



Engineering and Testing for EMC and Safety Compliance

## TYPE CERTIFICATION REPORT

**Com-Net Ericsson Critical Radio Systems, Inc.**  
3315 Old Forest Road  
P.O. Box 2000  
Lynchburg, VA 24501  
804-385 2580 (Bryan McWatters)

**MODEL: Panther 300P UHF-H (470-512MHz)**  
**FCC ID: OWDTR-0008-A**

*January 8, 2001*

<b>STANDARDS REFERENCED FOR THIS REPORT</b>	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	§15.109: RADIATED EMISSIONS LIMITS
PART 22: 1998	PUBLIC MOBILES SERVICES
PART 74: 1998	LOW POWER AUXILIARY STATION
PART 90: 1998	PRIVATE LAND MOBILE RADIO SERVICES
PART 95 (A): 1998	GENERAL MOBILE 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

<b>FCC Rules Parts</b>	<b>Frequency Range</b>	<b>Output Power (W)</b>	<b>Freq. Tolerance</b>	<b>Emission Designator</b>
22, 74, 90, 95 (A)	470-512 MHz	4.2	2.5 ppm	11K0F3E
22, 74, 90, 95 (A)	470-512 MHz	4.2	2.5 ppm	16K0F3E
22, 74, 90, 95 (A)	470-512 MHz	1.1	2.5 ppm	11K0F3E
22, 74, 90, 95 (A)	470-512 MHz	1.1	2.5 ppm	16K0F3E

### REPORT PREPARED BY:

**Test Engineer: Daniel Baltzell**  
**Administrative Writer: Melissa Fleming**

*Document Number: 2000497*

*No part of this report may be reproduced without the full written approval of Rhein Tech Laboratories, Inc.*



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

## TABLE OF CONTENTS

<b>1 GENERAL INFORMATION.....</b>	<b>4</b>
1.1 TEST FACILITY.....	4
1.2 RELATED SUBMITTAL(S)/GRANT(S) .....	4
1.3 CONFORMANCE STATEMENT .....	5
1.4 TESTED SYSTEM DETAILS .....	6
1.5 CONFIGURATION OF TESTED SYSTEM .....	6
1.6 FIELD STRENGTH CALCULATION.....	7
1.7 CONDUCTED MEASUREMENT.....	8
1.8 RADIATED MEASUREMENT .....	8
<b>2 FCC RULES AND REGULATIONS PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED.....</b>	<b>9</b>
2.1 TEST PROCEDURE .....	9
2.2 TEST DATA .....	9
2.3 TEST EQUIPMENT.....	9
<b>3 PART 2.1046 (A) RF POWER OUTPUT: RADIATED - ERP.....</b>	<b>10</b>
3.1 TEST PROCEDURE .....	10
3.2 TEST DATA .....	11
3.3 TEST EQUIPMENT.....	11
<b>4 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS .....</b>	<b>12</b>
4.1 TEST PROCEDURE .....	12
4.2 TEST DATA .....	12
4.3 TEST EQUIPMENT.....	13
<b>5 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION .....</b>	<b>14</b>
5.1 TEST PROCEDURE .....	14
5.2 TEST DATA .....	14
5.3 TEST EQUIPMENT.....	14
<b>6 FCC RULES AND REGULATIONS PART 2 §2.1049 (C) (1): OCCUPIED BANDWIDTH.....</b>	<b>15</b>
6.1 TEST PROCEDURE .....	15
6.2 TEST DATA .....	15
6.3 TEST EQUIPMENT.....	16
<b>7 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY.....</b>	<b>17</b>
7.1 TEST PROCEDURE .....	17
7.2 TEST DATA .....	17
7.2.1 <i>Frequency stability/Temperature variation</i> .....	17
7.2.2 <i>Frequency stability/Voltage variation (Battery end-point= 5.99VDC)</i> .....	18
7.3 TEST EQUIPMENT.....	18
<b>8 FCC RULES AND REGULATIONS PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE.....</b>	<b>19</b>
8.1 TEST PROCEDURE .....	19
8.2 TEST DATA .....	19
8.3 TEST EQUIPMENT.....	20
<b>9 FCC RULES AND REGULATIONS PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE.....</b>	<b>21</b>



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

9.1	TEST PROCEDURE .....	21
9.2	TEST DATA .....	21
9.3	TEST EQUIPMENT .....	22
<b>10</b>	<b>FCC RULES AND REGULATIONS PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING .....</b>	<b>23</b>
10.1	TEST PROCEDURE .....	23
10.2	TEST DATA .....	23
10.3	TEST EQUIPMENT .....	25
<b>11</b>	<b>FCC RULES AND REGULATIONS PART 90 §90.214 : TRANSIENT FREQUENCY BEHAVIOR .....</b>	<b>26</b>
11.1	TEST PROCEDURE .....	26
11.2	TEST DATA .....	26
11.3	TEST EQUIPMENT .....	32
<b>12</b>	<b>FCC RULES AND REGULATIONS PART 2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH .....</b>	<b>33</b>
<b>13</b>	<b>FCC RULES AND REGULATIONS PART 1.1307, 1.1310, 2.1091, 2.1093: RF EXPOSURES COMPLIANCE.....</b>	<b>33</b>
<b>14</b>	<b>LABEL INFORMATION .....</b>	<b>34</b>
<b>15</b>	<b>BILL OF MATERIALS (PARTS LIST).....</b>	<b>35</b>
<b>16</b>	<b>PRODUCT DESCRIPTION .....</b>	<b>36</b>
<b>17</b>	<b>SCHEMATICS.....</b>	<b>40</b>
<b>18</b>	<b>BLOCK DIAGRAM.....</b>	<b>41</b>
<b>19</b>	<b>OPERATOR'S MANUAL.....</b>	<b>43</b>
<b>20</b>	<b>SAR TEST REPORT .....</b>	<b>44</b>
<b>21</b>	<b>TEST CONFIGURATION PHOTOGRAPHS .....</b>	<b>45</b>
<b>22</b>	<b>INTERNAL PHOTOGRAPHS .....</b>	<b>46</b>
<b>23</b>	<b>EXTERNAL PHOTOGRAPHS .....</b>	<b>51</b>



