Engineering and Testing for EMC and Safety Compliance

Accredited under NVLAP Lab Code 200061-0

# Certification Report

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## MODEL: MASTR III VHF Base Station (136–154 MHz)

### FCC ID: OWDTR-0048-E
### IC: 3636B-0048

***June 8, 2007***

| Standards Referenced for this Report | |
|---|---|
| Part 2: 2006 | Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| Part 15: 2006 | Radio Frequency Devices - §15.109: Radiated Emissions Limits |
| Part 90: 2006 | Private Land Portable Radio Services |
| ANSI TIA-603-C-2004 | Land Portable FM or PM Communications Equipment - Measurement and Performance Standards |
| ANSI TIA/EIA–102.CAAA; 2004 | Digital C4FM/CQPSK Transceiver Measurement Methods |
| RSS-119, Issue 9, June 2007 | Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41 to 960 MHz |

| Frequency Range (MHz) | Rated Transmit Power (W) (Conducted) | Frequency Tolerance (ppm) | Emission Designator (Calculated) |
|---|---|---|---|
| 136–154 | 10-110 | 0.93 | 16K0F3E (WB Voice) |
| 136–154 | 10-110 | 0.93 | 11K0F3E (NB Voice) |
| 136–154 | 10-110 | 0.93 | 14K2F1D (2 level FSK WB) |
| 136–154 | 10-110 | 0.93 | 14K2F1E (2 level FSK WB) |
| 136–154 | 10-110 | 0.93 | 10K5F1D (C4FM) |
| 136–154 | 10-110 | 0.93 | 10K5F1E (C4FM) |
| 136–154 | 10-110 | 0.93 | 9K93F1D (2 level FSK NB) |
| 136–154 | 10-110 | 0.93 | 9K93F1E (2 level FSK NB) |

**Report Prepared by Test Engineer: Dan Biggs**

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# 1 General Information

This 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 **MASTR III VHF Base Station; FCC ID: OWDTR-0048-E, IC: 3636B-0048**. 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 Part 90 and Industry Canada RSS-119. 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 submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

## 1.2 Related Submittal(s)/Grant(s)

This is an original application report.

## 1.3 Test System Details

The base station can use one of two receive synthesizer modules/front ends (EA101684V1/19D902782G1 or EA101684V2/19D902782G2), both of which were tested, and is configured with one of the two at the time of customer order. Additionally, the frequency reference shown is an optional item also configured to a system at the time of customer order, and was tested in additional to the internal frequency reference.

## 1.4 Grant Notes

Conducted power shown is rated power. Actual measured conducted power is shown in the test report.

## 2 Tested System Details

The test sample was received on March 8, 2007. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this testing, as applicable.

**Table 2-1: Equipment under Test (EUT)**

The test system contains the following components:

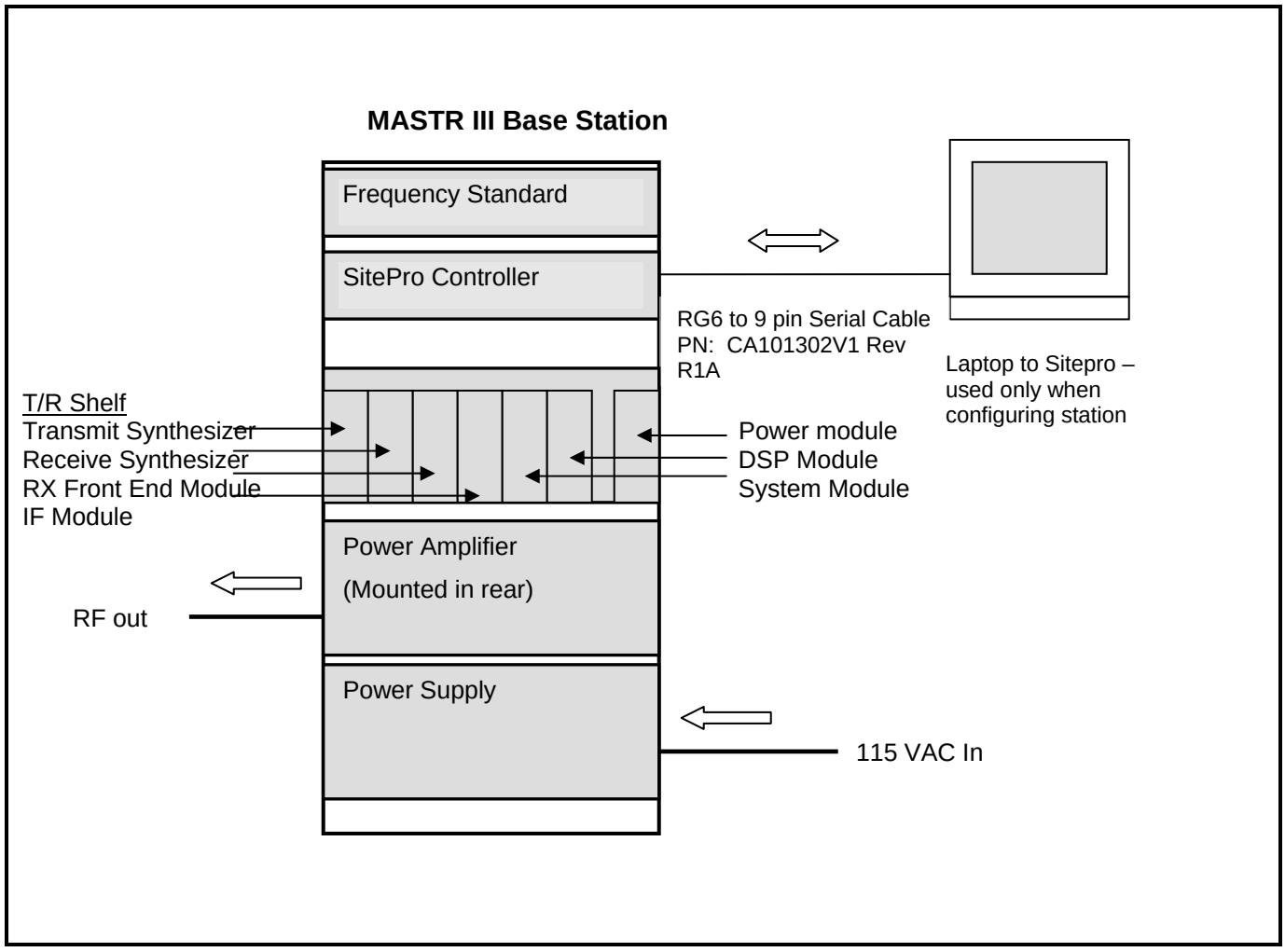
| Part | Manufacturer | Model | PN/SN | FCC ID | RTL Bar Code |
|---|---|---|---|---|---|
| MASTR III VHF Base Station | M/A-COM, Inc. | SXG_ _ _ (1) | N/A | OWDTR-0048-E | N/A |
| **T/R Shelf** | M/A-COM, Inc. | | 19D902839G2 | N/A | |
| Receive Synthesizer | M/A-COM, Inc. | N/A | EA101684V2 | N/A | 17804 |
| RX Front End Module | M/A-COM, Inc. | N/A | 19D902782G2 | N/A | 17801 |
| Transmit Synthesizer | M/A-COM, Inc. | N/A | EA101685V1 | N/A | 17802 |
| Receive Synthesizer | M/A-COM, Inc. | N/A | EA101684V1 | N/A | 17803 |
| RX Front End Module | M/A-COM, Inc. | N/A | 19D902782G1 | N/A | 17800 |
| IF Module | M/A-COM, Inc. | N/A | EA101401V1 | N/A | N/A |
| DSP Module | M/A-COM, Inc. | N/A | EA101800V1 | N/A | N/A |
| System Module | M/A-COM, Inc. | N/A | 19D902590G6 | N/A | N/A |
| Power Module | M/A-COM, Inc. | N/A | 19D902589G2 | N/A | N/A |
| Power Amplifier | M/A-COM, Inc. | 136-154 MHz | EA101292V11 | N/A | 17796 |
| SitePro Controller and Modem | M/A-COM, Inc. | SXMD6F | EA101209V20 | N/A | N/A |
| Frequency Standard | M/A-COM, Inc. | SXMD6G | CY102784V5 | N/A | 17917 |
| Power Supply | M/A-COM, Inc. | SXPS9 | PS103010V240 | N/A | N/A |

Footnotes:
(1) Model numbers depend upon equipment configuration for specific application, modulation mode.

**Table 2-2: Support Equipment**

| Part | Manufacturer | Model | PN/SN | FCC ID | RTL Bar Code |
|---|---|---|---|---|---|
| Notebook Computer | Panasonic | Toughbook | N/A | N/A | N/A |
| Serial Interface Cable | N/A | DB-9 | N/A | N/A | N/A |

**Figure 2-1: Configuration of Tested System**



## 3 FCC Rules and Regulations Part 2 §2.1033(c)(8) Voltages and Currents Through The Final Amplifying Stage

**Nominal DC Voltage:** 26.2 VDC
**Current:** 10.5 A

# 4 FCC Rules and Regulations Part 2 §2.1046(a): RF Power Output: Conducted; RSS-119 §4.1, 5.4: Output Power Test

## 4.1 Test Procedure

ANSI TIA-603-C-2004, section 2.2.1

The EUT was connected with a power sensor/meter through an appropriate 50 ohm attenuator. Attenuator loss was accounted for.

