Engineering and Testing for EMC and Safety Compliance

Accredited under A2LA Testing Certificate # 2653.01

FCC & IC Certification Report

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MODEL: M7300 VHF 50W Mobile Radio

FCC ID: OWDTR-0055-E
IC: 3636B-0055

August 21, 2009

Standards Referenced for this Report	
Part 2: 2008	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2008	Private Land Mobile Radio Services
TIA-EIA-603-C August 2004	Land Mobile FM or PM Communications Equipment – Measurement and Performance Standards
ANSI/TIA/EIA – 102.CAAA-2002	Digital C4FM/CQPSK Transceiver Measurement Methods
ANSI/TIA/EIA– 102.BAAA–1998	Project 25 FDMA Common Air Interface—New Technology Standards Project—Digital Radio Technical Standards
RSS-119 Issue 9 2007	Land Mobile and Fixed Radio Transmitters and Receivers 27.41 to 960.0 MHz

Report Prepared By: Daniel Baltzell

Document Number: 2009197

Frequency Range (MHz)	Measured Conducted Output Power (W)	Frequency Tolerance (ppm)	Emission Designator
136–174	50	0.5	16K0F3E (Voice)
136–174	50	0.5	11K0F3E (Voice)
136–174	50	0.5	14K2F1D (2 level WB)
136–174	50	0.5	14K2F1E (2 level WB)
136–174	50	0.5	9K9F1D (2 level NB 9600)
136–174	50	0.5	9K9F1E (2 level NB 9600)
136–174	50	0.5	7K1F1D (2 level NB 4800)
136–174	50	0.5	7K1F1E (2 level NB 4800)
136–174	50	0.5	8K4F1D (P25)
136–174	50	0.5	8K4F1E (P25)

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1 Test Result Summary

Test	FCC Reference	IC Reference	Result
RF Power Output	2.1046(a), 90.541(b), 90.542(a)(6)	RSS-119 5.4	Complies
Spurious Emissions at Antenna Terminals	2.1046(a), 90.541(b), 90.542(a)(6)	RSS-119 5.4	Complies
Field strength of spurious radiation	2.1053(a), 90.543(f)	RSS-119 5.5, 5.8	Complies
Occupied Bandwidth/Emission Masks	2.1049(c)(1), 90.543(d)	RSS-119 5.5, 5.8	Complies
Adjacent Channel Power	90.543	RSS-119 5.58	Complies
Frequency Stability vs. Temperature and Voltage	2.1055, 90.539	RSS-119 5.3	Complies
Modulation Characteristics	2.1047(a)(b)	N/A	Complies
Transient Frequency Response	90.214	RSS-119 5.9	Complies

2 General Information

The following Type Certification Report is prepared on behalf of **Harris Corporation** in accordance with the Federal Communications Commission and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the **M7300 Mobile Radio; FCC ID: OWDTR-0055-E, IC: 3636B-0055.**

The radio can be used with a GPS, remote and front mount control heads, and a motorcycle mount configuration and is subject to FCC DoC. DoC testing was performed for the aforementioned accessories and configurations, and the data is contained in a separate DoC report.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47 Parts 2 and 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.

2.1 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.

2.2 Related Submittal(s)/Grant(s)

N/A

2.3 Grant Notes

Power is continuously variable from 10–50 W.

3 Tested System Details

The test sample was received on July 9, 2009. Listed on the following page are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable. The device was programmed for multiple modes of operation and modulation types.

Table 3-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN	FCC ID	RTL Bar Code
VHF 50 W Mobile Radio	Harris Corporation	M7300	RU144750-041	OWDTR-0055-E	10959
Front Mount Control Head (Installed)	Harris Corporation	CH721	CU23218-0004	N/A	10960
VHF 50 W Mobile Radio	Harris Corporation	M7300	RU144750-041	OWDTR-0055-E	10961
Front Mount Control Head (Installed)	Harris Corporation	CH721	CU23218-0004	N/A	10962
132-960 MHz 0dB Roof Mount Antenna	Harris Corporation	N/A	AN102800V1	N/A	10952
136-174 0dB Roof Mount Antenna	Harris Corporation	N/A	AN-025147-001	N/A	10953
136-174 Magnetic Mount Antenna	Harris Corporation	N/A	AN-025147-005	N/A	10954
Combined GPS/VHF 136-174 Roof Mount Antenna	Harris Corporation	N/A	AN-025147-003	N/A	10955
GPS Roof Mount Antenna	Harris Corporation	N/A	AN-025187-001	N/A	10956
Magnetic Mount Antenna, 26 dB gain, 17' RG-174 Cable, Male SMA	Harris Corporation	N/A	AN-025187-003	N/A	10957
132-960 MHz 0dB Thick Roof Mount Antenna	Harris Corporation	MAMV-AN3L	AN-025147-001	N/A	10958
CAN Terminations (4)	Harris Corporation	N/A	CD-014027-001	N/A	10963
13.8V Power Supply	Samplex America	SEC 1223	03061-3J04-00763	N/A	17707
Speaker	Harris Corporation	N/A	LS102824V10R1A	N/A	17690
Microphone	Harris Corporation	N/A	MC-101616	N/A	17192
Test Box	Harris Corporation	N/A	N/A	N/A	N/A

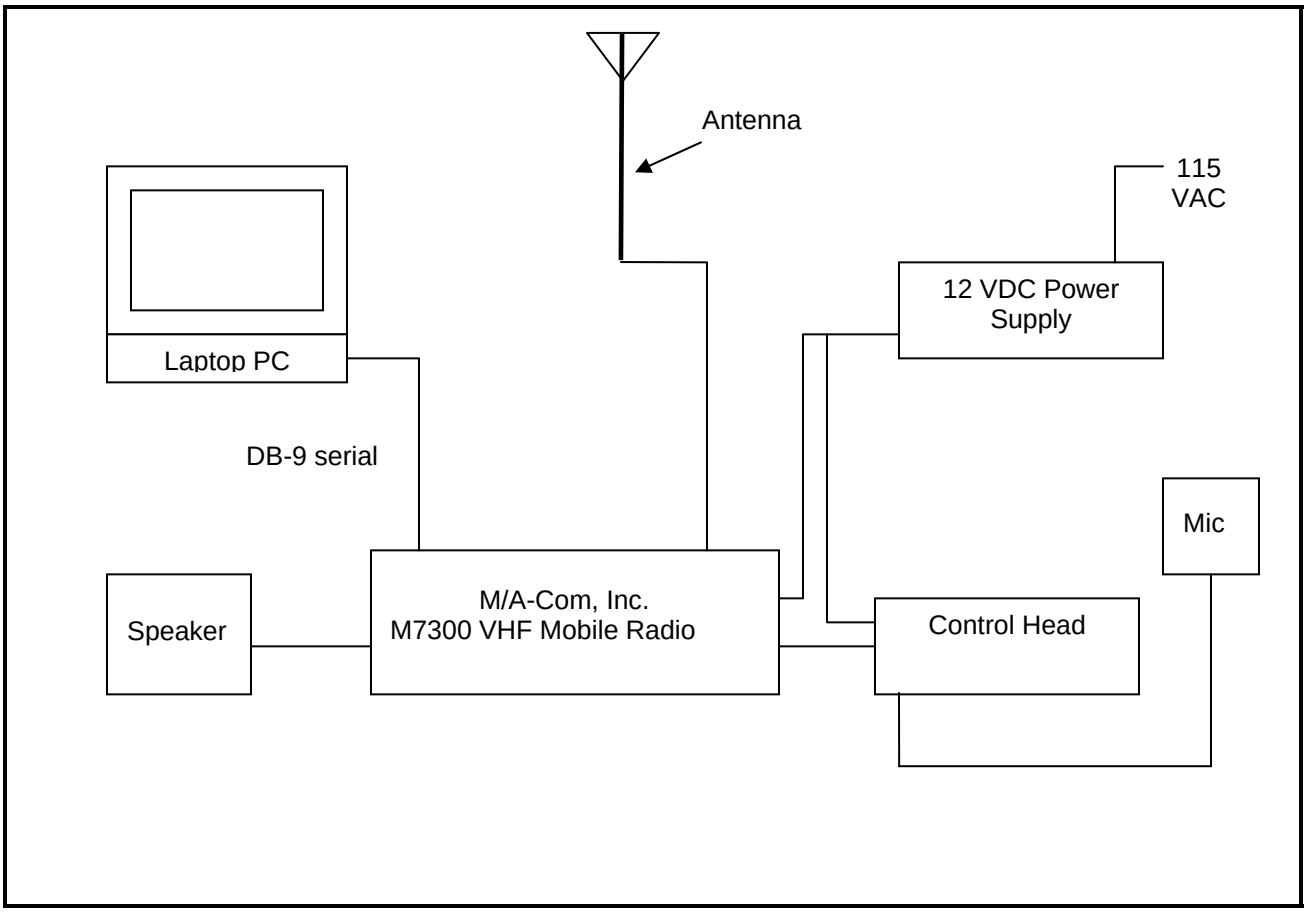


Figure 3-1: Configuration of Tested System

4 FCC Rules and Regulations Part 2.1033(C)(8) Voltages and Currents Through The Final Amplifying Stage

13.94 V / 9.43 A

5 FCC Rules and Regulations Part 2.1046(a): RF Power Output: Conducted, Part 90.541(b)/90.542(a)(6): Transmitting Power Limits, RSS-119 5.4: Transmitter Output Power

5.1 Test Procedure

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

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

Manufacturer's rated power: 50 W

5.2 Test Data

Table 5-1: RF Conducted Output Power - Measured

Frequency (MHz)	High Power (dBm)	High Power (W)	Low Power (dBm)	Low Power (W)
136.0125	47.33	54.075	40.29	10.691
145.5125	47.40	54.954	40.36	10.864
155.0125	47.30	53.703	40.25	10.593
164.5125	47.38	54.702	40.32	10.765
173.9875	47.32	53.951	40.25	10.593

Notes: Data presented is for Analog mode. All other modes were investigated and found to have equivalent power within measurement tolerances.