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

## 1 GENERAL INFORMATION

The following Report of a Type Certification is prepared on behalf of Com-Net Ericsson Critical Radio Systems, Inc. in accordance with the Federal Communications Commissions Regulations. The Equipment Under Test (EUT) was the **Panther 300P UHF-H (470-512MHz)**. The test results reported in this document relate only to the item that was tested. The digital interface portion of this transceiver, including the receiver, was tested and found in compliance with Part 15 Class B limits. A DoC report was prepared and is available upon request.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

### 1.1 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

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

This is a new application for certification



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

### 1.3 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 22: 1998	PUBLIC MOBILES SERVICES
PART 74: 1998	LOW POWER AUXILIARY STATION
PART 90: 1998	PRIVATE LAND MOBILE RADIO SERVICES
PART 95 (A): 1998	GENERAL MOBILE 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 (W)	Freq. Tolerance	Emission Designator
22, 74, 90, 95 (A)	470-512 MHz	4.2	2.5 ppm	11K0F3E
22, 74, 90, 95 (A)	470-512 MHz	4.2	2.5 ppm	16K0F3E
22, 74, 90, 95 (A)	470-512 MHz	1.1	2.5 ppm	11K0F3E
22, 74, 90, 95 (A)	470-512 MHz	1.1	2.5 ppm	16K0F3E

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

Furthermore, there was no deviation from, additions to or exclusions from the standards identified in this report.

Signature:

Date: January 9, 2001

Typed/Printed Name: Bruno Clavier

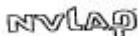
Position: Vice President of Operations  
(NVLAP Signatory)

Signature:

Date: January 9, 2001

Typed/Printed Name: Daniel Baltzell

Position: Test Engineer



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.



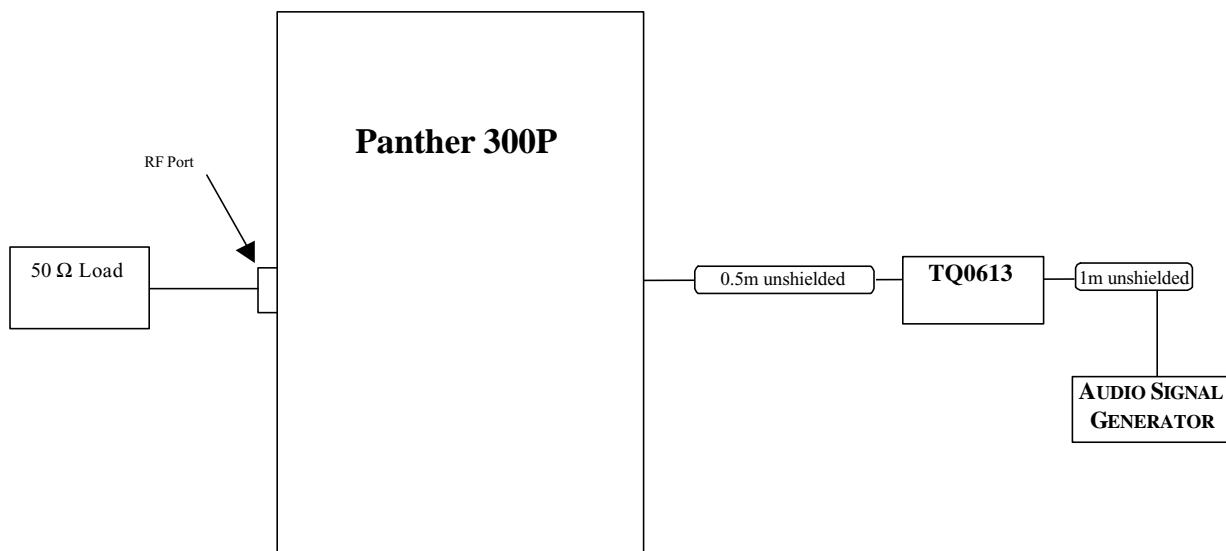
360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

## 1.4 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.

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID
RADIO	COM NET ERICSSON	300P	UH-05, UH-07	OWDTR-0008-A
ANTENNA "I" HELICAL STUB SPRING WHIP (470-512 MHz)	COM NET ERICSSON	KRE1011219/13	N/A	N/A
ANTENNA "G" 1/4 WAVE WHIP (450-512 MHz)	COM NET ERICSSON	KRE1011223/12	N/A	N/A
AUDIO TEST CABLE	COM NET ERICSSON	113 2472/46	N/A	N/A
TEST BOX	COM NET ERICSSON	TQ0613	N/A	N/A
BATTERY ELIMINATOR	COM NET ERICSSON	BKB191 213/3	N/A	N/A
MICROPHONE / SPEAKER	COM NET ERICSSON	KRY101 1640/1	N/A	N/A

## 1.5 CONFIGURATION OF TESTED SYSTEM





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

## 1.6 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:

$$FI(\mu V/m) = 10^{FI(dBuV/m)/20}$$

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:

$$49.3 \text{ dBuV} - 11.5 \text{ dB/m} = 37.8 \text{ dBuV/m}$$

$$10^{37.8/20} = 10^{1.89} = 77.6 \mu V/m$$



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

## 1.7 CONDUCTED MEASUREMENT

n/a. Battery powered device

## 1.8 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.*



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

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

### 2.1 TEST PROCEDURE

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

The EUT was connected to a coaxial attenuator having a  $50\ \Omega$  load impedance.