## 4.2 Test Data

**Table 4-1: RF Power Output (High Power): Carrier Output Power (Unmodulated)**

| Channel | Frequency (MHz) | RF Power Measured (W)* |
|---|---|---|
| 1 (High Power) | 143.0 | 110.4 |

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

**Table 4-2: RF Power Output (Rated Power)**

| Rated Power (W) |
|---|
| 110.0 |

**Table 4-3: Test Equipment for Testing RF Power Output - Conducted**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901184 | Agilent Technologies | E4416A | EPM-P Power Meter, Single Channel | GB41050573 | 10/03/07 |
| 901356 | Agilent Technologies | E9323A | Power Sensor | 31764-264 | 10/03/07 |
| 900819 | Weinschel Corporation | BF0830 | Attenuator 10 db | N/A | 12/02/08 |

**Test Personnel:**

| Dan Biggs |  | March 15, 2007 |
|---|---|---|
| Test Technician/Engineer | Signature | Date Of Test |

# 5 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals; Part 90 §90.210: Emissions Masks; RSS-119 §4.2: Transmitter Unwanted Emissions

## 5.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.13.

The transmitter was interfaced with a spectrum analyzer through an appropriate 50 ohm attenuator and a notch filter. The transmitter was operated at maximum power. Attenuator, notch filter, and cable losses were accounted for.

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.

## 5.2 Test Data

Frequency range of measurement per Part 2.1057: 9 kHz to 10xFc.

Limit = 50 + 10 Log (P) dB or 70 dB, whichever is greater.

The worst case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

**Table 5-1: Conducted Spurious Emissions – 143 MHz; Narrow Band; High Power**

Freq = 143.0 MHz - Limit = 50 + 10 Log P = 70.4 dBc - Conducted Power = 50.4 dBm = 110.4 W

| Frequency (MHz) | Notch/Cable Loss (dB) | Level (dBc) | Limit (dBc) | Margin(dB) |
|---|---|---|---|---|
| 286 | 0.13 | 107.6 | 70.4 | -37.2 |
| 429 | 0.25 | 103.0 | 70.4 | -32.6 |
| 572 | 0.25 | 112.2 | 70.4 | -41.8 |
| 715 | 0.13 | 111.9 | 70.4 | -41.5 |
| 858 | 0.67 | 110.8 | 70.4 | -40.3 |
| 1001 | 1.25 | 103.2 | 70.4 | -32.8 |
| 1144 | 2.60 | 109.3 | 70.4 | -38.9 |
| 1287 | 5.60 | 106.4 | 70.4 | -36.0 |
| 1430 | 6.70 | 101.9 | 70.4 | -31.5 |

**Table 5-2: Test Equipment for Testing Conducted Spurious Emissions**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901215 | Hewlett Packard | 8596EM | EMC Analyzer (9 kHz–12.8 GHz) | 3826A00144 | 10/16/07 |
| 901396 | MCE Weinschel | 48-40-34 | Attenuator, 40 dB, DC-18 GHz, 100 W | 93453 | 01/13/09 |
| 901424 | Insulated Wire Inc. | KPS-1503-360-KPS | RF cable 36" | NA | 12/05/07 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs |  | March 16, 2007 |
| Test Technician/Engineer | Signature | Date Of Test |

# 6 FCC Rules and Regulations Part 2 §2.1053(a): Field Strength of Spurious Radiation; RSS-119 §5.11, RSS-Gen: Unwanted Emissions

## 6.1 Test Procedure

ANSI TIA-603-C-2004, 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.

$P_d$(dBm) = $P_g$(dBm) – cable loss (dB) + antenna gain (dB)

where:

$P_d$ is the dipole equivalent power
$P_g$ is the generator output power into the substitution antenna

## 6.2 Test Data

### 6.2.1 CFR 47 Part 90.210 Requirements

Limit = 50 + 10 Log (P) dB or 70 dB, whichever is greater. 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.

The EUT transmitting at high power was determined to be the worst case emissions level and is reported in the following tables.

**Table 6-1: Field Strength of Spurious Radiation – 143.0 MHz; Narrow Band; High Power**

Freq = 143.0 MHz - Limit = 50 + 10 Log P = 70.4 dBc - Conducted Power = 50.4 dBm = 110.4 W

Note: Transmit Synthesizer - EA101685V1

| Frequency (MHz) | Measured Level (dBuv) | | Signal Gen. Level (db) | | Cable Loss (dB) | Antenna Gain (dBd) | | Corrected Level (dBc) | | Limit (dBc) | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 143.0 | H | V | H | V | | H | V | H | V | | H | V |
| 286.00 | 32.3 | 36.5 | -86.7 | -79.2 | 2.7 | -0.6 | -0.8 | 140.4 | 133.1 | 70.4 | -70.0 | -62.7 |
| 429.00 | 42.6 | 45.2 | -70.9 | -68.6 | 3.1 | -0.6 | -1.2 | 125.0 | 123.3 | 70.4 | -54.6 | -52.9 |
| 572.00 | 38.5 | 48.9 | -73.2 | -60.1 | 3.5 | -1.3 | -1.4 | 128.4 | 115.4 | 70.4 | -58.0 | -45.0 |
| 715.00 | 37.6 | 30.4 | -72.3 | -76.2 | 3.9 | -1.3 | -2.0 | 127.9 | 132.5 | 70.4 | -57.5 | -62.1 |
| 858.00 | 35.9 | 30.7 | -70.3 | -72.9 | 4.1 | -1.1 | -1.8 | 125.9 | 129.2 | 70.4 | -55.5 | -58.8 |
| 1001.00 | 75.8 | 76.6 | -32.4 | -32.7 | 4.4 | 1.1 | 0.7 | 86.2 | 86.9 | 70.4 | -15.8 | -16.5 |
| 1144.00 | 41.9 | 42.0 | -66.0 | -65.5 | 4.5 | 1.9 | 2.9 | 119.1 | 117.6 | 70.4 | -48.7 | -47.2 |
| 1287.00 | 53.4 | 53.5 | -50.3 | -51.3 | 4.7 | 3.9 | 3.9 | 101.6 | 102.6 | 70.4 | -31.2 | -32.2 |
| 1430.00 | 22.0 | 24.0 | -78.5 | -76.8 | 5.1 | 4.4 | 4.4 | 129.7 | 128.0 | 70.4 | -59.3 | -57.6 |

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

**Table 6-2: Test Equipment for Testing Field Strength of Spurious Radiation**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 900791 | Schaffner-Chase | CBL6112 | Antenna (25 MHz–2 GHz) | 2099 | 06/12/07 |
| 900154 | Compliance Design, Inc. | Roberts Dipole | Adjustable Elements Dipole 30-1000 MHz Antennas | 00401 | 01/07/08 |
| 900814 | Electro-Metrics | EM-6961 (RGA-60) | Double Ridges Guide Antenna (1-18 GHz) | 2310 | 03/30/09 |
| 901020 | Hewlett Packard | 8564E | Portable Spectrum Analyzer (9 kHz-40 GHz) | 3943A01719 | 10/28/07 |
| 901281 | Rhein Tech Laboratories | PR-1040 (10-2000 MHz) | Amplifier | 1004 | 01/19/08 |
| 901426 | Insulated Wire Inc. | KPS-1503-3600-KPS | RF Cable, 30' | NA | 12/05/07 |
| 901425 | Insulated Wire, Inc. | KPS-1503-2400-KPS | RF Cable, 20' | NA | 12/05/07 |
| 901424 | Insulated Wire Inc. | KPS-1503-360-KPS | RF Cable 36" | NA | 12/05/07 |

**Test Personnel:**

| Daniel Biggs | Daniel Biggs | March 22, 2007 |
|---|---|---|
| Test Technician/Engineer | Signature | Date Of Test |

## 7 FCC Rules and Regulations Part 2 §2.1049: Occupied Bandwidth; Part 90 §90.210(g): Emissions Masks; RSS-119 §4.2: Transmitter Unwanted Emissions

### 7.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.11.

The transmitter was interfaced with a spectrum analyzer through an appropriate 50 ohm attenuator and a notch filter. The transmitter was operated at maximum power. Attenuator losses were accounted for.

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.

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence of 9600 bps.

**Limit Mask B:**

(1) On any frequency removed from the assigned frequency by more than 50%, but not more than 100% of the authorized bandwidth: **at least 25 dB**.
(2) On any frequency removed from the assigned frequency by more than 100%, but not more than 250% of the authorized bandwidth: **at least 35 dB**.
(3) On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth: **at least 43 + 10 log (P) dB.**

