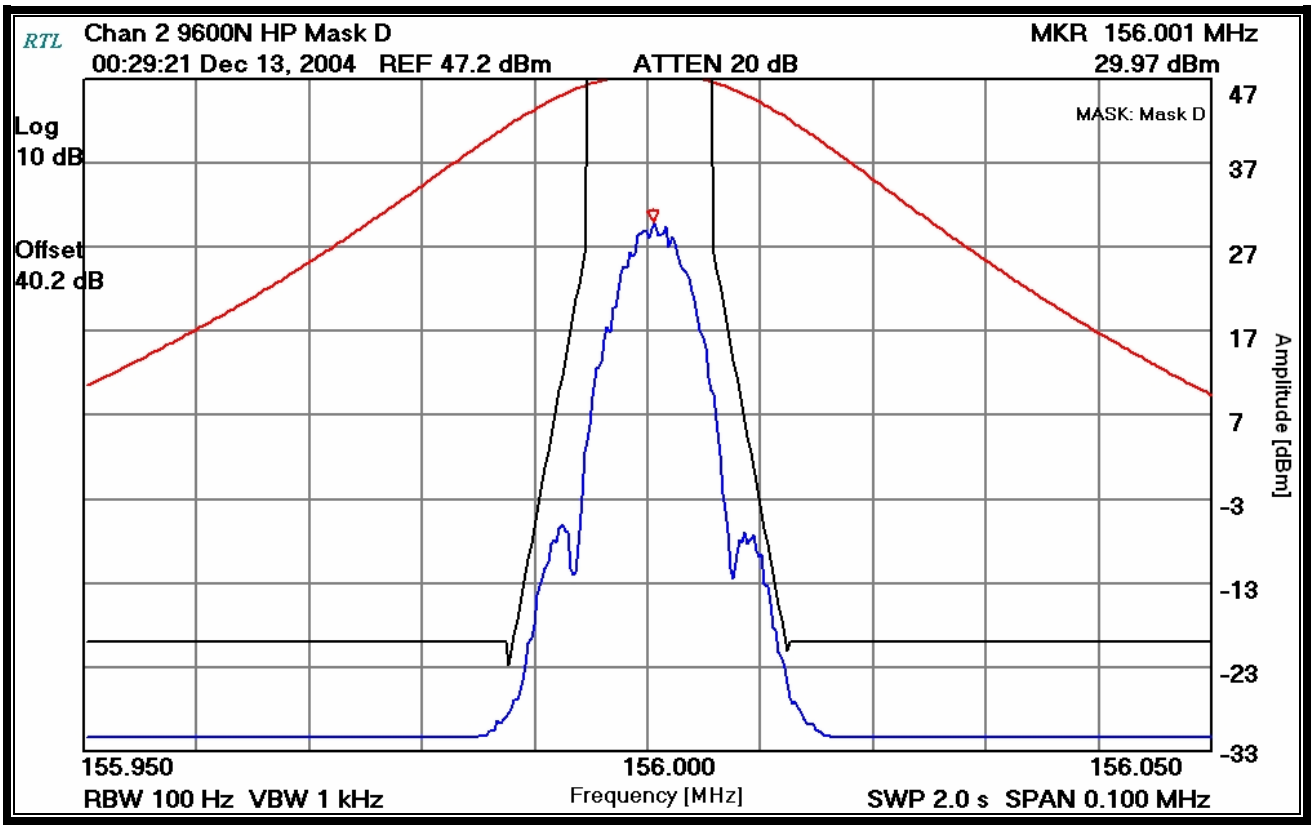
PLOT 8-2: OCCUPIED BANDWIDTH; NARROWBAND; ANALOG MODULATION: 2,500 HZ



PLOT 8-3: OCCUPIED BANDWIDTH; 9600 BPS; WIDEBAND; 2 LEVEL DIGITAL MODULATION



PLOT 8-4: OCCUPIED BANDWIDTH; 9600 BPS; NARROWBAND; 2 LEVEL DIGITAL MODULATION



PLOT 8-5: OCCUPIED BANDWIDTH; NARROWBAND; P25 DIGITAL MODULATION

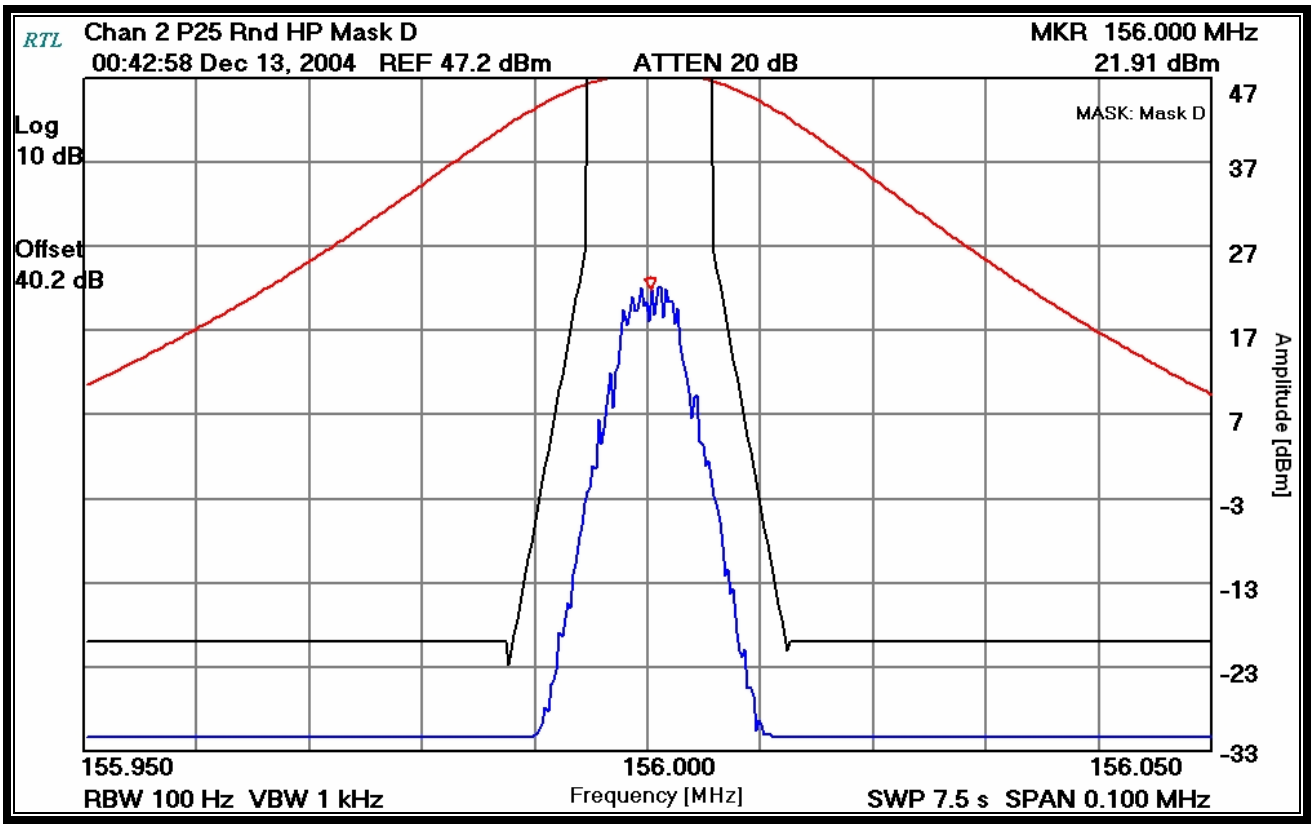


TABLE 8-1: TEST EQUIPMENT USED FOR TESTING OCCUPIED BANDWIDTH

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05

TEST PERSONNEL:

DANIEL BIGGS	Daniel Biggs	DECEMBER 12 AND 13, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATES OF TEST

9 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY; RSS-119 §7: FREQUENCY STABILITY

9.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +60°C.