### 2.2 TEST DATA

The following channel (in MHz) were tested: 470.025, 491.025, 511.972  
The worst-case Output Power (highest) levels are shown.

#### CARRIER OUTPUT POWER (UNMODULATED)

Power Setting	RF Power measured (Watt)*
Low	1.1
High	4.2

\*Measurement accuracy: +/- 3%

#### Rated Power:

Power Setting	Rated Power (W)
Low	1
High	4

### 2.3 TEST EQUIPMENT

Power Meter	HP437B	s/n 2949A02966
	HP 8901A	s/n 2545A04102 (power mode)
Power Sensor	HP8481B	s/n 2702A05059
Frequency Counter	HP8901A	s/n 2545A04102 (Frequency mode)



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

### 3 PART 2.1046 (A) RF POWER OUTPUT: RADIATED - ERP

#### 3.1 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 1/2 wave dipole antenna and polarized in accordance with the EUT's antenna polarization. The 1/2 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 1/2 wave dipole antenna. The signal generator corrected level is the ERP level

Calculation Method:

$$P_{Watt} = \frac{E_{v/m}^2 \times d_m^2}{30 \times 1.64}$$



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

### 3.2 TEST DATA

Settings:

- High Power: 4.2 Watt delivered to antenna
- 4W Panther 300P radiated power measurements (3 meter)

Frequency (MHz)	Level Measured (dB $\mu$ V)	Site Factor (dB/m)	ERP* Calculated (dBm)	ERP** Substitution Method (dBm)	Antenna
470.023	103.7	31.0	37.3	37.1	“G”
491.022	102.8	31.0	36.4	36.6	“G”
511.972	103.5	31.0	37.1	36.3	“G”

\*Antenna as specified by manufacturer (unity gain)

\*\*Measurement accuracy is +/- 1.5 dB

Frequency (MHz)	Level Measured (dB $\mu$ V)	Site Factor (dB/m)	ERP* Calculated (dBm)	ERP** Substitution Method (dBm)	Antenna
470.023	102.9	31.0	36.5	37.5	“T”
491.022	102.9	31.0	36.5	37.7	“T”
511.972	103.5	31.0	37.3	37.5	“T”

\*Antenna as specified by manufacturer (unity gain)

\*\*Measurement accuracy is +/- 1.5 dB

### 3.3 TEST EQUIPMENT

Spectrum Analyser  
Antenna

HP8566B  
Roberts 1/2 wave dipoles



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

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

### 4.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, Section 2.2.13

The transmitter is terminated with a  $50\Omega$  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.

### 4.2 TEST DATA

Frequency range of measurement per Part 2.1057: 9kHz to  $10 \times F_c$

Limits: Mask B (dBm):  $P(\text{dBm}) - (43 + 10 \times \text{LOG } P(\text{W}))$

Mask D (dBm):  $P(\text{dBm}) - (50 + 10 \times \text{LOG } P(\text{W}))$

The following channel (in MHz) were investigated: 470.025, 491.025, 511.972

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.

Channel 4 (470.025 MHz) – 4 Watt and 12.5 kHz Channel Bandwidth: Mask D

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
940.050	-44.0	-20.0	-24.0
1410.075	-35.7	-20.0	-15.7
1880.100	-49.7	-20.0	-29.7
2350.125	-36.2	-20.0	-16.2
2820.150	-67.5	-20.0	-47.5
3290.175	-71.5	-20.0	-51.5
3760.200	-60.8	-20.0	-40.8
4230.225	-62.8	-20.0	-42.8
4700.250	-71.2	-20.0	-51.2

Channel 5 (491.025 MHz) – 4 Watt and 12.5 kHz Channel Bandwidth: Mask D

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
982.050	-51.0	-20.0	-31.0
1473.075	-47.1	-20.0	-27.1
1964.100	-29.9	-20.0	-9.9
2455.125	-55.1	-20.0	-35.1
2946.150	-71.4	-20.0	-51.4
3437.175	-71.9	-20.0	-51.9
3928.200	-72.6	-20.0	-52.6
4419.225	-62.8	-20.0	-42.8
4910.250	-69.2	-20.0	-49.2



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

Channel 6 (511.972 MHz) – 4 Watt and 12.5 kHz Channel Bandwidth: Mask D

Frequency (MHz)	Level Measured (dBm)	Limit (dBm)	Margin (dB)
1023.944	-44.5	-20.0	-24.5
1535.916	-47.1	-20.0	-27.1
2047.888	-42.4	-20.0	-22.4
2559.860	-61.1	-20.0	-41.1
3071.832	-70.2	-20.0	-50.2
3583.804	-63.2	-20.0	-43.2
4095.776	-58.1	-20.0	-38.1
4607.748	-68.7	-20.0	-48.7
5119.720	-69.2	-20.0	-49.2

### 4.3 TEST EQUIPMENT

Audio Generator:

Synthesized Level Generator HP3336B s/n 2127A00559  
Audio Signal Analyzer Tektronix ASG 100 s/n B032374

Spectrum Analyzer:

HP8564E s/n 3943A01719  
HP8546A s/n 3525A00159



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

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

### 5.1 TEST PROCEDURE

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

The transmitter is terminated with a  $50 \Omega$  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.

