Engineering and Testing for EMC and Safety Compliance

# TYPE CERTIFICATION REPORT

**M/A-Com, Inc.**
**221 Jefferson Ridge Parkway**
**Lynchburg, VA 28061**
**Daryl Popowitch**
**Phone: (434) 455-9527**
**E-Mail: Popowitda@tycoelectronics.com**

## MODEL: M7100IP 800 MHz Mobile Radio
## 806-870 MHz

**FCC ID: OWDTR-0022-E**

***May 6, 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 90: 2003 | PRIVATE LAND MOBILE RADIO SERVICES |
| ANSI C63.4-2001 | AMERICAN NATIONAL STANDARD FOR METHODS OF MEASUREMENT OF RADIO NOISE EMISSIONS FROM LOW -VOLTAGE ELECTRICAL AND ELECTRONIC EQUIPMENT IN THE RANGE OF 9 KHZ – 40 GHZ |
| 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 (MHz) | Maximum Measured Output Power (W) Conducted | Measured Frequency Tolerance (ppm) | Emission Designator |
|---|---|---|---|
| 806-821, 851-866 | 36.4 | 0.98 | 16K0F3E (WB Voice) |
| 821-824, 866-869 | 36.4 | 0.98 | 12K8F3E (NPSPAC Voice) |
| 806-821, 851-866 | 36.4 | 0.98 | 10K3F1D (2 level WB 9600) measured |
| 806-821, 851-866 | 36.4 | 0.98 | 10K3F1E (2 level WB 9600) measured |
| 821-824, 866-869 | 36.4 | 0.98 | 10K0F1D (2 level NPSPAC 9600) measured |
| 821-824, 866-869 | 36.4 | 0.98 | 10K0F1E (2 level NPSPAC 9600) measured |
| 806-824, 851-869 | 36.4 | 0.98 | 8K0F1D (4 Level) measured |
| 806-824, 851-869 | 36.4 | 0.98 | 8K0F1E (4 Level) measured |

**REPORT PREPARED BY TEST ENGINEER: DAN BIGGS**

*Document Number: 2003158/ QRTL03-964A*

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# 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 **M7100IP 800 MHz Mobile Radio; FCC ID: OWDTR-0022-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, 1992. 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 1992).

## 1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application report.

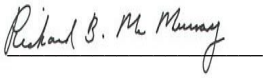
## 2 CONFORMANCE STATEMENT

| STANDARDS REFERENCED FOR THIS REPORT | |
|---|---|
| PART 2: 1999 | FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS |
| PART 15: 1999 | §15.109: RADIATED EMISSIONS LIMITS |
| PART 90: 1998 | PRIVATE LAND MOBILE RADIO SERVICES |
| ANSI C63.4-1992 | 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 603-1-2002 | ADDENDUM TO ANSI/TIA/EIA 603-2002 |
| 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 (MHz) | Maximum Measured Output Power (W) Conducted | Measured Frequency Tolerance (ppm) | Emission Designator |
|---|---|---|---|
| 806-821, 851-866 | 36.4 | 0.98 | 16K0F3E (WB Voice) |
| 821-824, 866-869 | 36.4 | 0.98 | 12K8F3E (NPSPAC Voice) |
| 806-821, 851-866 | 36.4 | 0.98 | 10K3F1D (2 level WB 9600) measured |
| 806-821, 851-866 | 36.4 | 0.98 | 10K3F1E (2 level WB 9600) measured |
| 821-824, 866-869 | 36.4 | 0.98 | 10K0F1D (2 level NPSPAC 9600) measured |
| 821-824, 866-869 | 36.4 | 0.98 | 10K0F1E (2 level NPSPAC 9600) measured |
| 806-824, 851-869 | 36.4 | 0.98 | 8K0F1D (4 Level) measured |
| 806-824, 851-869 | 36.4 | 0.98 | 8K0F1E (4 Level) measured |

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:  Date: May 6, 2004

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

Signature:  Date: May 6, 2004

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

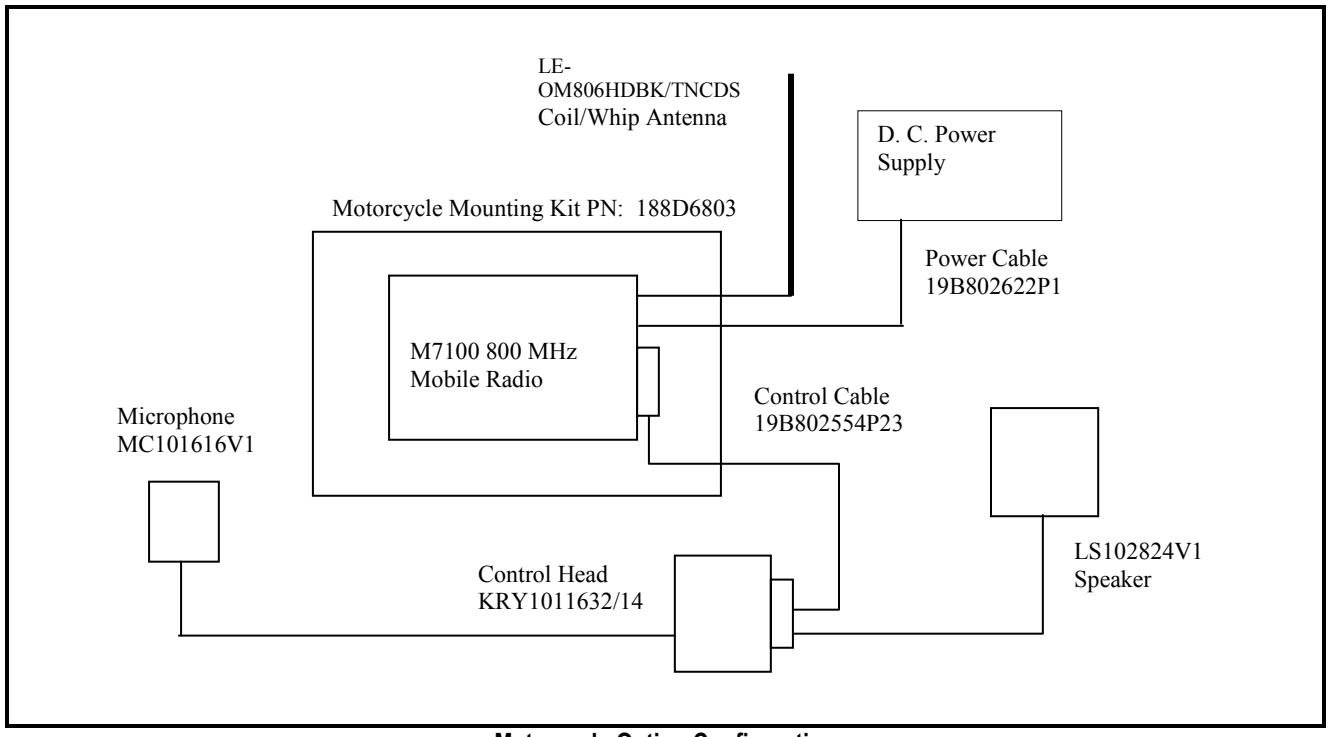
## 3 TESTED SYSTEM DETAILS

The test sample was received on October 7, 2003. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

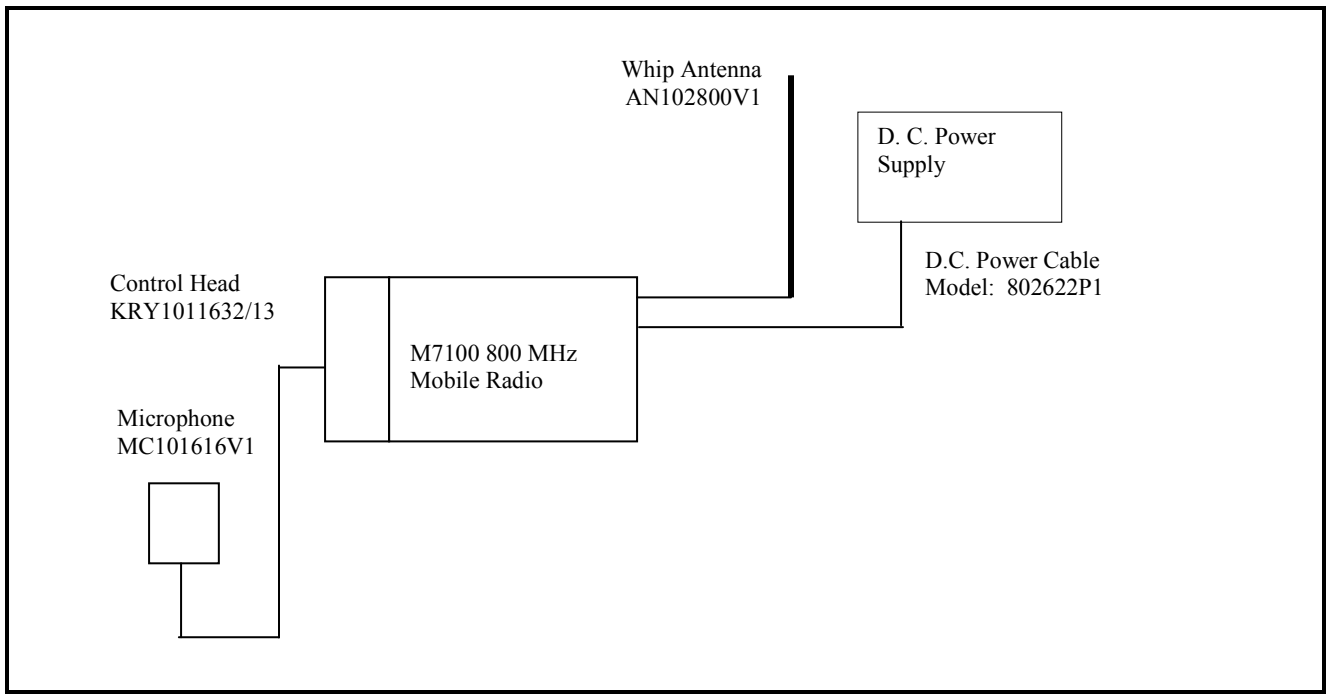
**TABLE 3-1: EQUIPMENT UNDER TEST (EUT)**

| Part | Manufacturer | Model | PN/SN | FCC ID | RTL Bar Code |
|---|---|---|---|---|---|
| M7100 800 MHz Mobile Radio | M/A-COM, INC. | M7100IP | RU101188V131 | OWDTR-0022-E | 015701 |
| Control Head | M/A-COM, INC. | NA | KRY1011632/13 | NA | NA |
| Control Head | M/A-COM, INC. | NA | KRY1011632/14 | NA | NA |
| Motorcycle Kit | M/A-COM, INC. | NA | 188D6803 | NA | 15557 |
| Antenna | M/A-COM, INC. | Coil/Whip | LE-OM806HDBK/TNCDS | NA | NA |
| Microphone | M/A-COM, INC. | NA | MC101616V1 | NA | NA |
| Power Cable | M/A-COM, INC. | 802622P1 | 19B802622P1 | NA | NA |
| ¼ Wave Roof Mount Antenna | M/A-COM, INC. | D2AN1R | AN102800V1 | NA | NA |
| Control Cable | M/A-COM, Inc. | NA | 19B802554P23 | NA | NA |
| Speaker | M/A-COM, Inc. | NA | LS102824V1 | NA | NA |

**FIGURE 3-1: CONFIGURATIONS OF TESTED SYSTEMS**




**Motorcycle Option Configuration**




**Standard Configuration**

## 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**: 7.5 AMPS

# 5 FCC RULES AND REGULATIONS PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED

## 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: 806, 822.9, 851, 867.9 and 870.

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

| Channel | Frequency (MHz) | RF Power Measured (Watt)* |
|---|---|---|
| 1 (High Power) | 806 | 35.5 |
| 2 (High Power) | 822.9 | 35.2 |
| 3 (High Power) | 851 | 36.4 |
| 4 (High Power) | 867.9 | 35.9 |
| 5 (High Power) | 870 | 36.1 |
| 1 (Low Power) | 806 | 9.6 |
| 2 (Low Power) | 822.9 | 9.5 |
| 3 (Low Power) | 851 | 9.4 |
| 4 (Low Power) | 867.9 | 9.7 |
| 5 (Low Power) | 870 | 9.6 |

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

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

| Rated Power (W) |
|---|
| 35 |

**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 | 07/30/04 |

TEST PERSONNEL:

| DANIEL BIGGS |  | OCTOBER 7, 2003 |
|---|---|---|
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

# 6 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

## 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) – (43+10xLOG P(W))

The following channels (in MHz) were investigated: 806, 851, and 870. 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 – 806 MHZ – HIGH POWER**

(806 MHz); 25 kHz channel spacing; Mask B; Conducted power = 35.5 W

| Frequency (MHz) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|
| 1612 | 90.67 | 58.50 | -32.17 |
| 2418 | 82.50 | 58.50 | -24.00 |
| 3224 | 79.16 | 58.50 | -20.66 |
| 4030 | 67.50 | 58.50 | -9.00 |
| 4836 | 74.50 | 58.50 | -16.00 |
| 5642 | 68.67 | 58.50 | -10.17 |
| 6448 | 85.84 | 58.50 | -27.34 |
| 7254 | 80.84 | 58.50 | -22.34 |
| 8060 | 75.16 | 58.50 | -16.66 |

**TABLE 6-2: CONDUCTED SPURIOUS EMISSIONS CHANNEL 1 – 806 MHZ – LOW POWER**

(806 MHz); 25 kHz channel spacing; Mask B; Conducted power = 9.6 W

| Frequency (MHz) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|
| 900 | 85.66 | 52.82 | -32.84 |
| 1350 | 76.82 | 52.82 | -24.00 |
| 1800 | 79.65 | 52.82 | -26.83 |
| 2250 | 67.82 | 52.82 | -15.00 |
| 2700 | 79.32 | 52.82 | -26.50 |
| 3150 | 63.99 | 52.82 | -11.17 |
| 3600 | 79.82 | 52.82 | -27.00 |
| 4050 | 75.99 | 52.82 | -23.17 |
| 8060 | 69.98 | 52.82 | -17.16 |