**Limit Mask C:**

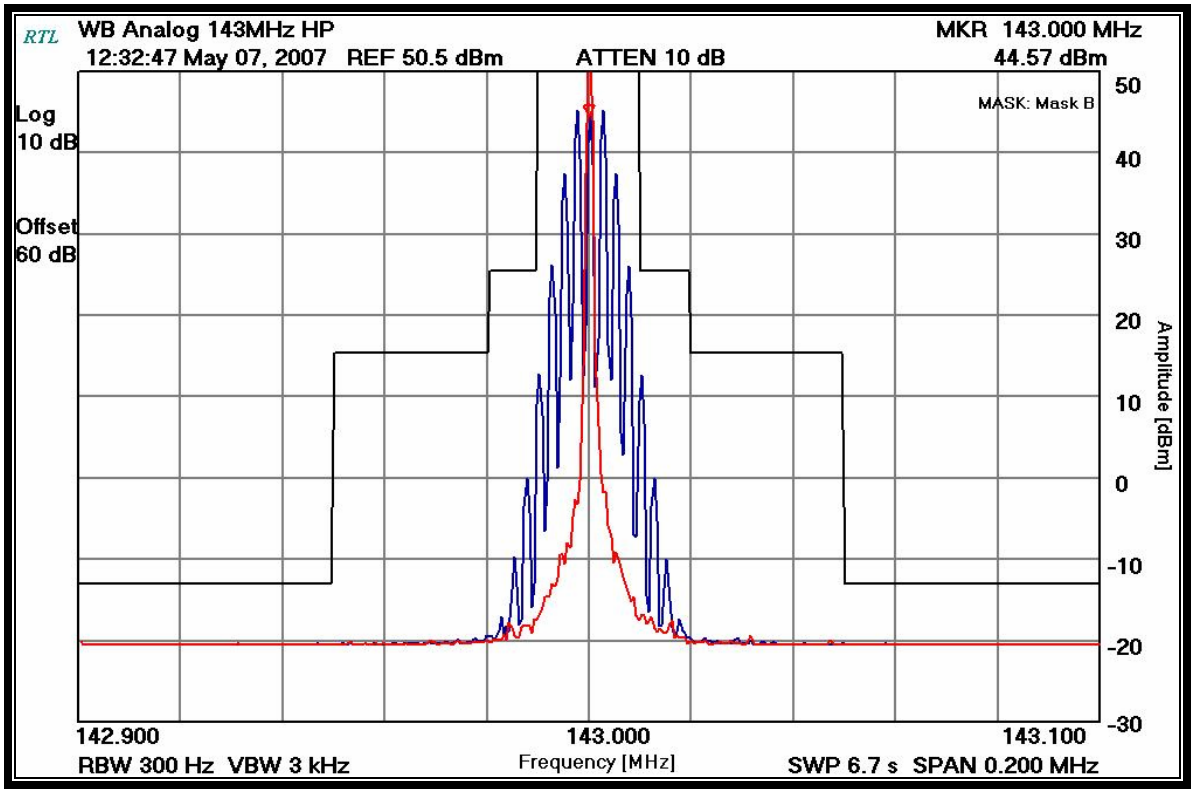
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: **at least 83 log (fd/5) dB**;
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: **at least 29 log ($fd^2$/11) dB or 50 dB, whichever is the lesser attenuation;**
(3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: **at least 43 + 10 log (P) dB.**

**Limit Mask D:**

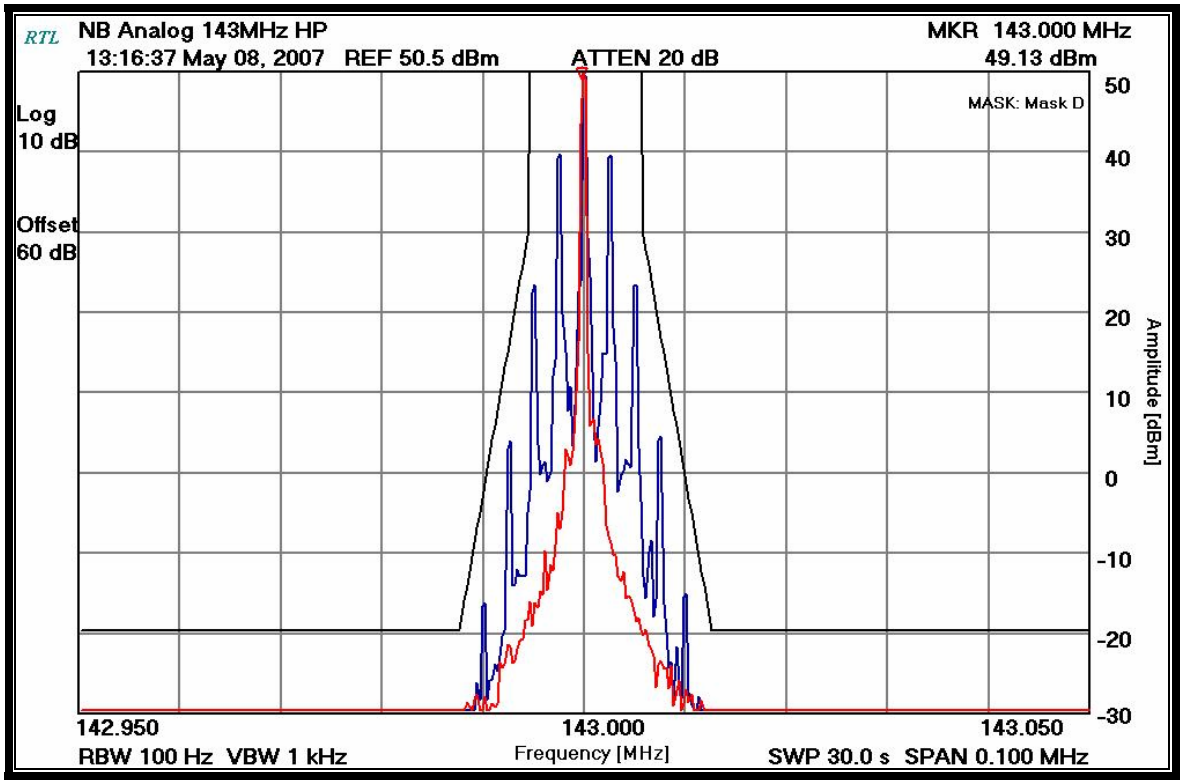
(1) On any frequency removed from the center of the authorized bandwidth $f_0$: **zero dB**;
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz, but not more than 12.5 kHz: **at least 7.27(fd-2.88 KHz) dB;**
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: **at least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.**

## 7.2 Test Data

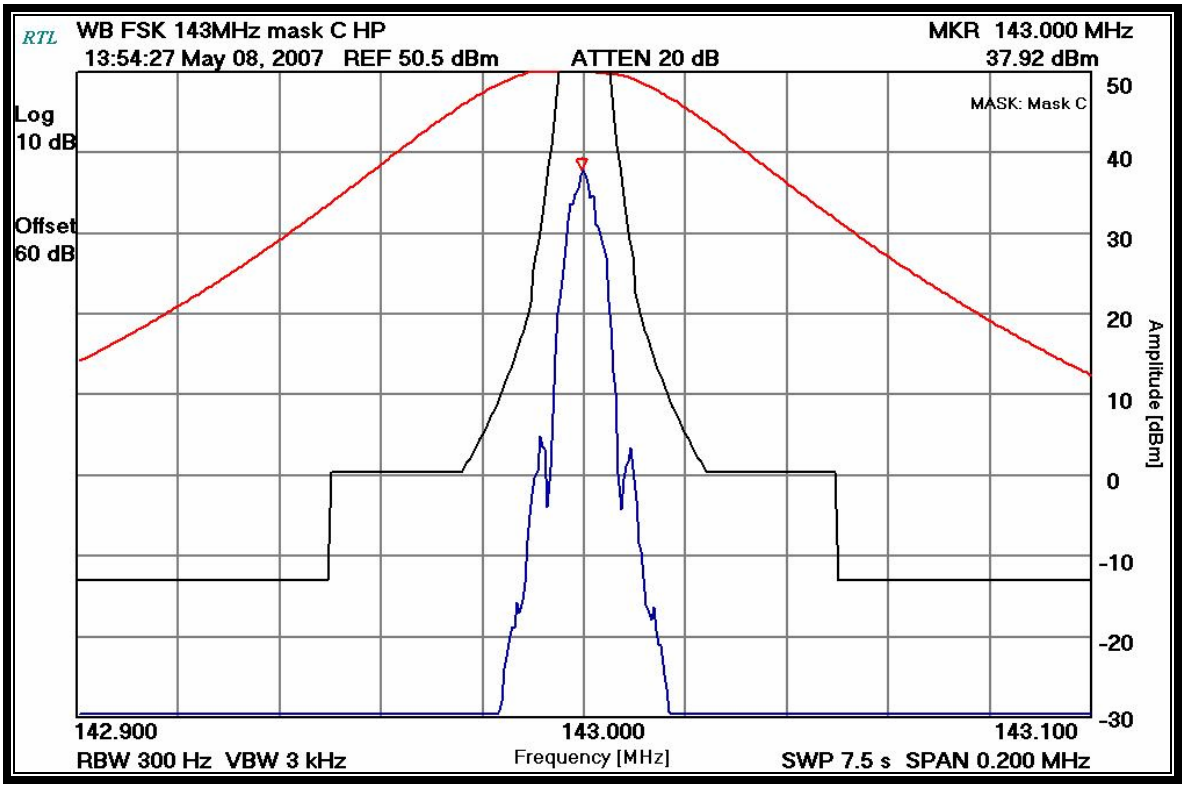
**Plot 7-1: Occupied Bandwidth – 143 MHz; Mask B; Wide Band; Analog**