The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A one half hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied from the battery end point to maximum voltage.

The worst-case test data are shown below in Table 9-1.

9.2 TEST DATA

9.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

Limit is 5.0 ppm for mobile device with a 12.5 kHz channel bandwidth. Worst-case deviation was found to be -0.7 ppm at 60°C.

PLOT 9-1: TEMPERATURE FREQUENCY STABILITY

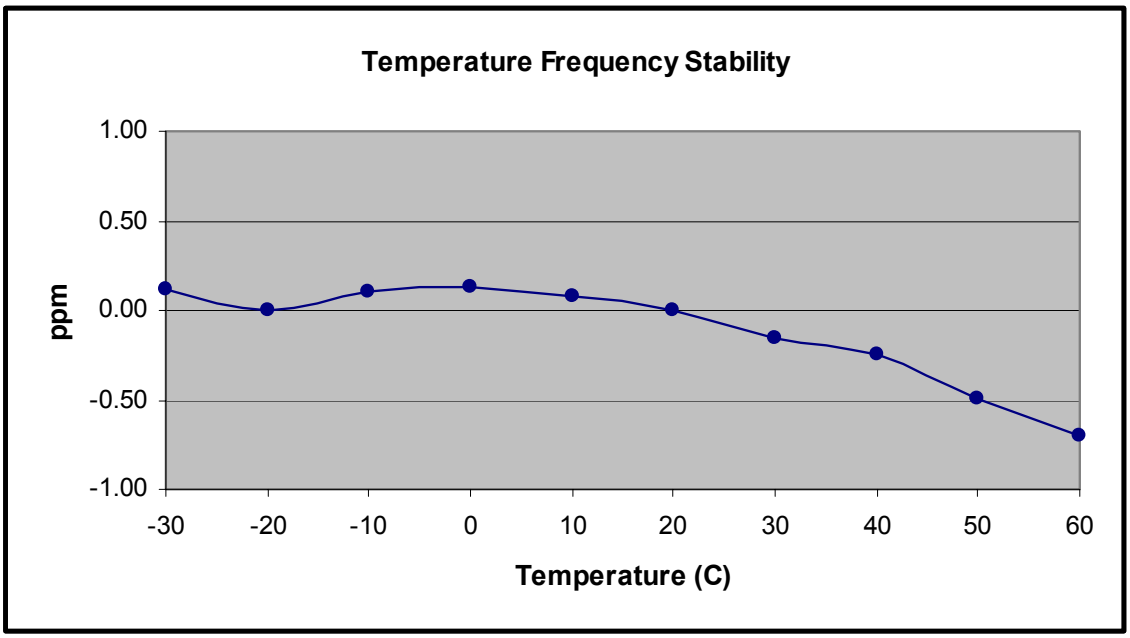


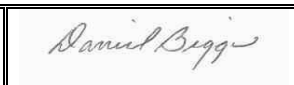
TABLE 9-1: TEMPERATURE FREQUENCY STABILITY CHANNEL 2, 156.0 MHZ

Temperature C	Measured Frequency (MHz)	ppm
-30	156.000021	0.12
-20	156.000004	0.01
-10	156.000019	0.10
0	156.000024	0.13
10	156.000016	0.08
20 (reference)	156.000003	0.00
30	155.999978	-0.16
40	155.999965	-0.24
50	155.999926	-0.49
60	155.999894	-0.70

TABLE 9-2: TEST EQUIPMENT USED FOR TESTING FREQUENCY STABILITY/TEMPERATURE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	02/03/05
901300	Agilent	53131A	Universal Counter	MY40001345	11/17/05

TEST PERSONNEL:

DANIEL BIGGS		DECEMBER 13, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

9.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION

Worst-case variation is 0.01 ppm.

PLOT 9-2: VOLTAGE FREQUENCY STABILITY

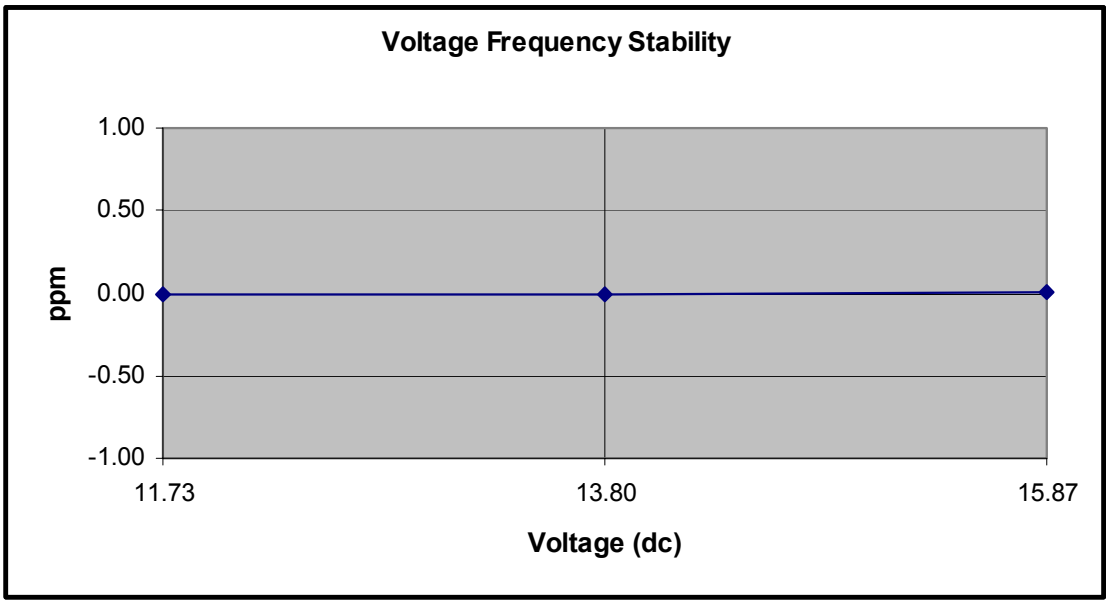


TABLE 9-3: FREQUENCY STABILITY/VOLTAGE VARIATION CHANNEL 2, 156.0 MHZ

Voltage (Vdc)	Measured Frequency (MHz)	ppm
11.73	156.000002	-0.01
13.80	156.000003	0.00
15.87	156.000004	0.01