### 5.2 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.

Radiated Emissions (Channel 4 at 470.025 MHz) Substitution Method						
Frequency (MHz)	Signal Generator Level (dBm)	Cable Loss (dB)*	Corrected Antenna Gain (dB)**	Corrected Signal Generator Level (dBm)	Limit Mask D (dBm)	Margin (dB)
940.050	-24.0	4.2	-1.2	-29.4	-20.0	-9.4
1410.075	-25.8	6.7	3.8	-28.7	-20.0	-8.7
1880.100	-20.1	7.7	4.8	-23.0	-20.0	-3.0
2350.125	-35.5	10.5	5.1	-40.9	-20.0	-20.9
2820.150	-44.5	12.0	5.9	-50.6	-20.0	-30.6
3290.175	-51.1	13.5	6.1	-58.5	-20.0	-38.5
3760.200	-45.8	15.9	5.9	-55.8	-20.0	-35.8
4230.225	-33.0	17.9	6.4	-44.5	-20.0	-24.5
4700.250	-39.0	21.3	7.0	-53.3	-20.0	-33.3

\*This insertion loss corresponds to the cable connecting the RF Signal Generator to the  $\frac{1}{2}$ wave dipole antenna.

\*\* Difference in gain (ref. To a  $\frac{1}{2}$  wave dipole)

### 5.3 TEST EQUIPMENT

Antenna:	CHASE CBL6112	s/n 2099
Amplifier:	HP8449B	s/n 3008A00505
Spectrum analyzer:	HP8564E	s/n 3943A01719
RF Signal Generator	HP8648C	s/n 3537A01741
Synthesized Sweeper	HP83752A	s/n 3610A00846