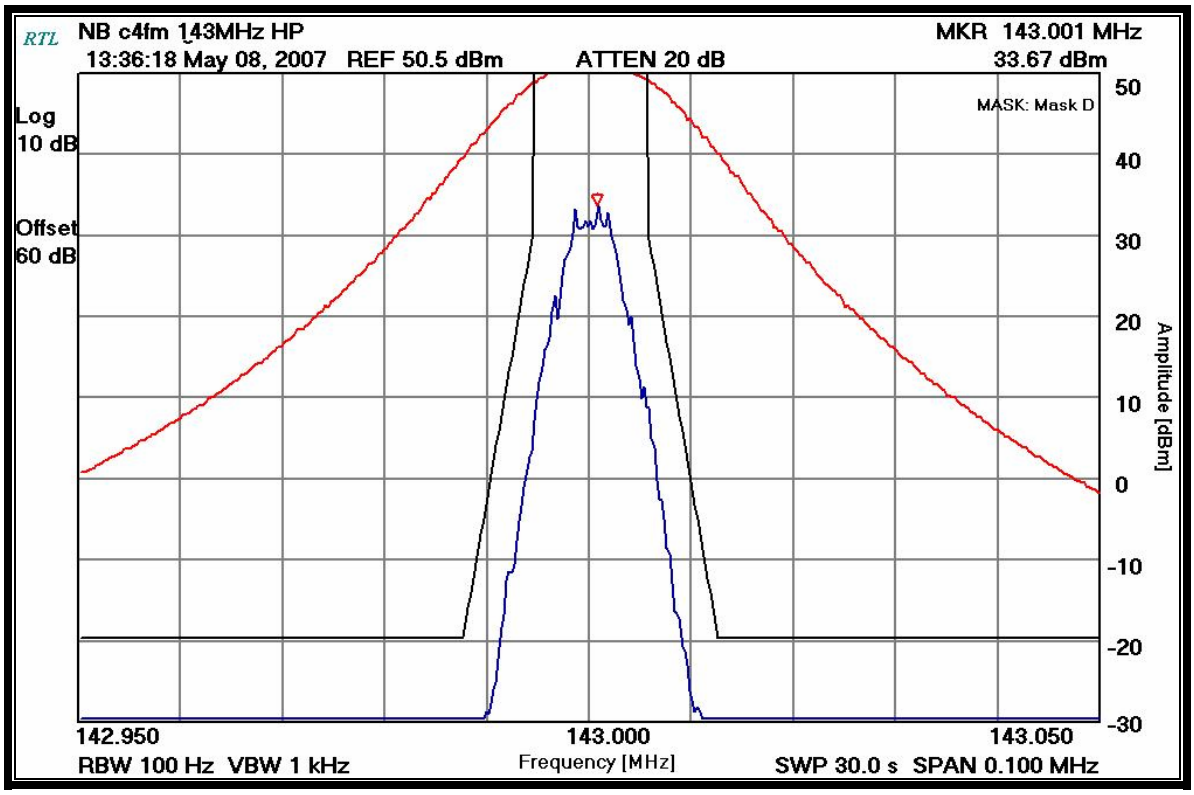
**Plot 7-2: Occupied Bandwidth – 143 MHz; Mask D; Narrow Band; Analog**



**Plot 7-3: Occupied Bandwidth – 143 MHz; Mask C; Wide Band FSK 9600 BPS**



**Plot 7-4: Occupied Bandwidth – 143 MHz; Mask D; Narrow Band C4FM 9600 BPS**



**Plot 7-5: Occupied Bandwidth – 143 MHz; Mask D; Narrow Band FSK 9600 BPS**

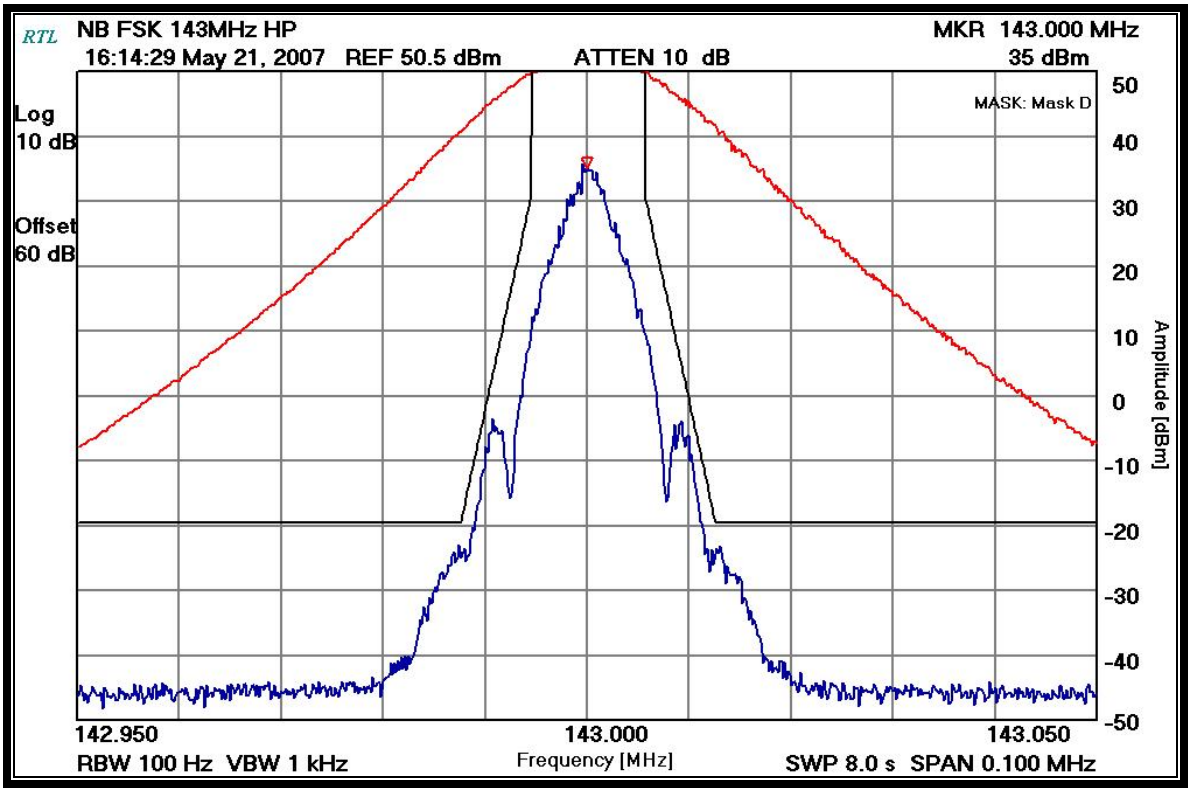



**Table 7-1: Test Equipment for Testing Occupied Bandwidth**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901215 | Hewlett Packard | 8596EM | EMC Analyzer (9 kHz – 12.8 GHz) | 3826A00144 | 10/16/07 |
| 901396 | MCE Weinschel | 48-40-34 | Attenuator, 40 dB, DC-18 GHz, 100 W | 93453 | 12/02/08 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs | Daniel Biggs | May 7, 8, 21, 2007 |
| Test Technician/Engineer | Signature | Dates of Tests |

# 8 FCC Rules and Regulations Part 90 §90.213 and Part 2 §2.1055: Frequency Stability

## 8.1 Test Procedure

ANSI/TIA-603-C-2004, 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°C 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 8-1 and Table 8-3.

## 8.2 Test Data

### 8.2.1 CFR 47 Part 90.213 Requirements

In the 150–174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm.

### 8.2.2 Frequency Stability/Temperature Variation

**Plot 8-1: Temperature Frequency Stability – 143 MHz – Internal Frequency Reference**

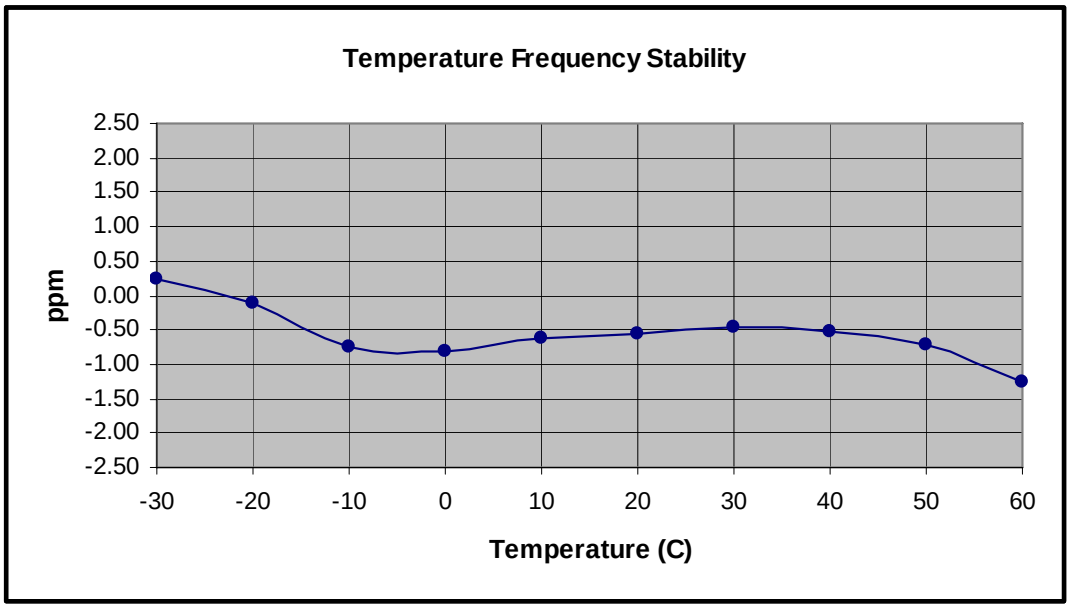



**Table 8-1: Frequency Stability/Temperature Variation – 143 MHz – Internal Frequency Reference**

| Temperature °C | Measured Frequency (MHz) | ppm |
|---|---|---|
| -30 | 143.000033 | 0.23 |
| -20 | 142.999982 | -0.13 |
| -10 | 142.999893 | -0.75 |
| 0 | 142.999885 | -0.80 |
| 10 | 142.999911 | -0.62 |
| 20 | 142.999919 | -0.57 |
| 30 | 142.999932 | -0.48 |
| 40 | 142.999923 | -0.54 |
| 50 | 142.999898 | -0.71 |
| 60 | 142.999822 | -1.24 |