TABLE 9-4: TEST EQUIPMENT USED FOR TESTING FREQUENCY STABILITY/VOLTAGE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	02/03/05
901300	Agilent	53131A	Universal Counter	MY40001345	11/17/05

TEST PERSONNEL:

DANIEL BIGGS	Daniel Biggs	DECEMBER 13, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

10 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE

10.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.6

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

The input audio level at 1000 Hz was set to produce 20% of the rated system deviation. This point is shown as the 0 dB reference level, noted DEVref. The audio signal generator was varied from 100 Hz to 5 kHz with the input level held constant. The deviation in kHz was recorded using a modulation analyzer as DEVfreq. The response in dB relative to 1 kHz was calculated as follows:

Audio Frequency Response = 20 LOG (DEVfreq/DEVref)

10.2 TEST DATA

PLOT 10-1: MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE

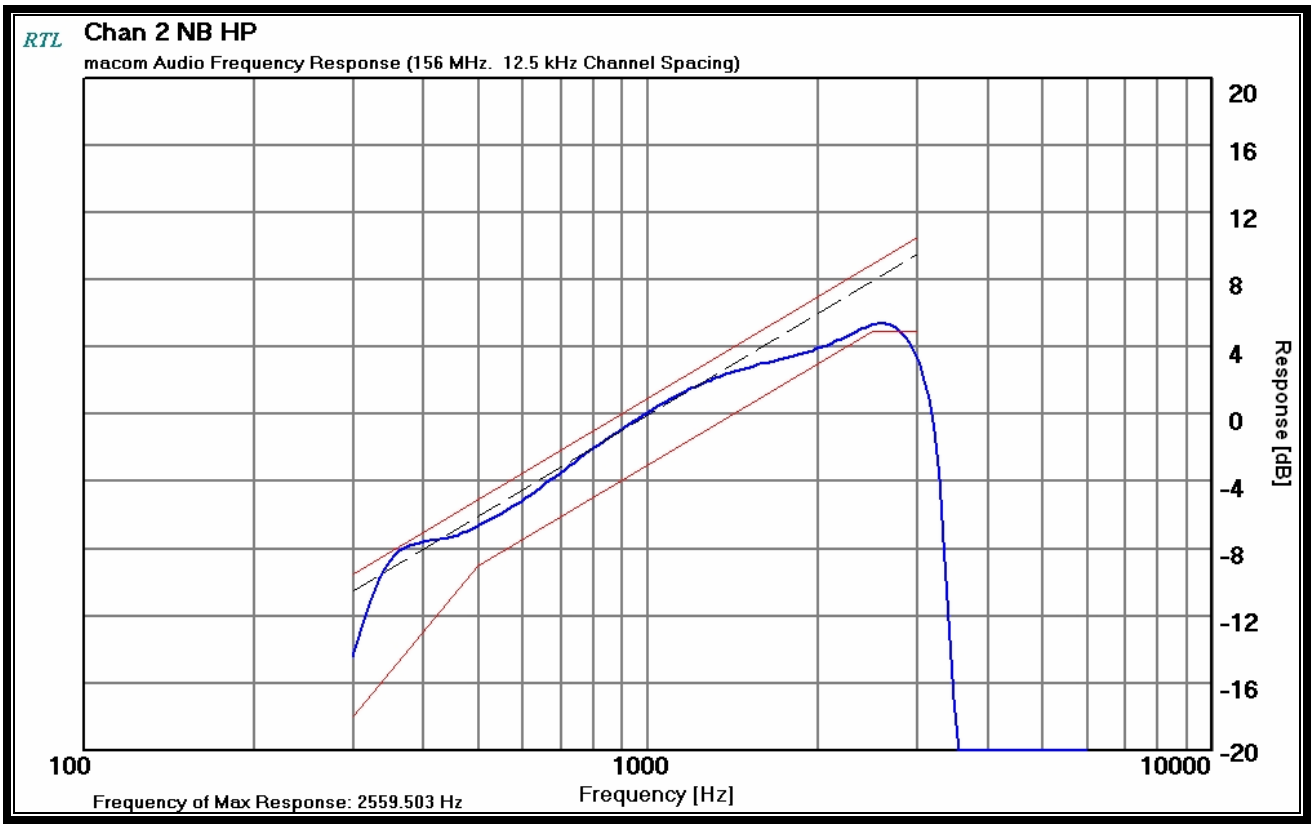


TABLE 10-1: TEST EQUIPMENT USED FOR TESTING AUDIO FREQUENCY RESPONSE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

DANIEL BIGGS		DECEMBER 12, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

11 FCC PART 2 §2.1047(A): MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER; RSS-119 §6.6: AUDIO LOW-PASS FILTER

11.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, 2.2.15

The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

11.2 TEST DATA

PLOT 11-1: MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER

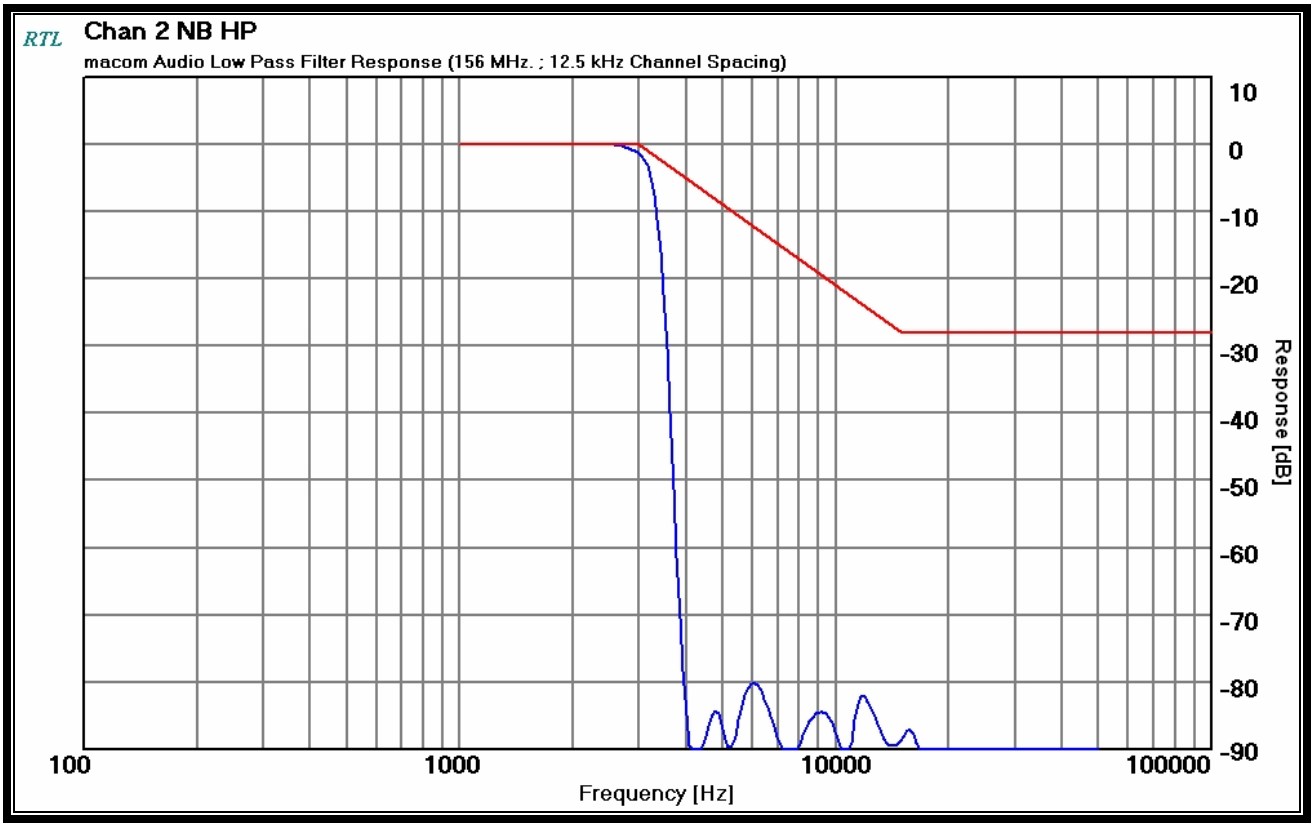
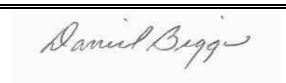