**TABLE 6-3: CONDUCTED SPURIOUS EMISSIONS CHANNEL 3 – 851 MHZ – HIGH POWER**

(851 MHz); 25 kHz channel spacing; Mask B; Conducted power = 36.4 W

| Frequency (MHz) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|
| 1702 | 92.11 | 58.61 | -33.50 |
| 2553 | 83.77 | 58.61 | -25.16 |
| 3404 | 84.95 | 58.61 | -26.34 |
| 4255 | 66.27 | 58.61 | -7.66 |
| 5106 | 75.77 | 58.61 | -17.16 |
| 5957 | 78.45 | 58.61 | -19.84 |
| 6808 | 74.61 | 58.61 | -16.00 |
| 7659 | 77.61 | 58.61 | -19.00 |
| 8510 | 76.61 | 58.61 | -18.00 |

**TABLE 6-4: CONDUCTED SPURIOUS EMISSIONS CHANNEL 3 – 851 MHZ – LOW POWER**

(851 MHz); 25 kHz channel spacing; Mask B; Conducted power = 9.4 W

| Frequency (MHz) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|
| 1702 | 84.73 | 52.73 | -32.00 |
| 2553 | 77.39 | 52.73 | -24.66 |
| 3404 | 79.07 | 52.73 | -26.34 |
| 4255 | 67.56 | 52.73 | -14.83 |
| 5106 | 79.39 | 52.73 | -26.66 |
| 5957 | 77.23 | 52.73 | -24.50 |
| 6808 | 67.40 | 52.73 | -14.67 |
| 7659 | 71.90 | 52.73 | -19.17 |
| 8510 | 72.89 | 52.73 | -20.16 |

**TABLE 6-5: CONDUCTED SPURIOUS EMISSIONS CHANNEL 5 – 870 MHZ – HIGH POWER**

(870 MHz); 25 kHz channel spacing; Mask B; Conducted power = 36.1 W

| Frequency (MHz) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|
| 1740 | 86.40 | 58.58 | -27.82 |
| 2610 | 81.57 | 58.58 | -22.99 |
| 3480 | 85.40 | 58.58 | -26.82 |
| 4350 | 68.74 | 58.58 | -10.16 |
| 5220 | 69.57 | 58.58 | -10.99 |
| 6090 | 81.40 | 58.58 | -22.82 |
| 6960 | 79.57 | 58.58 | -20.99 |
| 7830 | 80.57 | 58.58 | -21.99 |
| 8700 | 72.91 | 58.58 | -14.33 |

**TABLE 6-6: CONDUCTED SPURIOUS EMISSIONS CHANNEL 5 – 870 MHZ – LOW POWER**

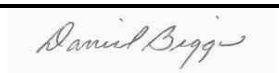
(870 MHz); 25 kHz channel spacing; Mask B; Conducted power = 9.75 W

| Frequency (MHz) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|
| 1740 | 80.06 | 52.89 | -27.17 |
| 2610 | 80.06 | 52.89 | -27.17 |
| 3480 | 81.22 | 52.89 | -28.33 |
| 4350 | 71.56 | 52.89 | -18.67 |
| 5220 | 75.39 | 52.89 | -22.50 |
| 6090 | 79.72 | 52.89 | -26.83 |
| 6960 | 73.73 | 52.89 | -20.84 |
| 7830 | 74.39 | 52.89 | -21.50 |
| 8700 | 67.73 | 52.89 | -14.84 |

**TABLE 6-7: TEST EQUIPMENT USED FOR TESTING (CONDUCTED SPURIOUS EMISSIONS)**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 901215 | Hewlett Packard | 8596EM | EMC Analyzer (9 kHz - 12.8 GHz) | 3826A00144 | 08/27/04 |
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 08/06/04 |
| 901054 | Hewlett Packard | HP 3586B | Selective Level Meter | 1928A01892 | 09/09/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS |  | OCTOBER 9, 2003 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

# 7 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION

## 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 3 – 851 MHZ; WIDE BAND; HIGH POWER**

Radiated Spurious Emissions
Mid Band Channel 2 (851 MHz, wideband)
Limit = 43 + 10 Log P = 58.61 dBc
Conducted Power = 45.61 dBm = 36.4 W

| Frequency (MHz) | Spectrum Analyzer Level (dBuV) | Signal Generator Level (dBm) | Cable Loss* (dB) | Antenna Gain (dBd) | Corrected Signal Generator Level (dBc) | Margin (dB) |
|---|---|---|---|---|---|---|
| 1702.025 | 36.7 | -51.5 | 0.94 | 2.8 | 95.3 | -36.6 |
| 2553.038 | 45.7 | -46.5 | 1.22 | 3.4 | 89.9 | -31.3 |
| 3404.050 | 46.7 | -44.2 | 1.32 | 4.2 | 86.9 | -28.3 |
| 4255.063 | 59.5 | -28.0 | 1.43 | 5.2 | 69.8 | -11.2 |
| 5106.075 | 64.7 | -23.8 | 1.59 | 5.8 | 65.2 | -6.6 |
| 5957.088 | 61.0 | -28.5 | 1.64 | 5.2 | 70.6 | -11.9 |
| 6808.100 | 53.7 | -36.2 | 1.72 | 9.9 | 73.6 | -15.0 |
| 7659.113 | 47.5 | -40.3 | 1.8 | 7.4 | 80.3 | -21.7 |
| 8510.125 | 39.5 | -42.0 | 2.1 | 9.6 | 80.1 | -21.5 |

*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 3 – 851 MHZ; WIDE BAND; LOW POWER**

Radiated Spurious Emissions
Mid Band Channel 2 (851 MHz, wideband)
Limit = 43 + 10 Log P = 52.73 dBc
Conducted Power = 39.73 dBm = 9.4 W

| Frequency (MHz) | Spectrum Analyzer Level (dBuV) | Signal Generator Level (dBm) | Cable Loss* (dB) | Antenna Gain (dBd) | Corrected Signal Generator Level (dBc) | Margin (dB) |
|---|---|---|---|---|---|---|
| 1702.025 | 32.3 | -55.8 | 0.94 | 2.8 | 93.7 | -41.0 |
| 2553.038 | 42.7 | -49.5 | 1.22 | 3.4 | 87.1 | -34.3 |
| 3404.050 | 31.2 | -59.7 | 1.32 | 4.2 | 96.5 | -43.8 |
| 4255.063 | 43.5 | -44.0 | 1.43 | 5.2 | 80.0 | -27.2 |
| 5106.075 | 41.7 | -46.8 | 1.59 | 5.8 | 82.4 | -29.6 |
| 5957.088 | 37.2 | -52.3 | 1.64 | 5.2 | 88.5 | -35.8 |
| 6808.100 | 38.5 | -51.3 | 1.72 | 9.9 | 82.9 | -30.1 |
| 7659.113 | 33.2 | -54.7 | 1.8 | 7.4 | 88.8 | -36.1 |
| 8510.125 | 31.0 | -50.5 | 2.1 | 9.6 | 82.7 | -30.0 |

*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 Date |
|---|---|---|---|---|---|
| 901053 | Schaffner-Chase | CBL6112 | Antenna (25 MHz – 2 GHz) | 2648 | 07/03/04 |
| 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 | 07/15/04 |
| 900917 | Hewlett Packard | 8648C | Synthesized. Signal Generator (9 kHz - 3200 MHz) | 3537A01741 | 05/02/04 |
| 900928 | Hewlett Packard | HP 83752A | Synthesized Sweeper (.01 - 20 GHz) | 3610A00866 | 08/05/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS |  | OCTOBER 10, 2003 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

# 8 FCC RULES AND REGULATIONS PART 2 §2.1049 (C) (1): OCCUPIED BANDWIDTH

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

## 8.1 TEST PROCEDURE

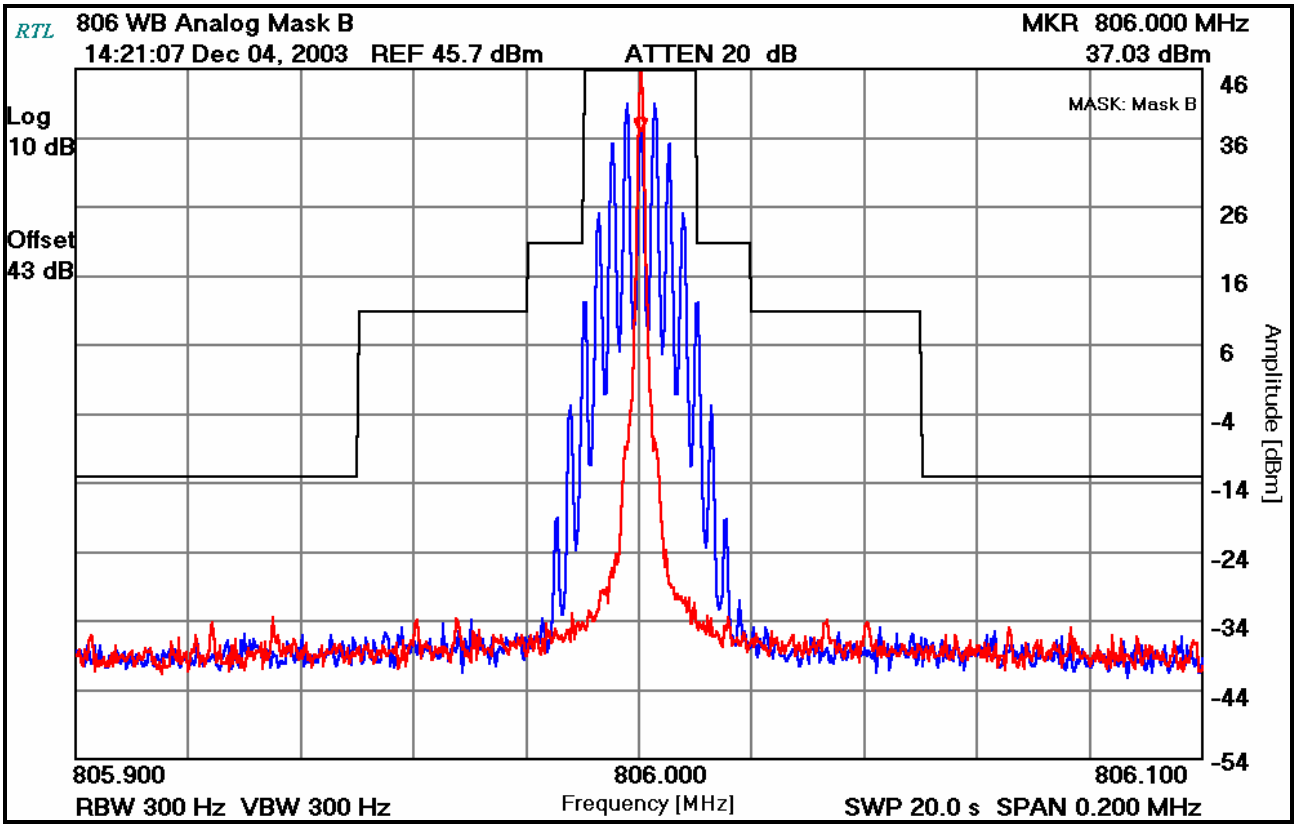
ANSI/TIA/EIA-603-2002, section 2.2.11 and TIA/EIA-102.CAAA-2002 section 2.2.5

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.

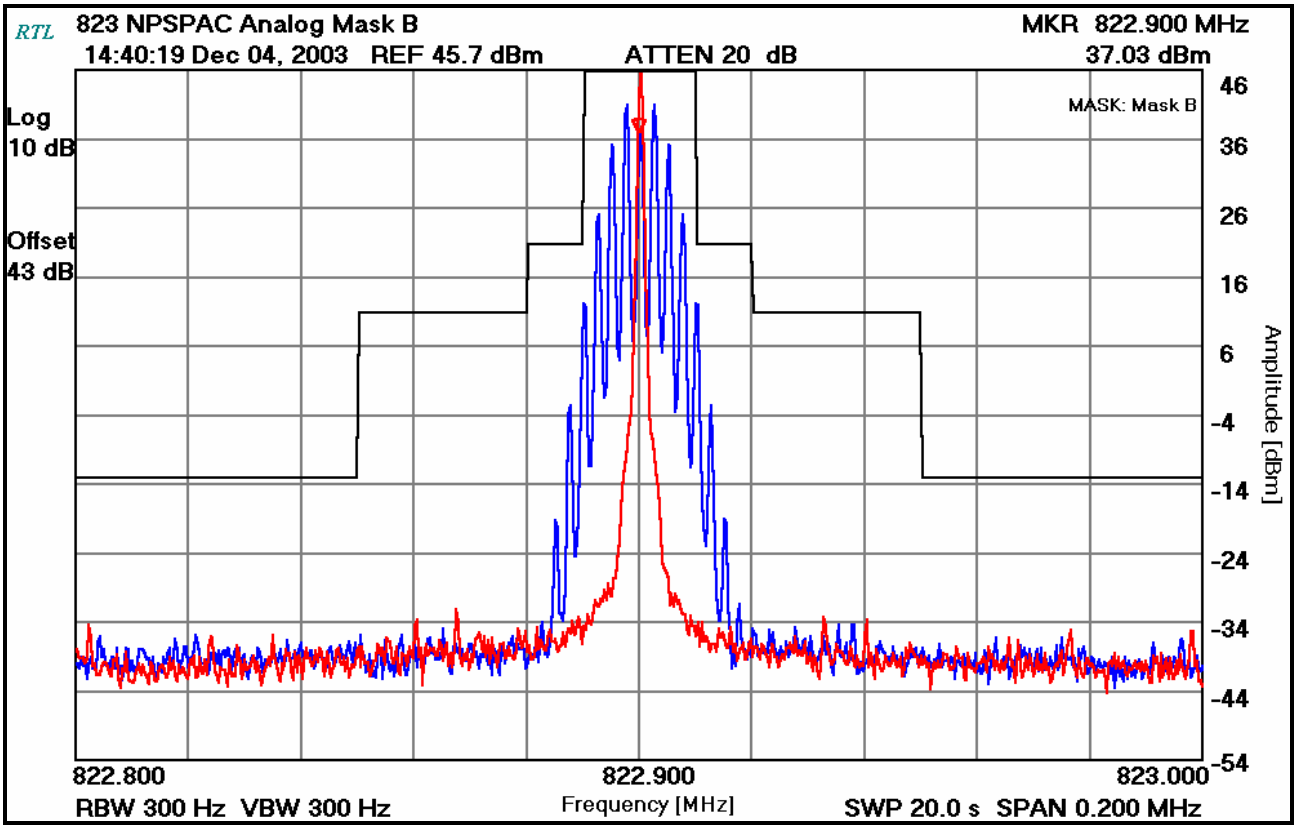
Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps

## 8.2 TEST DATA

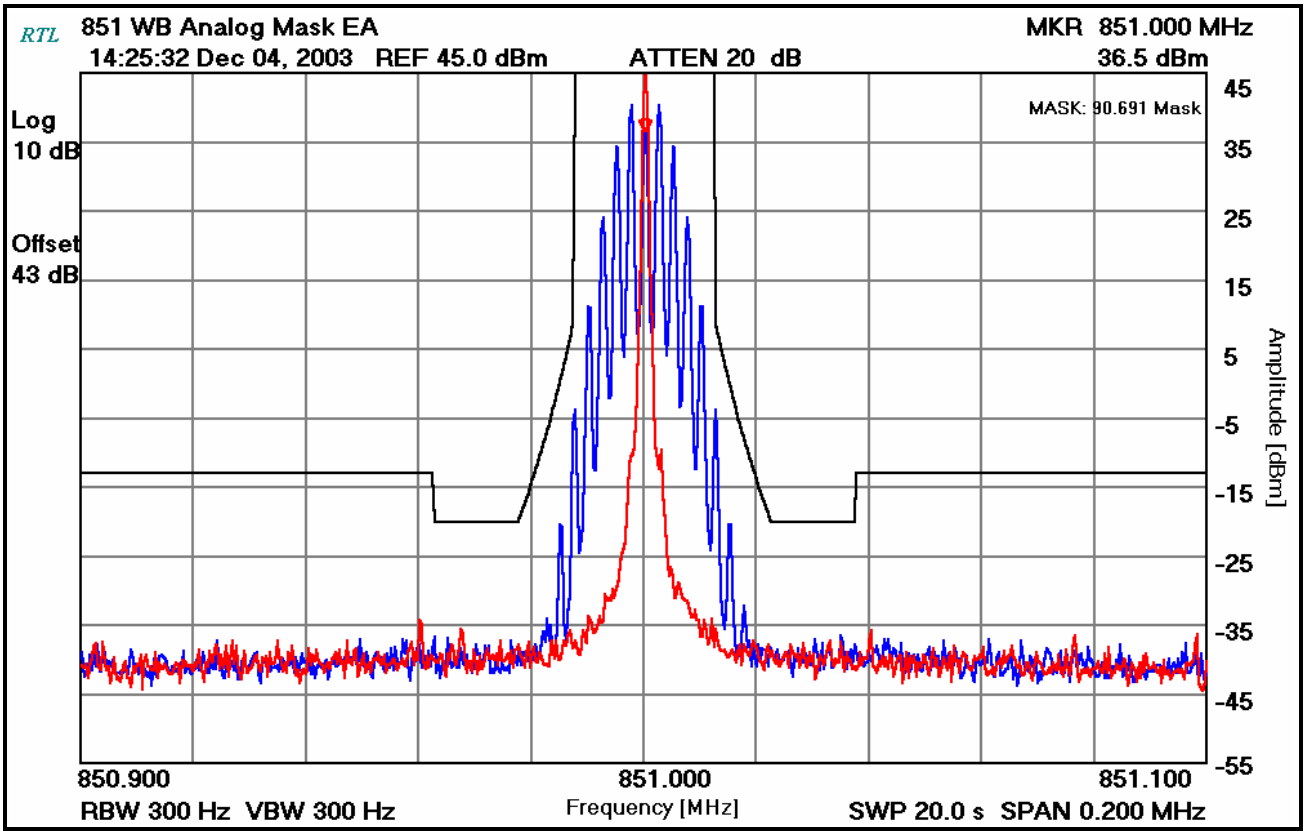
**PLOT 8-1: OCCUPIED BANDWIDTH; WIDE BAND; AUDIO MODULATION: 2,500 HZ (MASK B)**



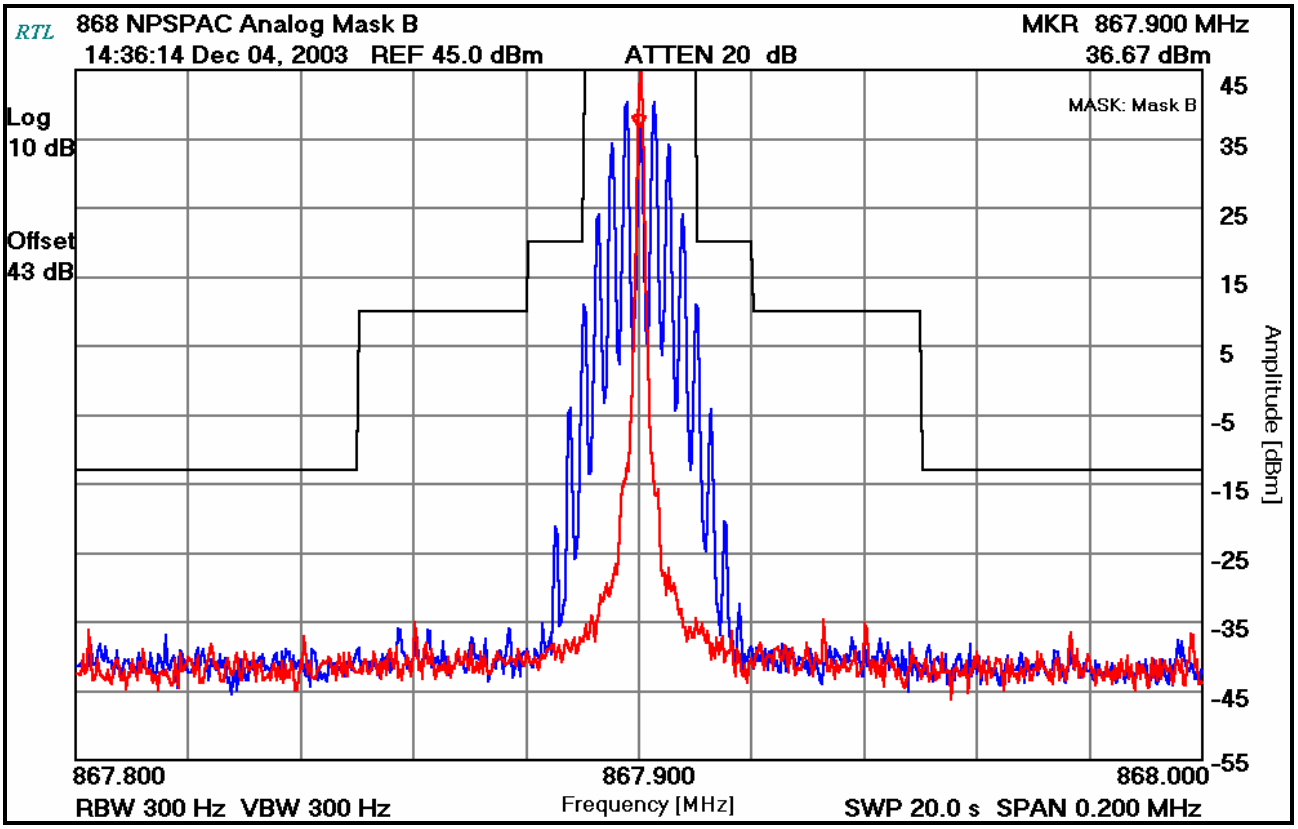
**PLOT 8-2: OCCUPIED BANDWIDTH; NPSPAC; AUDIO MODULATION: 2,500 HZ (MASK B)**



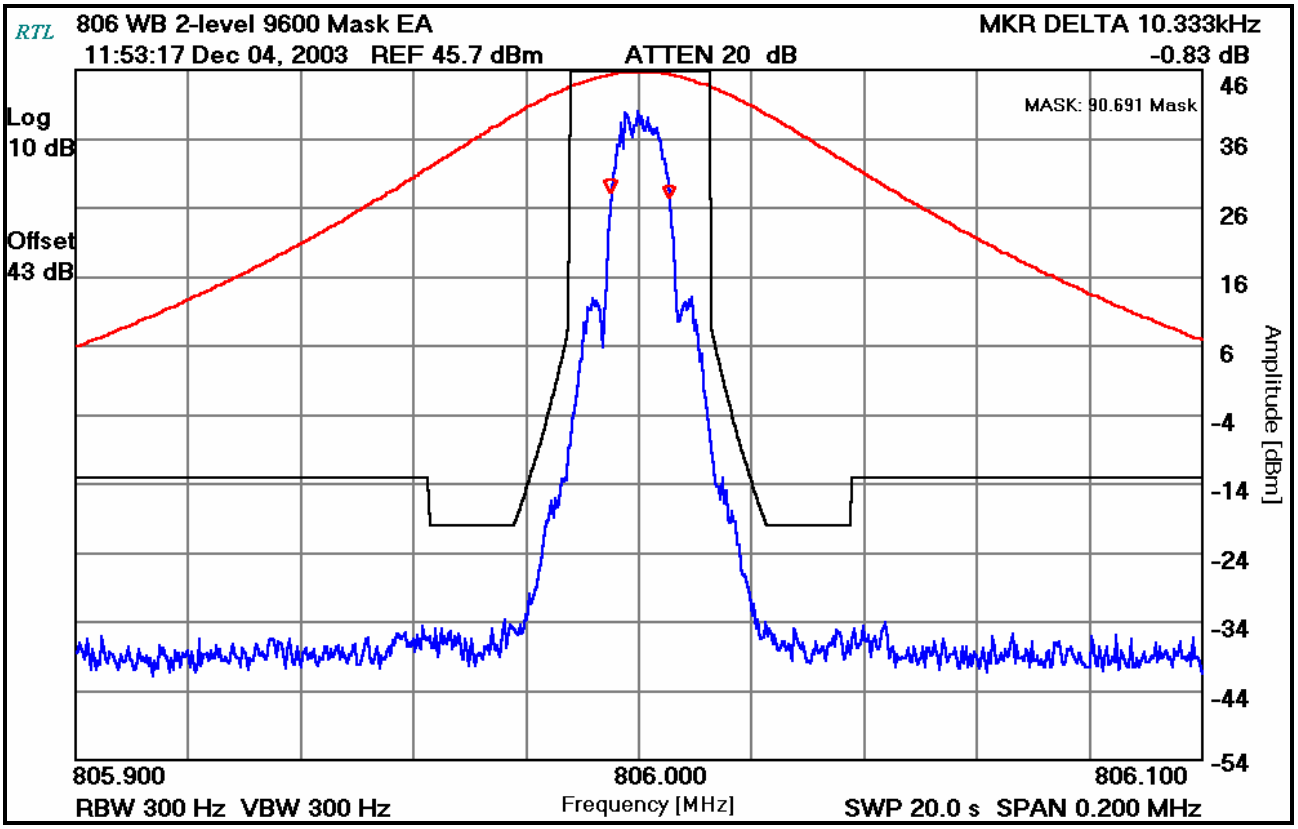
**PLOT 8-3: OCCUPIED BANDWIDTH; WIDE BAND; AUDIO MODULATION: 2,500 HZ (MASK EA)**