Table 5-2: Test Equipment Used For Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	11/5/09
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	11/5/09
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/3/09

Test Personnel:

Daniel Baltzell		July 9, 2009
EMC Test Engineer	Signature	Date Of Test

6 FCC Rules and Regulations Part 2.1051: Spurious Emissions at Antenna Terminals; Part 90.543: Emission Limitations, RSS-119 5.8: Transmitter 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.

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps for OTP and 9,600 bps for P25 modes.

6.2 Test Data

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

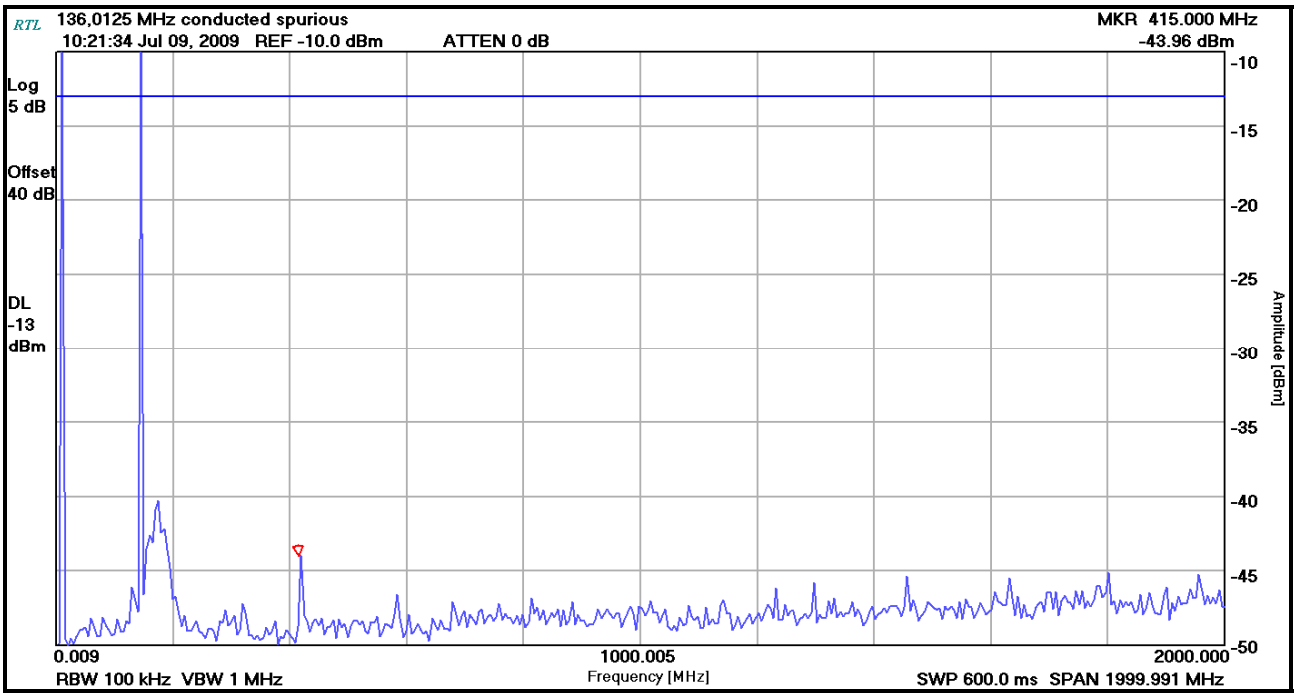
Limits: (43 + 10 LOG P(W))

The following channels (in MHz) were investigated:

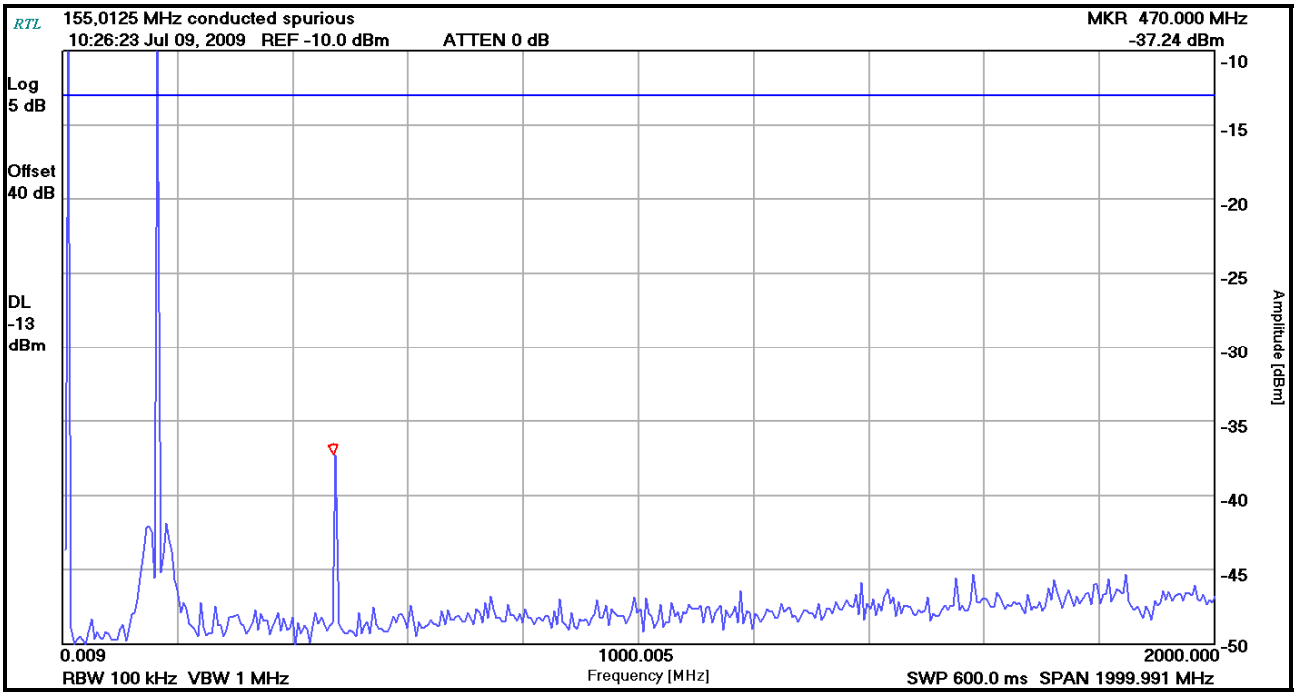
136.0125, 155.0125, and 173.9875

Both high and low power settings were checked; high power was found to be worst case. All modes were investigated and analog mode is presented as representative data.

Plot 6-1: 136.0125 MHz - Analog High Power



Plot 6-2: 155.0125 MHz – Analog High Power



Plot 6-3: 173.9875 MHz – Analog High Power

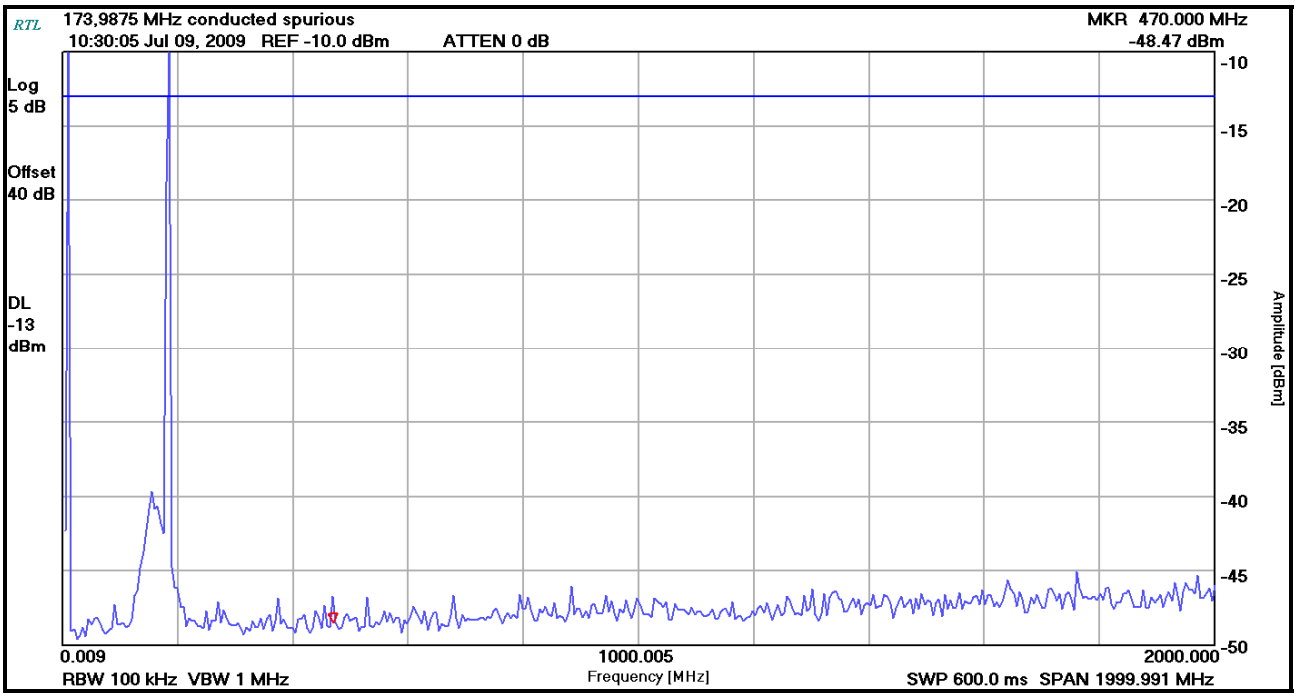


Table 6-1: Test Equipment Used For Testing Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/23/09
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/3/09
901129	Par Electronics	188-174 (25W)	VHF Notch Filters	N/A	3/10/12

Test Personnel:

Daniel Baltzell		July 9, 2009
EMC Test Engineer	Signature	Date Of Test

7 FCC Rules and Regulations Part 2.1053(a): Field Strength of Spurious Radiation; Part 90 90.543(f): Out of Band Emissions Limit; RSS-119 5.8: 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. Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps for OTP and 9,600 bps for P25 and EDACS modes.