**Plot 8-2: Temperature Frequency Stability – 143 MHz – External Frequency Reference**

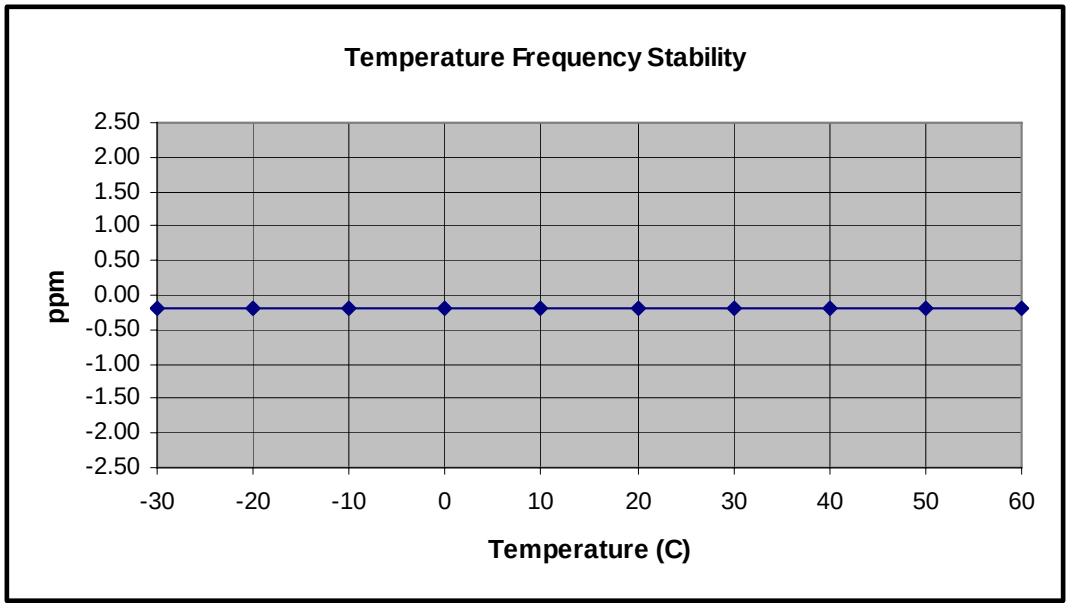


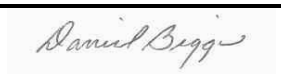

**Table 8-2: Frequency Stability/Temperature Variation – 143 MHz – External Frequency Reference**

| Temperature °C | Measured Frequency (MHz) | ppm |
|---|---|---|
| -30 | 142.999974 | -0.18 |
| -20 | 142.999975 | -0.17 |
| -10 | 142.999975 | -0.17 |
| 0 | 142.999975 | -0.17 |
| 10 | 142.999975 | -0.17 |
| 20 | 142.999975 | -0.17 |
| 30 | 142.999975 | -0.17 |
| 40 | 142.999975 | -0.17 |
| 50 | 142.999975 | -0.17 |
| 60 | 142.999975 | -0.17 |

**Table 8-3: Test Equipment for Testing Frequency Stability/Temperature**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 900946 | Tenney Engineering, Inc. | TH65 | Temperature Chamber with Humidity | 11380 | 01/20/08 |
| 901396 | MCE Weinschel | 48-40-34 | Attenuator, 40 dB, DC-18 GHz, 100 W | 93453 | 12/02/08 |
| 901424 | Insulated Wire Inc. | KPS-1503-360-KPS | RF cable 36" | NA | 12/12/07 |
| 901300 | Agilent Technologies | 53131A | Frequency Counter | MY40001345 | 12/15/07 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs |  | March 23 & May 23, 2007 |
| Test Technician/Engineer | Signature | Dates Of Tests |

### 8.2.3 Frequency Stability/Voltage Variation

**Plot 8-3: Temperature Frequency Stability – 143 MHz – Internal Frequency Reference**

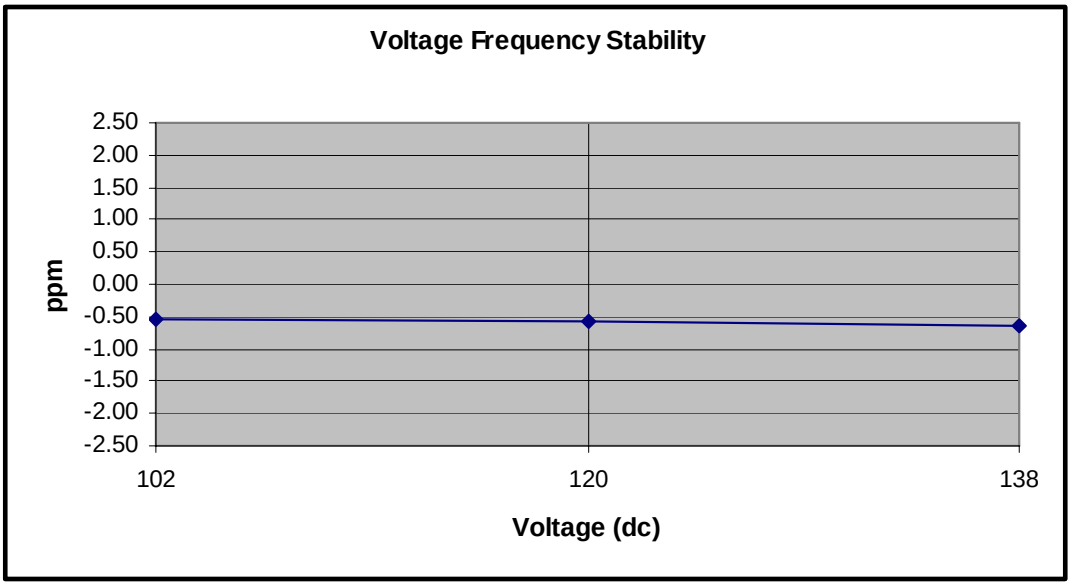



**Table 8-4: Frequency Stability/Voltage Variation – 143 MHz – Internal Frequency Reference**

| Voltage (VAC) | Measured Frequency (MHz) | ppm |
|---|---|---|
| 102 | 142.999925 | -0.52 |
| 120 | 142.999920 | -0.56 |
| 138 | 142.999910 | -0.63 |

**Plot 8-4: Temperature Frequency Stability – 143 MHz – External Frequency Reference**

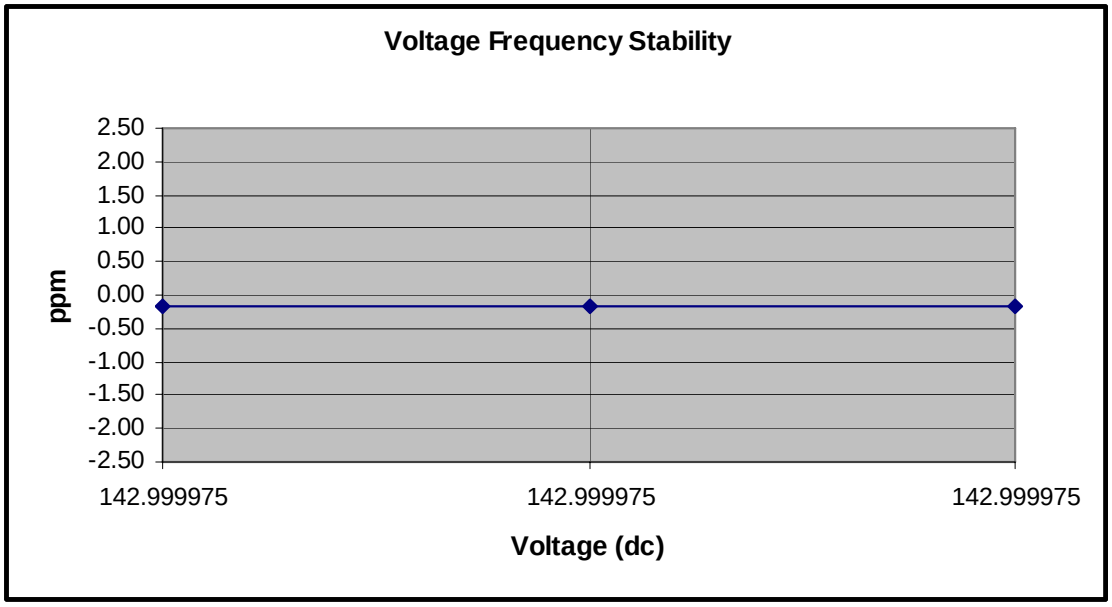



**Table 8-5: Frequency Stability/Voltage Variation – 143 MHz – External Frequency Reference**

| Voltage (VAC) | Measured Frequency (MHz) | ppm |
|---|---|---|
| 102 | 142.999975 | -0.17 |
| 120 | 142.999975 | -0.17 |
| 138 | 142.999975 | -0.17 |

**Table 8-6: Test Equipment for Testing Frequency Stability/Voltage**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901300 | Agilent Technologies | 53131A | Frequency Counter | MY40001345 | 12/15/07 |
| 901396 | MCE Weinschel | 48-40-34 | Attenuator, 40 dB, DC-18 GHz, 100 W | 93453 | 12/02/08 |
| 901424 | Insulated Wire Inc. | KPS-1503-360-KPS | RF cable 36" | N/A | 12/12/07 |
| 901247 | Wavetek | DM25XT | Digital Multimeter | 40804098 | 12/07/07 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs |  | March 23 & May 23, 2007 |
| Test Technician/Engineer | Signature | Dates Of Tests |

# 9 FCC Rules and Regulations Part 2 §2.1047(a): Modulation Characteristics - Audio Frequency Response

## 9.1 Test Procedure

ANSI TIA-603-C-2004, 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)

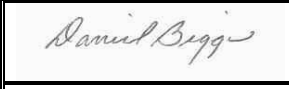
## 9.2 Test Data

**Plot 9-1: Modulation Characteristics - Audio Frequency Response – 143 MHz**

**Table 9-1: Test Equipment for Testing Audio Frequency Response**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 12/19/07 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 07/21/07 |
| 901054 | Hewlett Packard | 3586B | Selective Level Meter | 1928A01892 | 10/19/07 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs |  | March 15, 2007 |
| Test Technician/Engineer | Signature | Date Of Test |

## 10 FCC Rules and Regulations Part 2 §2.1047(a): Modulation Characteristics – Audio Low Pass Filter

### 10.1 Test Procedure

ANSI TIA-603-C-2004, 2.2.15.

