Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

Topaz3, L.L.C.
10828 NW Air World Drive
Kansas City, MO 64153

MODEL: MURS-22 and MURS-25

FCC ID: O7KMURS22

June 8, 2001

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 95: 1998	PERSONAL RADIO SERVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
ANSI/TIA/EIA603- 1992	LAND MOBILE FM OR PM COMMUNICATIONS EQUIPMENT MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA 603-1-1998	ADDENDUM TO ANSI/TIA/EIA 603-1992

FCC Rules Parts	Frequency Range	Output Power ERP (W)	Freq. Tolerance	Emission Designator
95(J)	151.820	1.4	5 ppm	11K0F3E
95(J)	151.880	1.4	5 ppm	11K0F3E
95(J)	151.940	1.4	5 ppm	11K0F3E
95(J)	154.570	1.4	5 ppm	11K0F3E
95(J)	154.600	1.4	5 ppm	11K0F3E

REPORT PREPARED BY:

EMC Engineer: Daniel Baltzell
Technical Writer: Melissa Fleming

Document Number: 2001083 / 2001127 / 2001137 / QRTL01-040

360 Herndon Parkway, Suite 1400
Herndon, VA 20170
Phone: 703-689-0368; Fax: 703-689-2056; Metro: 703-471-6441

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF PLOTS

TABLE OF PHOTOGRAPHS

TABLE OF APPENDIX

1 GENERAL INFORMATION

The following Report of a Type Certification is prepared on behalf of ***Topaz3, L.L.C. Standard Co., LTD*** in accordance with the Federal Communications Commissions Rules and Regulations. The Equipment Under Test (EUT) was the ***MURS-22 and MURS-25; FCC ID: O7KMURS22***. 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 DIFFERENCE BETWEEN MODELS

The MURS-22 is a 2-Watt, 2 Channel, VHF Radio. The MURS-25 is a 2-Watt, 5 Channel, VHF Radio. The following information is on the MURS-25:

1. LCD for easy user interface
2. A 6th channel option for Repeater Interface: TX – 154.600, RX – 154.570
3. Other user features such as Channel Scan, TOT, and VOX.
4. Weather Receiver function on 162.400, 162.425, 162.450, 162.475, 162.500, 162.525, and 162.550.

1.2 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 Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.3 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 Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.4 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application report.

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

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 95: 1998	PERSONAL RADIO SERVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
ANSI/TIA/EIA603- 1992	LAND MOBILE FM OR PM COMMUNICATIONS EQUIPMENT MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA 603-1-1998	ADDENDUM TO ANSI/TIA/EIA 603-1992

FCC Rules Parts	Frequency Range	Output Power ERP (W)	Freq. Tolerance	Emission Designator
95(J)	151.820	1.4	5 ppm	11K0F3E
95(J)	151.880	1.4	5 ppm	11K0F3E
95(J)	151.940	1.4	5 ppm	11K0F3E
95(J)	154.570	1.4	5 ppm	11K0F3E
95(J)	154.600	1.4	5 ppm	11K0F3E

I, 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 FCC Part 2, FCC Part 95 Certification methodology.

Signature: ______________ Date: June 5, 2001

Typed/Printed Name: Desmond A. Fraser Position: President (NVLAP Signatory)

NVLAP *Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 200061-0.*

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

3 TESTED SYSTEM DETAILS

Listed below is the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

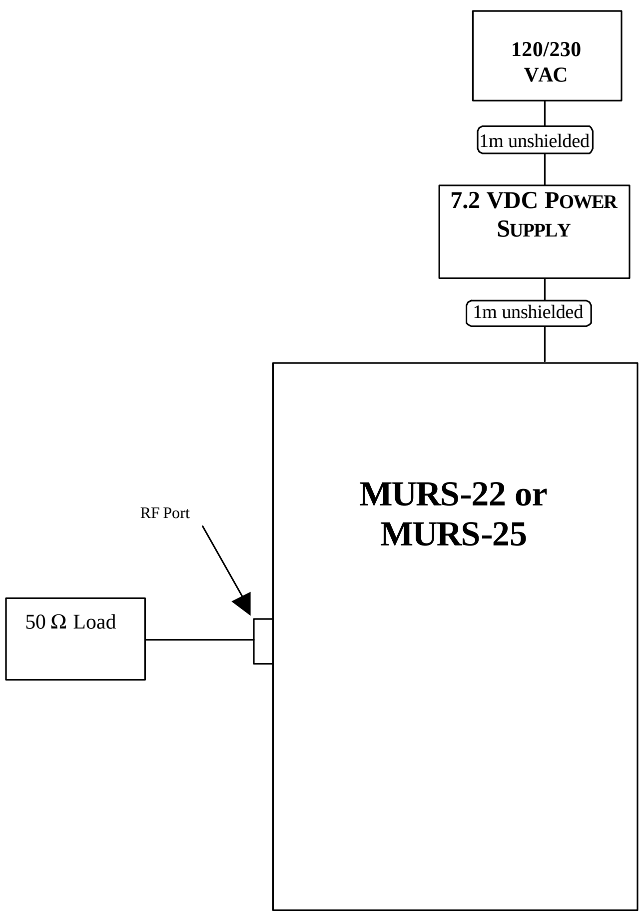
TABLE 3-1: EQUIPMENT UNDER TEST

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID
RADIO	TOPAZ3, L.L.C.	MURS-22	N/A	O7KMURS22
RADIO	TOPAZ3, L.L.C.	MURS-25	N/A	O7KMURS22

TABLE 3-2: EQUIPMENT USED IN TEST CONFIGURATION

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID
ANTENNA WHIP	TOPAZ3, L.L.C.	N/A	N/A	N/A
BATTERY	TOPAZ3, L.L.C.	N/A	N/A	N/A
BATTERY CHARGER	TOPAZ3, L.L.C.	N/A	N/A	N/A

FIGURE 3-1: CONFIGURATION OF TESTED SYSTEM



4 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)
FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(uV/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

49.3 dBuV - 11.5 dB/m = 37.8 dBuV/m

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

5 CONDUCTED MEASUREMENT

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from (150/450) kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

5.1 PART 15.207(D) CONDUCTED EMISSION TEST RESULTS

TABLE 5-1: CONDUCTED EMISSION {NEUTRAL SIDE (LINE 1)}

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
1.100	Pk	17.9	1.0	18.9	48.0	-29.1
1.100	Pk	17.9	1.0	18.9	48.0	-29.1
11.890	Pk	15.7	3.0	18.7	48.0	-29.3
17.710	Pk	15.4	3.7	19.1	48.0	-28.9
23.110	Pk	15.8	4.1	19.9	48.0	-28.1
28.730	Pk	15.4	4.4	19.8	48.0	-28.2

TABLE 5-2: CONDUCTED EMISSION {HOT SIDE (LINE 2)}

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.510	Pk	16.8	0.9	17.7	48.0	-30.3
1.130	Pk	15.5	1.0	16.5	48.0	-31.5
2.400	Pk	16.3	1.5	17.8	48.0	-30.2
8.780	Pk	17.1	2.4	19.5	48.0	-28.5
16.760	Pk	16.2	3.6	19.8	48.0	-28.2
27.780	Pk	15.9	4.4	20.3	48.0	-27.7

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

APRIL 18, 2001
DATE OF TEST

TABLE 5-3: EQUIPMENT USED FOR TESTING

Conducted Emissions					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
900931	HP	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	05/16/02
900070	Solar		LISN		

6 RADIATED MEASUREMENT

Before final measurements of radiated emissions were made on the open-field three meter range, the EUT was scanned indoors at a three meter distance in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

6.1 FCC PART 15 §15.109(A) RADIATED EMISSION TEST RESULTS (DIGITAL INTERFACE / RECEOVER)

The worst-case test data are reported for the MURS-22 and the MURS-25.

TABLE 6-1: RADIATED EMISSION DATA (MURS-22) RECEIVER

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
130.120	Qp	V	30	1.0	19.2	-15.4	3.8	43.5	-39.7
260.240	Qp	V	23	1.0	18.7	-14.4	4.3	46.0	-41.7
390.361	Qp	V	25	1.0	18.6	-10.8	7.8	46.0	-38.2
520.481	Qp	V	17	1.0	18.2	-7.8	10.4	46.0	-35.6
650.601	Qp	V	12	1.0	18.1	-5.5	12.6	46.0	-33.4
780.722	Qp	V	27	1.0	18.2	-4.2	14.0	46.0	-32.0
910.842	Qp	V	33	1.0	18.4	-3.4	15.0	46.0	-31.0

TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 6-2: RADIATED EMISSION DATA {CHANNEL 1: 151.82 MHZ} (MURS-25)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
130.120	Qp	V	90	1.0	35.1	-9.9	25.2	43.5	-18.3
260.240	Qp	V	180	1.0	35.9	-7.8	28.1	46.0	-17.9
390.360	Qp	V	0	1.0	36.1	-3.5	32.6	46.0	-13.4
520.480	Qp	V	225	1.0	33.5	0.5	34.0	46.0	-12.0
650.600	Qp	V	270	1.0	33.7	3.4	37.1	46.0	-8.9
780.720	Qp	V	445	1.0	33.9	5.3	39.2	46.0	-6.8
910.840	Qp	V	225	1.0	34.1	6.6	40.7	46.0	-5.3

TABLE 6-3: RADIATED EMISSION DATA {CHANNEL 3: 151.94 MHZ} (MURS-25)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
130.240	Qp	V	145	1.0	35.2	-9.9	25.3	43.5	-18.2
260.480	Qp	V	270	1.0	32.6	-7.8	24.8	46.0	-21.2
390.720	Qp	V	145	1.0	33.0	-3.5	29.5	46.0	-16.5
520.960	Qp	V	225	1.0	33.8	0.5	34.3	46.0	-11.7
651.200	Qp	V	270	1.0	33.9	3.4	37.3	46.0	-8.7
781.440	Qp	V	225	1.0	34.9	5.3	40.2	46.0	-5.8