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.

No emissions were found to be within a 20 dB margin of the limit; therefore, no emissions are listed.

Worst case emission was found to be Horizontal polarity with a margin of 42.5 dB below the limit at 775.063 MHz.

Table 7-1: Test Equipment Used For Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	12/12/10
900905	Rhein Tech Laboratories	PR-1040	30-2 GHz 40 dB Preamp	N/A	4/10/10
900913	Hewlett Packard	8546A	EMI Receiver	3325A00159	8/8/09
900917	Hewlett Packard	8648C	Signal Generator	3537A01741	9/10/09
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/17/09

Test Personnel:

Daniel Baltzell		July 11, 2009
Test Technician/Engineer	Signature	Date Of Test

8 FCC Rules and Regulations Part 2.1049(c)(1): Occupied Bandwidth; Part 90.210 Authorized Bandwidth; RSS-119 5.8: Transmitter Unwanted Emissions

Occupied Bandwidth - Compliance with the Emission Masks

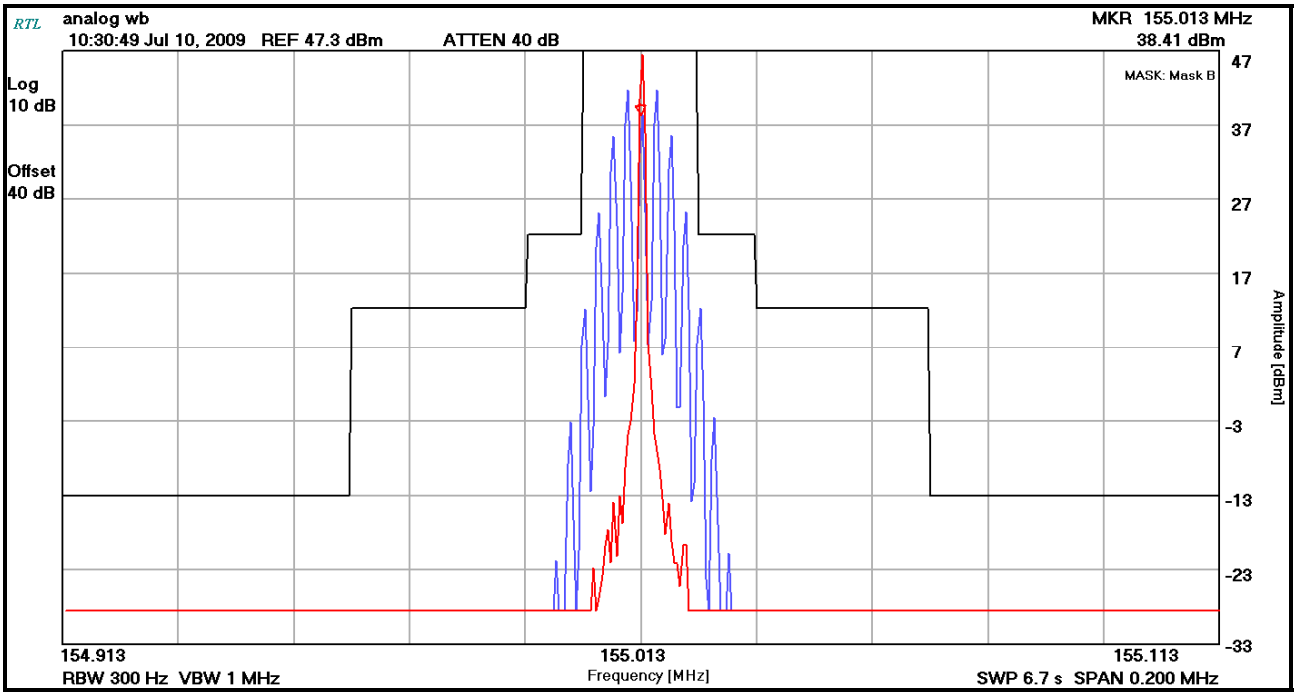
8.1 Test Procedure

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

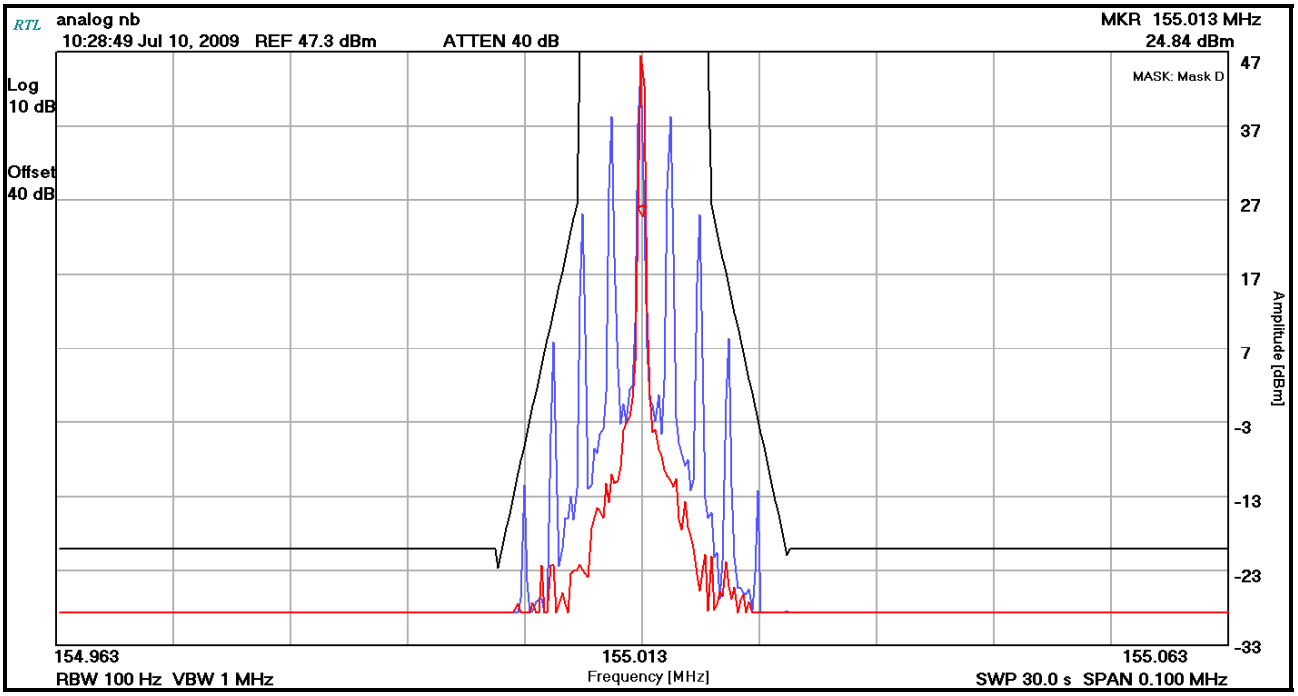
Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps for OTP and 9,600 bps for P25 and EDACS modes.

8.2 Test Data

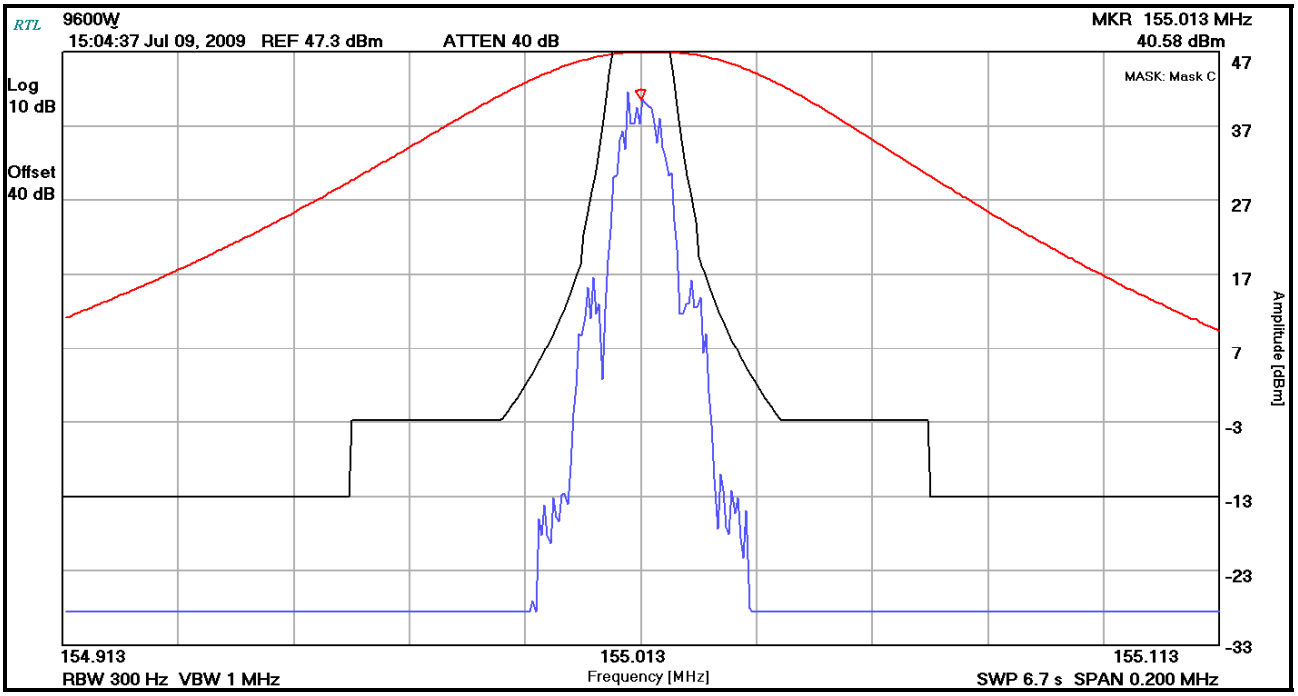
Plot 8-1: Occupied Bandwidth – 155.0125 MHz; Analog (Mask B)