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

### 10.2 Test Data

**Plot 10-1: Modulation Characteristics – Audio Low Pass Filter – 143 MHz**

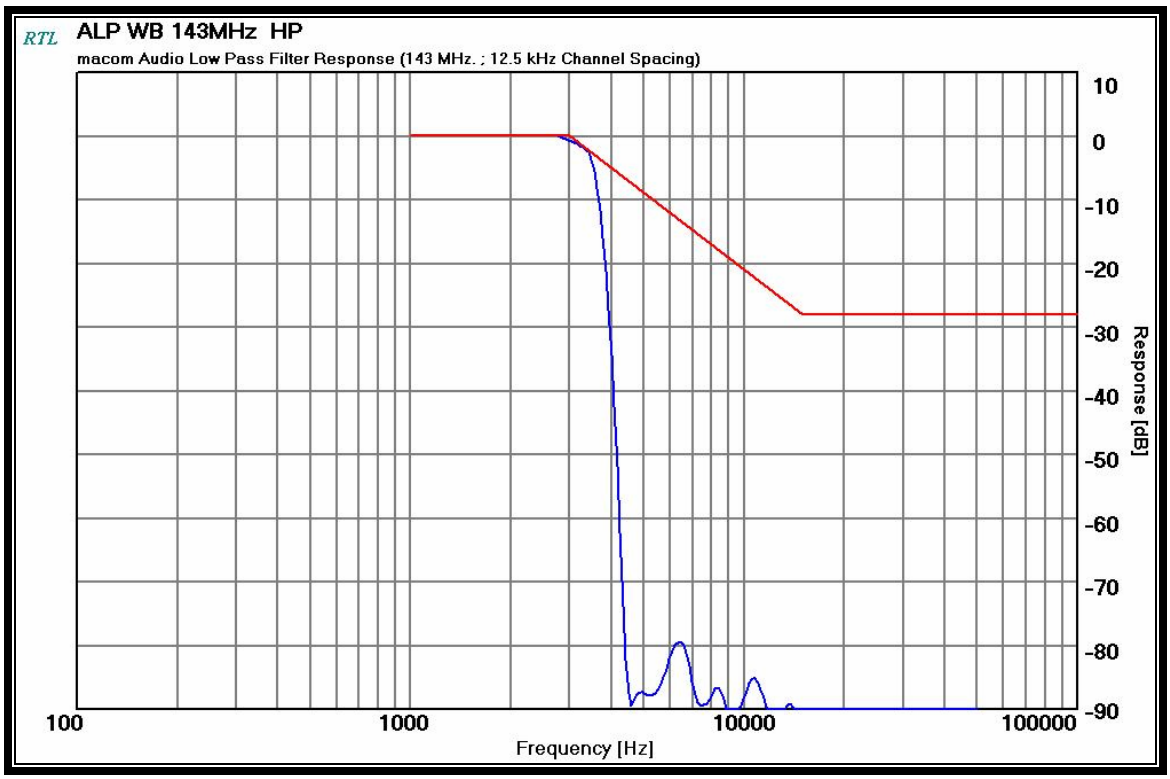


**Table 10-1: Test Equipment for Testing Audio Low Pass Filter Response**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 12/19/07 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 07/21/07 |
| 901054 | Hewlett Packard | 3586B | Selective Level Meter | 1928A01892 | 10/19/07 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs |  | March 15, 2007 |
| Test Technician/Engineer | Signature | Date Of Test |

## 11 FCC Rules and Regulations Part 2 §2.1047(b): Modulation Characteristics - Modulation Limiting

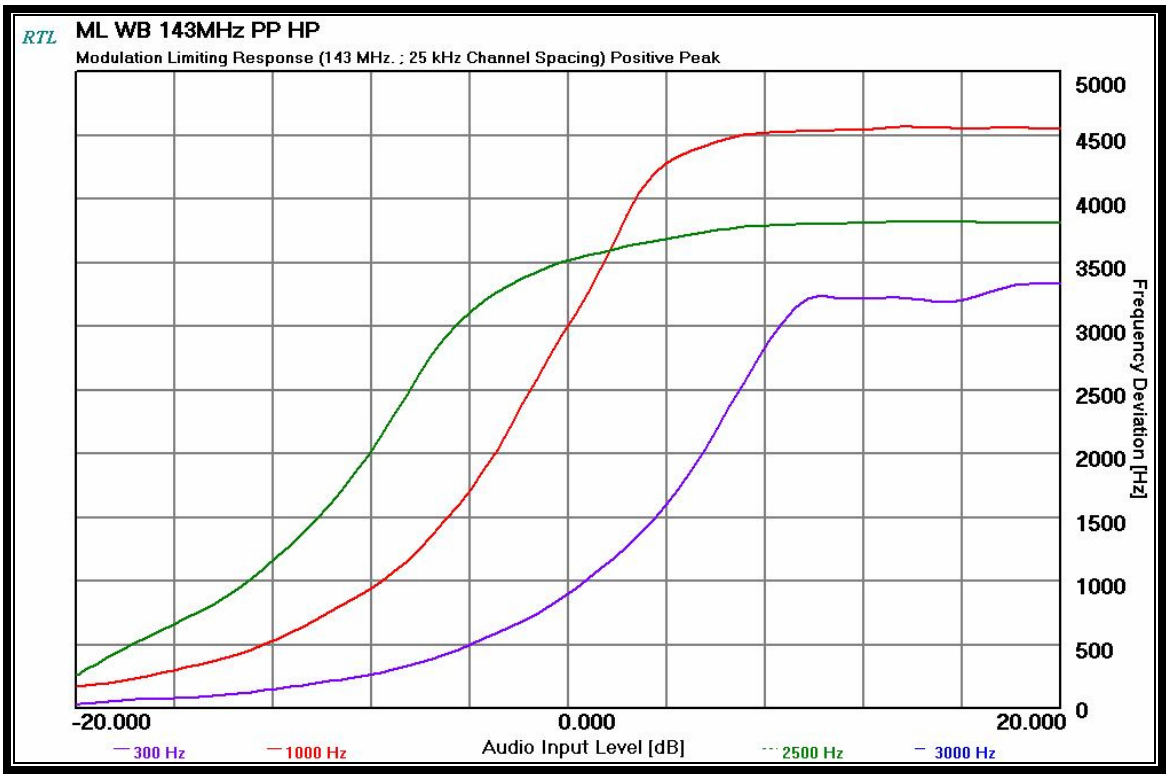
### 11.1 Test Procedure

ANSI TIA-603-C-2004, section 2.2.3.

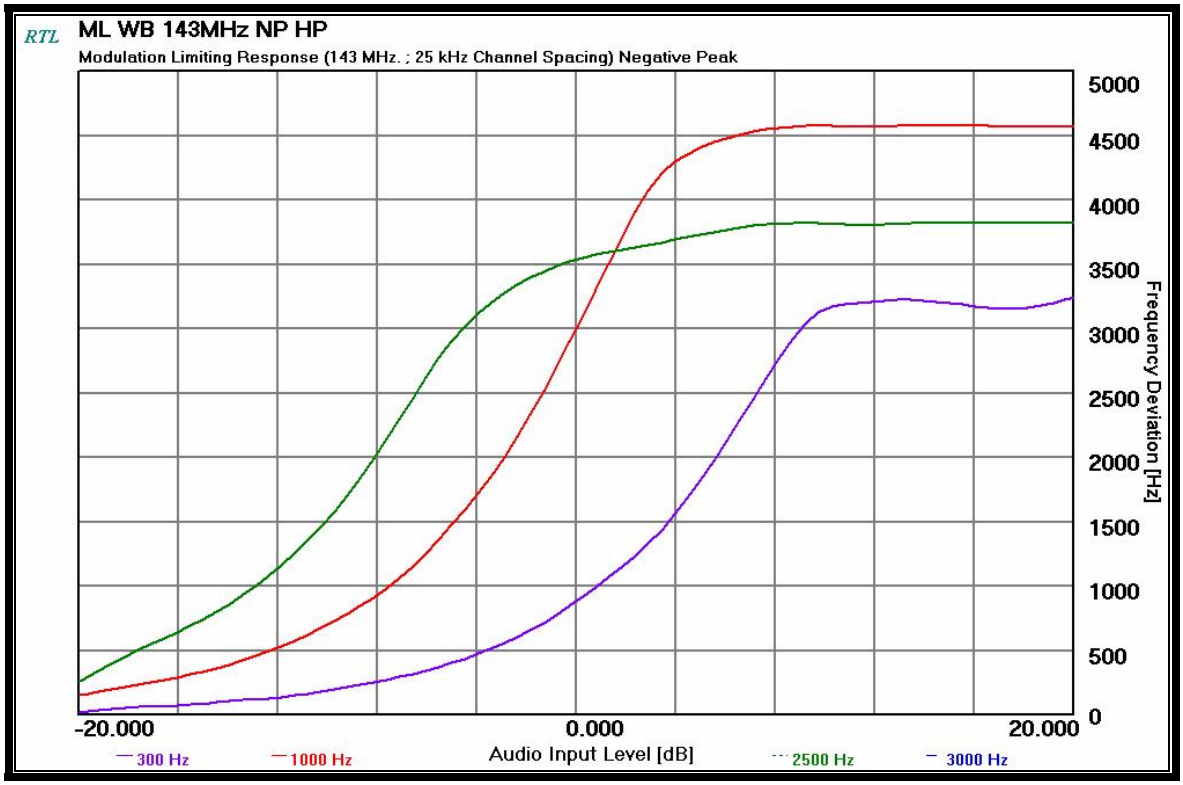
The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0 dB), the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500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