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

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

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

### 6.1 TEST PROCEDURE

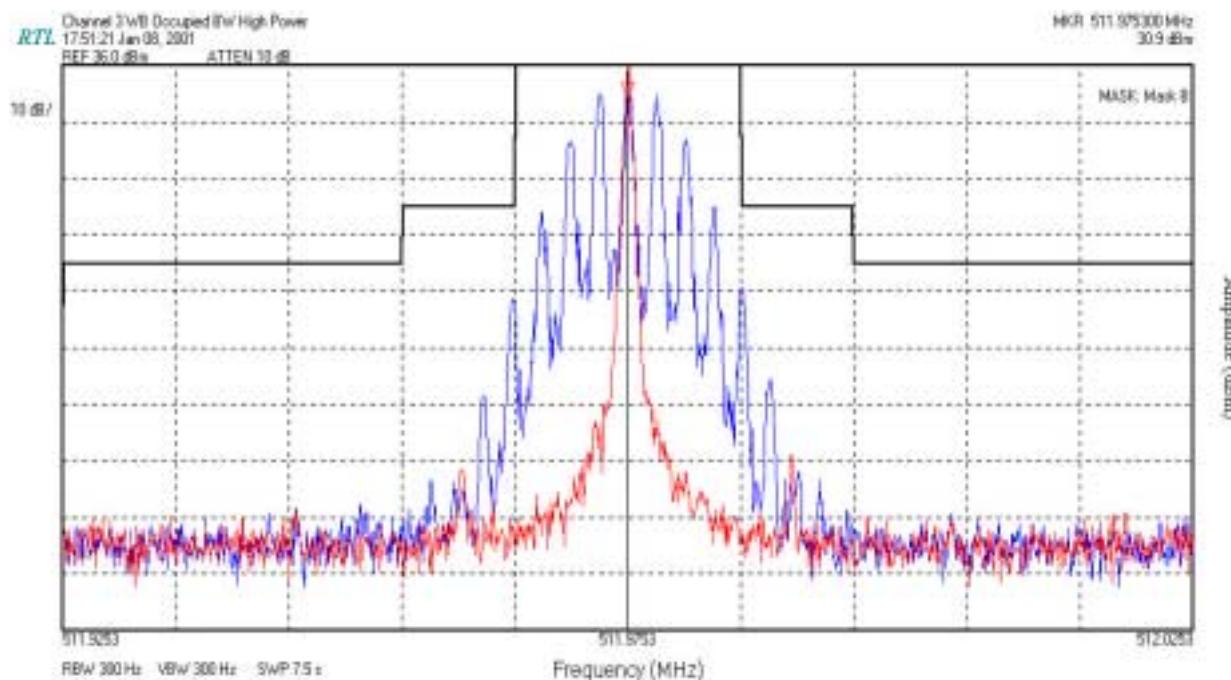
ANSI/TIA/EIA-603-1992, section 2.2.11

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

### 6.2 TEST DATA

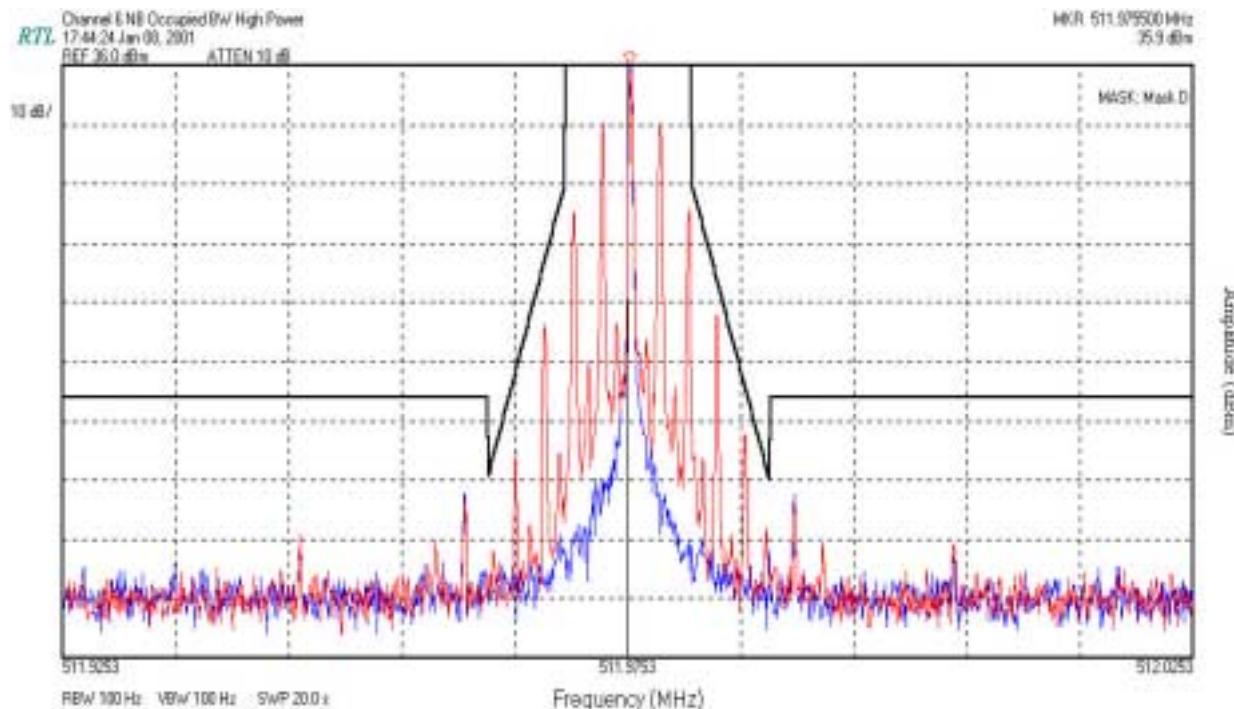
Channel 3: 4W for 25 kHz Channel Bandwidth: Mask B (Audio Modulation:2,500 Hz)





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

Channel 6: 4W for 12.5 kHz Channel Bandwidth: Mask D (Audio Modulation:2,500 Hz)



### 6.3 TEST EQUIPMENT

Spectrum Analyzer      HP8564E      s/n 3943A01719



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

## 7 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY

### 7.1 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.

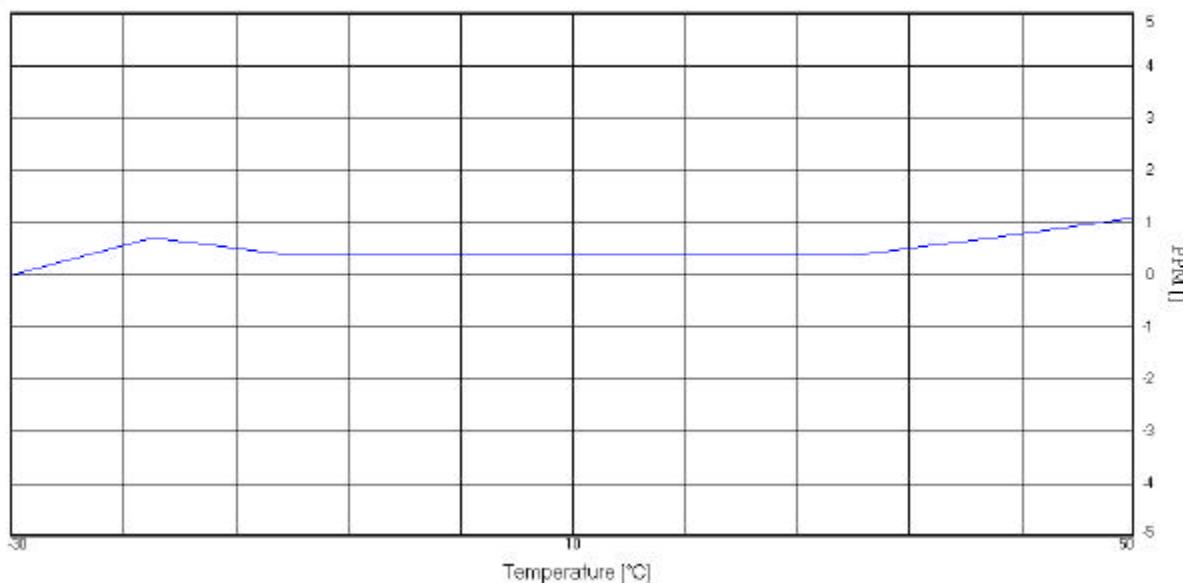
Additionally, the power supply voltage of the EUT was varied from the nominal voltage to the battery end-point.

The worst-case test data are shown.