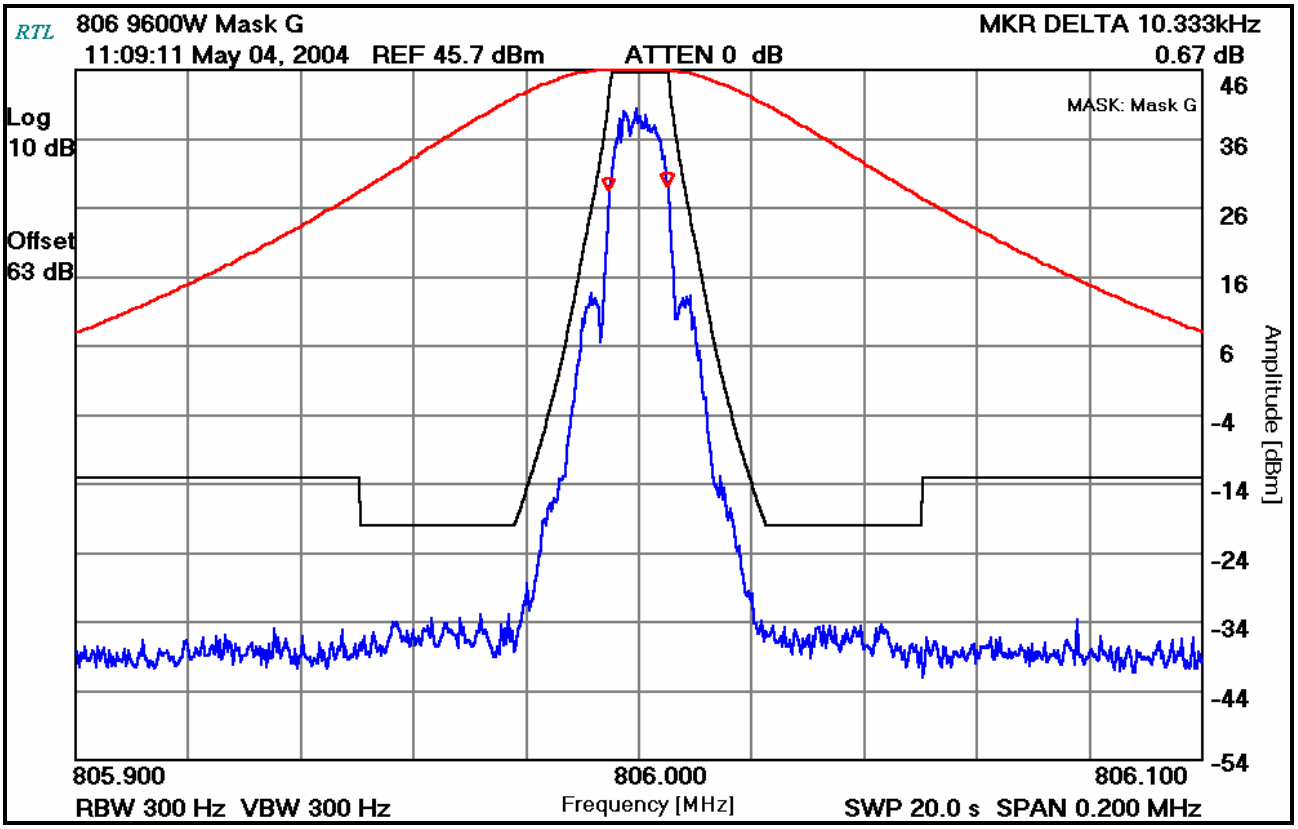
**PLOT 8-4: 99% OCCUPIED BANDWIDTH - NPSPAC; AUDIO MODULATION; (MASK B)**



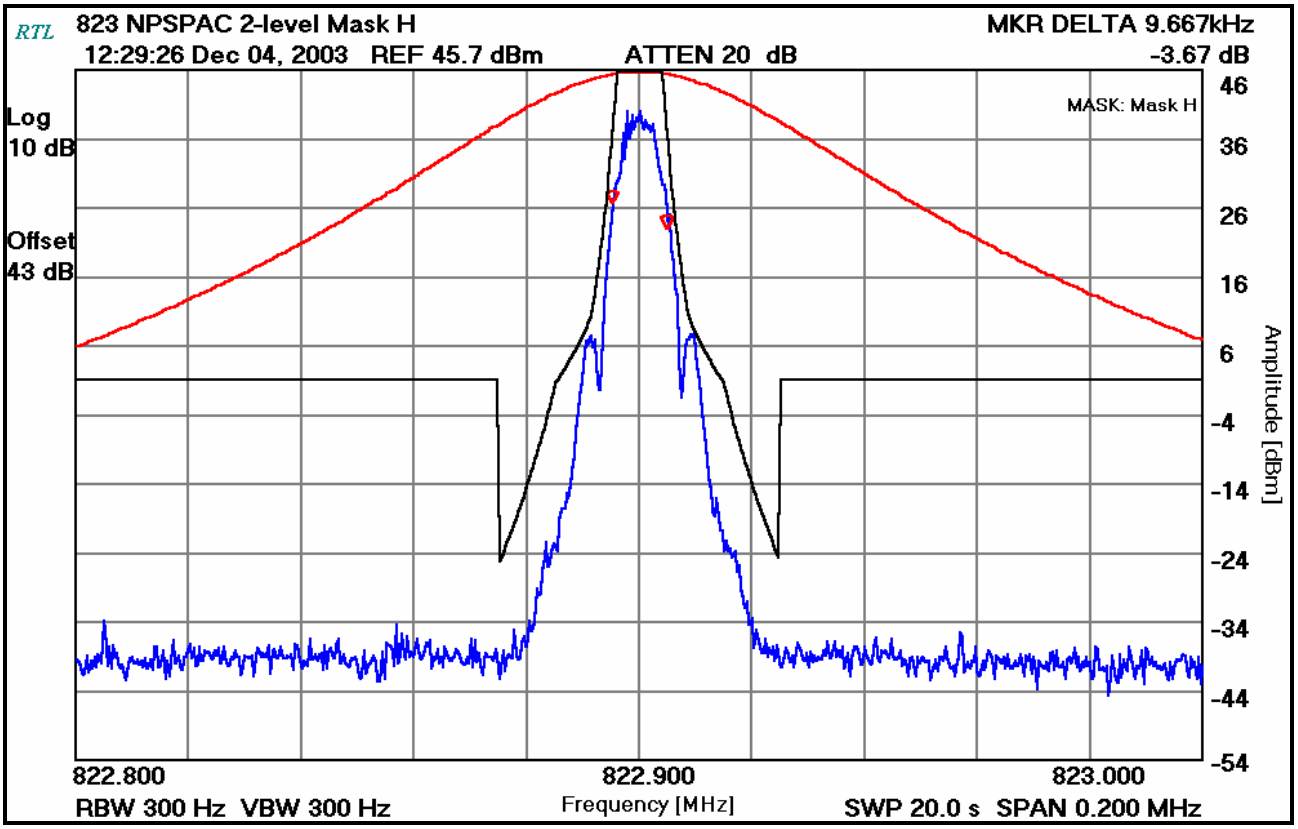
**PLOT 8-5: 99% OCCUPIED BANDWIDTH – 2-LEVEL; WIDE BAND; 9600; (MASK EA)**



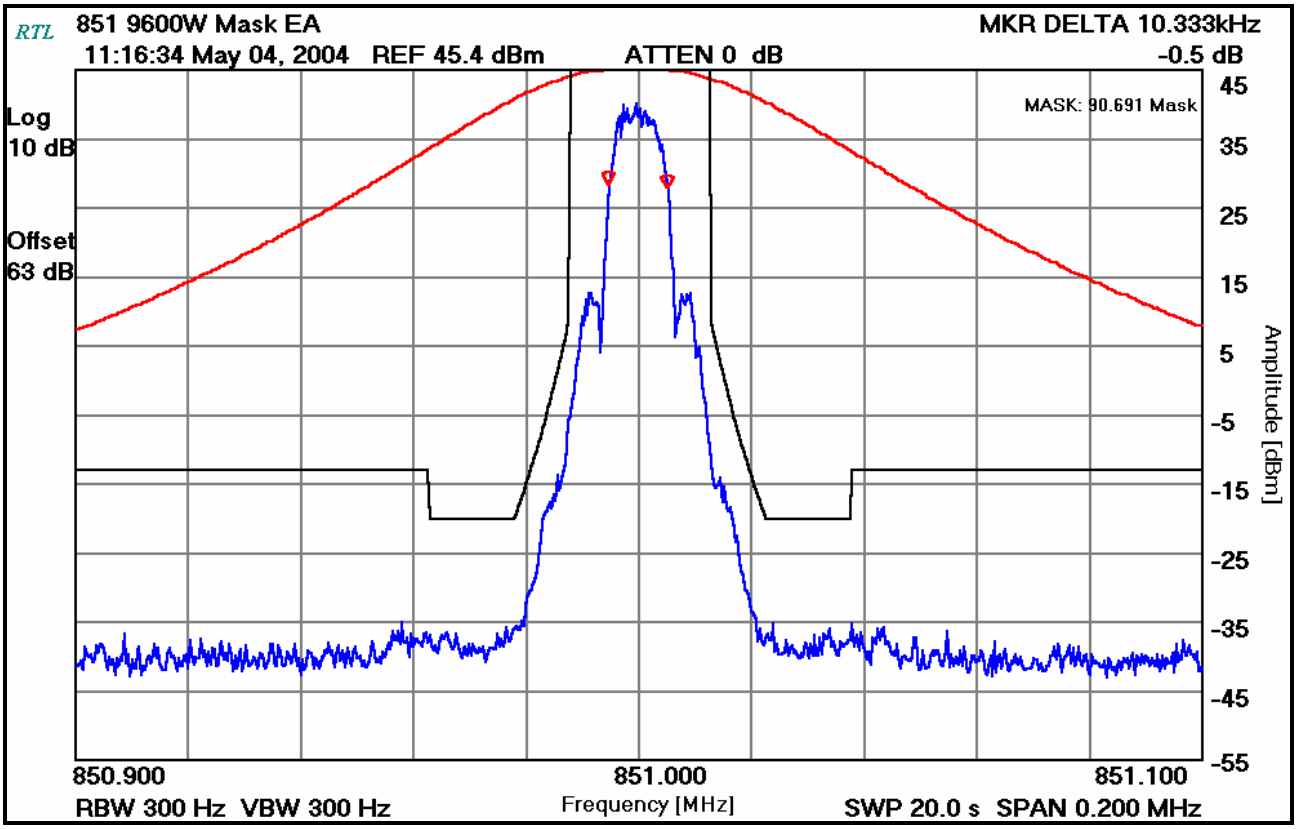
**PLOT 8-6: 99% OCCUPIED BANDWIDTH – 2-LEVEL; WIDE BAND; 9600; (MASK G)**



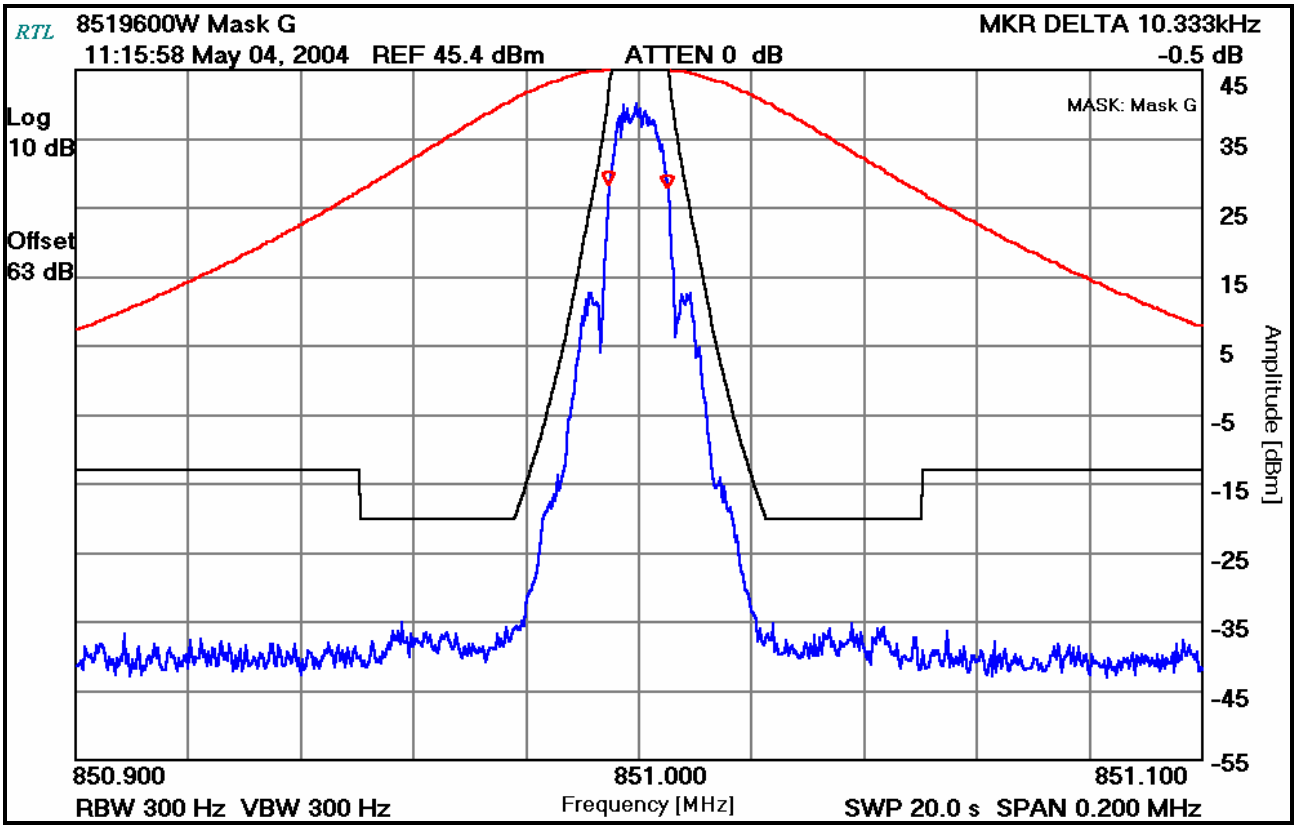
**PLOT 8-7: 99% OCCUPIED BANDWIDTH – 2-LEVEL; NPSPAC; 9600; (MASK H)**



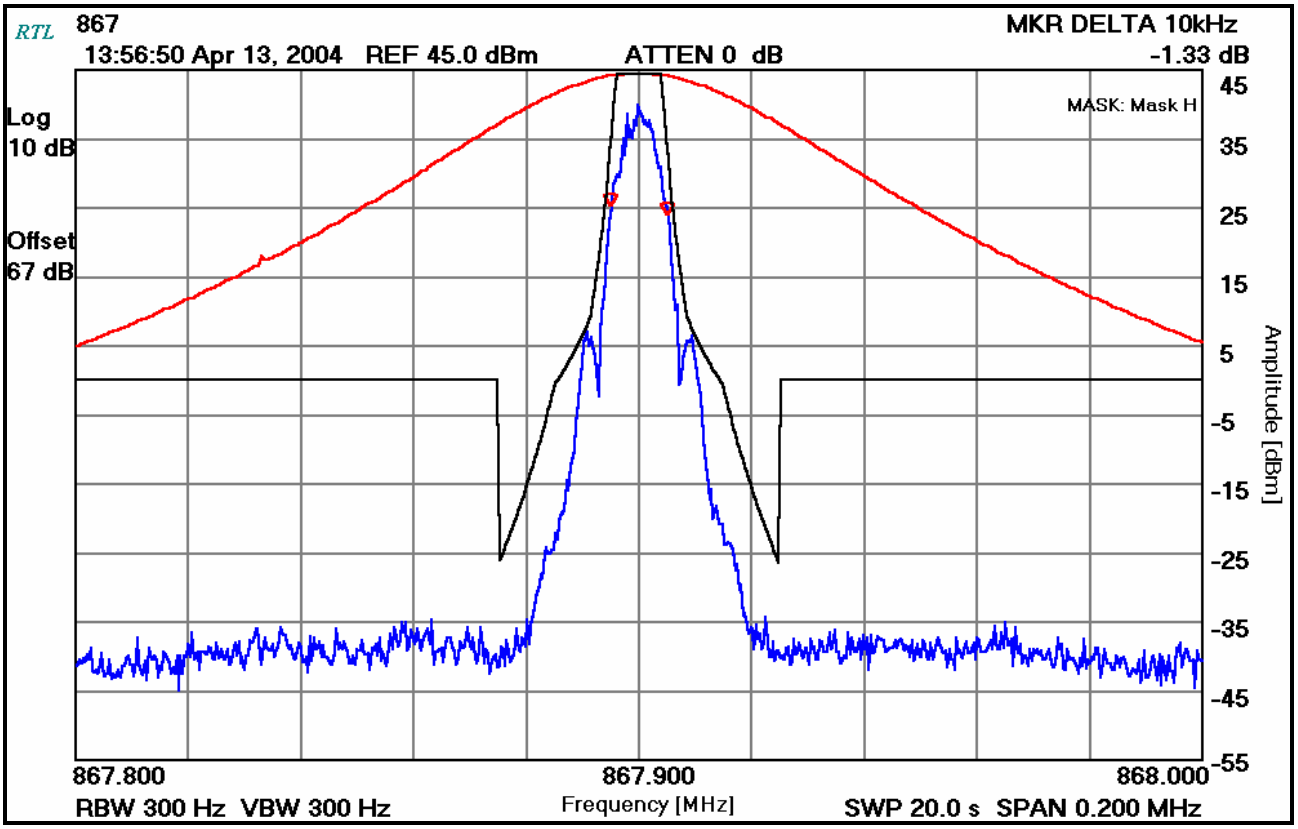
**PLOT 8-8: 99% OCCUPIED BANDWIDTH – 2-LEVEL; WIDE BAND; 9600; (MASK EA)**