### 11.2 Test Data

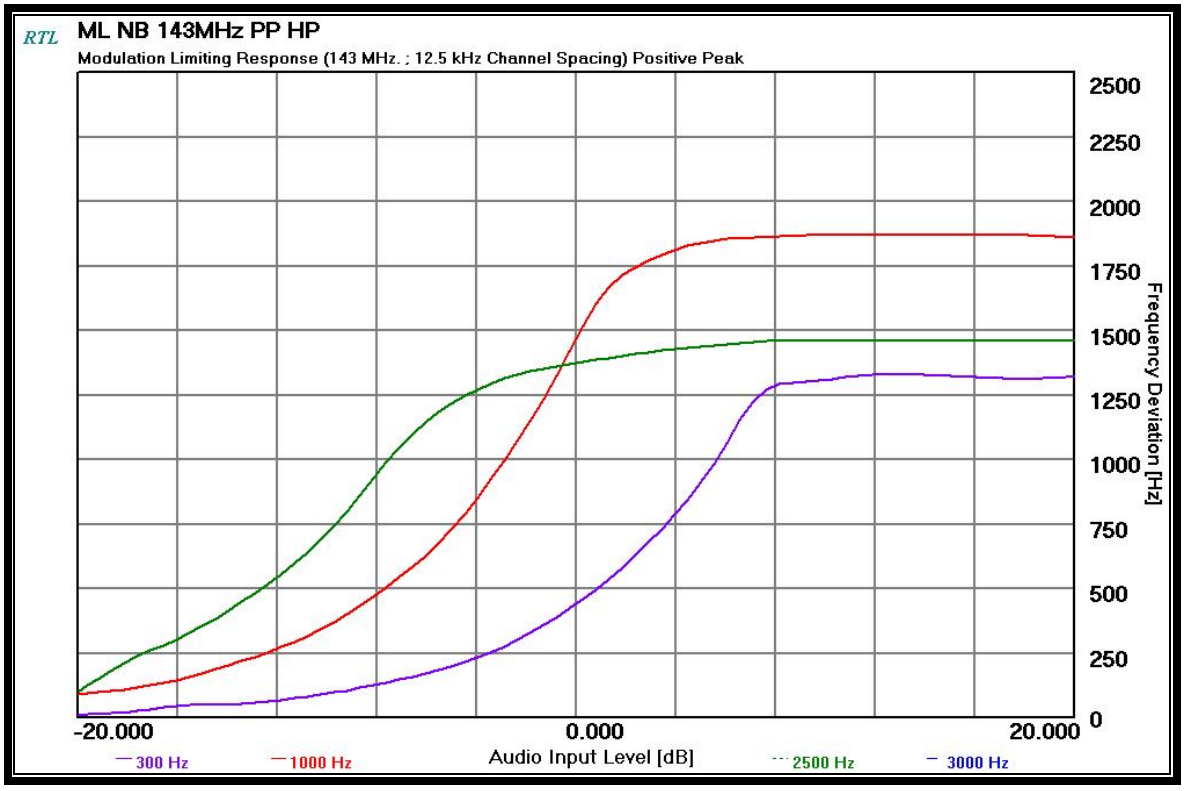
**Plot 11-1: Modulation Characteristics – Modulation Limiting: 143 MHz; Wide Band; Positive Peak**



**Plot 11-2: Modulation Characteristics – Modulation Limiting: 143 MHz; Wide Band; Negative Peak**



**Plot 11-3: Modulation Characteristics – Modulation Limiting: 143 MHz; Narrow Band; Positive Peak**



**Plot 11-4: Modulation Characteristics – Modulation Limiting: 143 MHz; Narrow Band; Negative Peak**

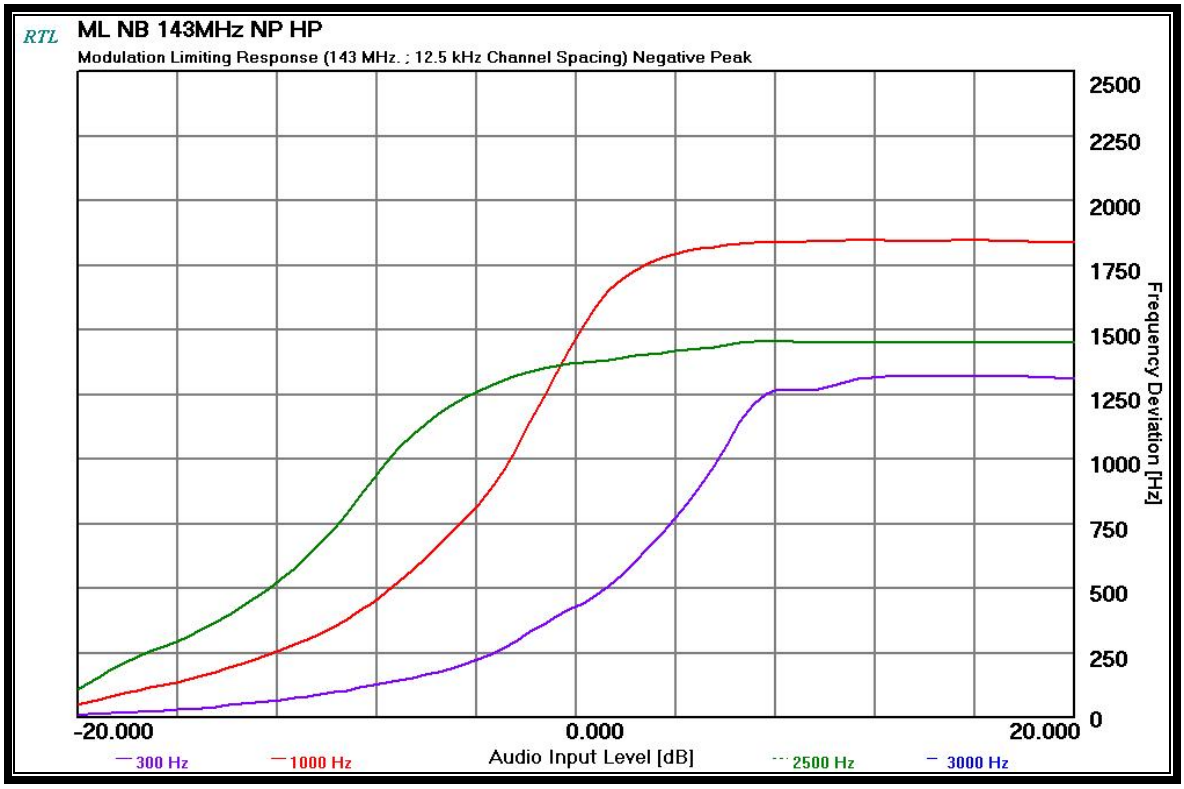



**Table 11-1: Test Equipment for Testing Modulation Limiting**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 901057 | Hewlett Packard | 3336B | Synthesizer/Level Generator | 2514A02585 | 12/19/07 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 07/21/07 |
| 901054 | Hewlett Packard | 3586B | Selective Level Meter | 1928A01892 | 10/19/07 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs | Daniel Biggs | March 15, 2007 |
| Test Technician/Engineer | Signature | Date Of Test |

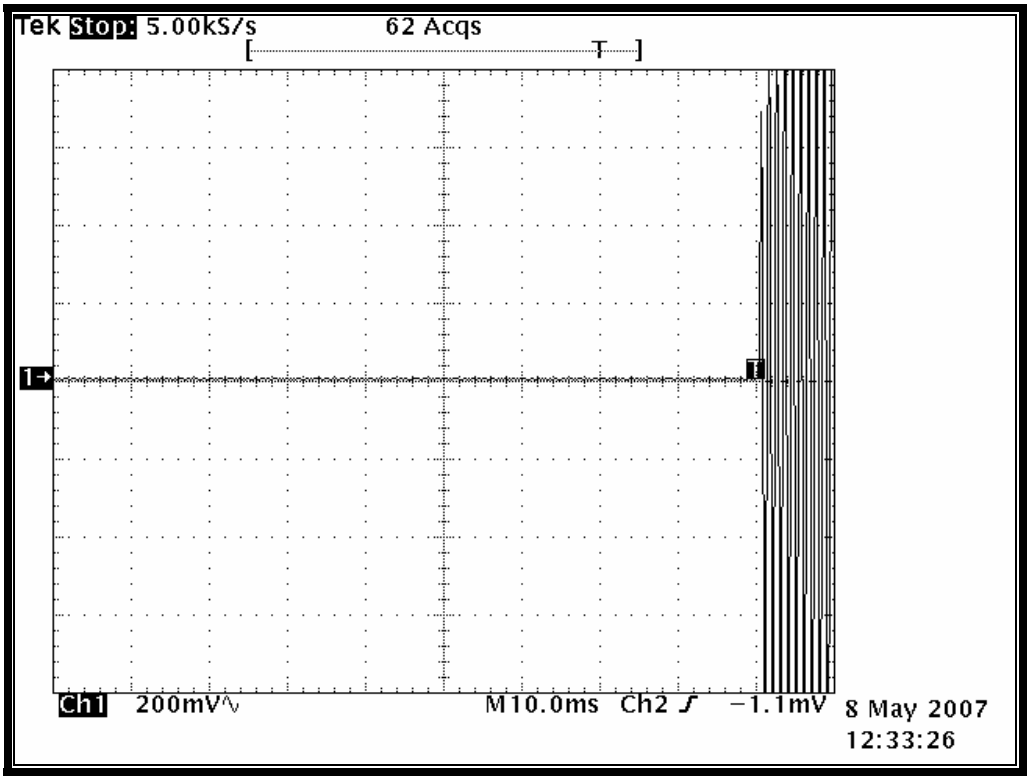
## 12 FCC Rules and Regulations Part 90 §90.214: Transient Frequency Behavior