### 7.2 TEST DATA

#### 7.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

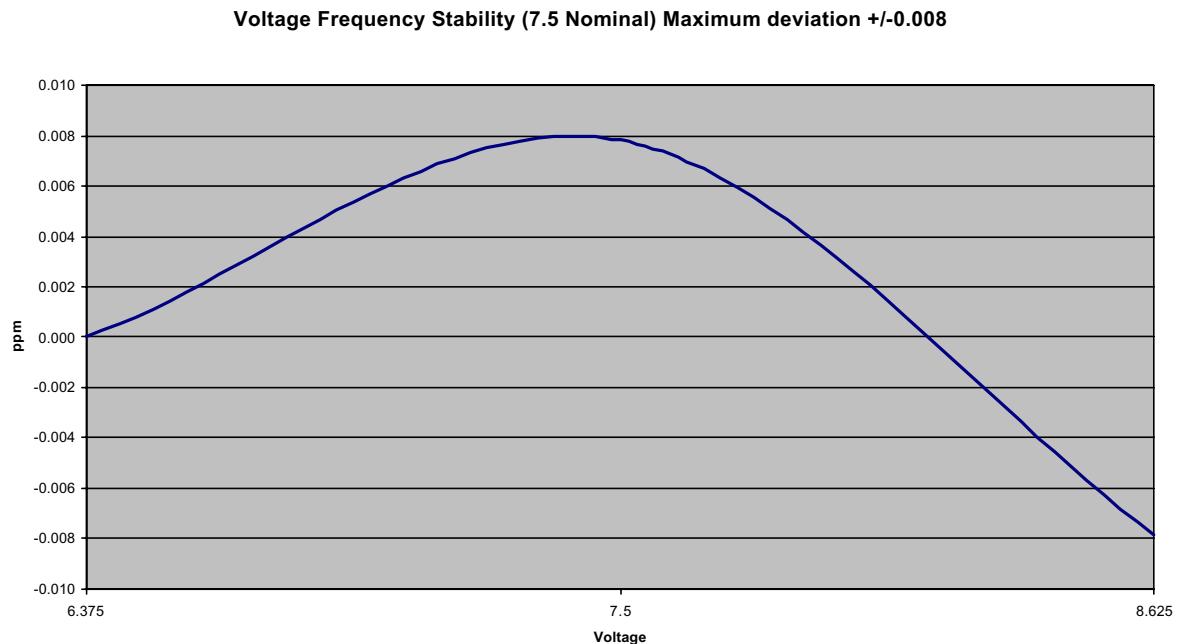
*RTL*





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

#### 7.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION (BATTERY END-POINT= 5.99VDC)



### 7.3 TEST EQUIPMENT

Temperature Chamber    Tenney TH65    s/n 11380

Frequency Counter    HP8901A (Frequency Mode)    s/n 2545A04102



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

## 8 FCC RULES AND REGULATIONS PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE

### 8.1 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 100Hz to 5kHz with the input level held constant.

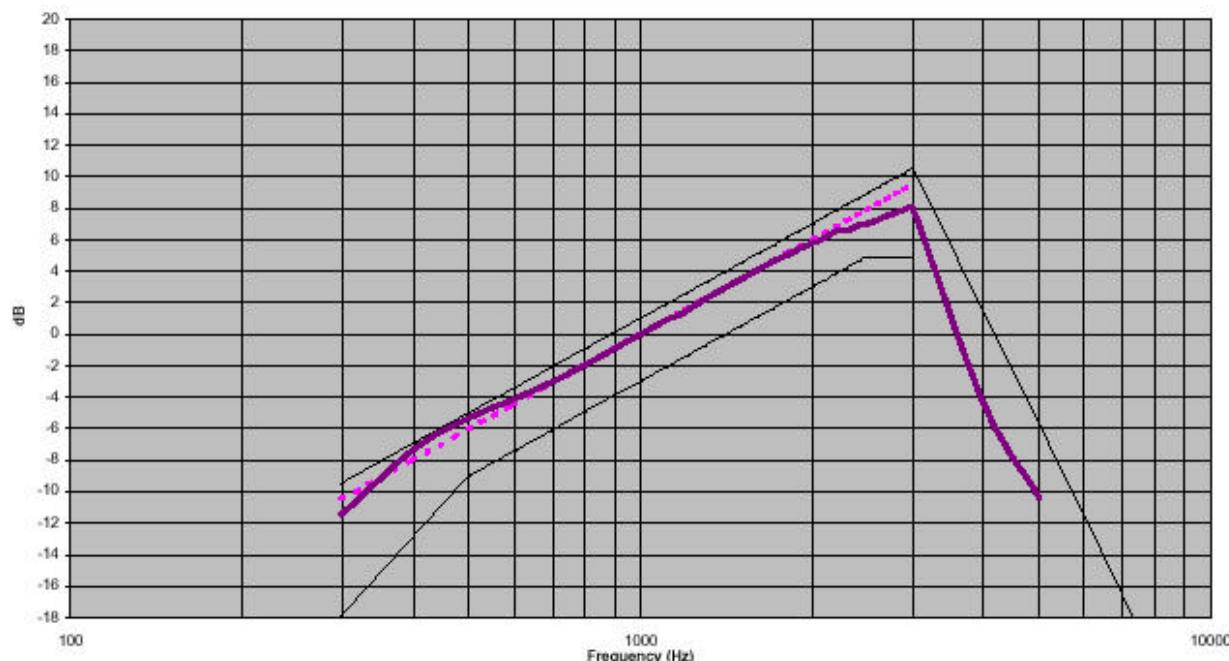
The deviation in kHz was recorded using a modulation analyzer as DEVfreq.

The response in dB relative to 1 kHz was calculated as follows:

Audio Frequency Response =  $20 \log (DEVfreq/DEVref)$

### 8.2 TEST DATA

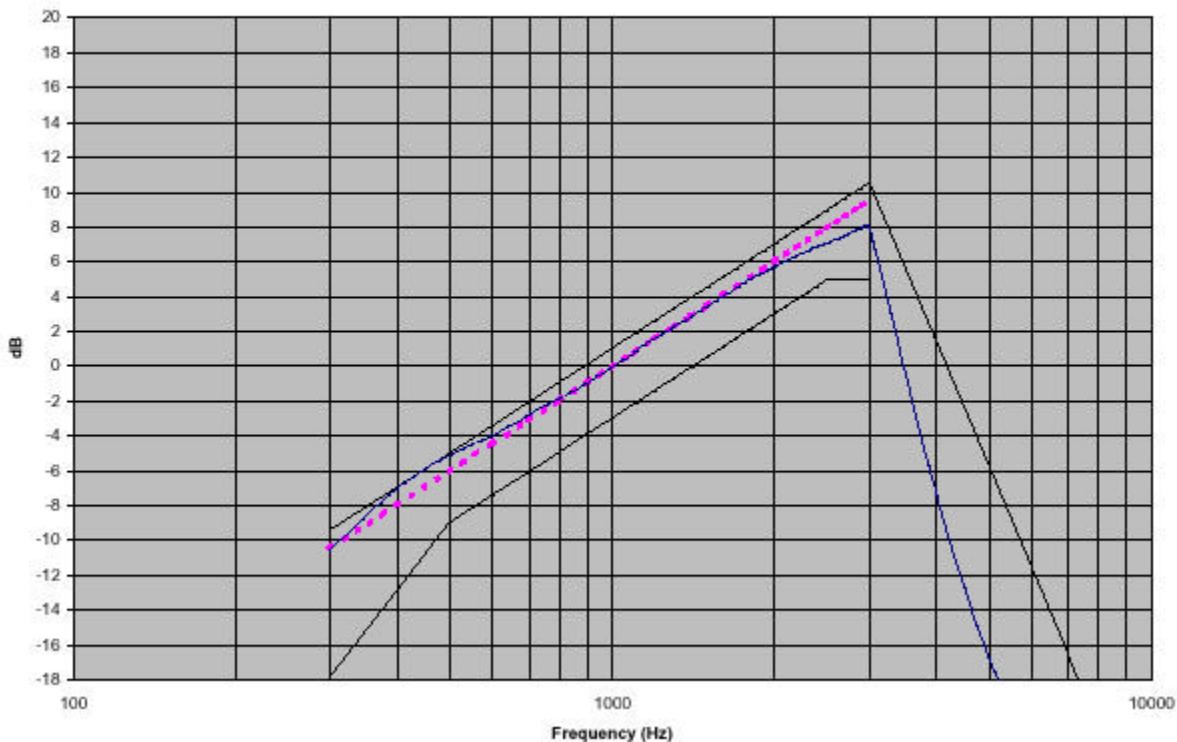
Channel 1 - 25kHz Audio Frequency Response





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

Channel 4 - 12.5 kHz Audio Frequency Response



### 8.3 TEST EQUIPMENT

Audio generator	HP3336B	s/n 2127A00559
Modulation analyzer	HP8901A	s/n 2545A04102



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

## 9 FCC RULES AND REGULATIONS PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE

### 9.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 2.2.15

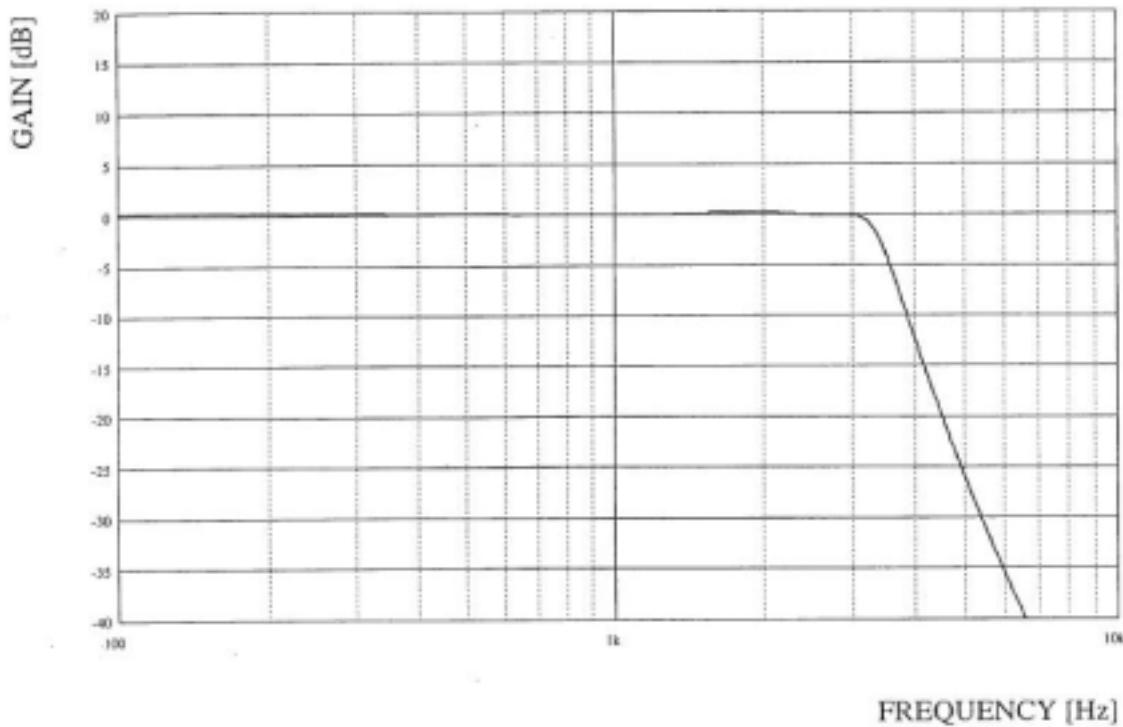
The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

### 9.2 TEST DATA

Note: The vertical scale is in dB relative to 1 kHz.