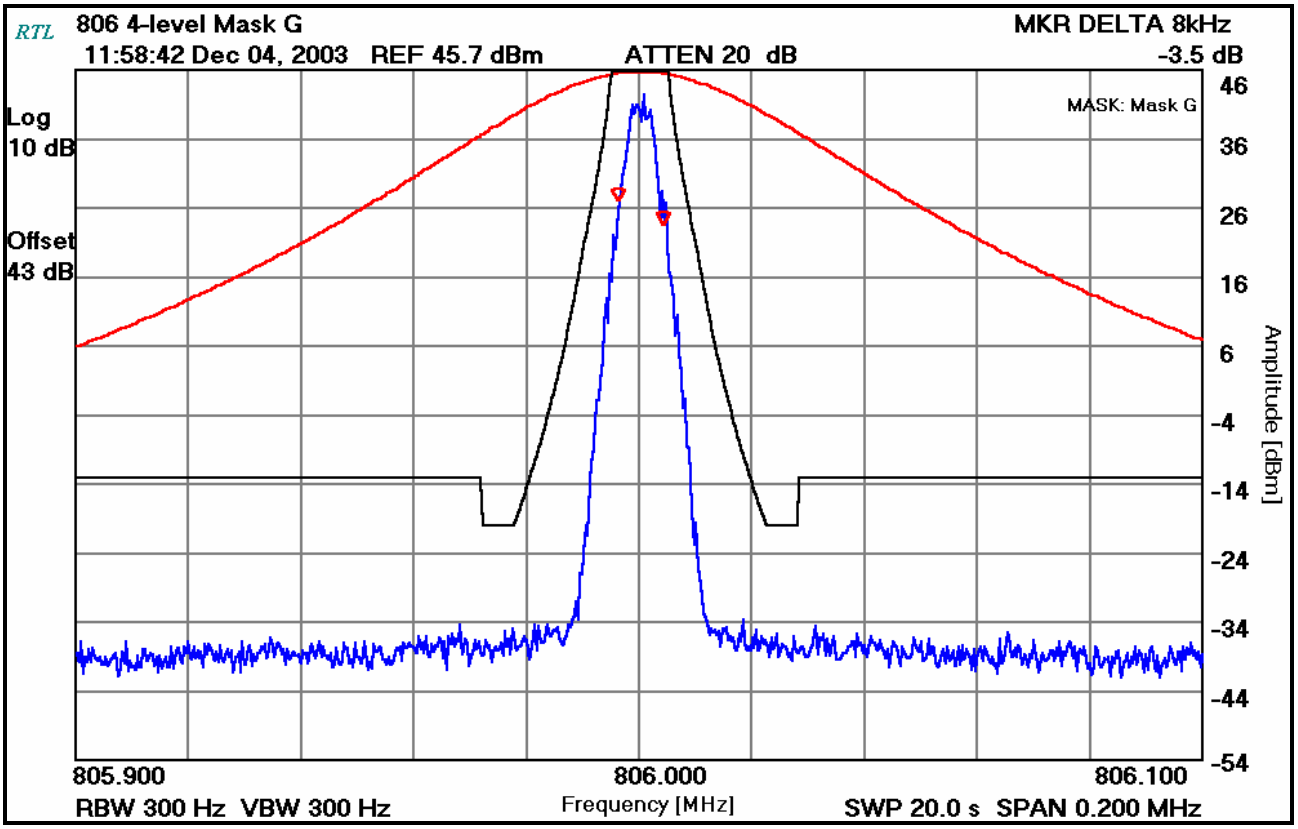
**PLOT 8-9: 99% OCCUPIED BANDWIDTH – 2-LEVEL; WIDE BAND; 9600; (MASK G)**



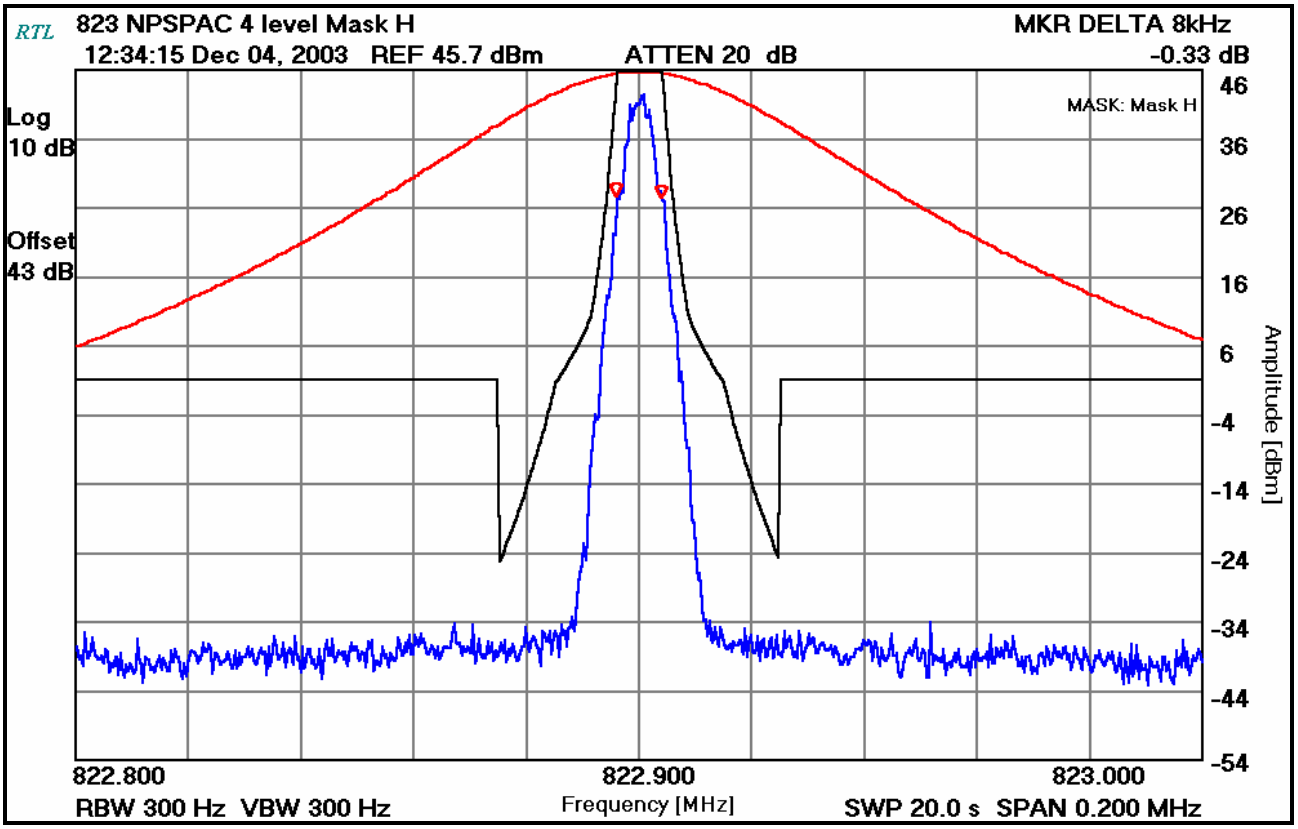
**PLOT 8-10: 99% OCCUPIED BANDWIDTH – 2-LEVEL; NPSPAC; 9600; (MASK H)**



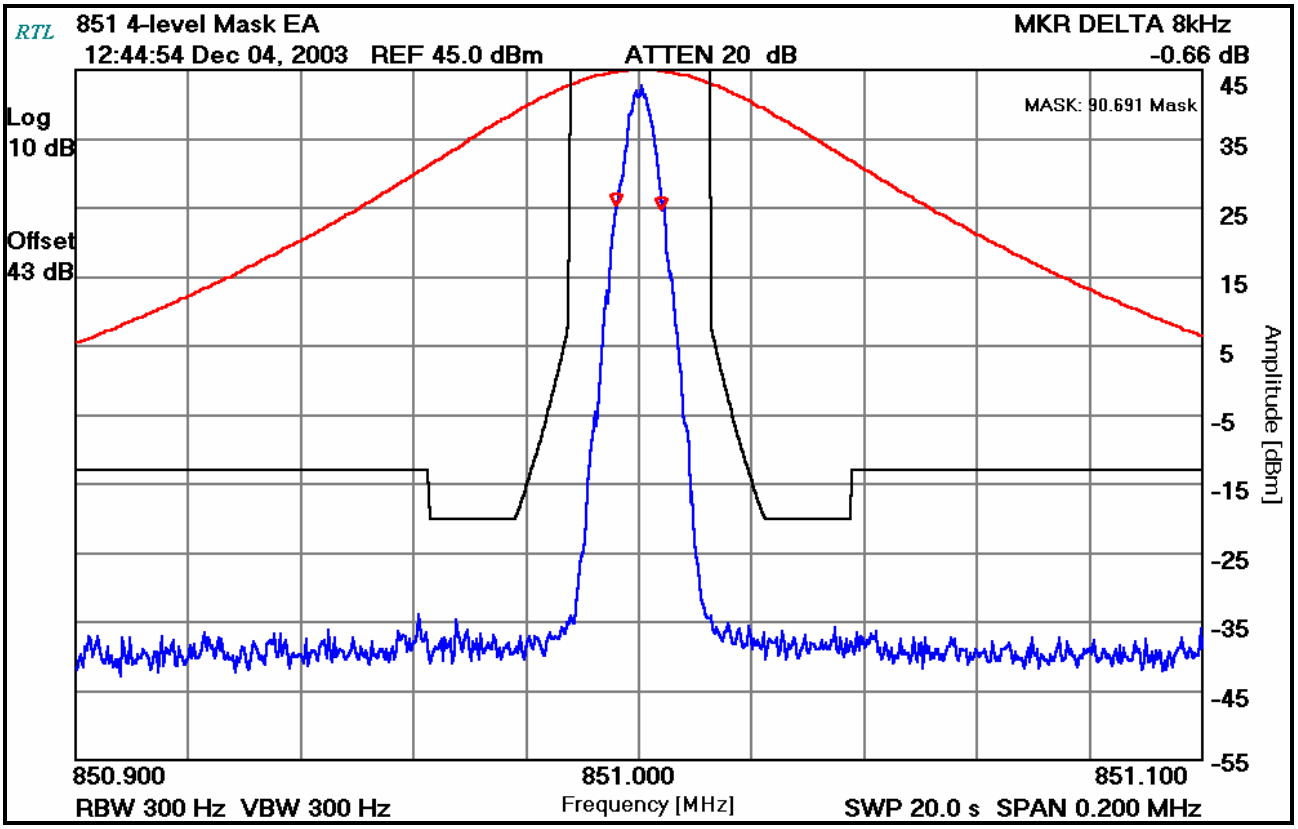
**PLOT 8-11: 99% OCCUPIED BANDWIDTH – 4-LEVEL; (MASK G)**



**PLOT 8-12: 99% OCCUPIED BANDWIDTH – 4-LEVEL; NPSPAC; (MASK H)**



**PLOT 8-13: 99% OCCUPIED BANDWIDTH – 4-LEVEL; (MASK EA)**



**PLOT 8-14: 99% OCCUPIED BANDWIDTH – 4-LEVEL; NPSPAC; (MASK H)**

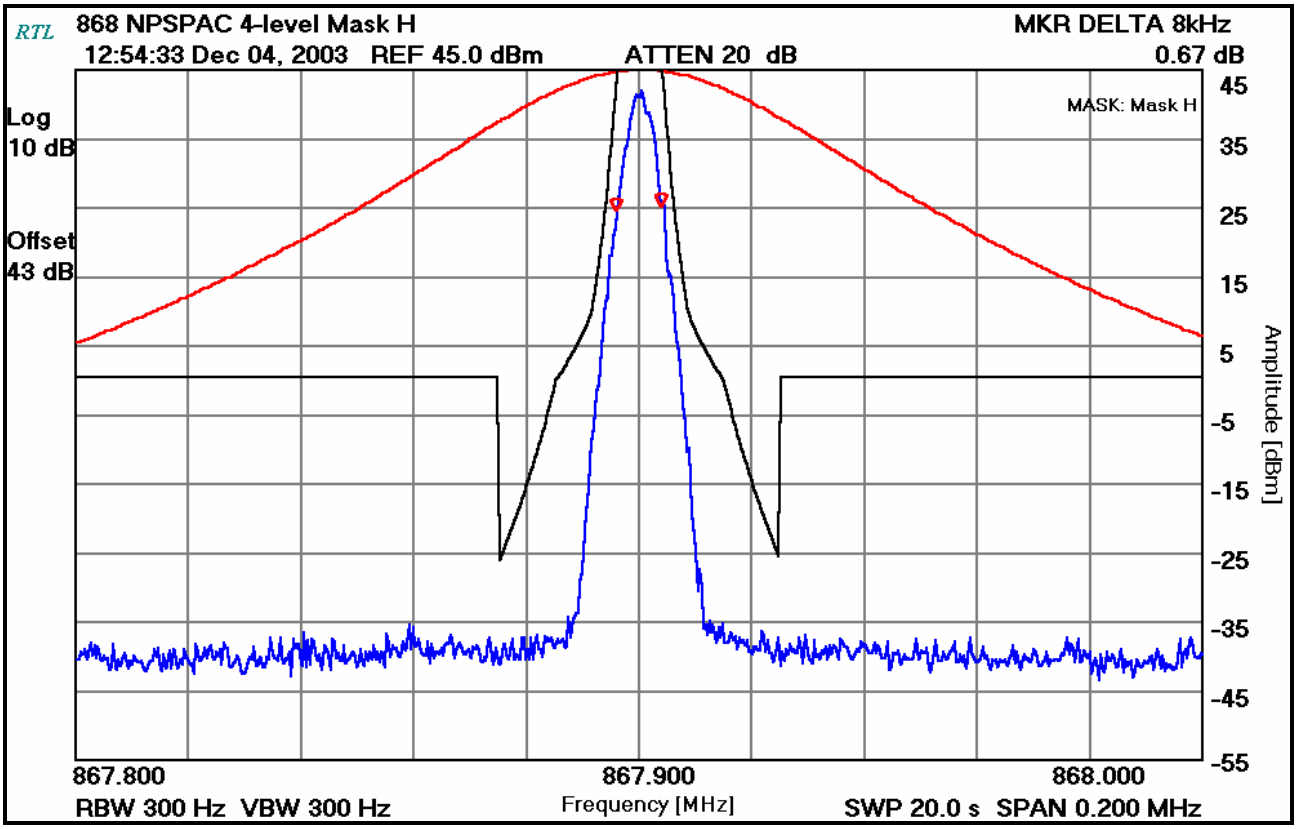



**TABLE 8-1: TEST EQUIPMENT USED FOR TESTING (OCCUPIED BANDWIDTH)**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 901020 | Hewlett Packard | 8564E | Portable Spectrum Analyzer (9 kHz - 40 GHz) | 3943A01719 | 07/15/04 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS | Daniel Biggs | DECEMBER 4, 2003, APRIL 13, 2004 & MAY 4, 2004 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

# 9 FCC RULES AND REGULATION PART 2 §2.1055: 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 ½ 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 +/-15% nominal input voltage.