TABLE 6-4: RADIATED EMISSION DATA {CHANNEL 6: 154.60 MHZ} (MURS-25)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
132.900	Qp	V	90	1.0	32.7	-9.8	22.9	43.5	-20.6
265.800	Qp	V	145	1.0	32.8	-7.4	25.4	46.0	-20.6
398.700	Qp	V	135	1.0	31.8	-3.1	28.7	46.0	-17.3
531.600	Qp	V	270	1.0	34.7	0.7	35.4	46.0	-10.6
664.500	Qp	V	90	1.0	33.2	3.3	36.5	46.0	-9.5
797.400	Qp	V	90	1.0	32.8	5.5	38.3	46.0	-7.7

TEST PERSONNEL:

Signature: ____________ **Date:** April 22, 2001

Typed/Printed Name: Franck K. Schuppius

TABLE 6-5: RADIATED EMISSION DATA {WEATHER CHANNEL: 162.40 MHZ} (MURS-25)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
130.120	Qp	V	90	1.0	34.0	-9.9	24.1	43.5	-19.4
260.240	Qp	V	270	1.0	33.8	-7.8	26.0	46.0	-20.0
390.360	Qp	V	145	1.0	32.5	-3.5	29.0	46.0	-17.0
520.480	Qp	V	225	1.0	33.6	0.5	34.1	46.0	-11.9
650.600	Qp	V	270	1.0	35.3	3.4	38.7	46.0	-7.3
780.720	Qp	V	0	1.0	33.4	5.3	38.7	46.0	-7.3
130.120	Qp	V	90	1.0	34.0	-9.9	24.1	43.5	-19.4

TABLE 6-6: RADIATED EMISSION DATA {WEATHER CHANNEL: 162.475 MHZ} (MURS-25)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
130.125	Qp	V	90	1.0	33.9	-9.9	24.0	43.5	-19.5
260.250	Qp	V	45	1.0	35.4	-7.8	27.6	46.0	-18.4
390.375	Qp	V	245	1.0	32.5	-3.5	29.0	46.0	-17.0
520.500	Qp	V	145	1.0	34.7	0.5	35.2	46.0	-10.8
650.625	Qp	V	270	1.0	34.5	3.4	37.9	46.0	-8.1
780.750	Qp	V	180	1.0	33.7	5.3	39.0	46.0	-7.0

TABLE 6-7: RADIATED EMISSION DATA {WEATHER CHANNEL: 162.55 MHZ} (MURS-25)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
130.185	Qp	V	90	1.0	35.0	-9.9	25.1	43.5	-18.4
260.370	Qp	V	145	1.0	33.5	-7.8	25.7	46.0	-20.3
390.555	Qp	V	225	1.0	33.5	-3.5	30.0	46.0	-16.0
520.740	Qp	V	225	1.0	34.5	0.5	35.0	46.0	-11.0
650.925	Qp	V	145	1.0	34.8	3.4	38.2	46.0	-7.8
781.110	Qp	V	225	1.0	33.8	5.3	39.1	46.0	-6.9

TEST PERSONNEL:

Signature: ______________ **Date:** April 22, 2001

Typed/Printed Name: Franck K. Schuppius

TABLE 6-8: EQUIPMENT USED FOR TESTING

Radiated Emissions					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771	03/27/02
900999	HP	8596EM Analyzer	Spectrum Analyzer (9KHz - 12.5GHz)	3826A00144	03/25/02
901053	Schaffner@Chase	CBL6112B	Bilog antenna (20 MHz - 2 GHz)	2648	05/24/02
900321	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020	N/A
900323	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020	N/A
900772	Electro Metrics	RGA 60	Horn Antenna	2310	03/25/02
900889	HP	85685A	RF Preselector for HP 8566B or 8568B (20Hz-2GHz)	3146A01309	11/08/01
900800	EMCO	3301B	Active monopole antenna (30 Hz – 50 MHz)	9809-4071	05/02/02

7 FCC PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED

7.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.1

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

7.2 TEST DATA

The following channel (in MHz) were tested 151.820, 151.880, 151.940, 154.570 and 154.600 MHz
The worst-case Output Power (highest) levels are shown.

TABLE 7-1: RF POWER OUTPUT (CONDUCTED) CARRIER OUTPUT POWER (UNMODULATED) (MURS-22)

Frequency	RF Power measured (Watt)*
151.820	2.138
154.570	2.158

TABLE 7-2: RF POWER OUTPUT (CONDUCTED) CARRIER OUTPUT POWER (UNMODULATED) (MURS-25)

Channel Number	Frequency	RF Power measured (Watt)*
1	151.82	1.820
2	151.88	1.820
3	151.94	1.820
4	154.57	1.875
5	154.60	1.879
6	154.60	1.879

*Measurement accuracy: +/- 3%

TEST PERSONNEL:

DANIEL BALTZELL	[signature]	MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 7-3: RF POWER OUTPUT (CONDUCTED) RATED POWER:

Channel Number	Frequency	RF Power measured (Watt)*
1	151.82	2.0
2	151.88	2.0
3	151.94	2.0
4	154.57	2.0
5	154.60	2.0
6	154.60	2.0

TEST PERSONNEL:

DANIEL BALTZELL	[signature]	MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 7-4: EQUIPMENT USED FOR TESTING

RF Power Output - Conducted					
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900770	Hewlett Packard	437B	Power Meter	2949A02966	02/16/02
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01
900769	Hewlett Packard	8481B	Power Sensor	2702A05059	02/09/02
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01

8 FCC PART 2.1046 (A) RF POWER OUTPUT: RADIATED - ERP

8.1 TEST PROCEDURE

Substitution Method:

The EUT was setup at an antenna to EUT distance of 3 meters on an open area test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane.

The physical arrangement of the EUT and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations.

The worst-case, maximum radiated emission was recorded and used as reference for the ERP measurement.

The EUT was then replaced by an ½ wave dipole antenna and polarized in accordance with the EUT's antenna polarization. The ½ wave dipole antenna was connected to a RF signal generator with a coaxial cable.

The search antenna height, and search antenna polarity was set to levels that produced the maximum reading obtained in step 3. The signal generator was adjusted to a level that produced the radiated emission level obtained in step 3.

The signal generator level was recorded and corrected by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal ½ wave dipole antenna. The signal generator corrected level is the ERP level

8.2 TEST DATA

Settings:

- Power: 2 Watt delivered to antenna*
- radiated power measurements (3 meter)

TABLE 8-1: RF POWER OUTPUT: RADIATED - ERP (MURS-22)

Frequency (MHz)	Signal Generator Level (dBm)*	Cable Loss (dB)	Corrected Antenna Gain (dBi)	Corrected level (dBm)	(Watt)
151.82	31.1	2.1	-0.3	28.7	0.7413
154.57	33.3	1.9	-0.2	31.3	1.349

*Antenna as specified by manufacturer
**Measurement accuracy is +/- 1.5 dB

TABLE 8-2: RF POWER OUTPUT: RADIATED - ERP (MURS-25)

Frequency (MHz)	Signal Generator Level (dBm)*	Cable Loss (dB)	Corrected Antenna Gain (dBi)	Corrected level (dBm)	(Watt)
151.82	32.2	3.3	-0.15	28.79	0.757
151.88	31.7	3.3	-0.15	28.29	0.675
151.94	32.9	3.3	-0.15	29.41	0.873
154.57	29.3	3.4	-0.15	25.77	0.378
154.60	29.3	3.4	-0.15	25.79	0.379
154.60	32.6	3.4	-0.15	29.09	0.811

*Antenna as specified by manufacturer
**Measurement accuracy is +/- 1.5 dB

TEST PERSONNEL:

DANIEL BALTZELL	[signature]	MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 8-3: EQUIPMENT USED FOR TESTING

RF Power Output – Radiated - ERP					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	05/16/02
900154	Compliance Design Inc,	Roberts Dipole	Adjustable Elements Dipole Antenna (30-1000MHz)	-	07/266/01

9 FCC PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

9.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 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 1000 Hz.

9.1.1 FCC PART 90 REQUIREMENTS

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

Limits: Mask B (dBm): P(dBm) – (43+10xLOG P(W))
Mask D (dBm): P(dBm) – (50+10xLOG P(W))

Both 151.82 and 154.57 MHz were investigated, representing 25 kHz and 12.5 kHz channel spacing.

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.

9.2 TEST DATA

TABLE 9-1: SPURIOUS EMISSIONS (CHANNEL 1 (151.820 MHZ) – 2 WATT AND 11.25 KHZ CHANNEL BANDWIDTH: MASK B) (MURS-22)

Frequency (MHz)	Level Measured (-dBc)	Limit (-dBc)	Margin (dB)
303.64	-60.7	-46.3	-14.4
455.46	-74.6	-46.3	-28.3
607.28	-75.9	-46.3	-29.6
759.10	-83.3	-46.3	-37.0
910.92	-90.4	-46.3	-44.1
1062.74	-95.7	-46.3	-49.4
1214.56	-95.9	-46.3	-49.6
1366.38	-103.4	-46.3	-57.1
1518.20	-106.0	-46.3	-59.7

TABLE 9-2: SPURIOUS EMISSIONS (CHANNEL 2 (154.570 MHZ) – 2 WATT AND 12.5 KHZ CHANNEL BANDWIDTH: MASK D) (MURS-22)

Frequency (MHz)	Level Measured (-dBc)	Limit (-dBc)	Margin (dB)
309.14	-68.5	-53.3	-15.2
463.71	-72.9	-53.3	-19.5
618.28	-76.8	-53.3	-23.4
772.85	-80.7	-53.3	-27.4
927.42	-93.3	-53.3	-39.9
1081.99	-94.0	-53.3	-40.7
1236.56	-98.6	-53.3	-45.2
1391.13	-94.9	-53.3	-41.5
1545.70	-107.5	-53.3	-54.1

TEST PERSONNEL:

DANIEL BALTZELL	[signature]	MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

9.3 TEST DATA

TABLE 9-3: SPURIOUS EMISSIONS (CHANNEL 1 (151.820 MHZ) – 2 WATT AND 11.25 KHZ CHANNEL BANDWIDTH: MASK B) (MURS-25)

Frequency (MHz)	Level Measured (-dBc)	Limit (-dBc)	Margin (dB)
303.64	-60.7	-46.3	-14.4
455.46	-74.6	-46.3	-28.3
607.28	-75.9	-46.3	-29.6
759.10	-83.3	-46.3	-37.0
910.92	-90.4	-46.3	-44.1
1062.74	-95.7	-46.3	-49.4
1214.56	-95.9	-46.3	-49.6
1366.38	-103.4	-46.3	-57.1
1518.20	-106.0	-46.3	-59.7

TABLE 9-4: SPURIOUS EMISSIONS (CHANNEL 2 (154.570 MHZ) – 2 WATT AND 12.5 KHZ CHANNEL BANDWIDTH: MASK D) (MURS-25)

Frequency (MHz)	Level Measured (-dBc)	Limit (-dBc)	Margin (dB)
309.14	-68.5	-53.3	-15.2
463.71	-72.9	-53.3	-19.5
618.28	-76.8	-53.3	-23.4
772.85	-80.7	-53.3	-27.4
927.42	-93.3	-53.3	-39.9
1081.99	-94.0	-53.3	-40.7
1236.56	-98.6	-53.3	-45.2
1391.13	-94.9	-53.3	-41.5
1545.70	-107.5	-53.3	-54.1

TEST PERSONNEL:

DANIEL BALTZELL	Daniel W. Baltzell	MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 9-5: EQUIPMENT USED FOR TESTING

Spurious Emissions at Antenna Terminals)					
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	03/06/02
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	06/21/01
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	06/08/01
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	11/07/01

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

10.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.12

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 1000 Hz.