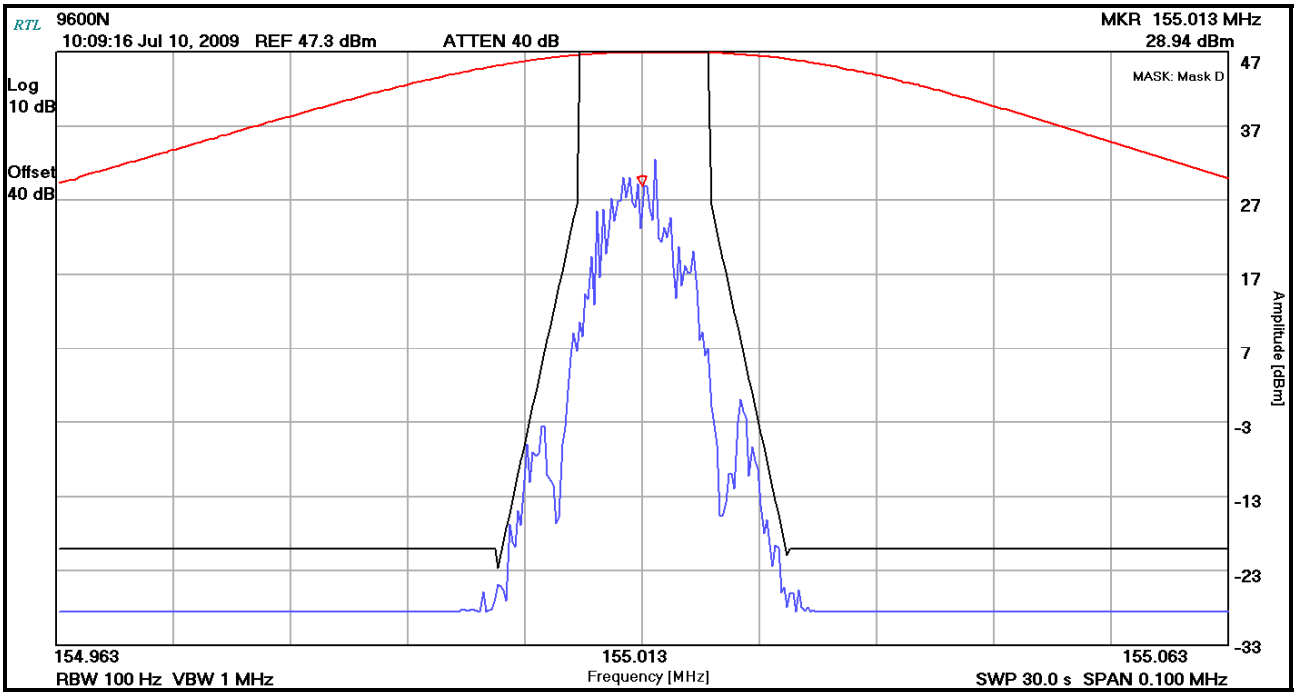
Plot 8-2: Occupied Bandwidth – 155.0125 MHz; Analog (Mask D)



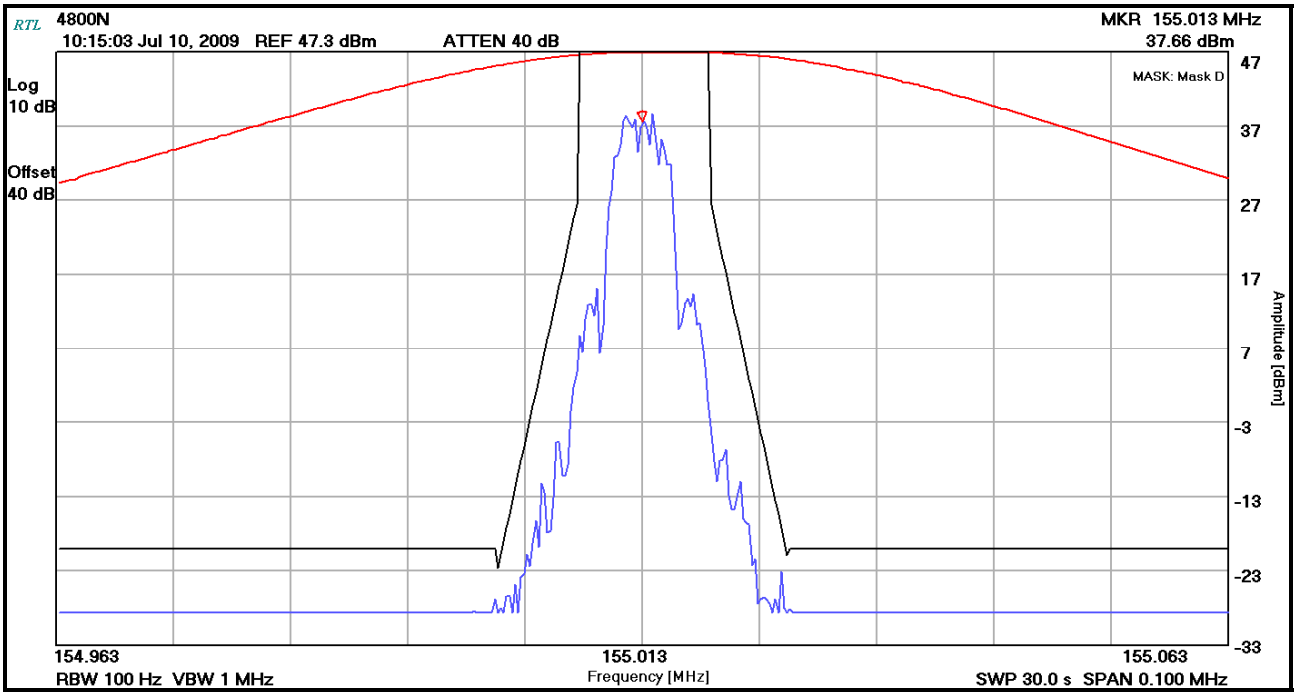
Plot 8-3: Occupied Bandwidth - 136.0125 MHz; 2-Level 9600 FSK (Mask C)



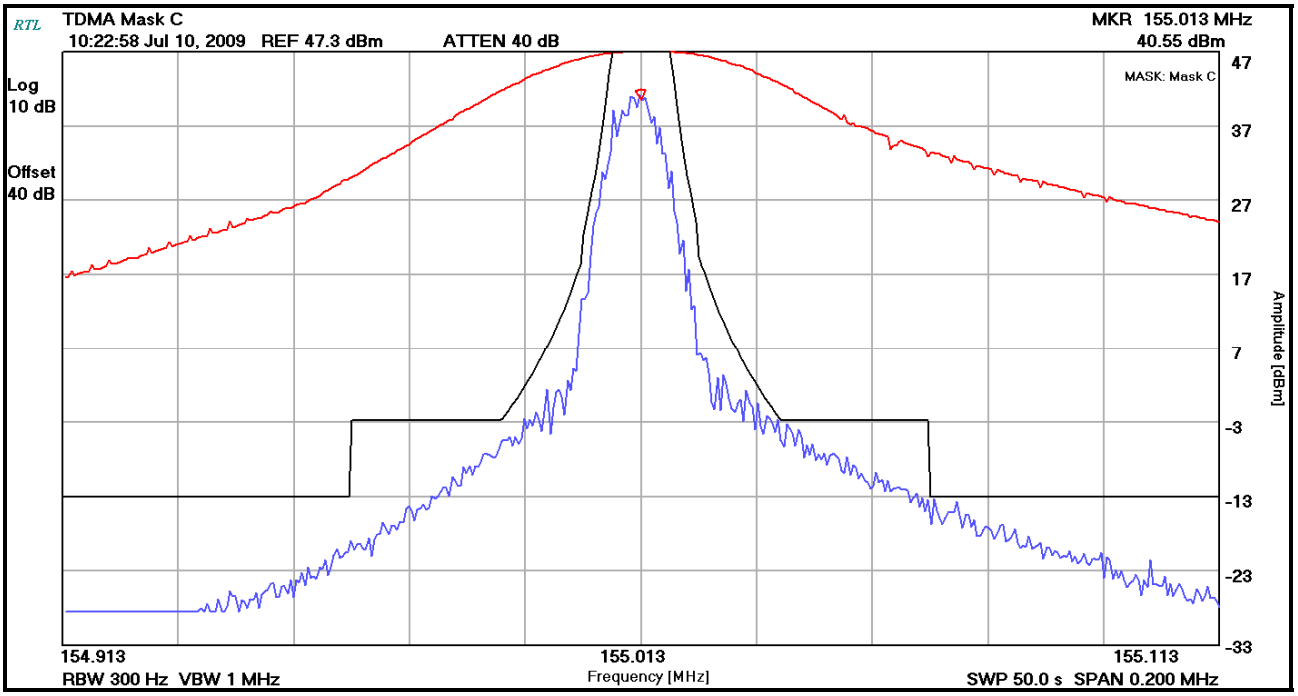
Plot 8-4: Occupied Bandwidth – 155.0125 MHz; 2-Level 9600 FSK (Mask D)