TABLE 11-1: TEST EQUIPMENT USED FOR TESTING AUDIO LOW PASS FILTER RESPONSE

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

DANIEL BIGGS		DECEMBER 12, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

12 FCC RULES AND REGULATIONS PART 2 §2.1047(B): MODULATION CHARACTERISTICS - MODULATION LIMITING; RSS-119 §6.6: FM MODULATION LIMITING AND AUDIO LOW-PASS FILTER

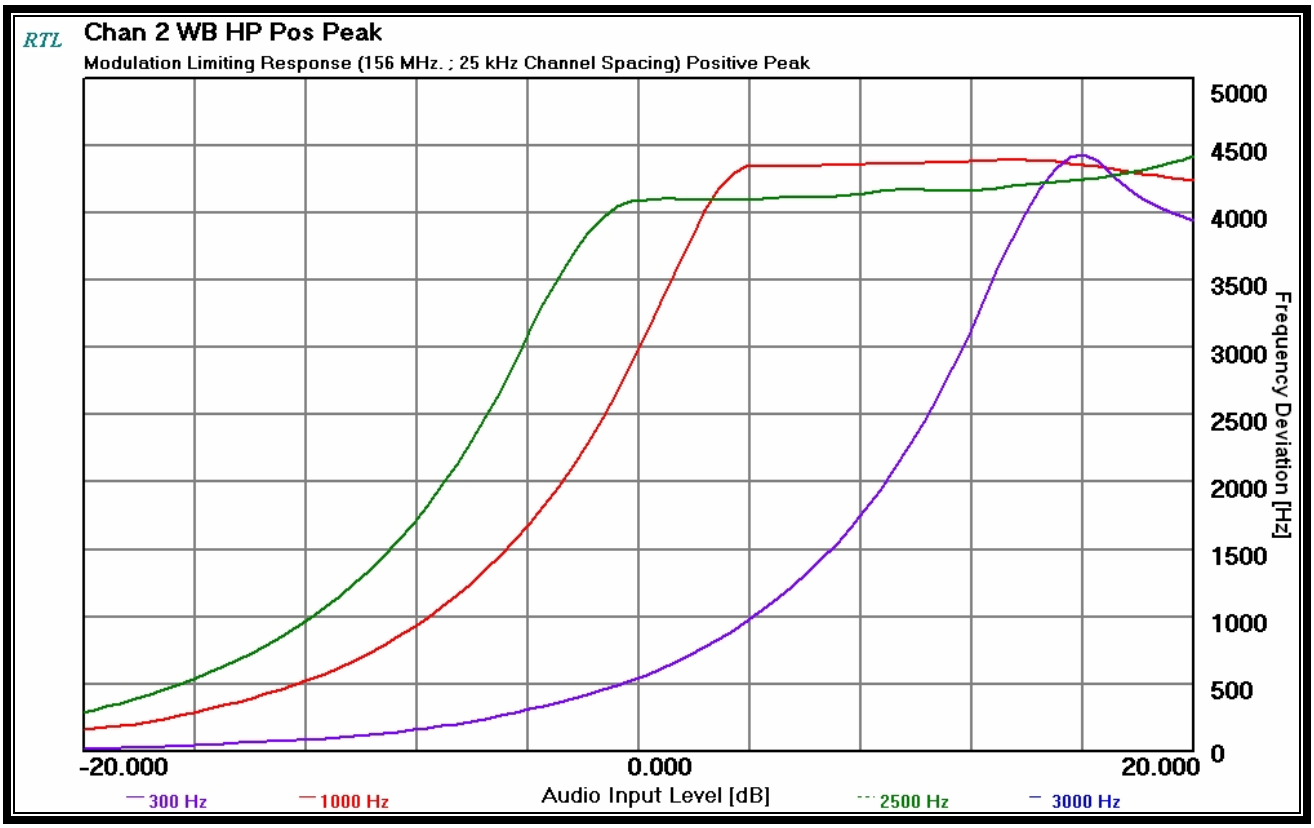
12.1 TEST PROCEDURE

ANSI/TIA/EIA-603-2002, section 2.2.3