The worst-case test data are shown below in Table 9-1 and Table 9-3.

## 9.2 TEST DATA

### 9.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

Limit is 1.5 ppm for a mobile device from 806-870 MHz. Worst-case deviation was found to be .98 ppm at -20°C.

**PLOT 9-1: TEMPERATURE FREQUENCY STABILITY**

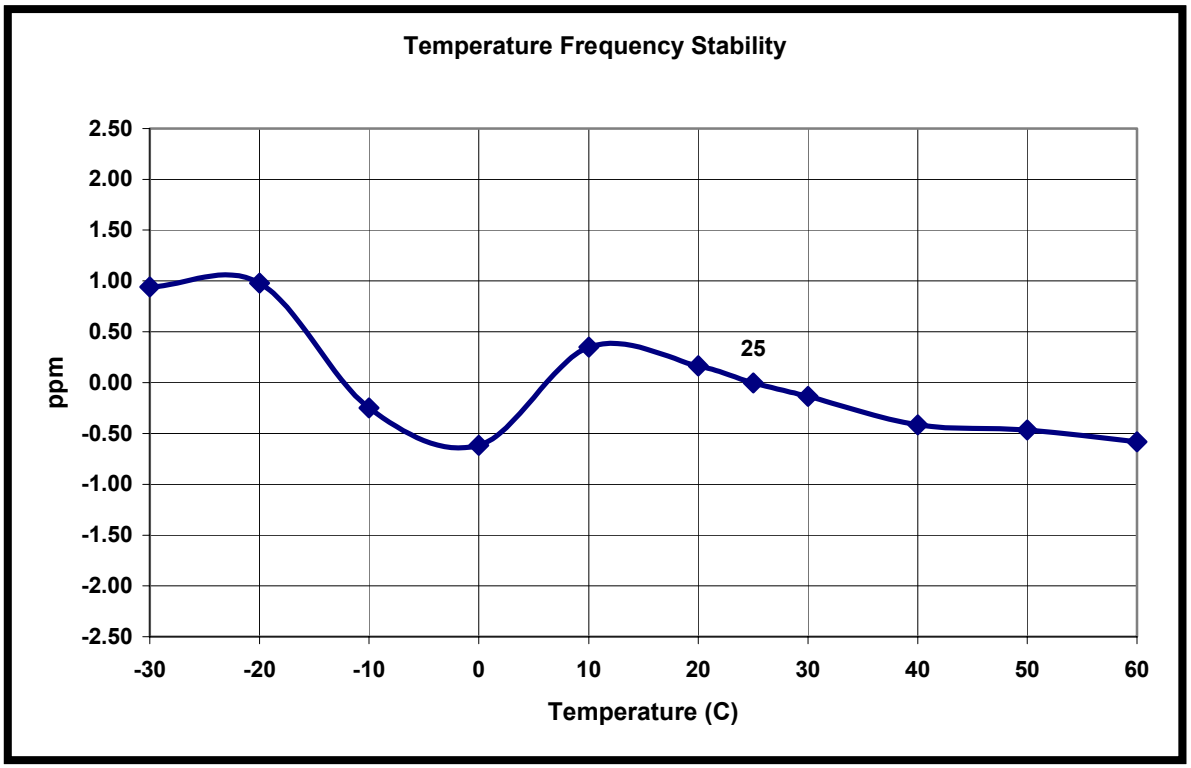



**TABLE 9-1: TEMPERATURE FREQUENCY STABILITY CHANNEL 2, 851.000 MHZ**

| Temperature C | Measured Frequency (MHz) | ppm |
|---|---|---|
| -30 | 851.001563 | 0.94 |
| -20 | 851.001595 | 0.98 |
| -10 | 851.000553 | -0.25 |
| 0 | 851.000239 | -0.62 |
| 10 | 851.001060 | 0.35 |
| 20 | 851.000903 | 0.16 |
| 25 | 851.000763 | 0.00 |
| 30 | 851.000650 | -0.13 |
| 40 | 851.000410 | -0.41 |
| 50 | 851.000368 | -0.46 |
| 60 | 851.000268 | -0.58 |

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

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 900946 | Tenney Engineering, Inc. | TH65 | Temperature Chamber with Humidity | 11380 | 02/03/05 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS |  | DECEMBER 10, 2003 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

### 9.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION

Worst-case variation is .21 ppm at the 15.87 vdc.

**PLOT 9-2: VOLTAGE FREQUENCY STABILITY**

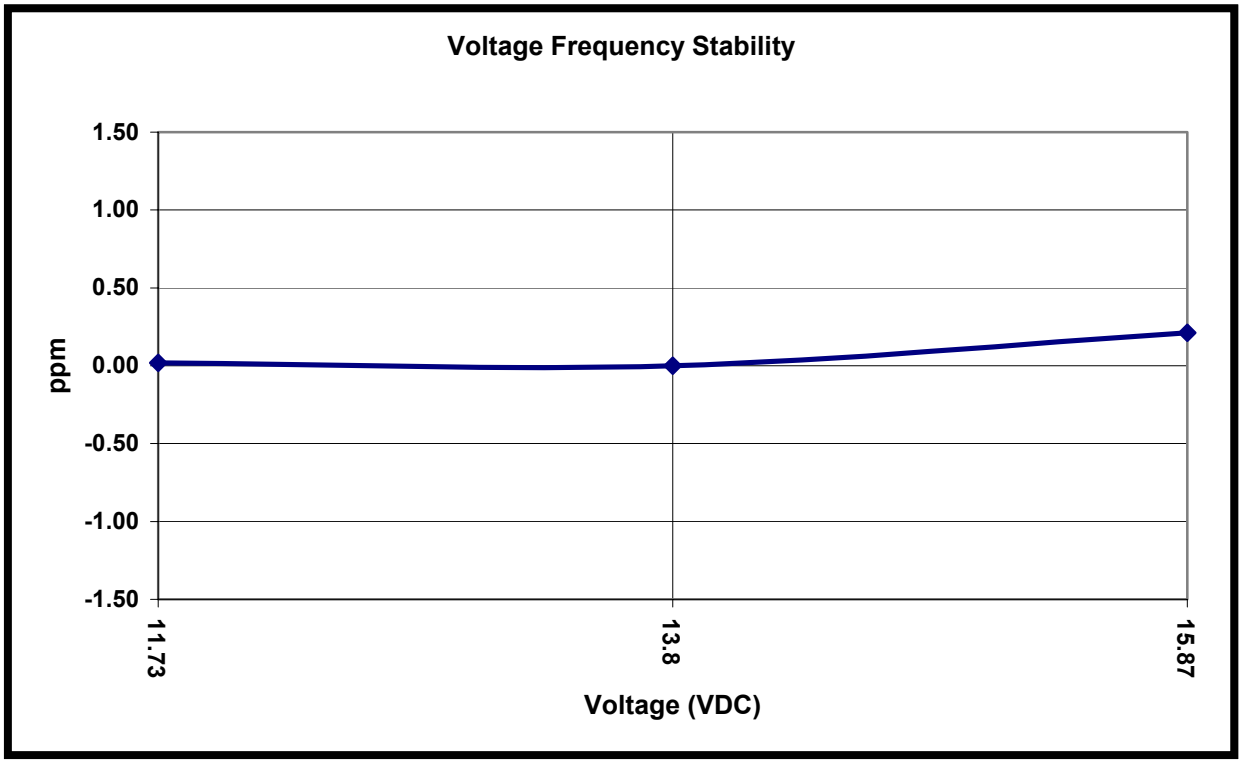



**TABLE 9-3: FREQUENCY STABILITY/VOLTAGE VARIATION CHANNEL 2, 851.000 MHZ**

| Voltage (VDC) | Measured Frequency (MHz) | ppm |
|---|---|---|
| 11.73 | 851.000700 | 0.02 |
| 13.8 | 851.000685 | 0.00 |
| 15.87 | 851.000865 | 0.21 |

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

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 901020 | Hewlett Packard | 8564E | Portable Spectrum Analyzer (9 kHz - 40 GHz) | 3943A01719 | 07/15/04 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS |  | DECEMBER 10, 2003 |
| 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 {25 KHZ CHANNEL BANDWIDTH}**

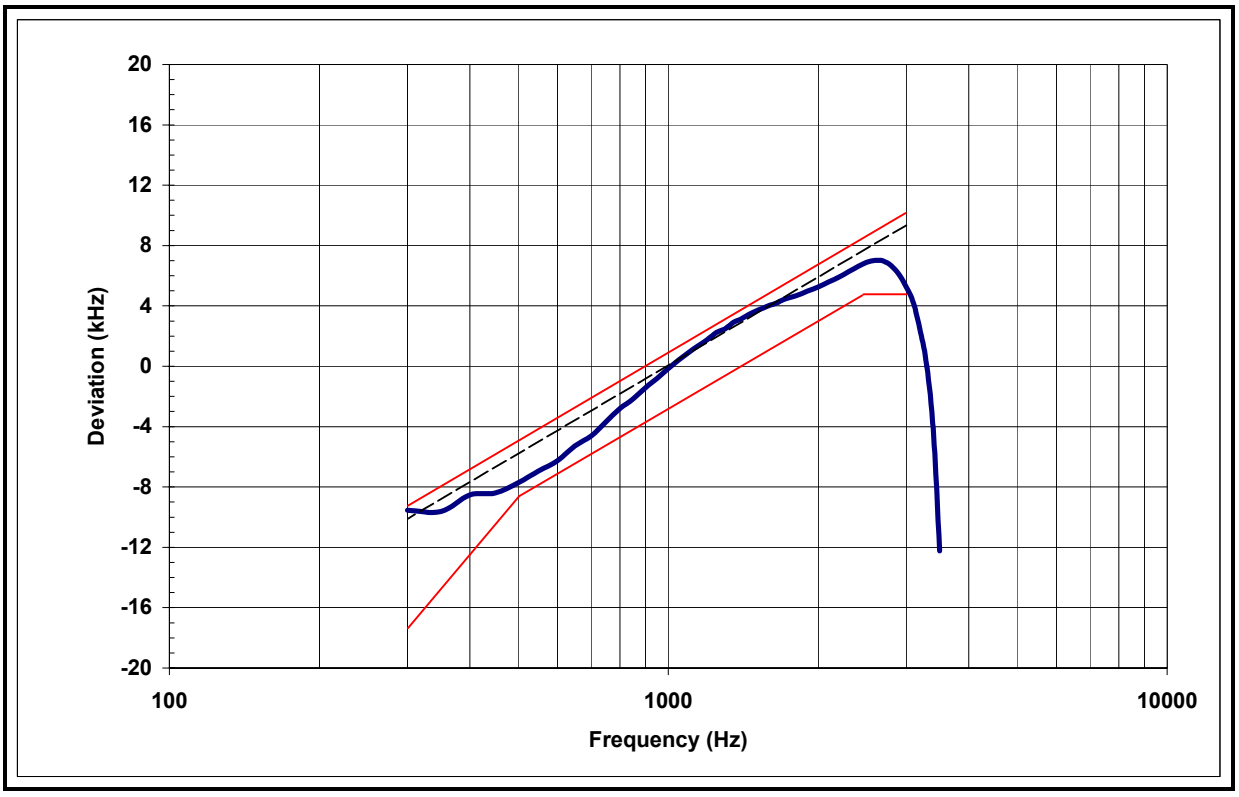


**TABLE 10-1: TEST EQUIPMENT USED FOR TESTING (AUDIO FREQUENCY RESPONSE)**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 08/06/04 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |
| 901054 | Hewlett Packard | HP 3586B | Selective Level Meter | 1928A01892 | 09/09/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS |  | OCTOBER 29, 2003 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