Refer to section "Radiated Measurement" in this report for further information.

10.2 TEST DATA

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 10-1: RADIATED EMISSIONS (CHANNEL 1AT 151.820 MHZ) - SUBSTITUTION METHOD (MURS-22)

2Watt at 11.25 kHz channel spacing						
Frequency (MHz)	**Signal Generator Emission Level (dBm)**	**Cable Loss (dB)**	**Antenna Gain (corrected to 1/2 wave) (dBi)**	**Corrected Emission Level (-dBc)**	**Limit (-dBc)**	**Margin (dB)**
303.64	-30.4	2.7	-0.8	-67.2	-46.3	-20.9
455.46	-22.7	3.7	-0.6	-60.3	-46.3	-14.0
607.28	-26.2	3.8	-1.2	-64.5	-46.3	-18.2
759.10	-34.6	4.5	-1.2	-73.6	-46.3	-27.3
910.92	-39.7	5.1	-1.1	-79.2	-46.3	-32.9
1062.74	-51.6	5.0	0.5	-89.4	-46.3	-43.1
1214.56	-55.6	6.0	1.9	-93.0	-46.3	-46.7
1366.38	-61.1	5.4	3.4	-96.4	-46.3	-50.1
1518.20	-54.7	6.6	4.7	-89.9	-46.3	-43.6

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

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

MAY 15, 2001
DATE OF TEST

TABLE 10-2: RADIATED EMISSIONS (CHANNEL 2 AT 154.57 MHZ) - SUBSTITUTION METHOD (MURS-22)

2Watt at 12.5 kHz channel spacing						
Frequency (MHz)	Signal Generator Emission Level (dBm)	Cable Loss (dB)	Antenna Gain (corrected to 1/2 wave) (dBi)	Corrected Emission Level (-dBc)	Limit (-dBc)	Margin (dB)
309.14	-32.5	2.9	-0.6	-69.3	-53.3	-16.0
463.71	-21.4	3.7	-0.6	-59.0	-53.3	-5.7
618.28	-33.9	3.9	-1.2	-72.3	-53.3	-19.0
772.85	-32.7	4.6	-1.3	-71.9	-53.3	-18.6
927.42	-25.4	4.8	-1.2	-64.7	-53.3	-11.4
1081.99	-36.5	5.1	0.7	-74.3	-53.3	-21.0
1236.56	-39.0	5.9	2.1	-76.1	-53.3	-22.8
1391.13	-36.6	5.9	3.6	-72.2	-53.3	-18.9
1545.70	-33.1	6.5	4.7	-68.3	-53.3	-14.9

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

TABLE 10-3: RADIATED EMISSIONS (CHANNEL 1AT 151.820 MHZ) - SUBSTITUTION METHOD (MURS-25)

2Watt at 11.25 kHz channel spacing						
Frequency (MHz)	Signal Generator Emission Level (dBm)	Cable Loss (dB)	Antenna Gain (corrected to 1/2 wave) (dBi)	Corrected Emission Level (-dBc)	Limit (-dBc)	Margin (dB)
303.64	-47.9	3.8	-0.65	-85.05	-45.7	-39.3
455.46	-45.1	4.7	-0.55	-83.09	-45.7	-37.4
607.28	-45.7	4.6	-1.15	-84.19	-45.7	-38.5
759.10	-51.1	5.2	-1.25	-90.27	-45.7	-44.5
910.92	-46.0	5.9	-1.15	-85.79	-45.7	-40.1
1062.74	-69.3	5.9	0.63	-107.31	-45.7	-61.6
1214.56	-70.4	6.9	2.12	-107.92	-45.7	-62.2
1366.38	-80.4	6.4	3.61	-115.93	-45.7	-70.2
1518.20	-78.7	7.5	4.67	-114.27	-45.7	-68.5

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

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

[signature]
SIGNATURE

MAY 15, 2001
DATE OF TEST

TABLE 10-4: RADIATED EMISSIONS (CHANNEL 3 AT 151.940 MHZ) - SUBSTITUTION METHOD (MURS-25)

2Watt at 11.25 kHz channel spacing						
Frequency (MHz)	**Signal Generator Emission Level (dBm)**	**Cable Loss (dB)**	**Antenna Gain (corrected to 1/2 wave) (dBi)**	**Corrected Emission Level (-dBc)**	**Limit (-dBc)**	**Margin (dB)**
303.88	-51.7	3.3	-0.65	-88.39	-45.7	-42.7
455.82	-61.5	5.5	-0.55	-100.33	-45.7	-54.6
607.76	-54.4	5.6	-1.15	-93.89	-45.7	-48.2
759.70	-51.1	5.8	-1.25	-90.87	-45.7	-45.1
911.64	-55.2	6.3	-1.15	-95.41	-45.7	-49.7
1063.58	-64.0	6.3	0.63	-102.41	-45.7	-56.7
1215.52	-69.5	7.2	2.12	-107.32	-45.7	-61.6
1367.46	-72.2	6.5	3.61	-107.83	-45.7	-62.1
1519.40	-69.8	7.4	4.67	-105.27	-45.7	-59.5

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

TABLE 10-5: RADIATED EMISSIONS (CHANNEL 6 AT 154.600 MHZ) - SUBSTITUTION METHOD (MURS-25)

2Watt at 12.5 kHz channel spacing						
Frequency (MHz)	**Signal Generator Emission Level (dBm)**	**Cable Loss (dB)**	**Antenna Gain (corrected to 1/2 wave) (dBi)**	**Corrected Emission Level (-dBc)**	**Limit (-dBc)**	**Margin (dB)**
309.2	-43.2	3.6	-0.65	-80.23	-52.7	-27.5
463.8	-43.1	4.3	-0.55	-80.71	-52.7	-28.0
618.4	-47.1	4.5	-1.15	-85.45	-52.7	-32.7
773.0	-53.4	5.1	-1.25	-92.47	-52.7	-39.7
927.6	-47.5	5.6	-1.15	-87.01	-52.7	-34.3
1082.2	-65.2	5.7	0.63	-103.01	-52.7	-50.3
1236.8	-74.3	6.5	2.12	-111.42	-52.7	-58.7
1391.4	-78.2	6.7	3.61	-114.03	-52.7	-61.3
1546.0	-76.0	7.1	4.67	-111.17	-52.7	-58.4

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

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

MAY 15, 2001
DATE OF TEST

TABLE 10-6: EQUIPMENT USED FOR TESTING

Field Strength (Spurious Radiation)					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
900791	Schaffner@Chase	CBL6112	Anetenna (25MHz – 2GHz)	2099	02/26/02

900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505	09/15/01
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	03/06/02
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 KHz to 3200 MHz)	3537A01741	04/10/02
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866	03/28/02

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

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

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

11.1 TEST PROCEDURE

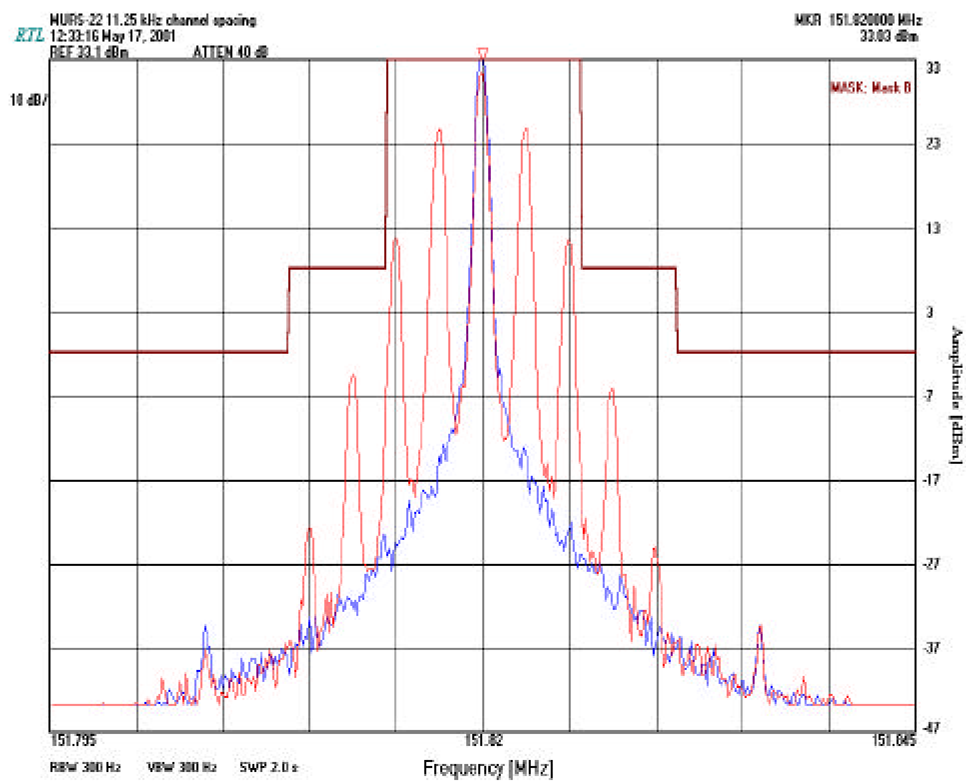
ANSI/TIA/EIA-603-1992, section 2.2.11

Device with audio modulation: Transmitter is modulated with a 2500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1000 Hz.