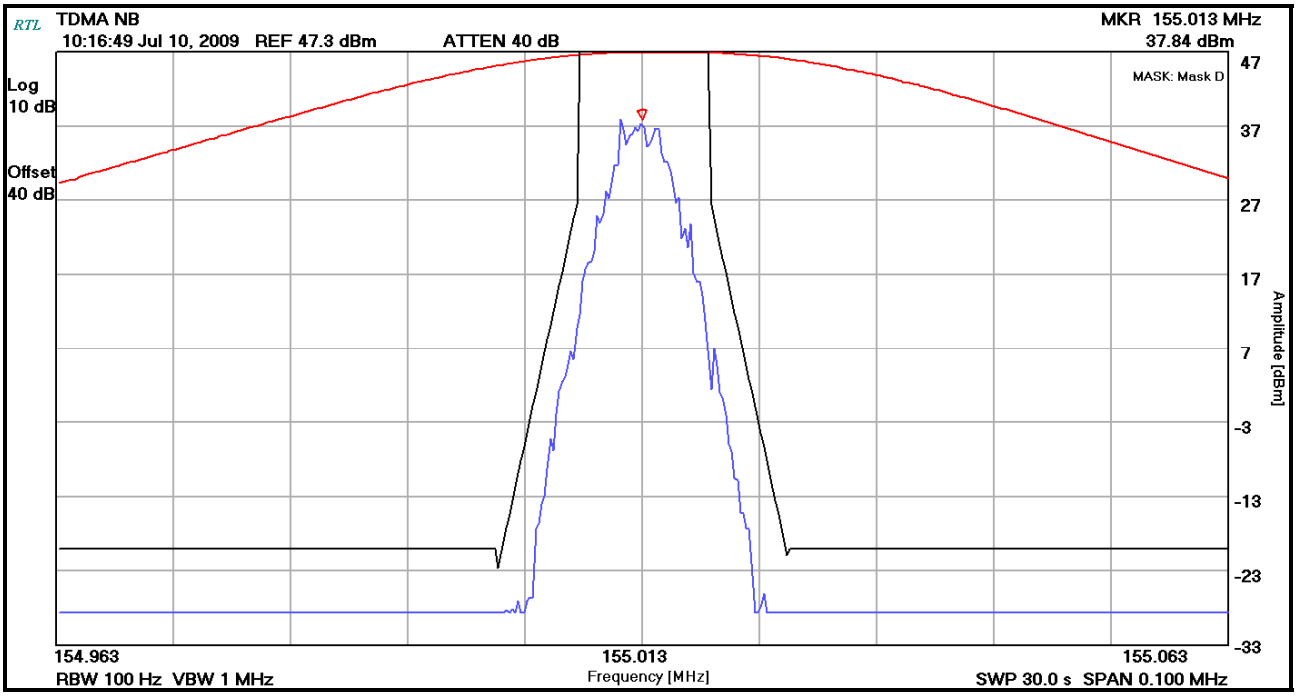
Plot 8-5: Occupied Bandwidth – 155.0125 MHz; 2-Level 4800 FSK; (Mask D)



Plot 8-6: Occupied Bandwidth – 155.0125 MHz; TDMA WB; (Mask C)



Plot 8-7: Occupied Bandwidth – 155.0125 MHz; TDMA NB; (Mask D)



Plot 8-8: Occupied Bandwidth – 155.0125 MHz; P25; (Mask D)

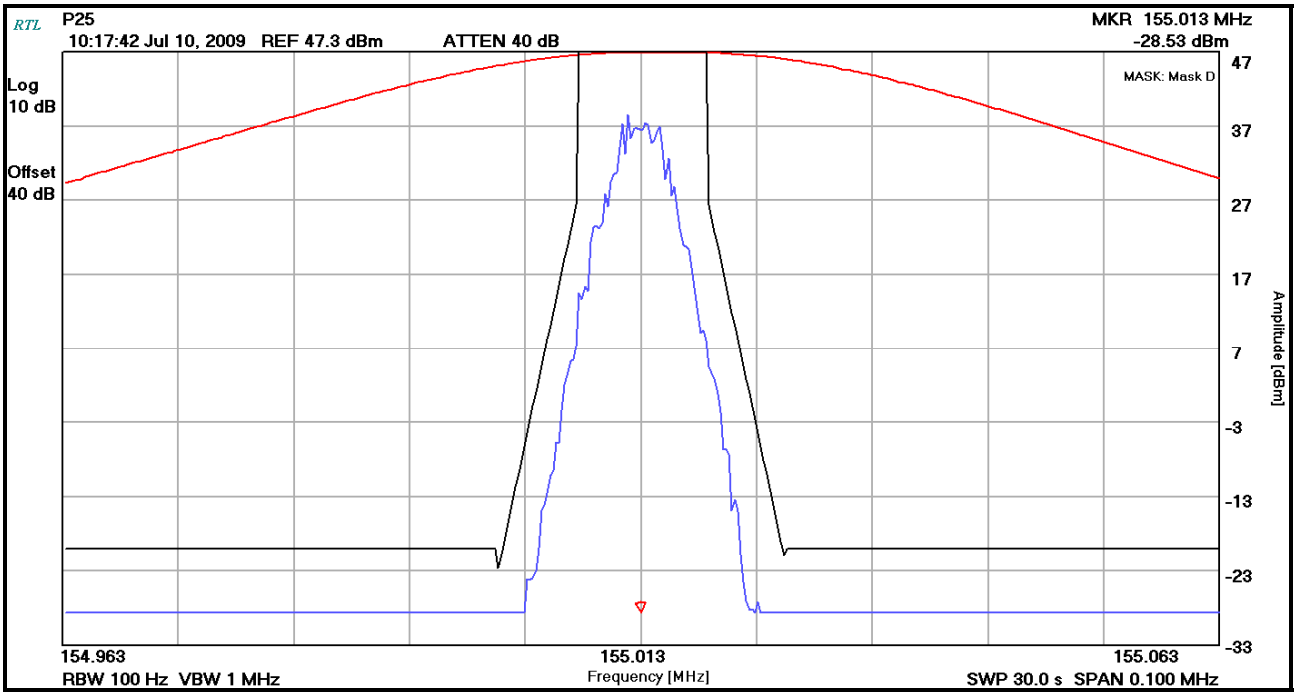


Table 8-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/23/09
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 40dB	BK5859	12/3/09

Test Personnel:

Daniel Baltzell		July 10, 2009
Test Technician/Engineer	Signature	Date Of Test

9 FCC Rules and Regulation Part 2.1055: Frequency Stability; Part 90.539: Frequency Stability; RSS-119 5.3: Transmitter 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 +50°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.

§90.213: Mobile stations over 2 W operating power - 1.5 ppm.

9.2 Test Data

Table 9-1: Temperature Frequency Stability – 155.0125 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	155.012519	-0.1
-20	155.012471	0.2
-10	155.012477	0.1
0	155.012442	0.4
10	155.012420	0.5
20 (reference)	155.012500	0.0
30	155.012486	0.1
40	155.012481	0.1
50	155.012481	0.1

The worst-case deviation was found to be 0.5 ppm. The requirement for this band at 12.5 kHz channel spacing is 1.5 ppm.

Result: The EUT is compliant.

9.2.1 Frequency Stability/Voltage Variation

Table 9-2: Frequency Stability/Voltage Variation – 155.0125 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.7	155.012505	-0.03
13.8 (reference)	155.012500	0.00
15.9	155.012496	0.03

Table 9-3: Test Equipment Used For Testing Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	08/08/09
901300	Agilent Technologies	53131A	Frequency Counter	MY40001345	6/18/10
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 40dB	BK5859	12/3/09

Test Personnel:

Daniel Baltzell		July 11, 2009
EMC Test Engineer	Signature	Date Of Test

10 FCC Part 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	1/15/10
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	9/9/09
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 40dB	BK5859	12/3/09

Test Personnel:

Daniel Baltzell		July 10, 2009
Test Technician/Engineer	Signature	Date Of Test

11 FCC Part 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

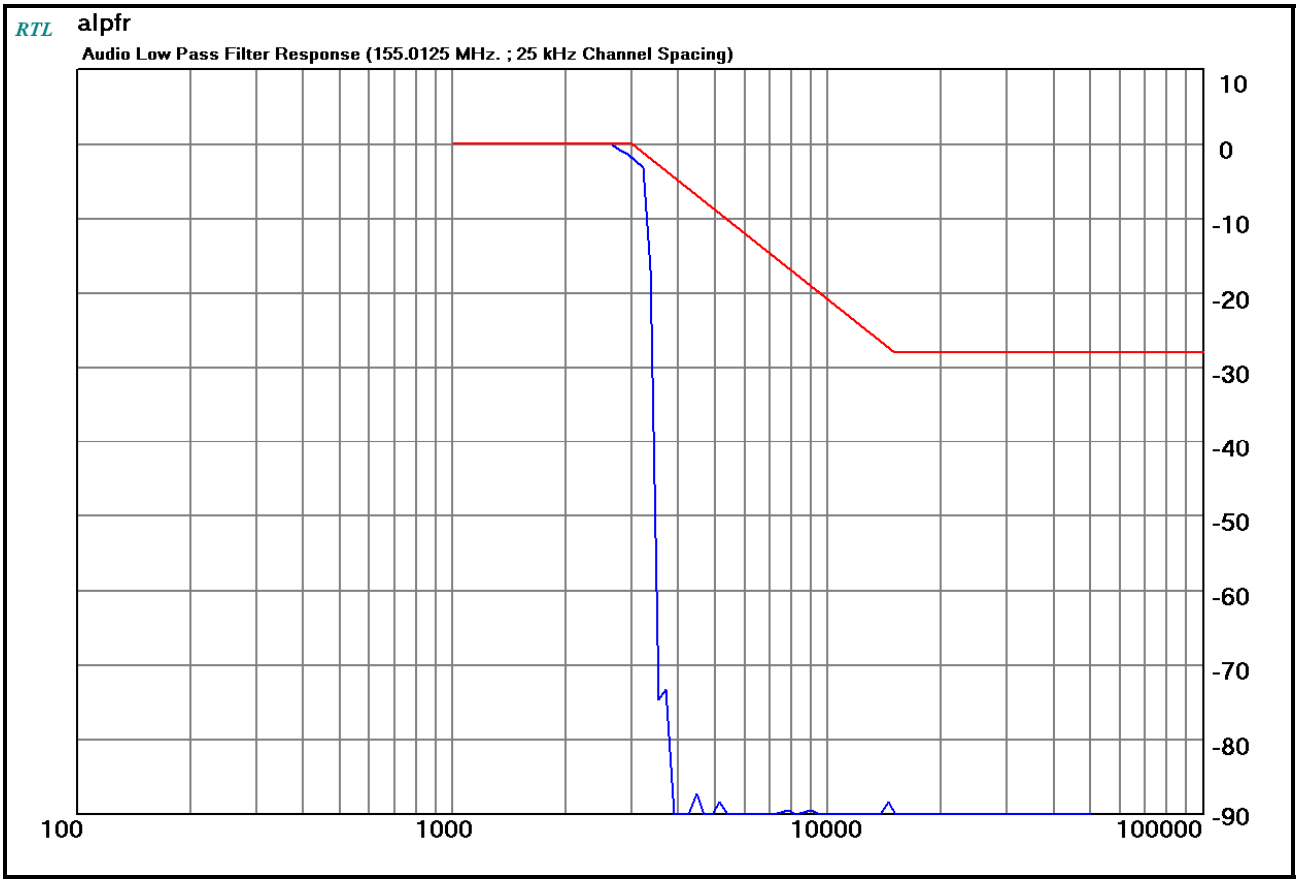


Table 11-1: Test Equipment Used For Testing Audio Low Pass Filter Response

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	1/15/10
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	09/9/09
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	11/10/09
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 40dB	BK5859	12/3/09

Test Personnel:

Daniel Baltzell		July 10, 2009
Test Technician/Engineer	Signature	Date Of Test

12 FCC Rules and Regulations Part 2.1047(b): Modulation Characteristics - Modulation Limiting

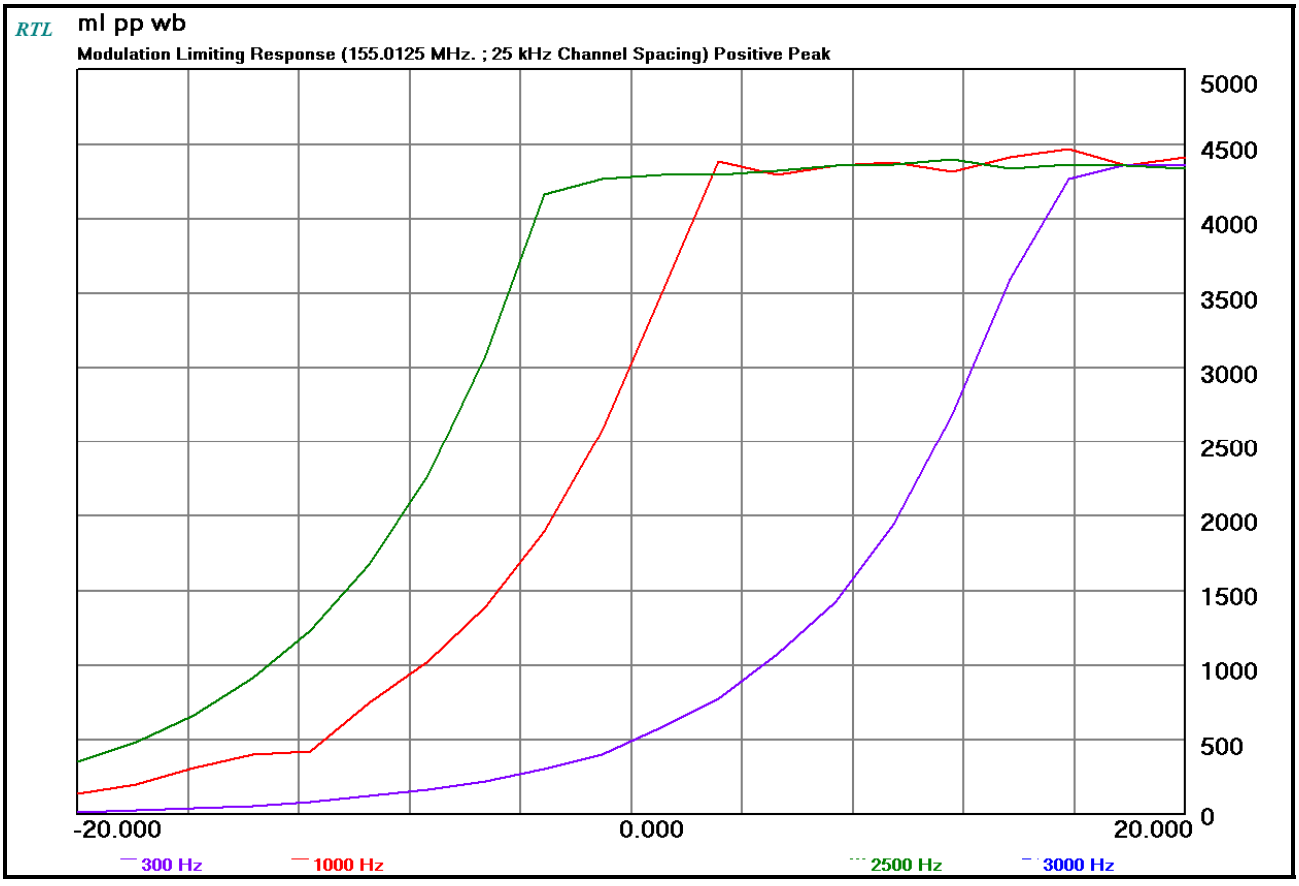
12.1 Test Procedure

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

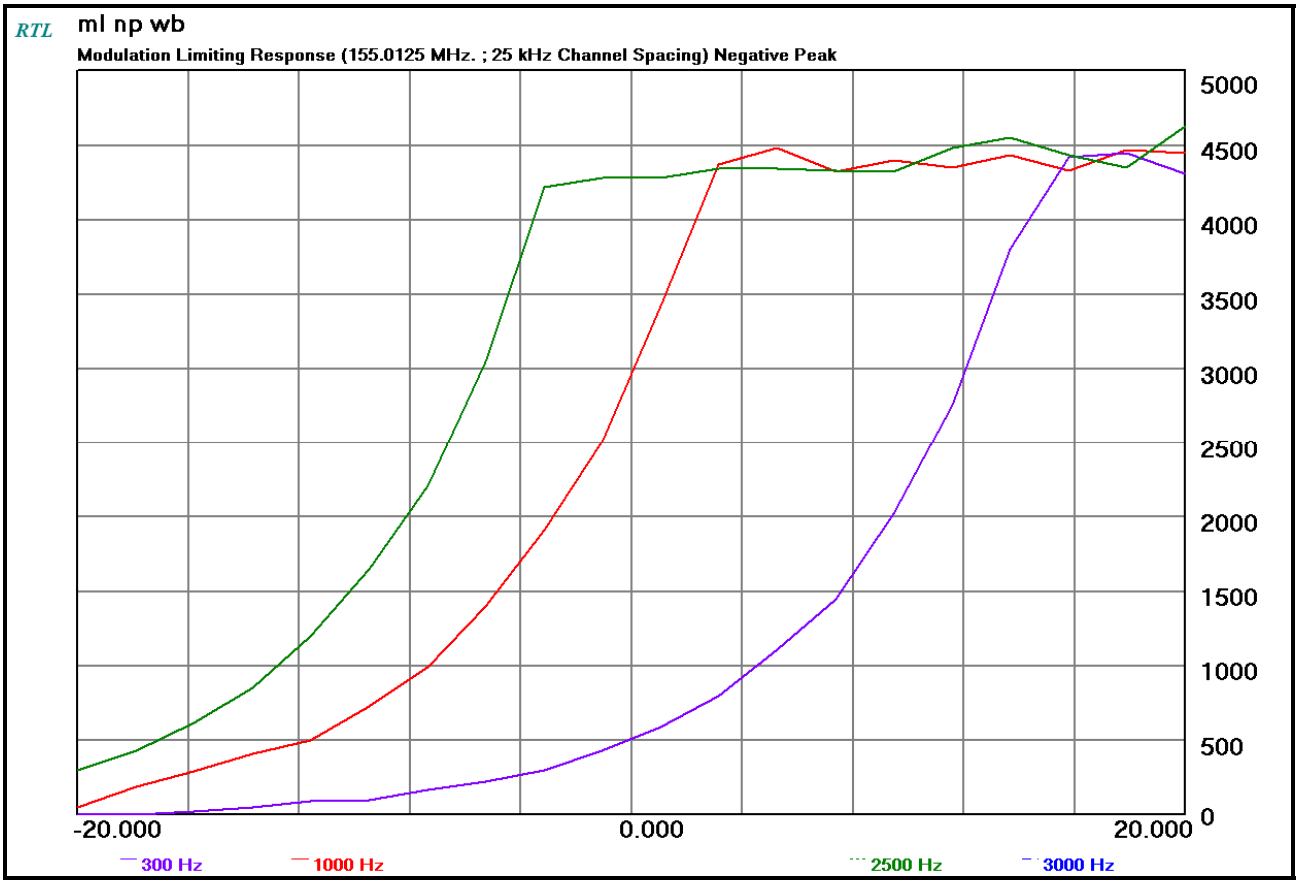
The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level (0 dB) as a reference, the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500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