## 11 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS – 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**

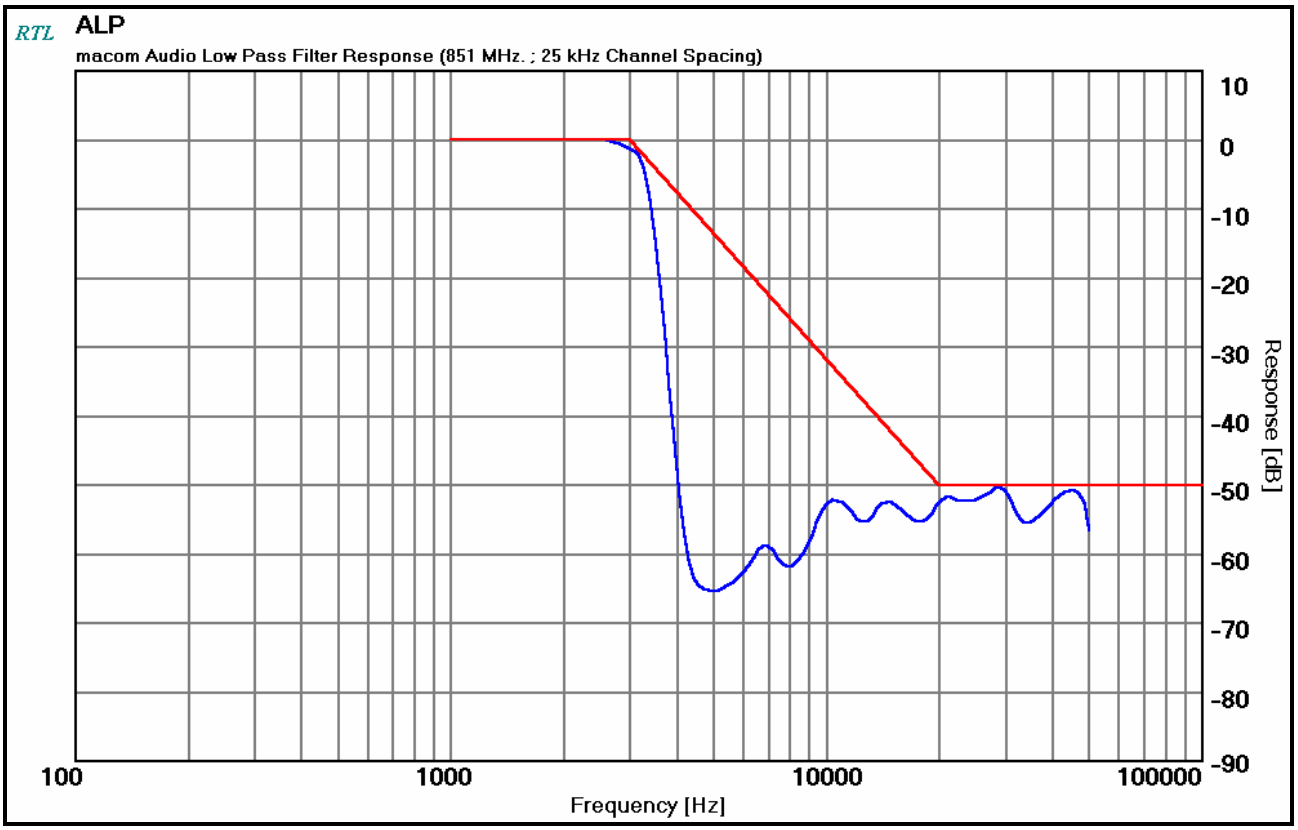


**TABLE 11-1: TEST EQUIPMENT USED FOR TESTING (AUDIO LOW PASS FILTER RESPONSE)**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 08/06/04 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |
| 901054 | Hewlett Packard | HP 3586B | Selective Level Meter | 1928A01892 | 09/09/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS |  | OCTOBER 29, 2003 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

## 12 FCC RULES AND REGULATIONS PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING

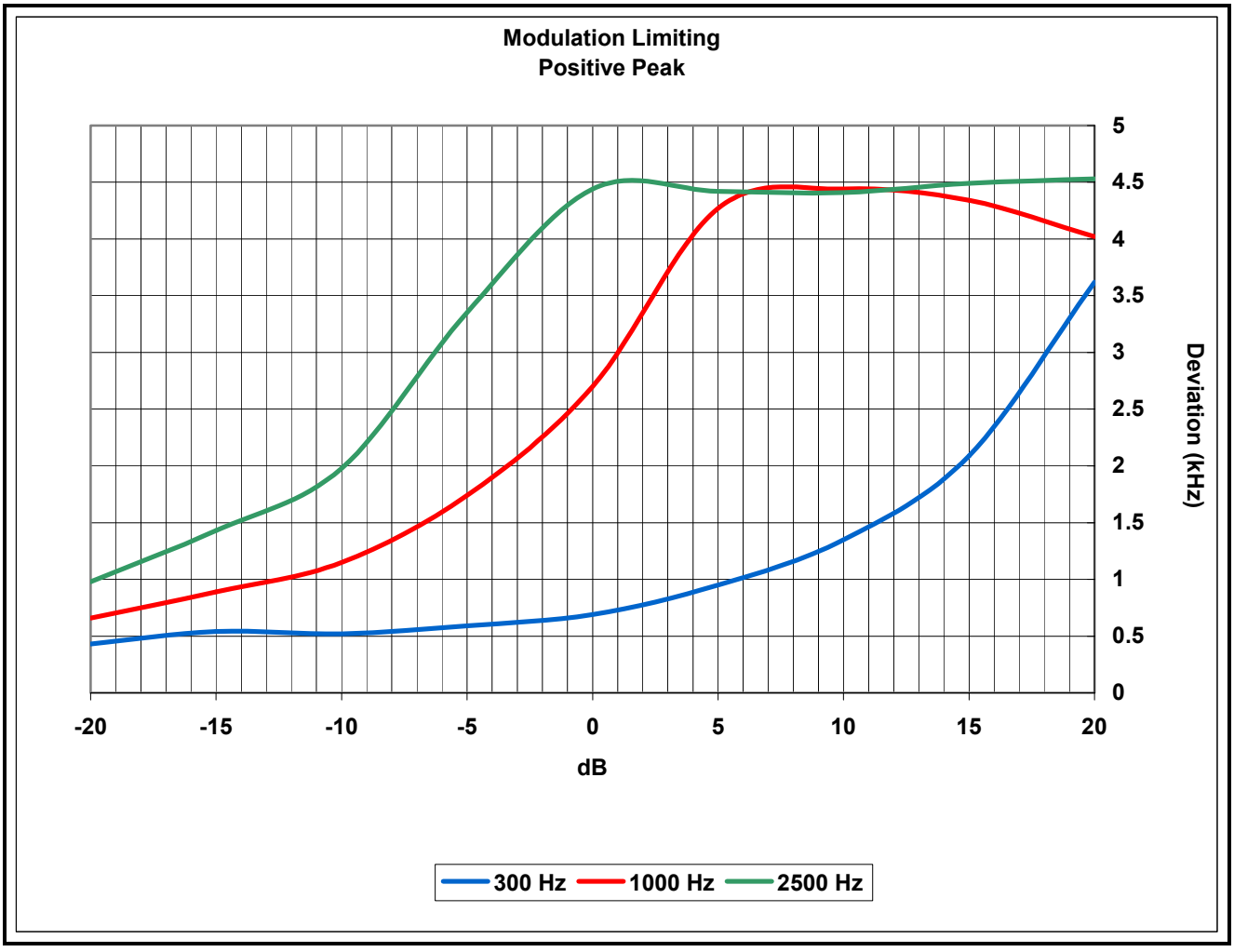
### 12.1 TEST PROCEDURE

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

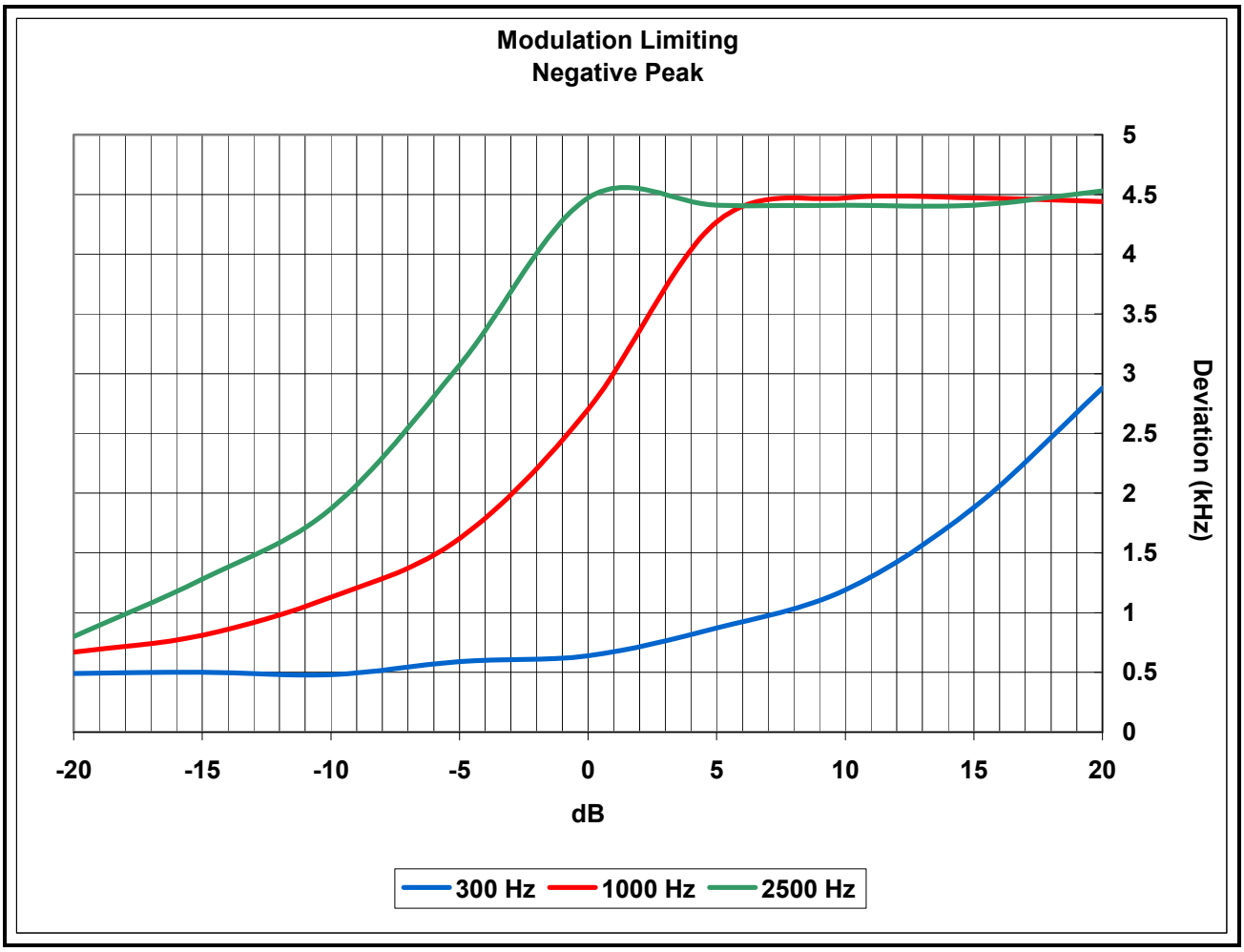
The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0dB) the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz.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

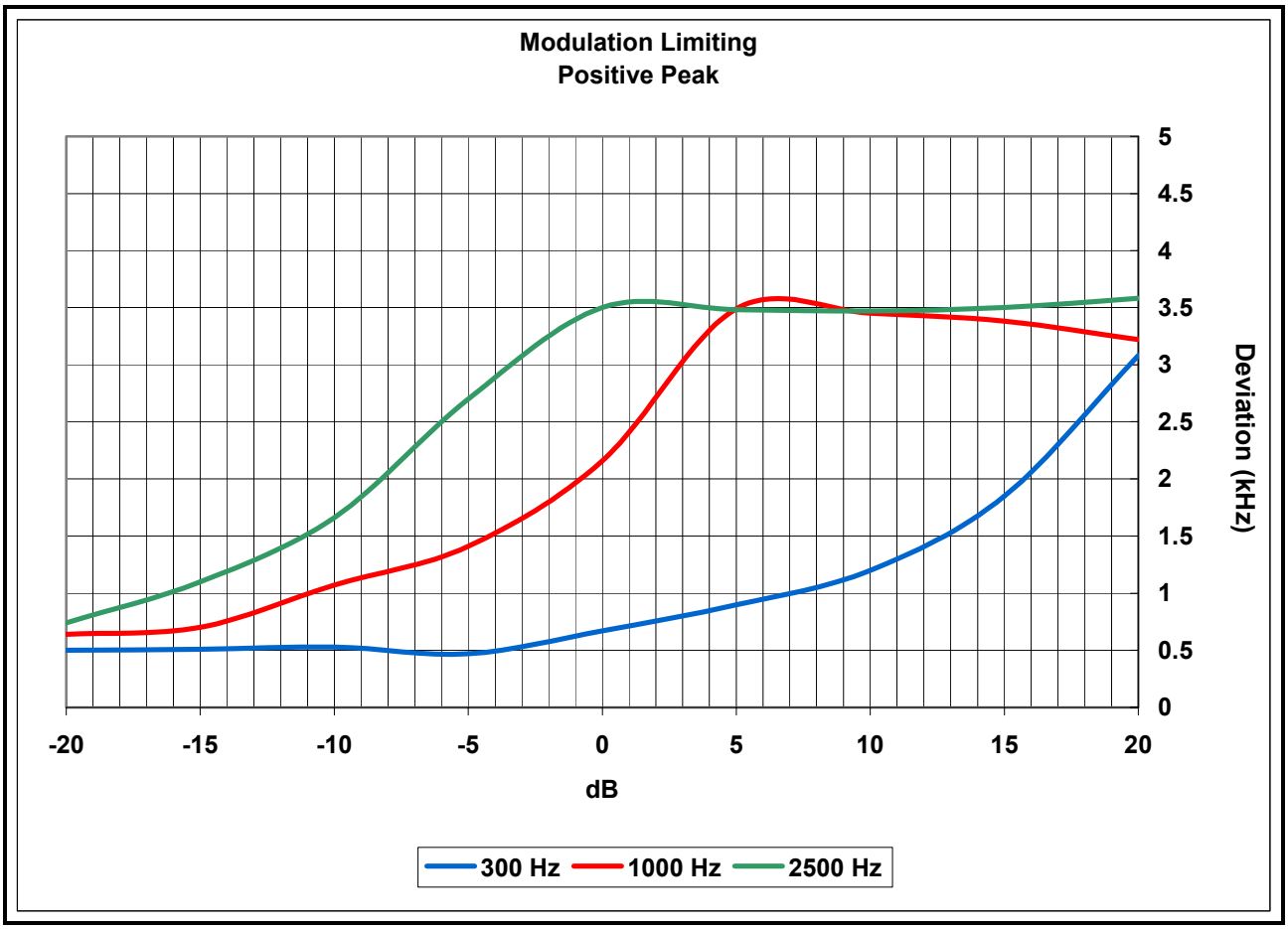
**PLOT 12-1: MODULATION CHARACTERISTICS – MODULATION LIMITING: WIDE BAND; POSITIVE PEAK**