### 12.1 Test Procedure

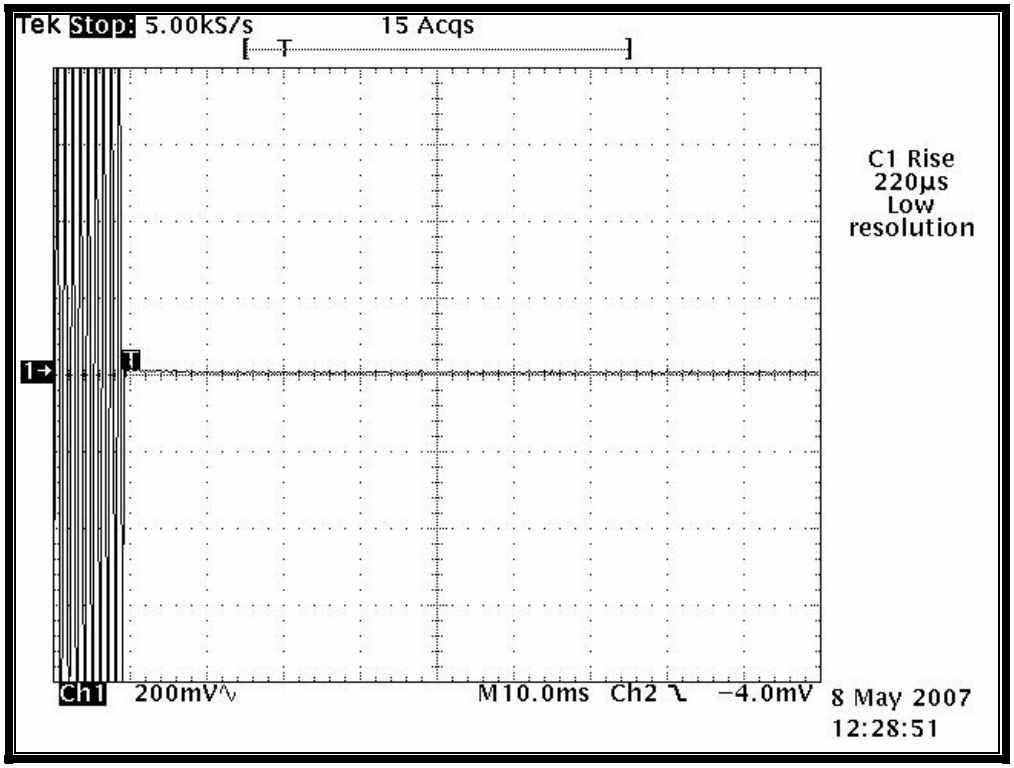
ANSI TIA-603-C-2004, section 2.2.3.

### 12.2 Test Data

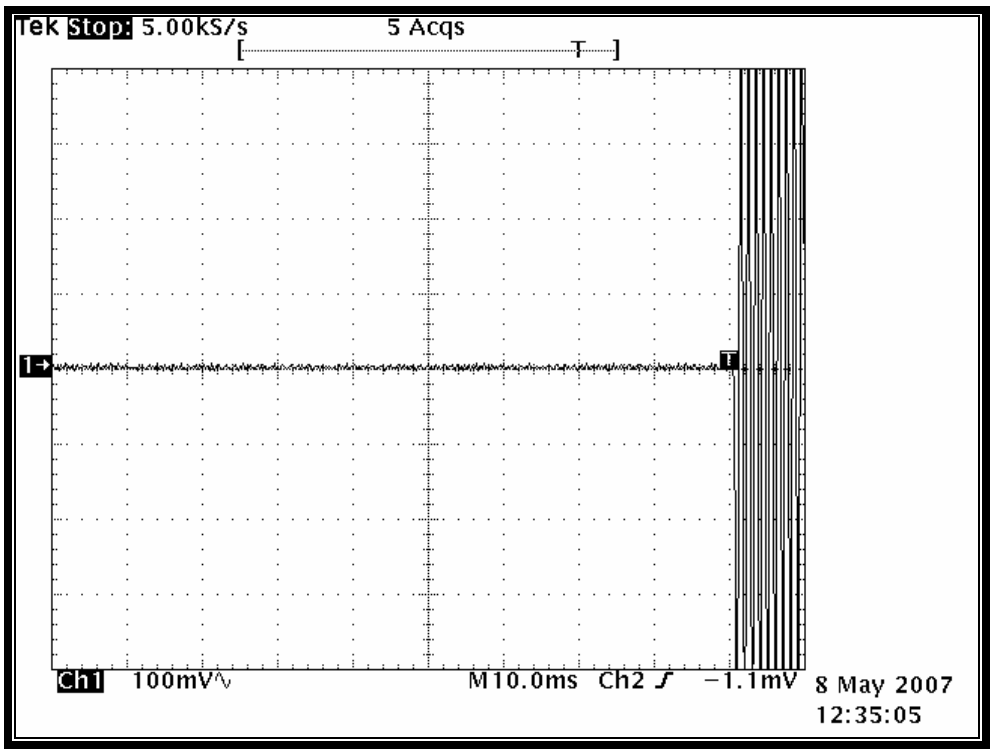
**Plot 12-1: Transient Frequency Behavior – 143 MHz; Wide Band; High Power; Carrier ON Time**



**Plot 12-2: Transient Frequency Behavior – 143 MHz; Wide Band; High Power; Carrier OFF Time**



**Plot 12-3: Transient Frequency Behavior – 143 MHz; Narrow Band; High Power; Carrier ON Time**



**Plot 12-4: Transient Frequency Behavior – 143 MHz; Narrow Band; High Power; Carrier OFF Time**

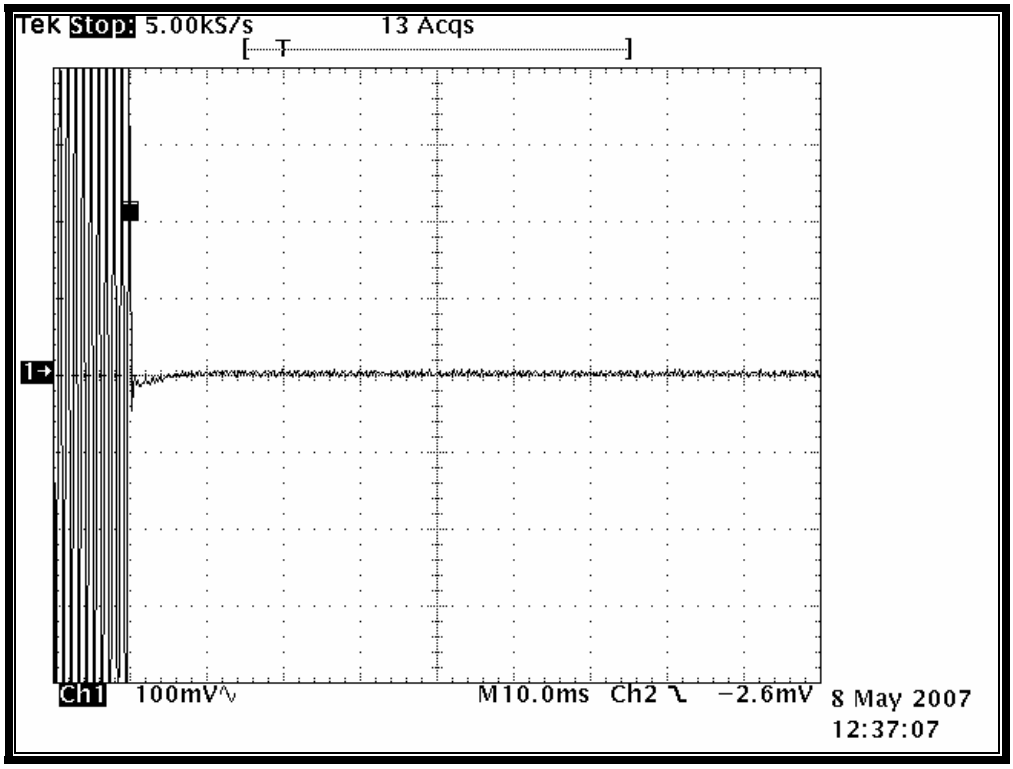



**Table 12-1: Test Equipment for Testing Transient Frequency Behavior**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due |
|---|---|---|---|---|---|
| 900917 | Hewlett Packard | 8648C | Signal Generator (100 kHz-3200 MHz) | 3537A01741 | 08/29/07 |
| 901118 | Hewlett Packard | 8901A Opt. 002-003 | Modulation Analyzer | 2406A00178 | 07/24/07 |
| 900561 | Tektronix | TDS540B | Oscilloscope | B020129 | 03/20/08 |
| 900352 | Werlatone | C1795 | Directional Coupler | 4989 | 06/06/08 |

**Test Personnel:**

| | | |
|---|---|---|
| Daniel Biggs | Daniel Biggs | March 27 & May 8, 2007 |
| Test Technician/Engineer | Signature | Dates Of Tests |

## 13 FCC Rules and Regulations Part 2 §90.202: Necessary Bandwidth and Emission Bandwidth

**FCC Mask 90.210(b, c, d,):**
**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 2-level FSK WB**
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) = 14.17 kHz
Emission designator: 14K2F1D, 14K2F1E

**Digital Voice and Data 2-level FSK NB**
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1900
2D/R = 0.625
Bn = 3.86D + 0.27R = 3.86(1900) + 0.27(9600) = 9.92 kHz
Emission designator: 9K9F1D, 9K9F1E

**P25 – C4FM (9600 bps):**
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 2826
K = 1
Bn = $[9600/\log_2(4) + 2\ (2826)\ (1)]$ = 10.452 kHz
Emission designator: 10K5F1D, 10K5F1E

## 14 Conclusion

The data in this measurement report shows that the **M/A-COM, Inc**. Model **MASTR III VHF Base Station, FCC ID: OWDTR-0048-E, IC: 3636B-0048**, complies with all the applicable requirements of Parts 90, 15 and 2 of the FCC Rules, and Industry Canada RSS-119, Issue 9, June 2007.