Device with digital modulation: N/A

11.2 TEST DATA

PLOT 11-1: CHANNEL 1: 2 W FOR 11.25 KHZ CHANNEL BANDWIDTH: MASK B (AUDIO MODULATION: 2,500 HZ) (MURS-22)

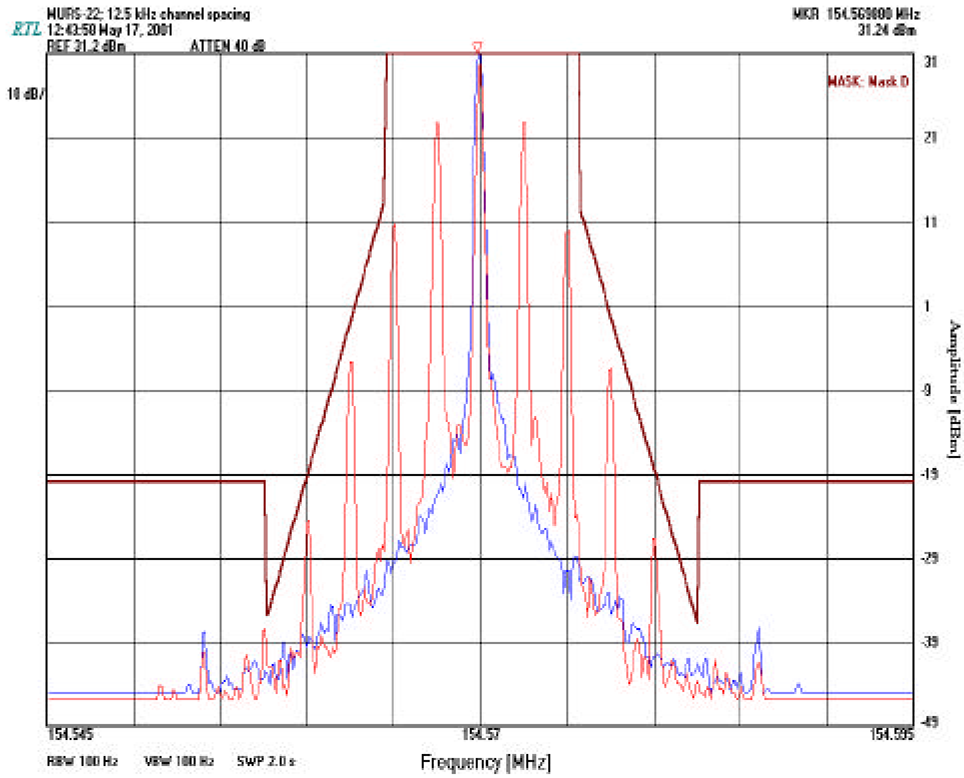


TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

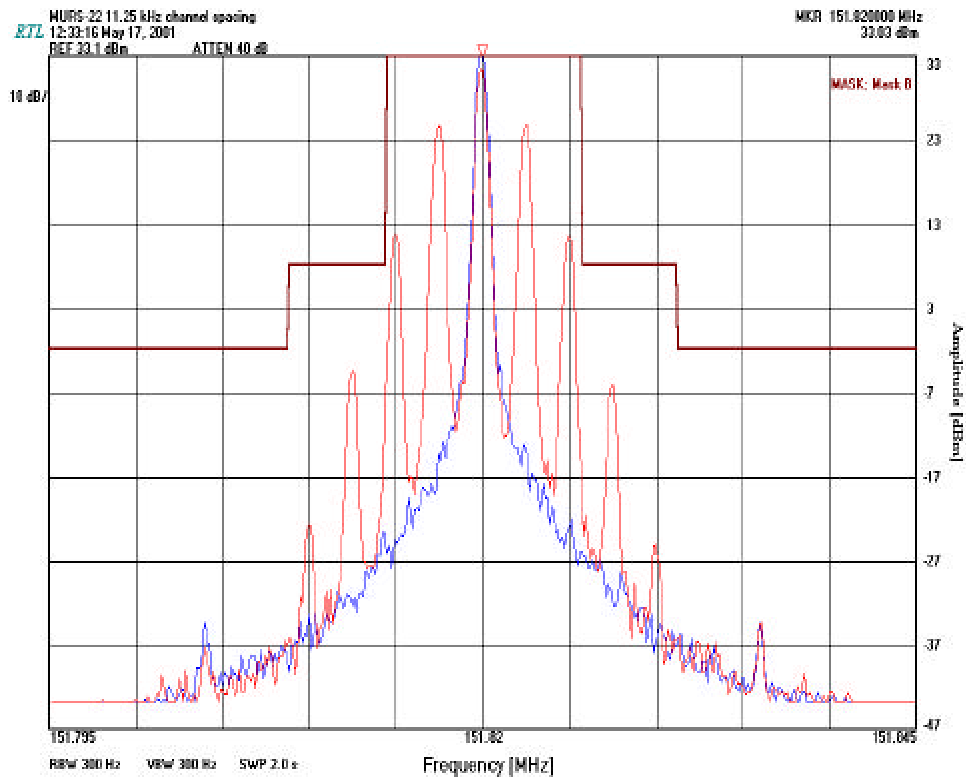
PLOT 11-2: CHANNEL 2: 2 W FOR 12.5 KHZ CHANNEL BANDWIDTH: MASK D (AUDIO MODULATION: 2,500 HZ) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

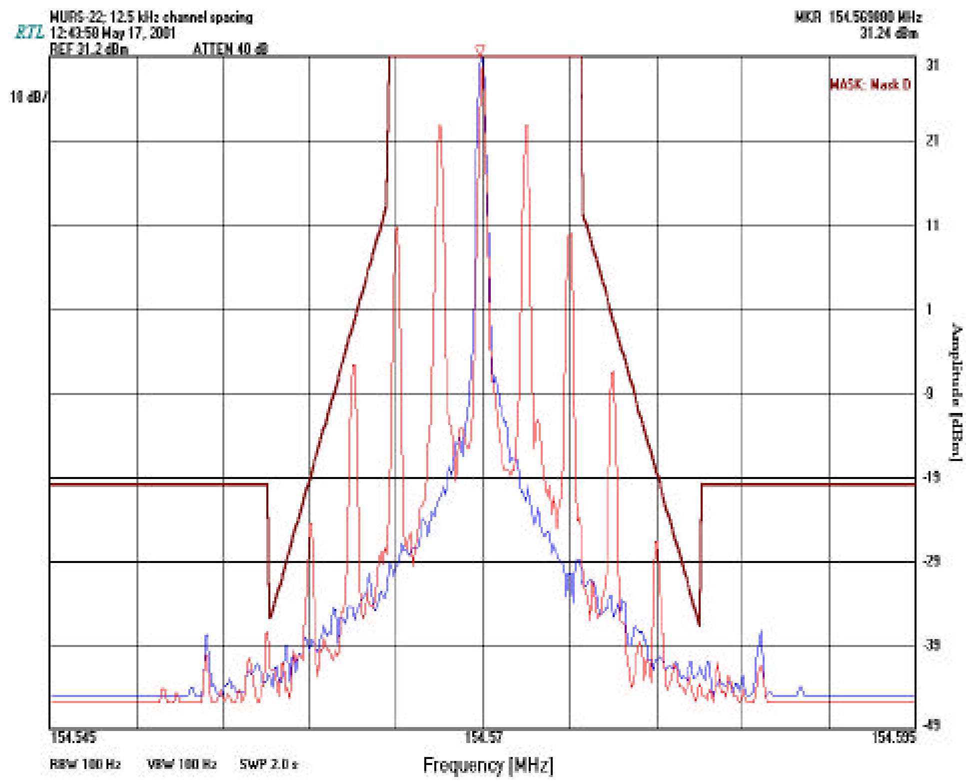
PLOT 11-3: CHANNEL 1: 2 W FOR 11.25 KHZ CHANNEL BANDWIDTH: MASK B (AUDIO MODULATION: 2,500 HZ) (MURS-25)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 11-4: CHANNEL 4: 2 W FOR 12.5 KHZ CHANNEL BANDWIDTH: MASK D (AUDIO MODULATION: 2,500 HZ) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

TABLE 11-1: EQUIPMENT USED FOR TESTING

Occupied Bandwidth					
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	03/06/02

12 FCC PART 2 §2.1055: FREQUENCY STABILITY

12.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 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 an hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter.
Additionally, the power supply voltage of the EUT was varied from 85% to 115% of the nominal voltage.

The worst-case test data are shown.

12.2 TEST DATA

12.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

Limit is 5 ppm for MURS devices.

The MURS-22 2 Watt radio was tested with 11.25 kHz and 12.5 kHz channel bandwidth. The worst-case temperature deviation on the following plot is for channel 1 (11.25 kHz channel bandwidth).

The MURS-25 2 Watt radio was tested with 11.25 kHz and 12.5 kHz channel bandwidth. The worst-case temperature deviation on the following plot is for channel 1 (11.25 kHz channel bandwidth).