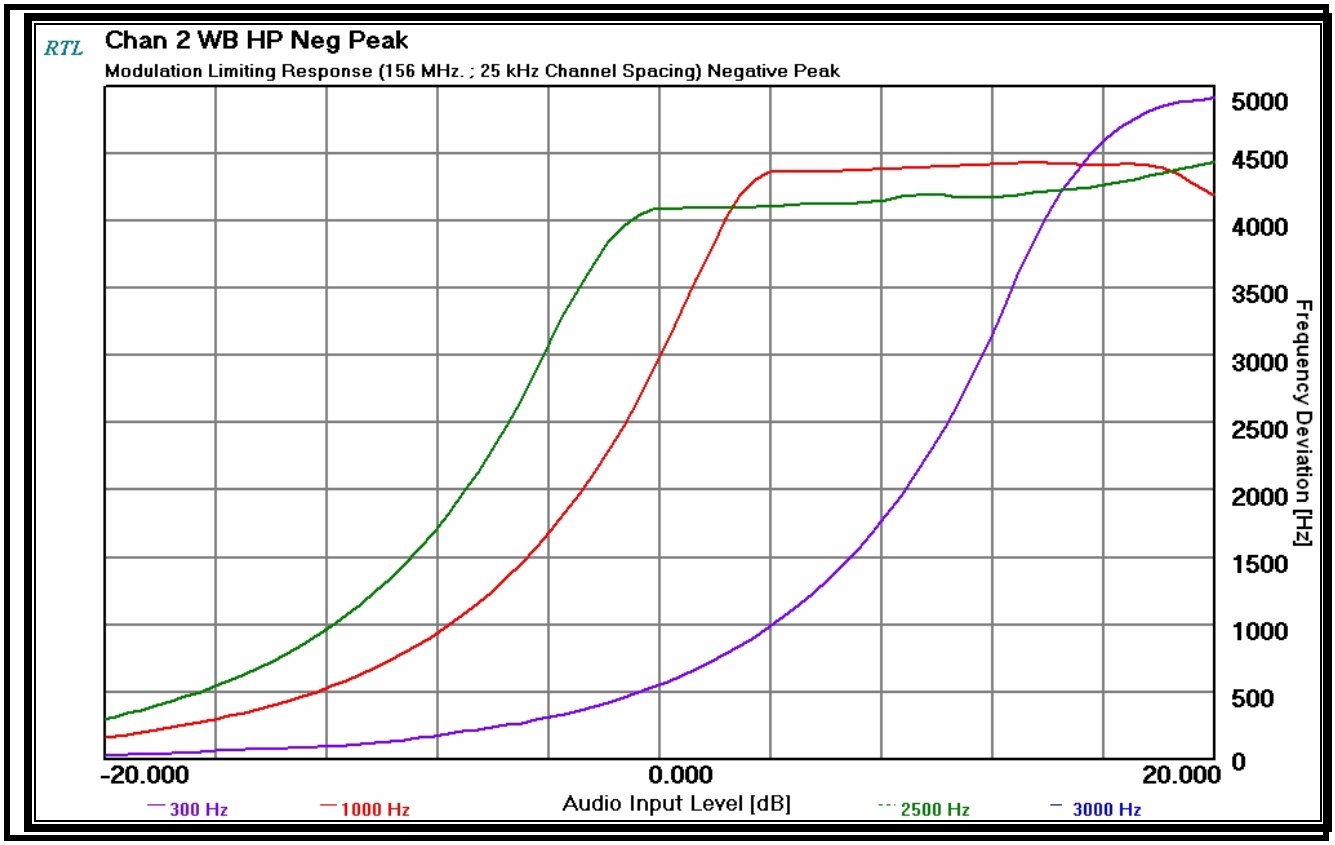
The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0 dB) the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz. The system deviation obtained as a function of the input level was recorded. Both positive and negative peak deviations were recorded.

12.2 TEST DATA

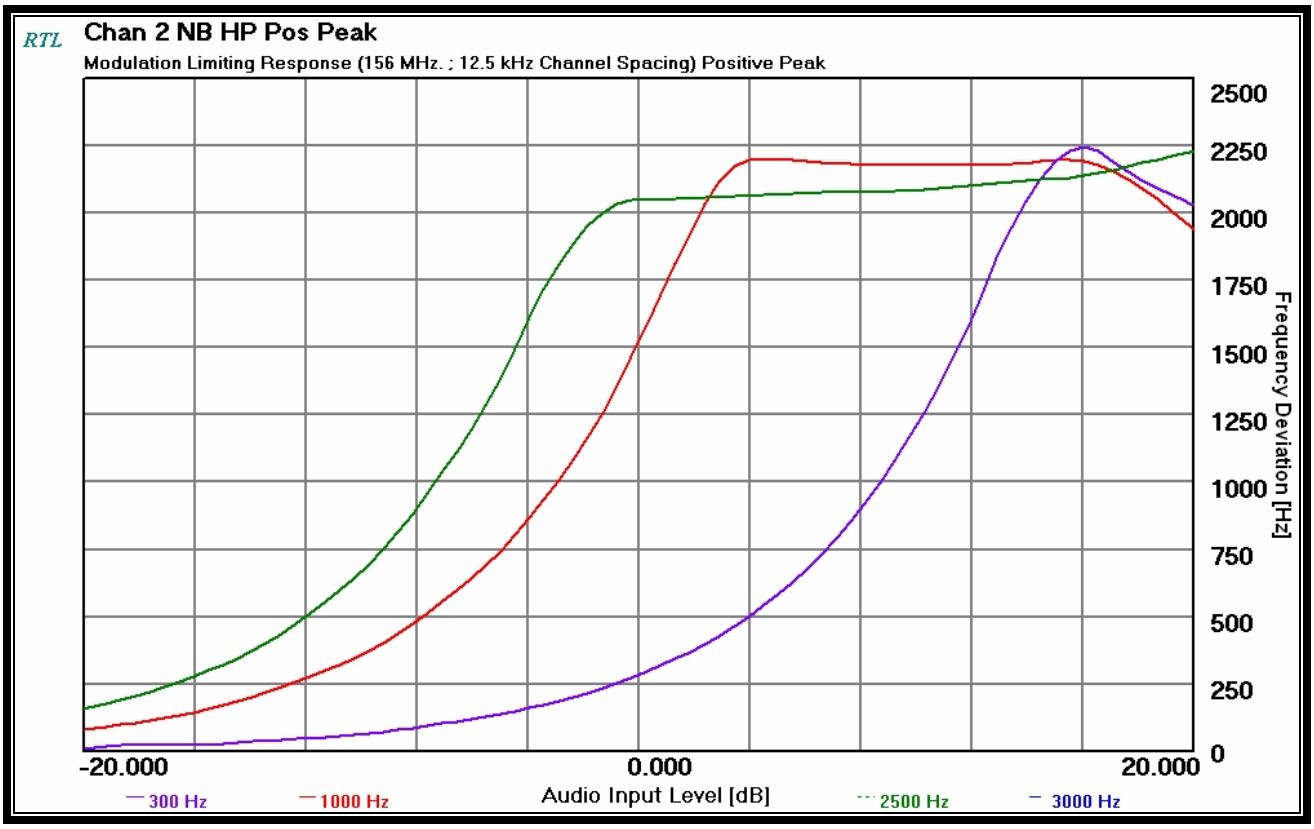
PLOT 12-1: MODULATION CHARACTERISTICS – MODULATION LIMITING: WIDEBAND; POSITIVE PEAK