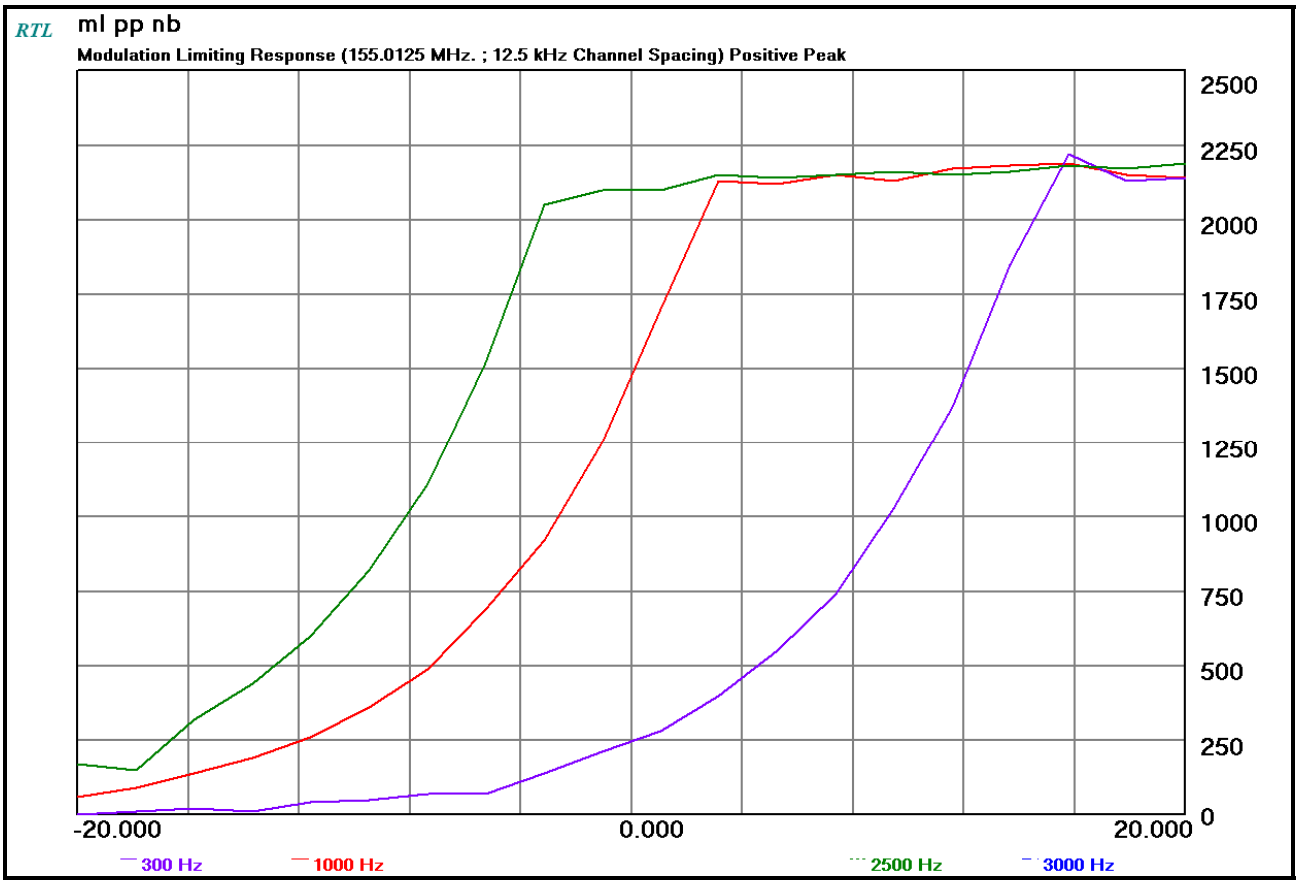
Plot 12-1: Modulation Characteristics – Modulation Limiting; Positive Peak; Wideband



Plot 12-2: Modulation Characteristics – Modulation Limiting; Negative Peak; Wideband



Plot 12-3: Modulation Characteristics – Modulation Limiting; Positive Peak; Narrowband



Plot 12-4: Modulation Characteristics – Modulation Limiting; Negative Peak; Narrowband

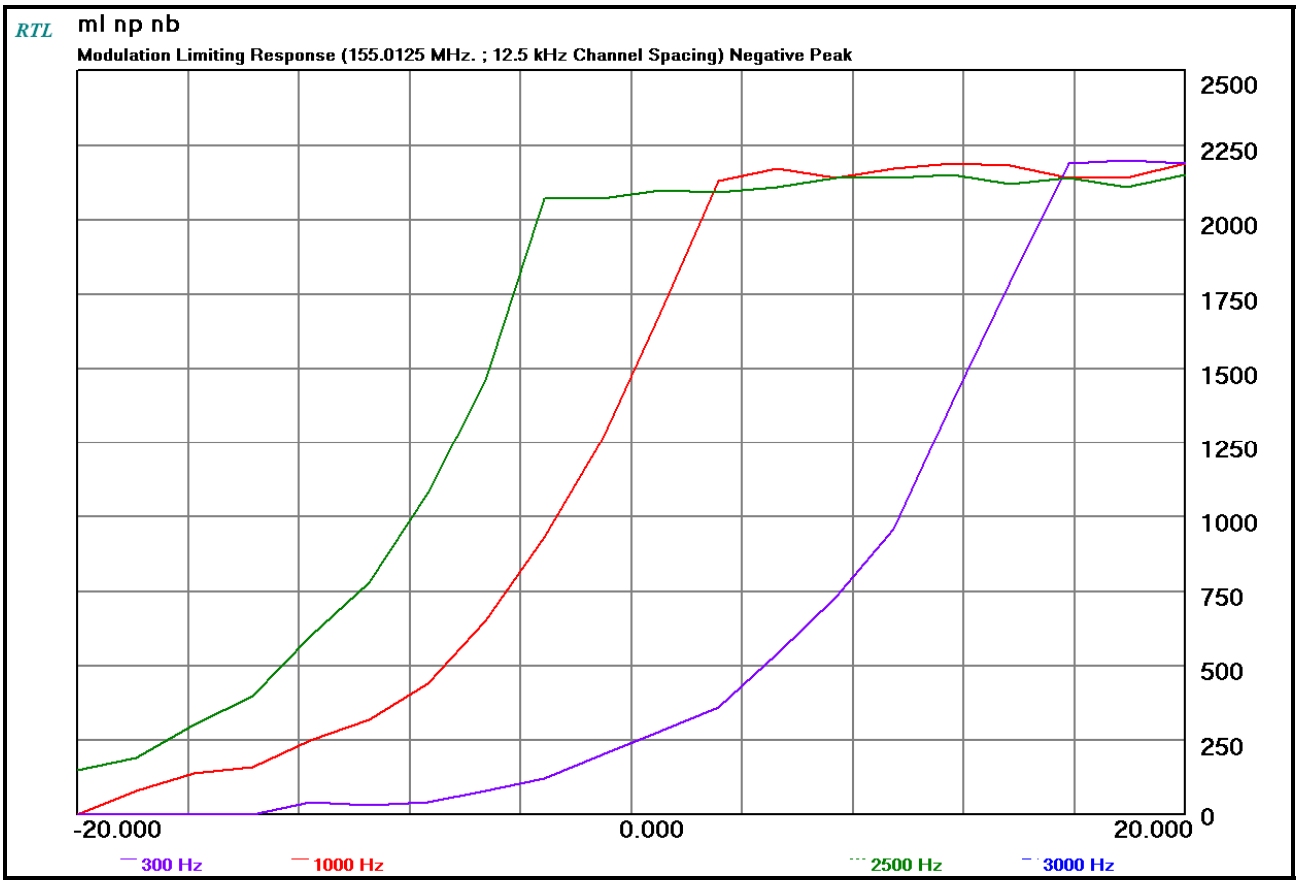


Table 12-1: Test Equipment Used For Testing Modulation Limiting

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	1/15/10
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	09/9/09
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 40dB	BK5859	12/3/09

Test Personnel:

Daniel Baltzell		July 10, 2009
Test Technician/Engineer	Signature	Date Of Test

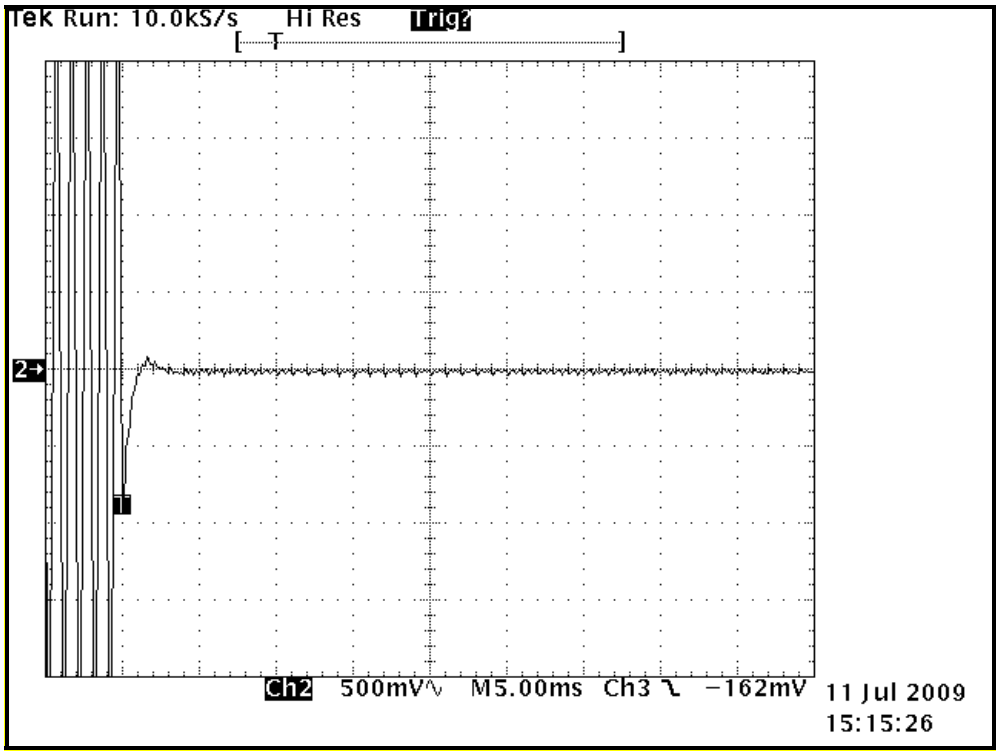
13 FCC Rules and Regulations Part §90.214; IC RSS-119 §5.9: Transient Frequency Response