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

PLOT 12-1: TEMPERATURE FREQUENCY STABILITY (MURS-22)

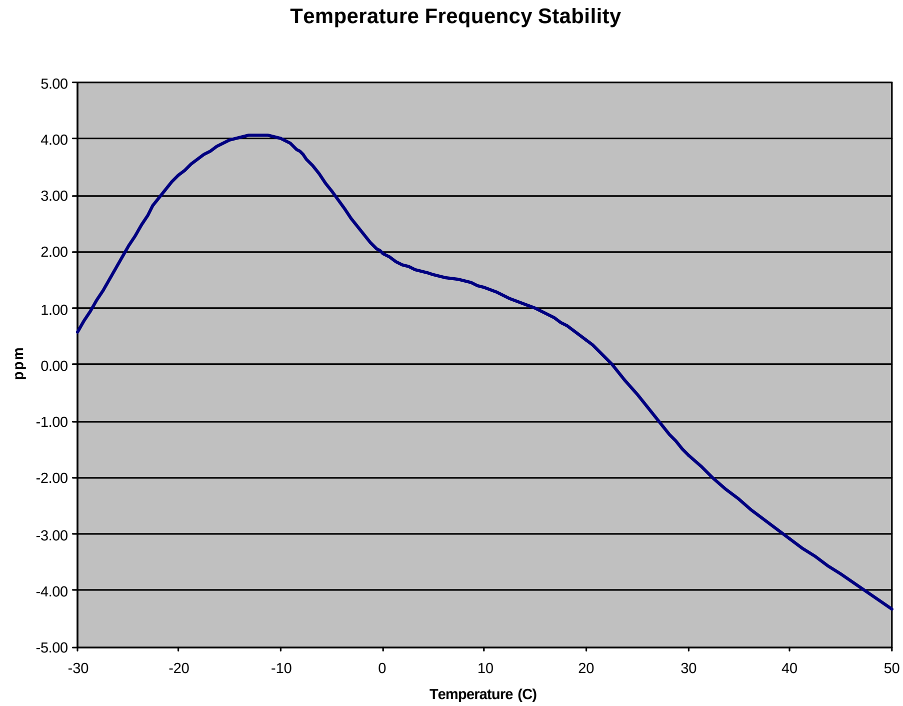


TABLE 12-1: NARROW BAND FREQUENCY STABILITY VS TEMPERATURE CHANNEL 1 = 151.82 MHZ (MURS-22)

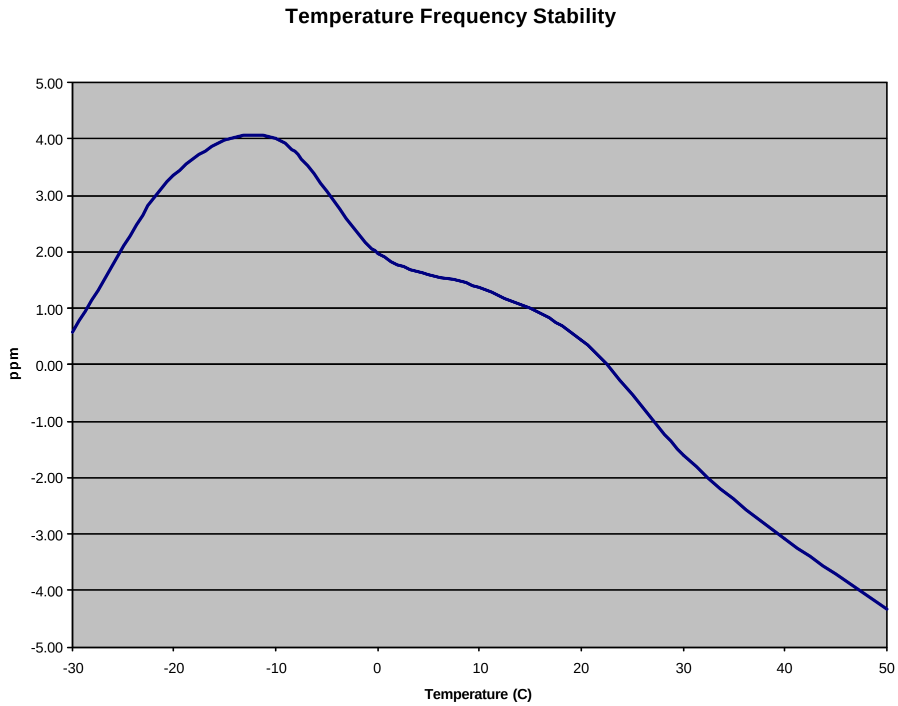
Temperature (C)	Frequency (MHz)	ppm
-30.00000	151.8200900	0.59
-20.00000	151.8205080	3.35
-10.00000	151.8206080	4.00
0.00000	151.8203000	1.98
10.00000	151.8202080	1.37
20.00000	151.8200670	0.44
30.00000	151.8197580	-1.59
40.00000	151.8195330	-3.08
50.00000	151.8193420	-4.33

TEST PERSONNEL:

DANIEL BALTZELL TEST TECHNICIAN/ENGINEER	[signature] SIGNATURE	MAY 15, 2001 DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

PLOT 12-2: TEMPERATURE FREQUENCY STABILITY (MURS-25)



Narrow Band Frequency Stability vs Temperature Channel 1 = 151.82 MHz

Temperature (C)	Frequency (MHz)	ppm
-30.00000	151.8200900	0.59
-20.00000	151.8205080	3.35
-10.00000	151.8206080	4.00
0.00000	151.8203000	1.98
10.00000	151.8202080	1.37
20.00000	151.8200670	0.44
30.00000	151.8197580	-1.59
40.00000	151.8195330	-3.08
50.00000	151.8193420	-4.33

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

MAY 15, 2001

TABLE 12-2: FREQUENCY STABILITY/VOLTAGE VARIATION (MURS-22)

Assigned Frequency 151.82 MHz

Battery end point = 3.3V

Voltage (7.2V +/- 85-115%)	Frequency (MHz)	ppm
6.12	151.819782	-1.44
7.2	151.819782	-1.44
8.28	151.819782	-1.44

TEST PERSONNEL:

DANIEL BALTZELL TEST TECHNICIAN/ENGINEER	SIGNATURE	MAY 15, 2001 DATE OF TEST

TABLE 12-3: EQUIPMENT USED FOR TESTING

Frequency Stability/Voltage					
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	11/07/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01

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

13.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 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 is 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 300Hz to 6kHz 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)

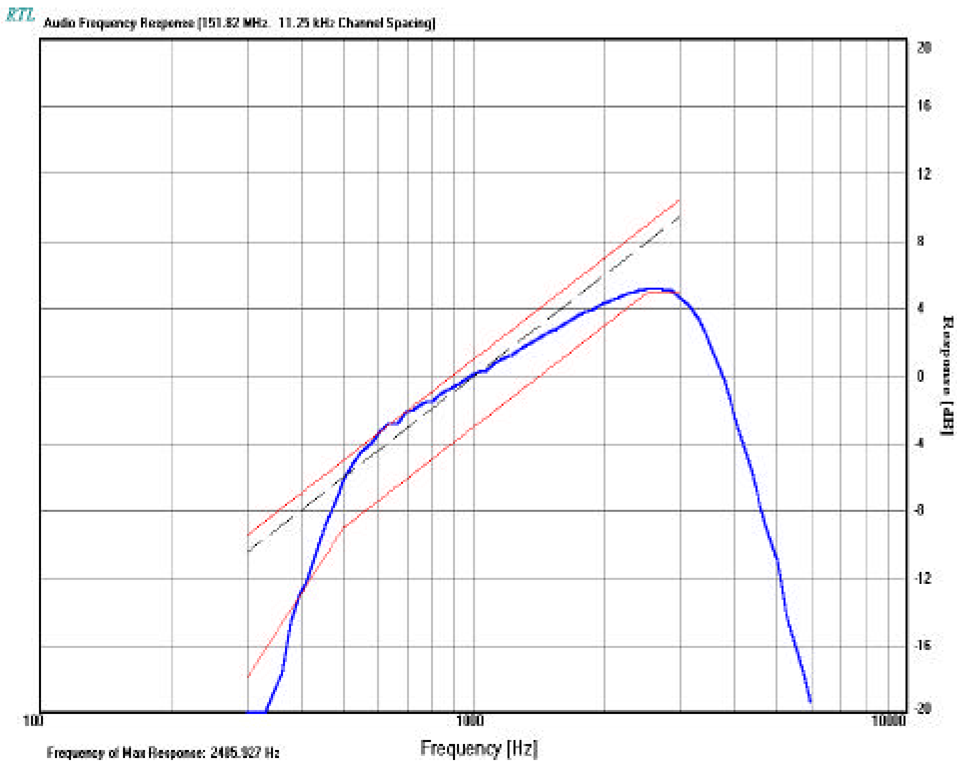
TABLE 13-1: EQUIPMENT USED FOR TESTING

Frequency Stability/Voltage					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	06/21/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

13.2 TEST DATA

PLOT 13-1: CHANNEL 1 – 11.25 KHZ AUDIO FREQUENCY RESPONSE (MURS-22)



TEST PERSONNEL:

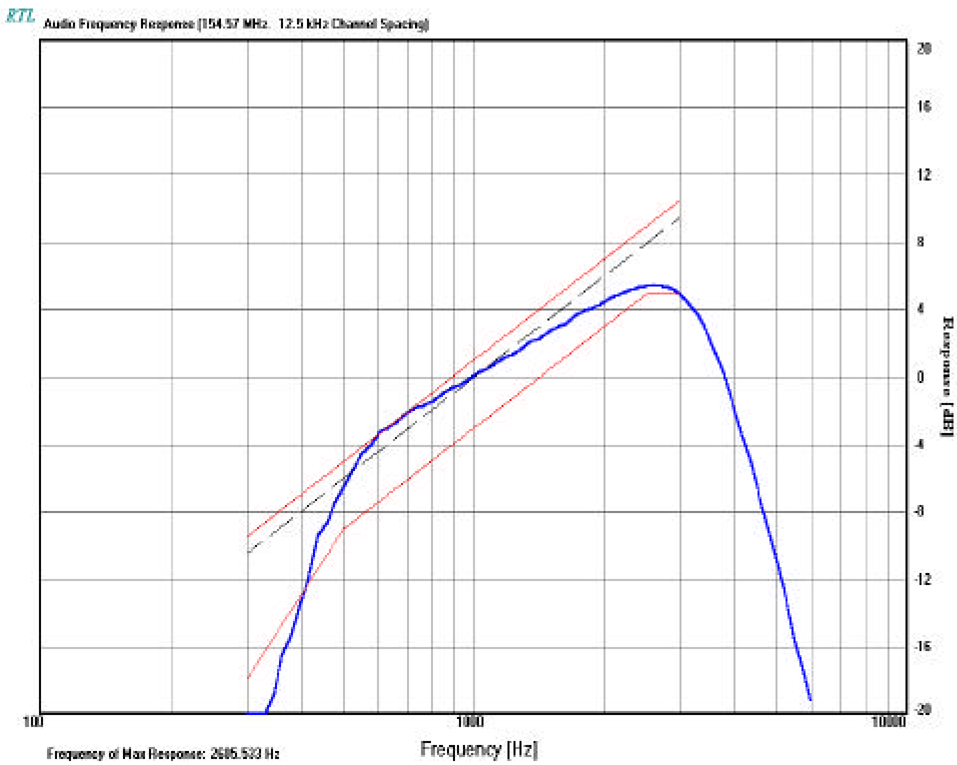
DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 13-2: CHANNEL 2 – 12.5 KHZ AUDIO FREQUENCY RESPONSE (MURS-22)

TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 13-3: CHANNEL 4 – 12.5 KHZ AUDIO FREQUENCY RESPONSE (MURS-25)



TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

MAY 15, 2001
DATE OF TEST

14 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE

14.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 2.2.15

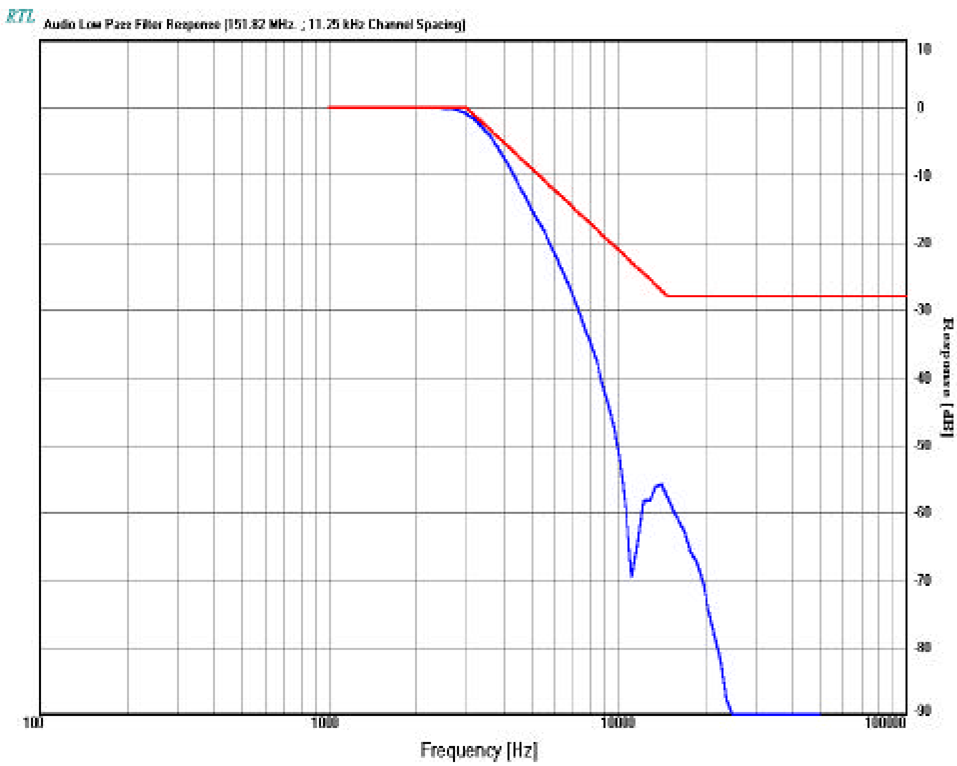
The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

TABLE 14-1: 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	06/21/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	06/08/01

14.2 TEST DATA

PLOT 14-1: CHANNEL 1 – 11.25 KHZ AUDIO LOW PASS FILTER RESPONSE (MURS-22)

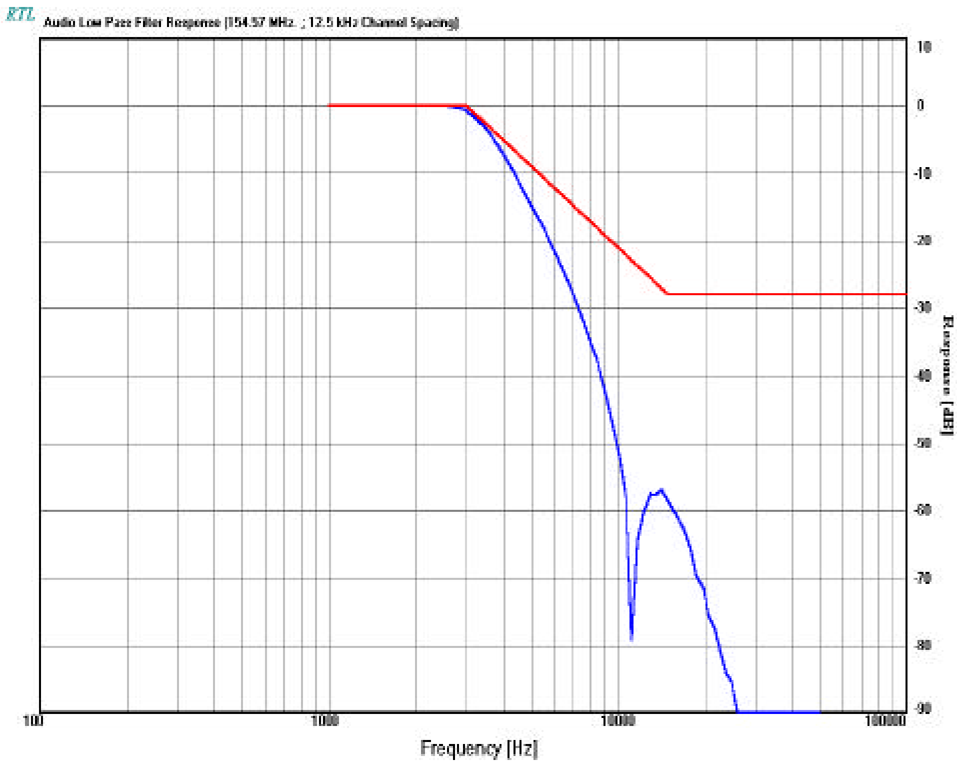


TEST PERSONNEL:

DANIEL BALTZELL TEST TECHNICIAN/ENGINEER	SIGNATURE	MAY 15, 2001 DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

PLOT 14-2: CHANNEL 2 – 12.5 KHZ AUDIO LOW PASS FILTER RESPONSE (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

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

15.1 TEST PROCEDURE

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

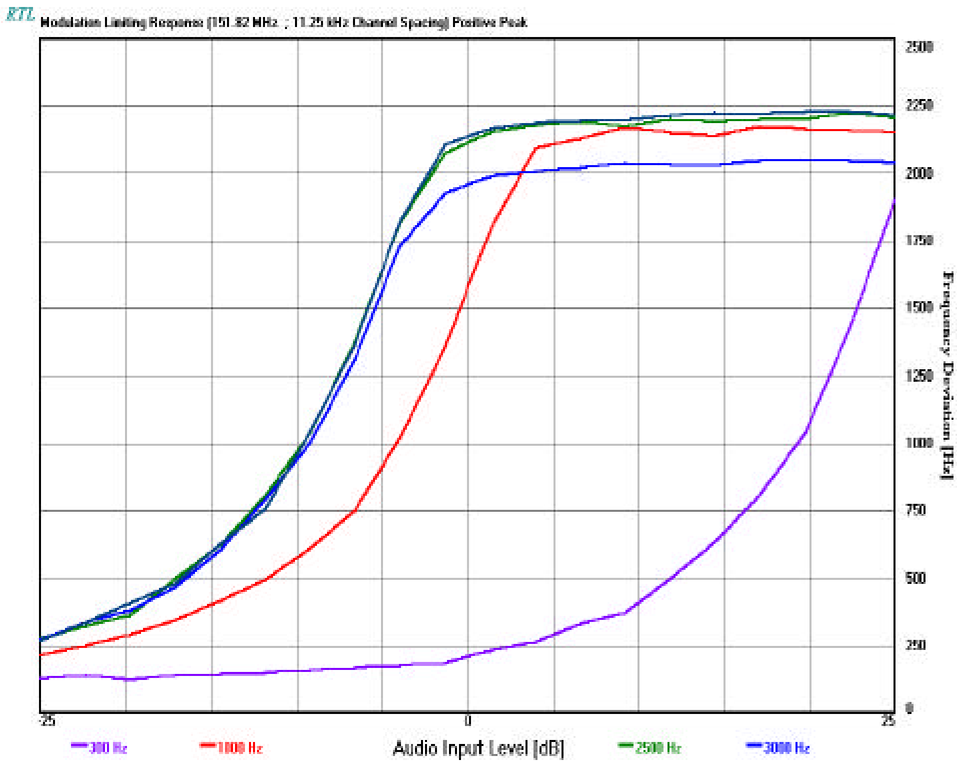
The transmitter is adjusted for full rated system deviation. The audio input level is adjusted for 60% of rated system deviation at 1000Hz. Using this level as a reference (0dB) the audio input level is varied from the reference to a level +20 dB above it and –20 dB under it, for modulation frequencies of 300Hz, 1,000Hz, and 2,500Hz. The system deviation obtained as a function of the input level is recorded.
Both Positive and Negative Peak deviations were recorded.