**PLOT 12-2: MODULATION CHARACTERISTICS – MODULATION LIMITING: WIDE BAND; NEGATIVE PEAK**



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



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

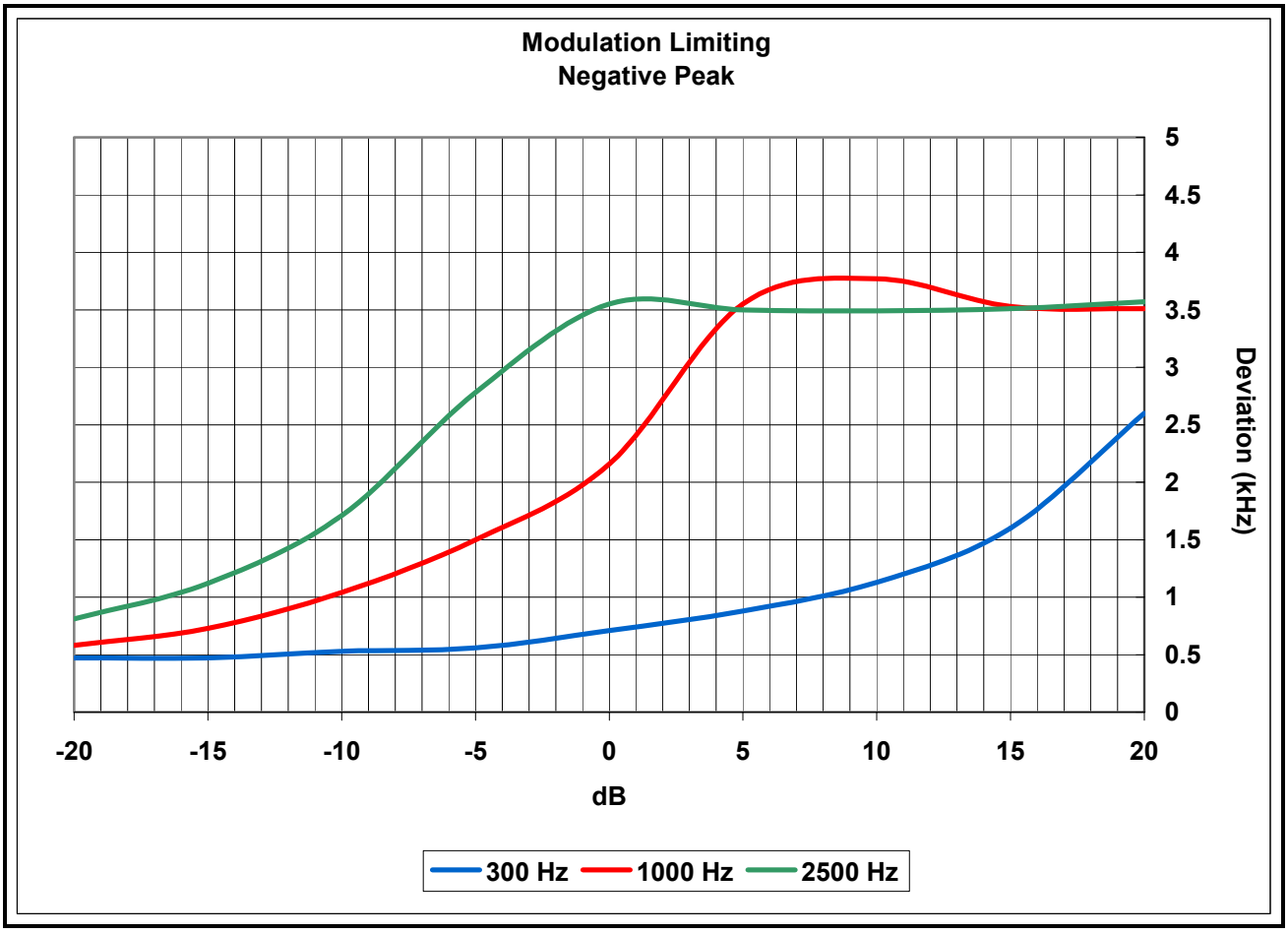



**TABLE 12-1: TEST EQUIPMENT USED FOR TESTING (MODULATION LIMITING)**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 08/06/04 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |
| 901054 | Hewlett Packard | HP 3586B | Selective Level Meter | 1928A01892 | 09/09/04 |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS | Daniel Biggs | OCTOBER 29, 2003 |
| TEST TECHNICIAN/ENGINEER | SIGNATURE | DATE OF TEST |

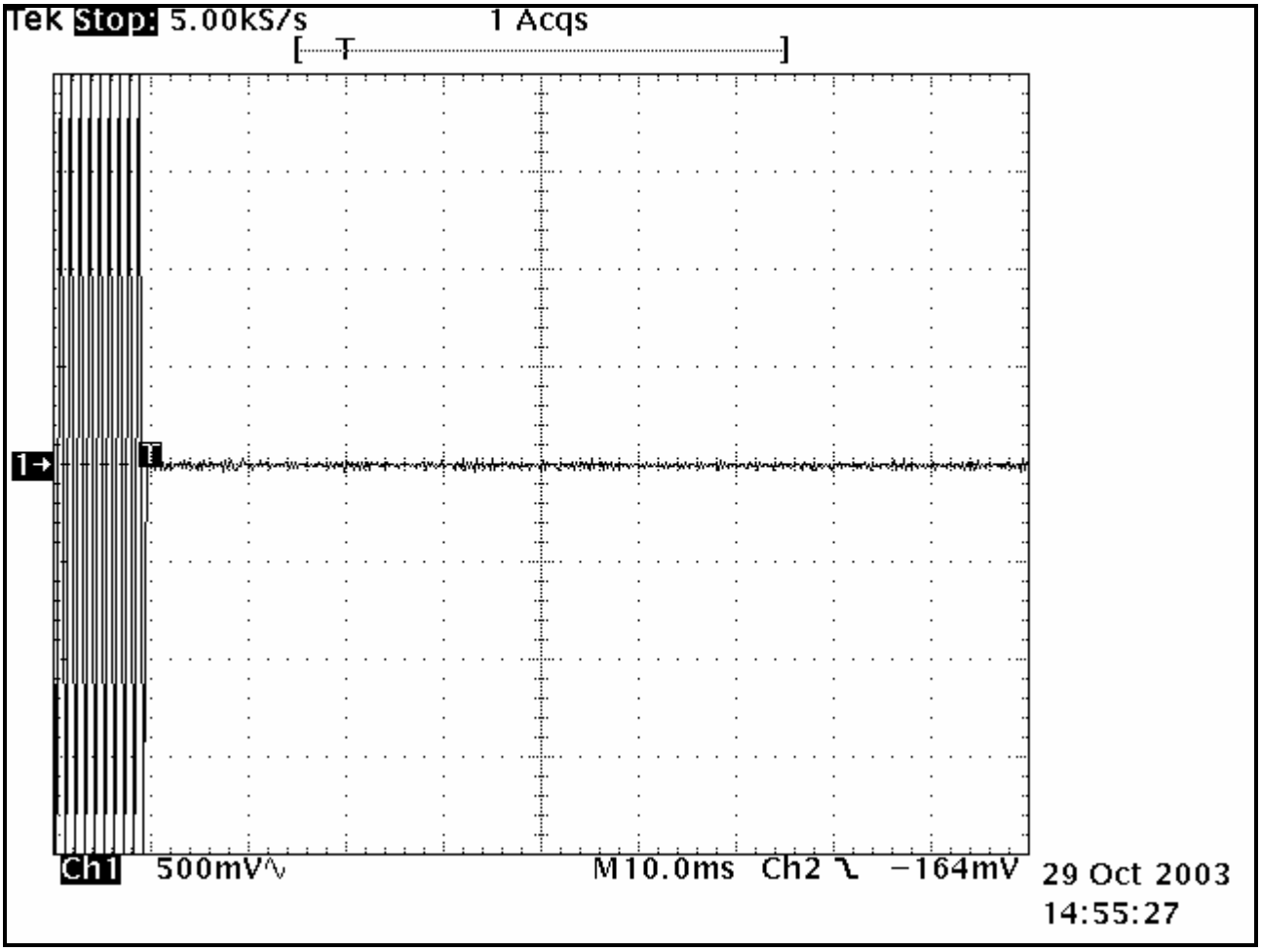
## 13 FCC RULES AND REGULATIONS PART 90 §90.214: TRANSIENT FREQUENCY BEHAVIOR

### 13.1 TEST PROCEDURE

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

### 13.2 TEST DATA

**PLOT 13-1: TRANSIENT FREQUENCY BEHAVIOR – 851 MHZ; HIGH POWER; WIDE BAND; CARRIER ON TIME**



**PLOT 13-2: TRANSIENT FREQUENCY BEHAVIOR – 851 MHZ; HIGH POWER; WIDE BAND; CARRIER OFF TIME**

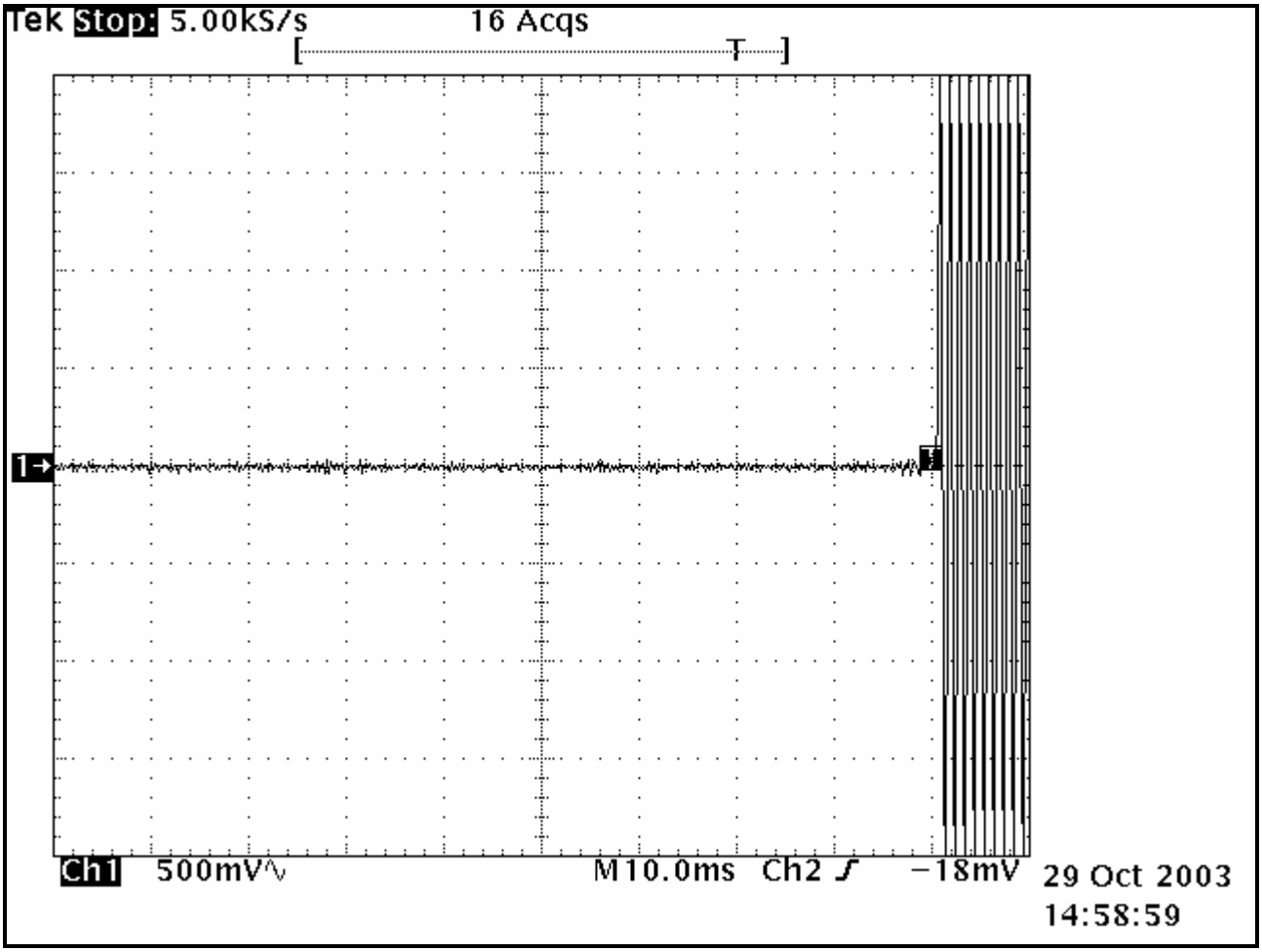



**TABLE 13-1: TEST EQUIPMENT USED FOR TESTING (TRANSIENT FREQUENCY BEHAVIOR)**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Date |
|---|---|---|---|---|---|
| 900917 | Hewlett Packard | 8648C | Signal Generator | 3537A01741 | 05/02/04 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 06/18/04 |
| 900561 | Tektronix | TDS540B | Oscilloscope | B020129 | 02/19/04 |
| 900352 | Werlatone | C1795 | Directional Coupler | 4989 | N/A |

TEST PERSONNEL:

| | | |
|---|---|---|
| DANIEL BIGGS | Daniel Biggs | OCTOBER 29, 2003 |
| 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

Necessary Bandwidth and Emission Bandwidth:

**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 – NPSPAC**
Calculation:
Max modulation(M) in kHz: 2.4
Max deviation (D) in kHz: 4
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 12.8 kHz
Emission designator: 12K8F3E

**Digital voice and data – 25 kHz separation**
**9600 Baud**
Measurement: 99.0% Occupied Bandwidth
Bn = 10.33 kHz
Emission designator: 10K3F1D, 10K3F1E

**Digital voice and data – NPSPAC**
**9600 Baud**
Measurement: 99.0% Occupied Bandwidth
Bn = 10.0 kHz
Emission designator: 10K0F1D, 10K0F1E

**C4FM –**
Measurement: 99.0% Occupied Bandwidth
Bn = 8.0 kHz
Emission designator: 8K0F1D, 8K0F1E

## 15 CONCLUSION

The data in this measurement report shows that the **M/A-COM, Inc**. Model **M7100IP 800 MHz Mobile Radio; FCC ID: OWDTR-0022-E,** complies with all the requirements of Parts 90, 15 and 2 of the FCC Rules, and Industry Canada RSS-119, Issue 6, 2000.