PLOT 12-2: MODULATION CHARACTERISTICS – MODULATION LIMITING: WIDEBAND; NEGATIVE PEAK



PLOT 12-3: MODULATION CHARACTERISTICS – MODULATION LIMITING: NARROWBAND; POSITIVE PEAK



PLOT 12-4: MODULATION CHARACTERISTICS – MODULATION LIMITING: NARROWBAND; NEGATIVE PEAK

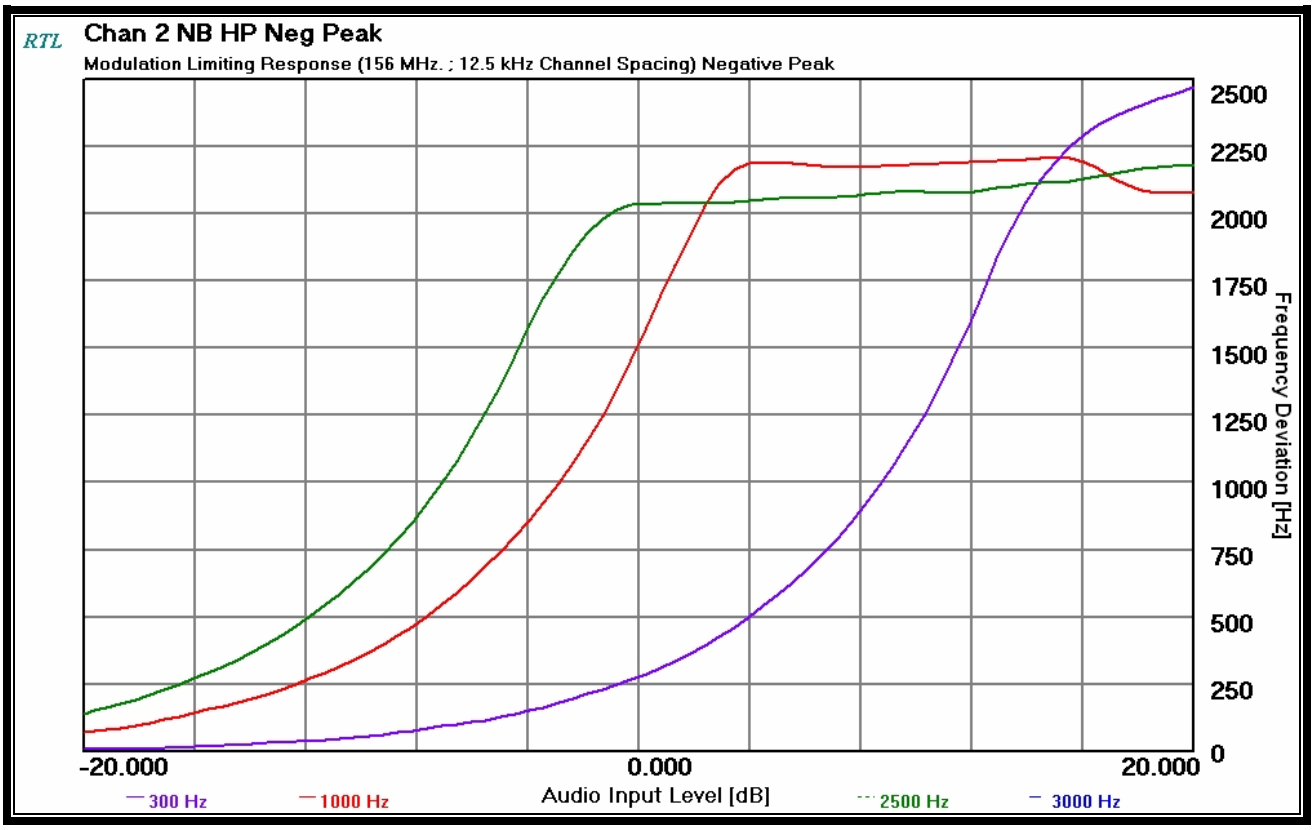


TABLE 12-1: TEST EQUIPMENT USED FOR TESTING MODULATION LIMITING

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	09/08/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	09/08/05

TEST PERSONNEL:

DANIEL BIGGS	Daniel Biggs	DECEMBER 12, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

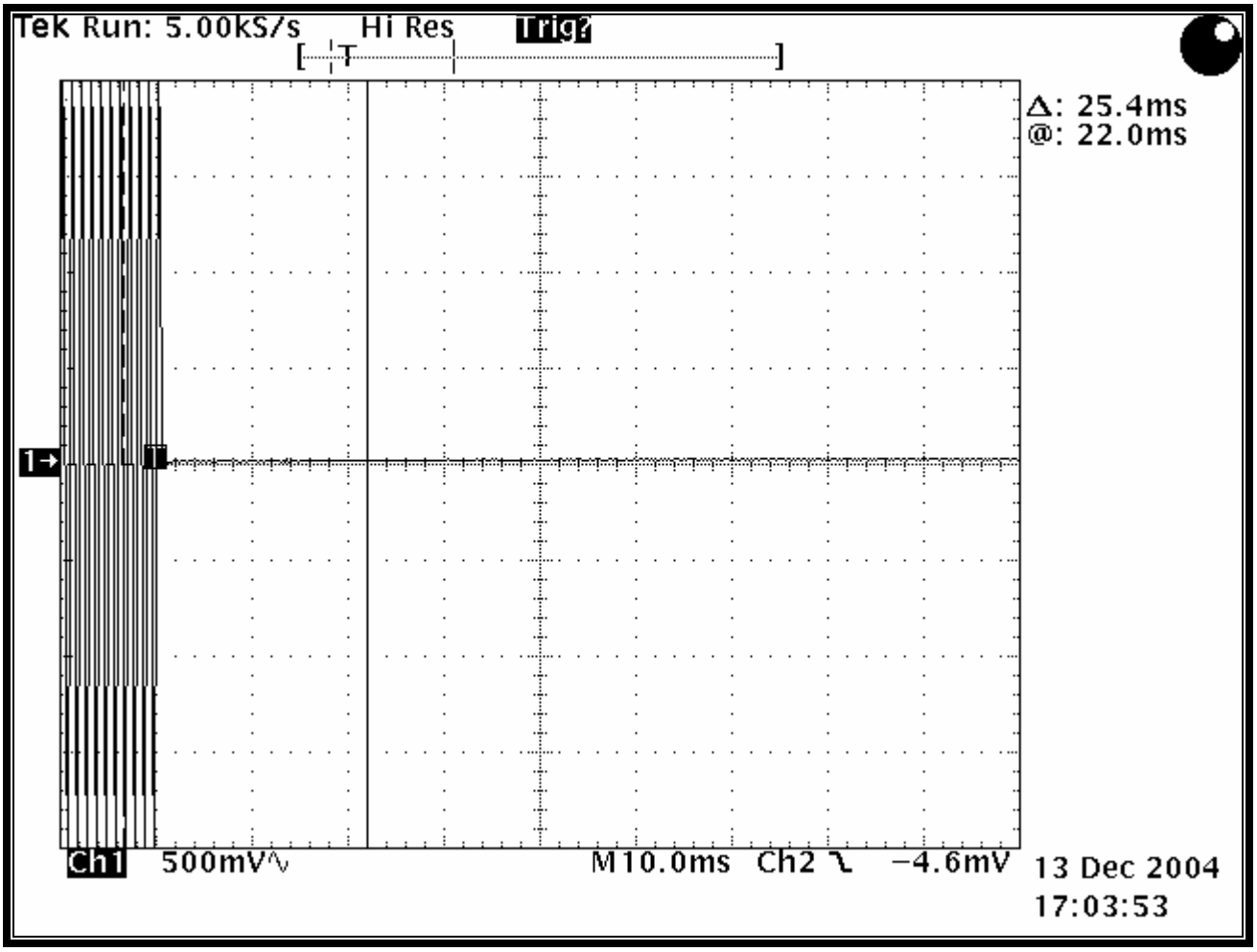
13 FCC RULES AND REGULATIONS PART 90 §90.214: TRANSIENT FREQUENCY BEHAVIOR; RSS-119 §6.5: TRANSIENT FREQUENCY BEHAVIOR