TABLE 15-1: EQUIPMENT USED FOR TESTING

MODULATION CHARACTERISTICS – MODULATION LIMITING					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	06/21/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	06/08/01

15.2 TEST DATA

PLOT 15-1: MODULATION CHARACTERISTICS - MODULATION LIMITING (CHANNEL 1 (11.25 KHZ CHANNEL SPACING) POSITIVE PEAK) (MURS-22)



TEST PERSONNEL:

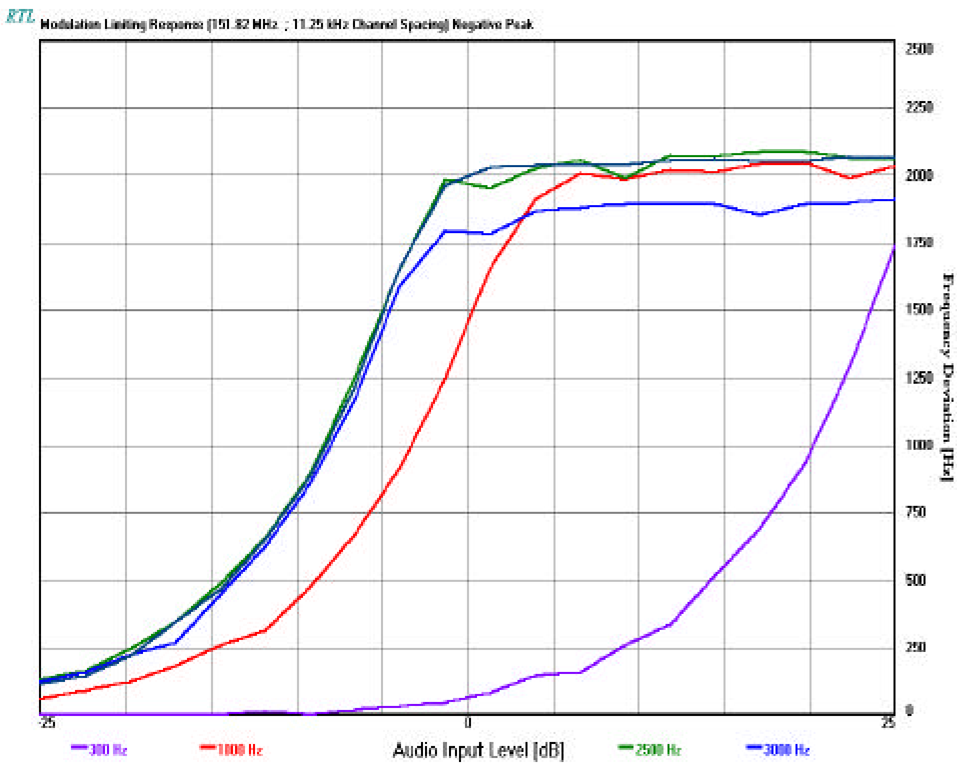
DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

MAY 15, 2001
DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

PLOT 15-2: MODULATION CHARACTERISTICS - MODULATION LIMITING (CHANNEL 1 (11.25 KHZ CHANNEL SPACING) NEGATIVE PEAK) (MURS-22)

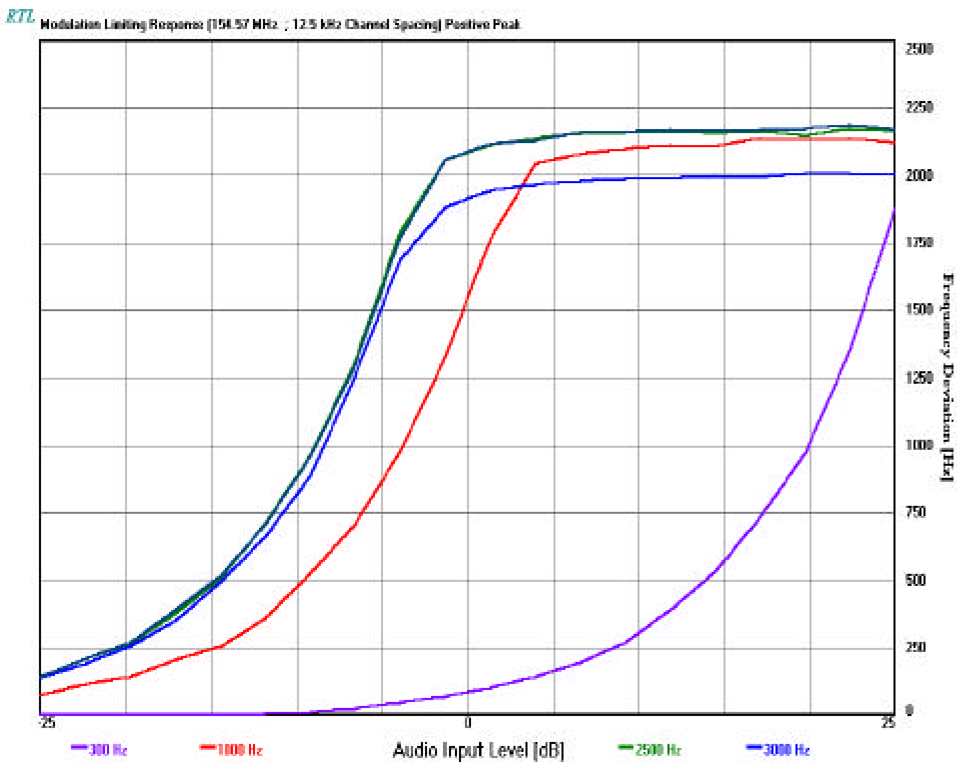


TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

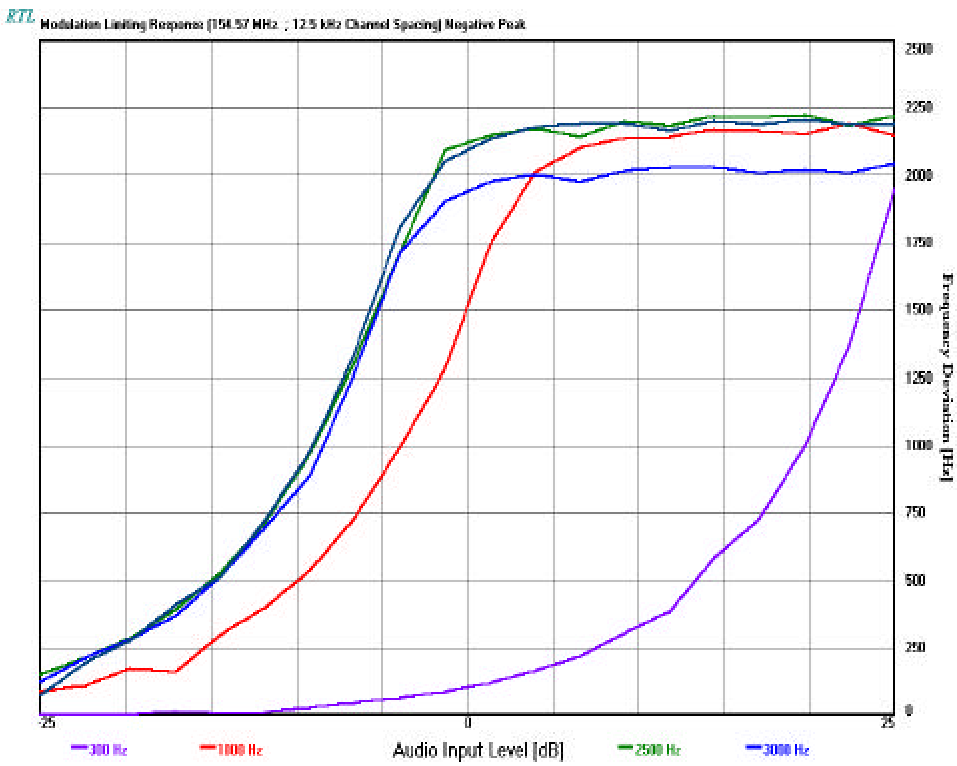
PLOT 15-3: MODULATION CHARACTERISTICS - MODULATION LIMITING (CHANNEL 2 (12.5 KHZ CHANNEL SPACING) POSITIVE PEAK) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 15, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 15-4: MODULATION CHARACTERISTICS - MODULATION LIMITING (CHANNEL 2 (12.5 KHZ CHANNEL SPACING) NEGATIVE PEAK) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

MAY 15, 2001
DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

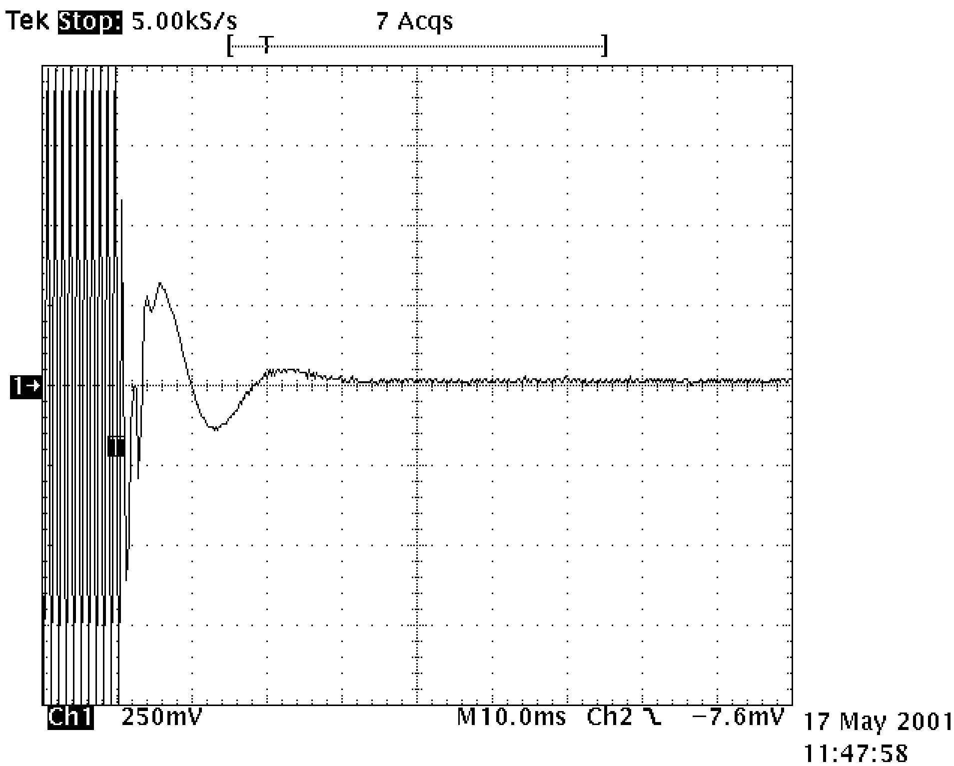
16 FCC PART 90 §90.214 : TRANSIENT FREQUENCY BEHAVIOR