13.1 Test Procedure

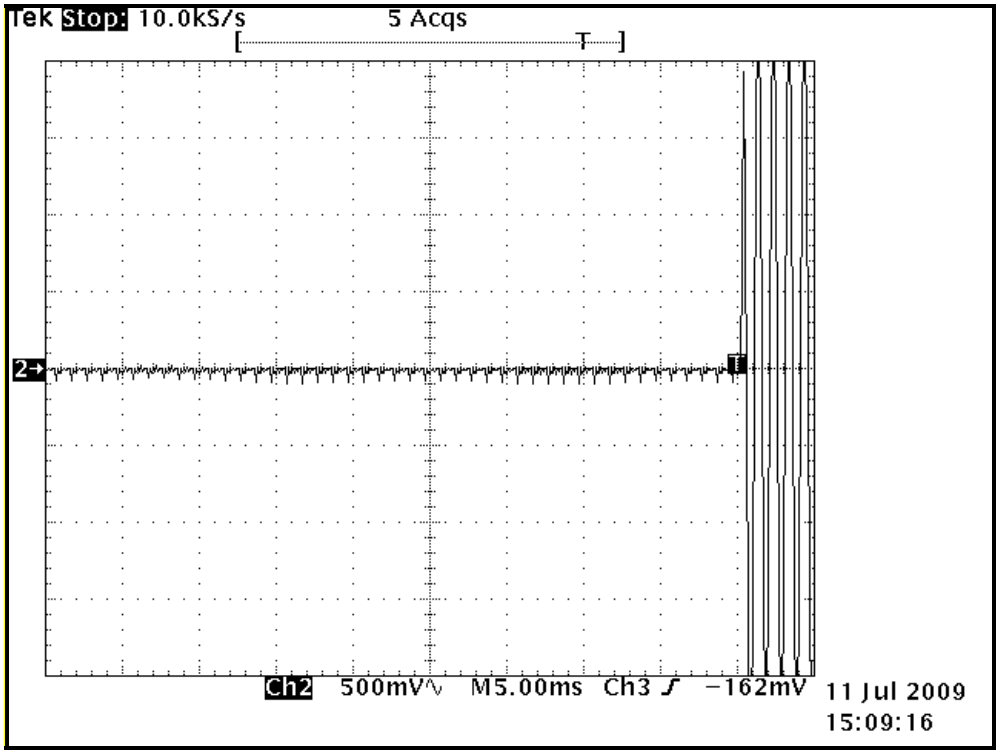
ANSI/TIA/EIA-603-1992, section 2.2.3

13.2 Test Data

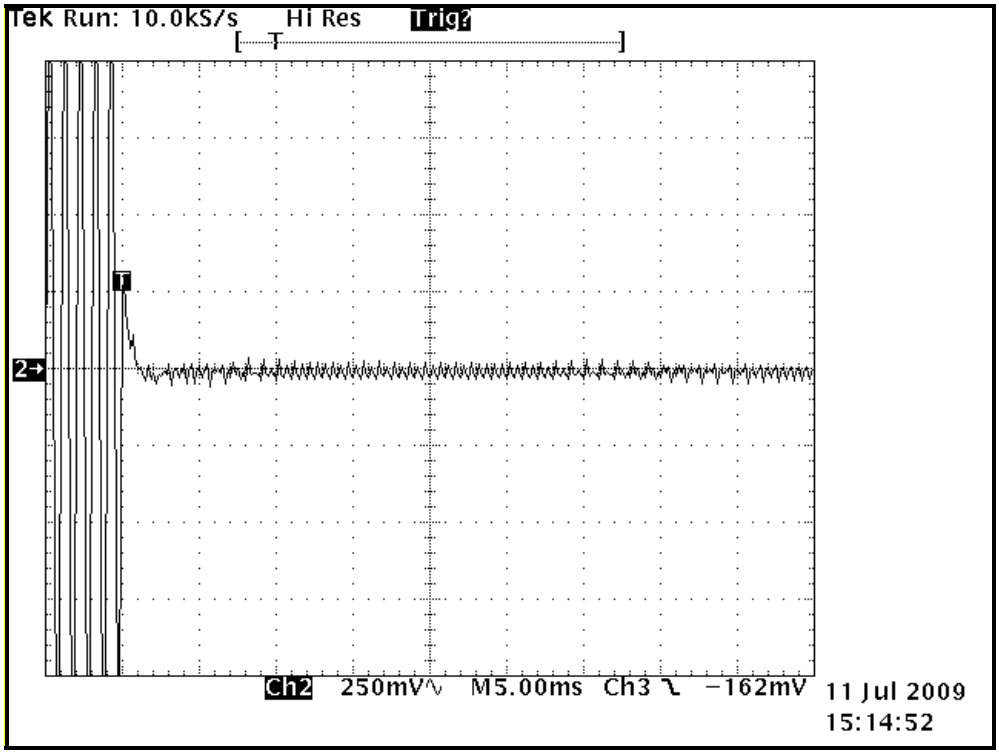
Plot 13-1: Transient Frequency Behavior – 155.0125 MHz; High Power; Wide Band; Carrier ON Time



Plot 13-2: Transient Frequency Behavior – 155.0125 MHz; High Power; Wide Band; Carrier OFF Time



Plot 13-3: Transient Frequency Behavior – 155.0125 MHz; High Power; Narrow Band; Carrier ON Time



Plot 13-4: Transient Frequency Behavior – 155.0125 MHz; High Power; Narrow Band; Carrier OFF Time

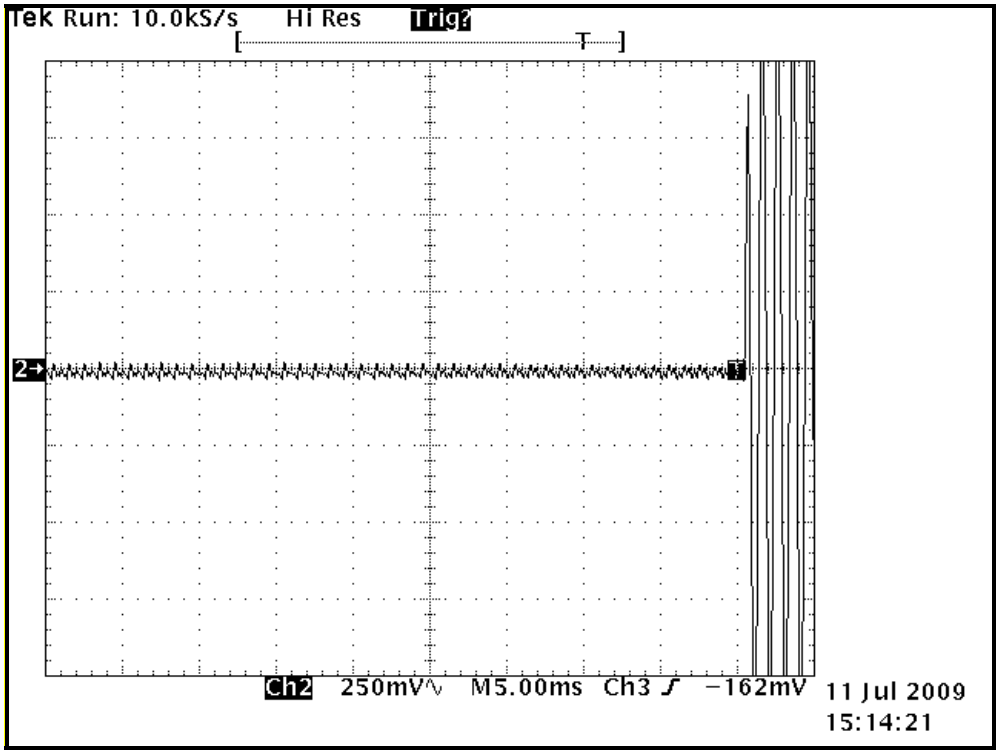


Table 13-1: Test Equipment Used For Testing Transient Frequency Behavior

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900917	Hewlett Packard	8648C	Synthesized Signal Generator (9 KHz - 3200 MHz)	3537A01741	9/10/09
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz – 1300 MHz)	2406A00178	9/09/09
900561	Tektronix	TDS540B	Oscilloscope	B020129	3/20/10
900352	Werlatone	Directional Coupler	Coupler	C1795/4989	7/9/10

Test Personnel:

Daniel Baltzell		July 11, 2009
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, 14K2F1E

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 **Harris Corporation** Model **M7300 VHF Mobile Radio, FCC ID: OWDTR-0055-E, IC: 3636B-0055,** complies with all the applicable requirements of Parts 90, 15 and 2 of the FCC Rules, and Industry Canada RSS-119, Issue 9, 2007.