13.1 TEST PROCEDURE

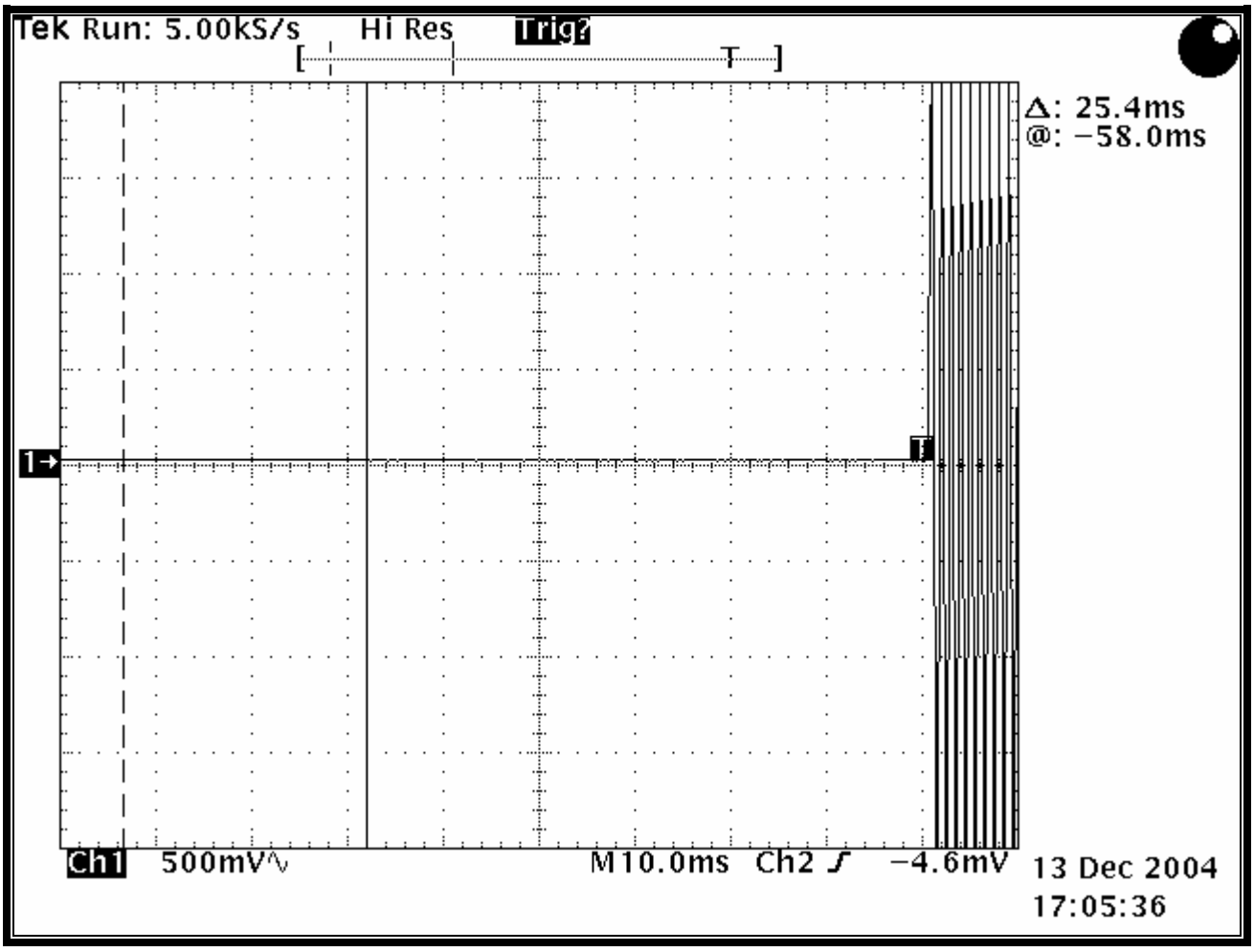
ANSI/TIA/EIA-603-2002, section 2.2.3

13.2 TEST DATA

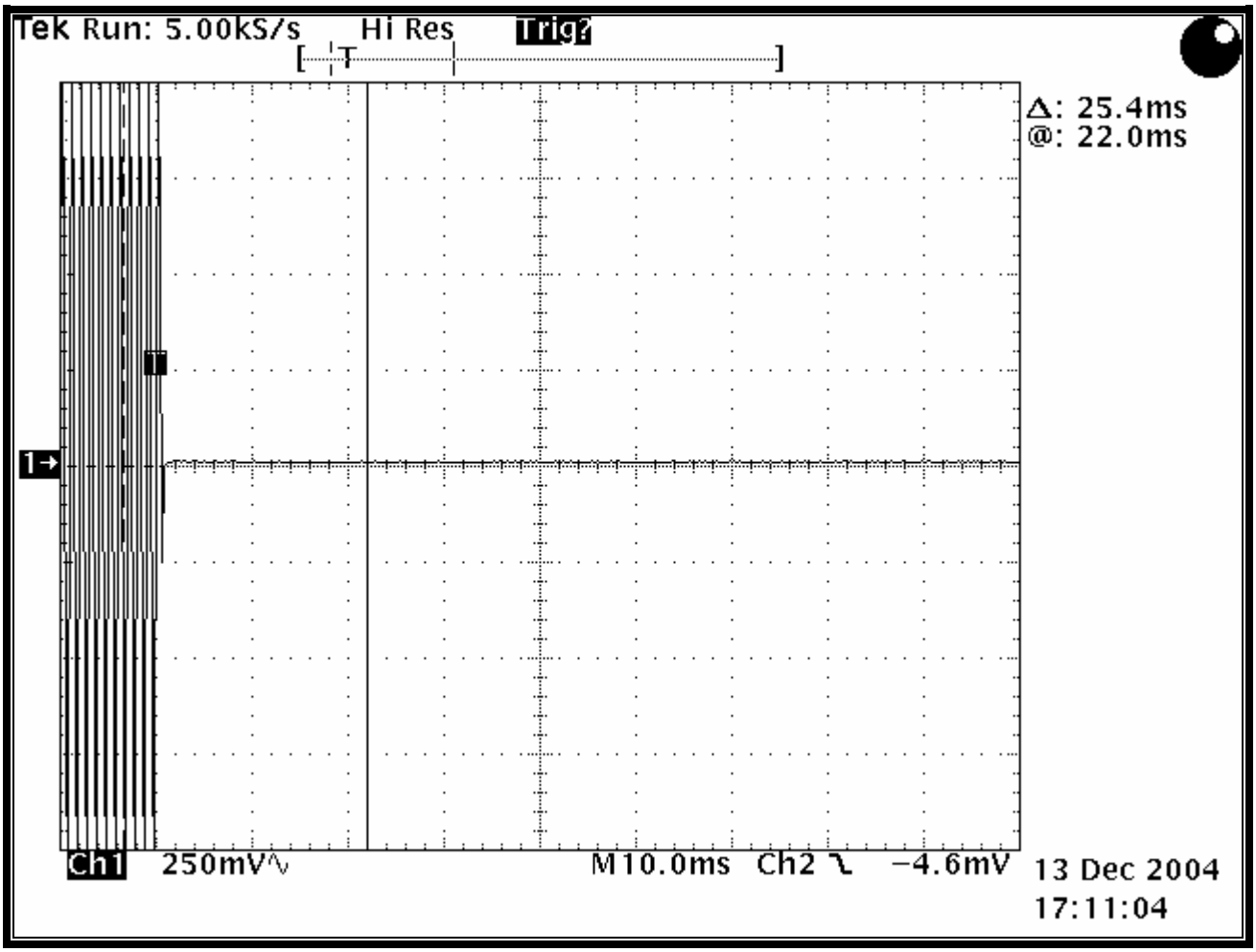
PLOT 13-1: TRANSIENT FREQUENCY BEHAVIOR – 156.0 MHZ; HIGH POWER; WIDEBAND; CARRIER ON TIME