16.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.19

16.2 TEST DATA

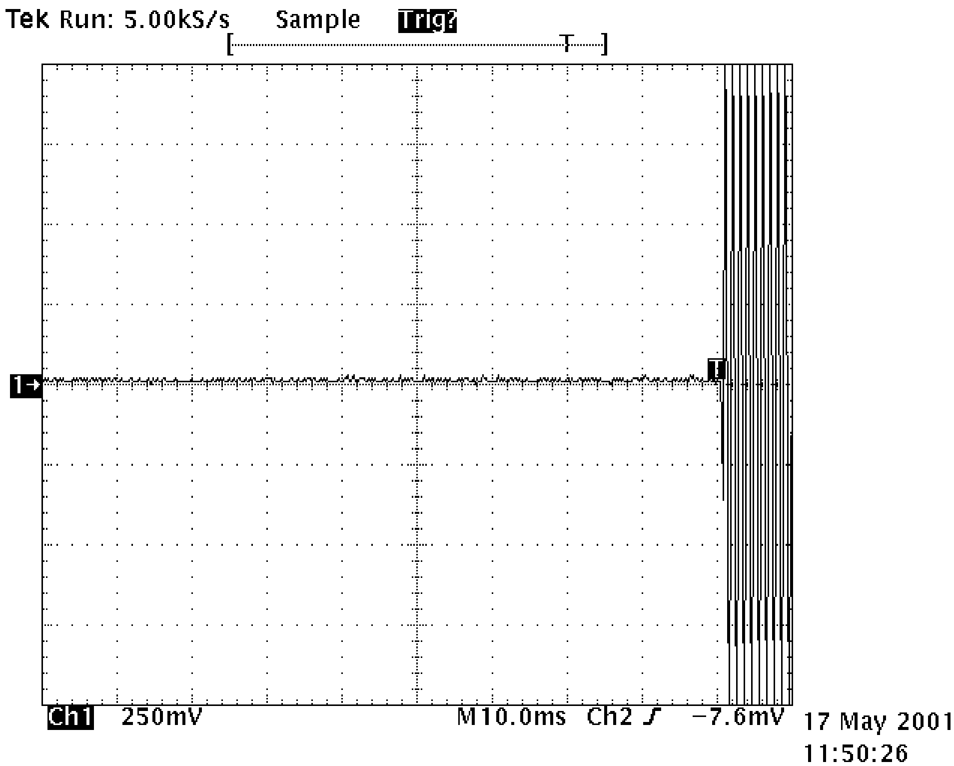
PLOT 16-1: TRANSIENT FREQUENCY BEHAVIOR (CHANNEL 1; 151.82 MHZ; 11.25 KHZ CHANNEL SPACING; ON) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 17, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 16-2: TRANSIENT FREQUENCY BEHAVIOR (CHANNEL 1; 151.82 MHZ; 11.25 KHZ CHANNEL SPACING; OFF) (MURS-22)



TEST PERSONNEL:

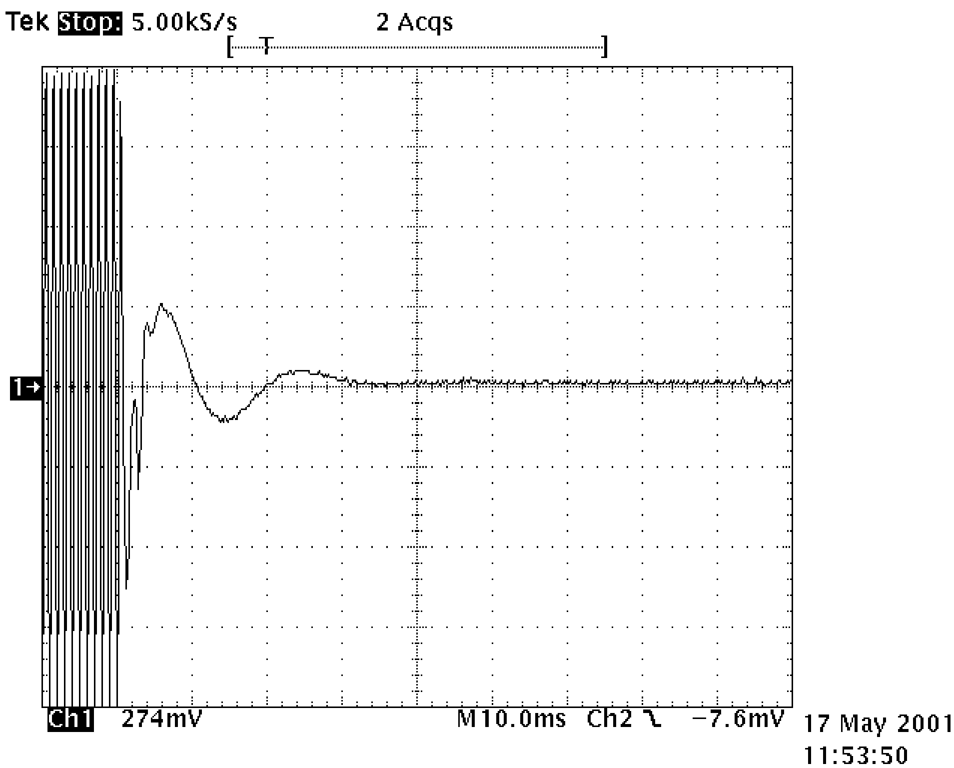
DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

MAY 17, 2001
DATE OF TEST

360 Herndon Parkway
Suite 1400
Herndon, VA 20170
http://www.rheintech.com

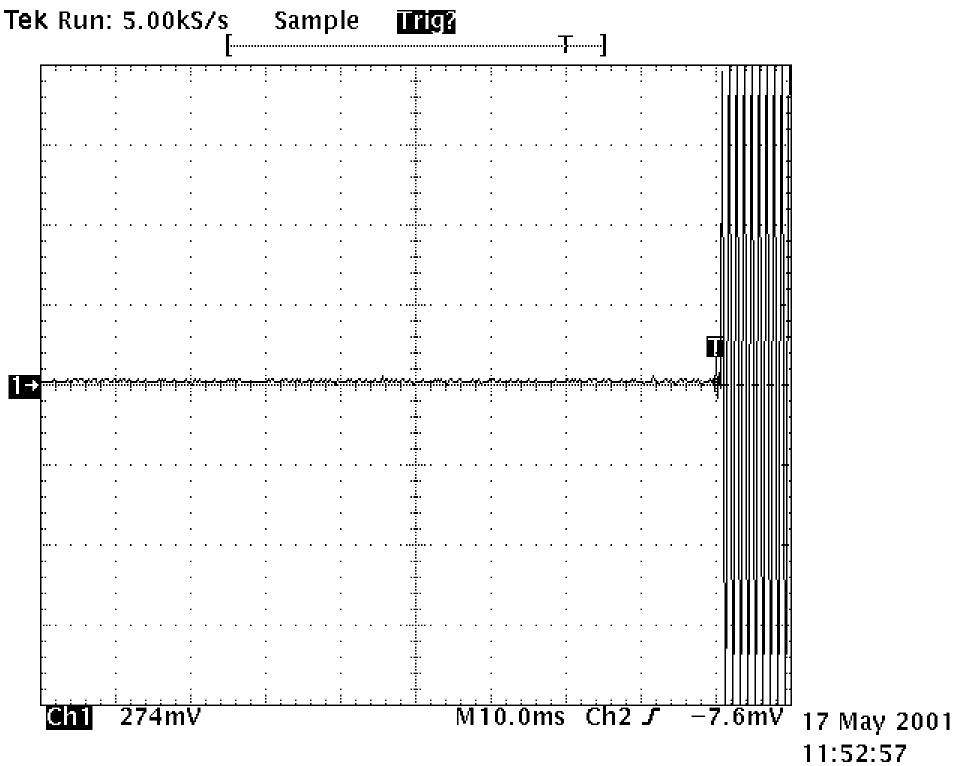
PLOT 16-3: TRANSIENT FREQUENCY BEHAVIOR (CHANNEL 2; 154.57 MHZ; 12.5 KHZ CHANNEL SPACING; ON) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 17, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

PLOT 16-4: TRANSIENT FREQUENCY BEHAVIOR (CHANNEL 2; 154.57 MHZ; 12.5 KHZ CHANNEL SPACING; OFF) (MURS-22)



TEST PERSONNEL:

DANIEL BALTZELL		MAY 17, 2001
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

Limits:

TABLE 16-1: REQUIREMENTS FOR EUT WITH 25 KHZ CHANNEL SPACING: (MURS-22)

Time Intervals (*)(**)	Maximum Frequency Difference(***)	150-174 MHz	421-512 MHz
t1(****)	± 25 kHz	5.0 mSec	10.0 mSec
t2	± 12.5 kHz	20.0 mSec	25.0 mSec
t3(****)	± 25 kHz	5.0 mSec	10.0 mSec

TABLE 16-2: REQUIREMENTS FOR EUT WITH 12.5 KHZ CHANNEL SPACING: (MURS-22)

Time Intervals (*)(**)	Maximum Frequency Difference(***)	150-174 MHz	421-512 MHz
t1(****)	± 12.5 kHz	5.0 mSec	10.0 mSec
t2	± 6.25 kHz	20.0 mSec	25.0 mSec
t3(****)	± 12.5 kHz	5.0 mSec	10.0 mSec

(*) t on is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
t 1 is the time period immediately following ton.
t2 is the time period immediately following t1.
t3 is the time period from the instant when the transmitter is turned off until toff.
toff is the instant when the 1 kHz test signal starts to rise.
(**) During the time from the end of t2 to the beginning of t3, the frequency difference must not exceed the limits specified in § 90.213.
(***) Difference between the actual transmitter frequency and the assigned transmitter frequency.
(****) If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

<u>Maximum frequency difference between time T2 and T3:</u> Calculation for Channel 6:
The frequency stability is required to be 2.5ppm.
Calculation for Channel 6:
4 div. on scope represent 12.5kHz for narrow band channel.
Therefore, 487.975M times 2.5 ppm times +/- 4 Divisions divided by 12.5kHz equals about +/- 0.4 division. 0.4 Div. correspond to 1.219 kHz

TABLE 16-3: EQUIPMENT USED FOR TESTING

Modulation Characteristics – Modulation Limiting					
RTL Asset #	**Manufacturer**	**Model**	**Part Type**	**Serial Number**	**Calibration Due Date**
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 KHz to 3200 MHz)	3537A01741	04/10/02
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01
900561	Tektronix	TDS650A	Oscilloscope (500 MHz BW)	B020129	11/02/01

17 FCC PART 2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

Type of Emission: F3E

Necessary Bandwidth and Emission Bandwidth:
11.25 kHz and 12.5kHz: Bn = 11K0F3E

Calculation:
Max modulation(M) in kHz : 3
Max deviation (D) in kHz: 2.5 (NB)
Constant factor (K) : 1
Bn = 2xM+2xDK