PLOT 13-2: TRANSIENT FREQUENCY BEHAVIOR – 156.0 MHZ; HIGH POWER; WIDEBAND; CARRIER OFF TIME



PLOT 13-3: TRANSIENT FREQUENCY BEHAVIOR – 156.0 MHZ; HIGH POWER; NARROWBAND; CARRIER ON TIME



PLOT 13-4: TRANSIENT FREQUENCY BEHAVIOR – 156.0 MHZ; HIGH POWER; NARROWBAND; CARRIER OFF TIME

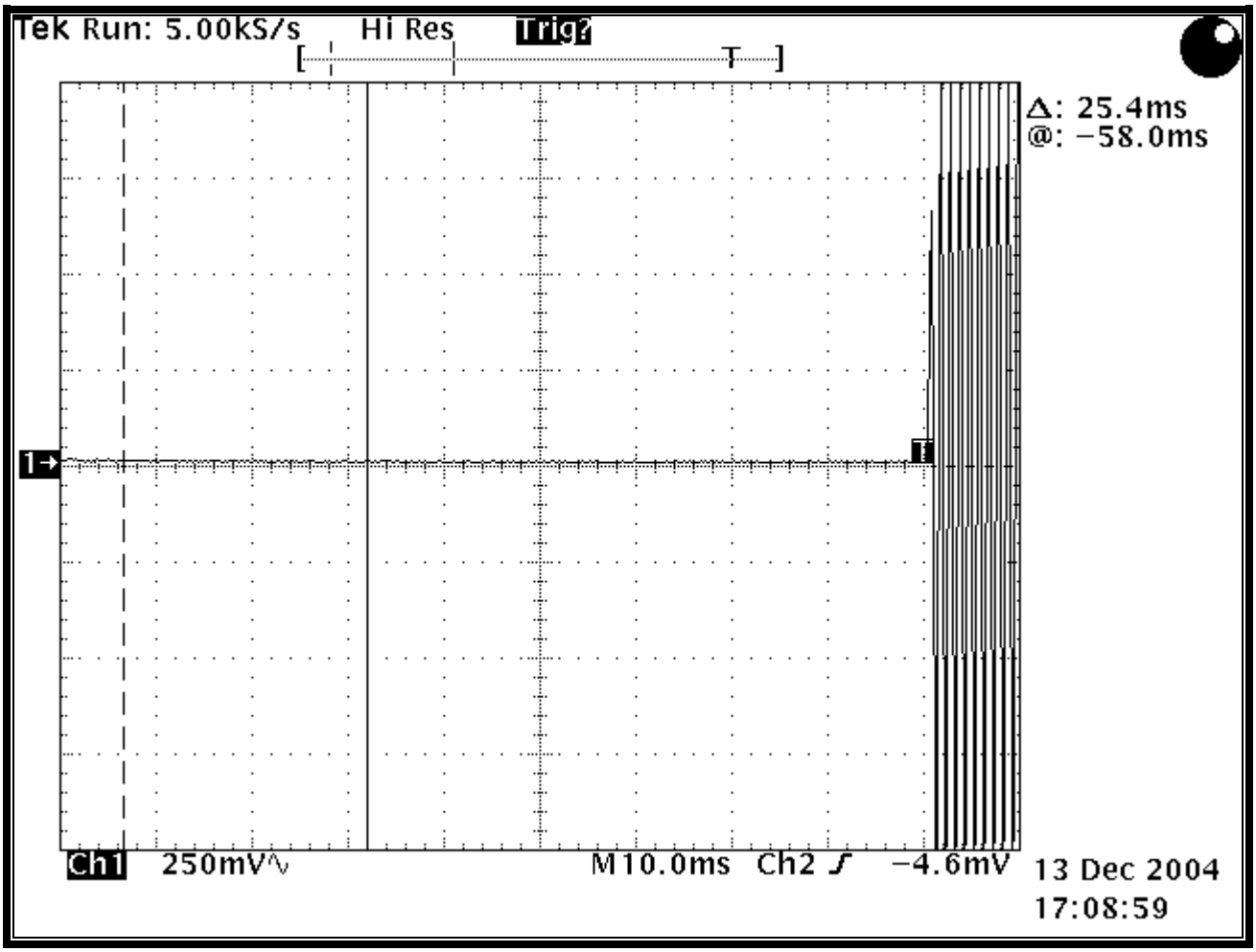


TABLE 13-1: TEST EQUIPMENT USED FOR TESTING TRANSIENT FREQUENCY BEHAVIOR

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900917	Hewlett Packard	8648C	Signal Generator	3537A01741	07/06/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	07/07/05
900561	Tektronix	TDS540B	Oscilloscope	B020129	03/02/05
900352	Werlatone	C1795	Directional Coupler	4989	N/A

TEST PERSONNEL:

DANIEL BIGGS	Daniel Biggs	DECEMBER 13, 2004
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

14 FCC RULES AND REGULATIONS PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

Type of Emission: F3E, F1D, F1E

Voice – 25 kHz channel separation
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 5
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 16.0 kHz
Emission designator: 16K0F3E

Voice – 12.5 kHz channel separation
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 2.5
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 11.0 kHz
Emission designator: 11K0F3E

Digital voice and data (9600W) – 25 kHz channel spacing
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 3000
2D/R = 0.625
Bn = 3.86D + 0.27R = 3.86(3000) + 0.27(9600) = 14.172 kHz
Emission designator: 14K2F1D

Digital voice and data (9600N) – 12.5 kHz channel spacing
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1900
2D/R = 0.396
Bn = 3.86D + 0.27R = 3.86(1900) + 0.27(9600) = 9.926 kHz
Emission designator: 9K9F1D, 9K9F1E

Digital voice and data (4800N) – 12.5 kHz channel spacing
Calculation:
Data rate in bps (R) = 4800
Peak deviation of carrier (D) = 1500
2D/R = 0.625
Bn = 3.86D + 0.27R = 3.86(1500) + 0.27(4800) = 7.086 kHz
Emission designator: 7K1F1D, 7K1F1E

P25 – 9600 bps:
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Bn = $[9600/\log_2(4) + 2 (1800) (1) = 8.400$ kHz
Emission designator: 8K4F1D, 8K4F1E

15 CONCLUSION

The data in this measurement report shows that the **M/A-COM, Inc**. Model **M7100(IP) VHF 50W Mobile Radio, FCC ID: OWDTR-0035-E** complies with all the requirements of Parts 90, 80, 74, 22, 15, and 2 of the FCC Rules, and Industry Canada RSS-119, Issue 6, 2000.