25 kHz channel bandwidth:

Fig.4. A LPF( $F_c=3.0\text{kHz}$ ) Frequency Response (Reference)

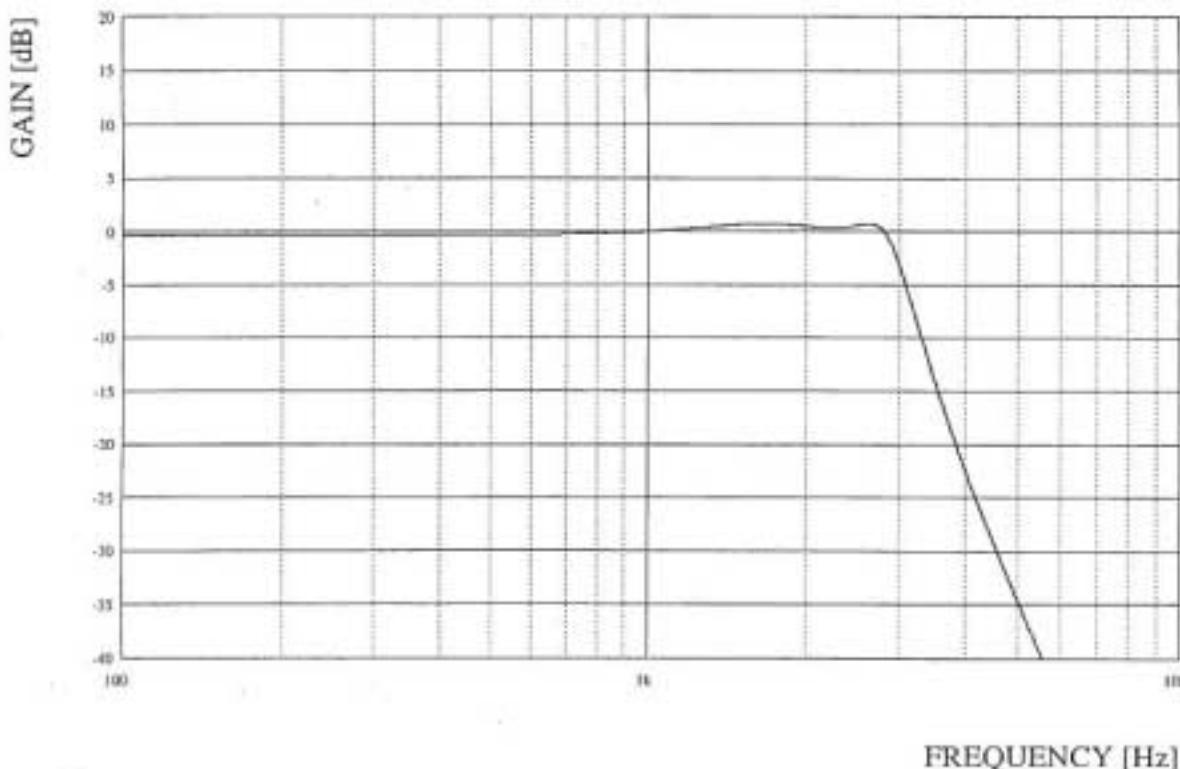




360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

12.5 kHz channel bandwidth:

Fig.4.B LPF( $F_c=2.55\text{kHz}$ ) Frequency Response (Reference)



### 9.3 TEST EQUIPMENT

Audio generator	HP3336B	s/n 2127A00559
Modulation analyzer	HP8901A	s/n 2545A04102
Selective level meter	HP3586B	s/n 1928A01892
Synthesizer/Level generator	HP3336B	s/n 2514A02585



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

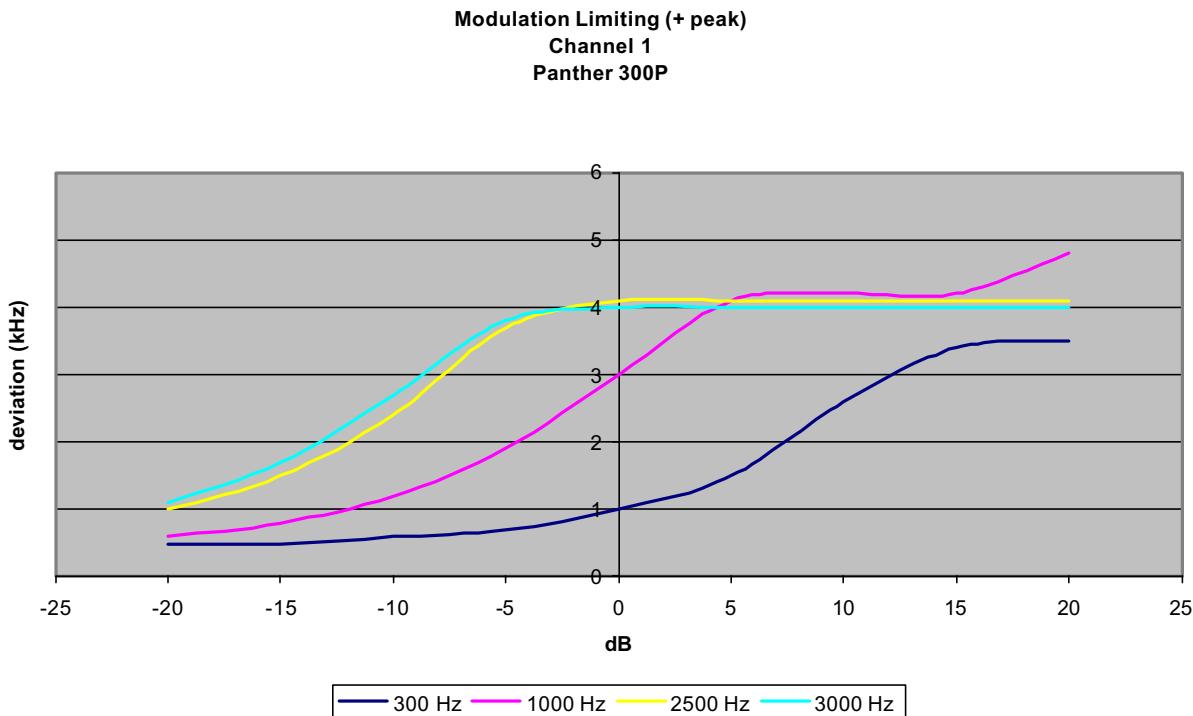
## 10 FCC RULES AND REGULATIONS PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING

### 10.1 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.

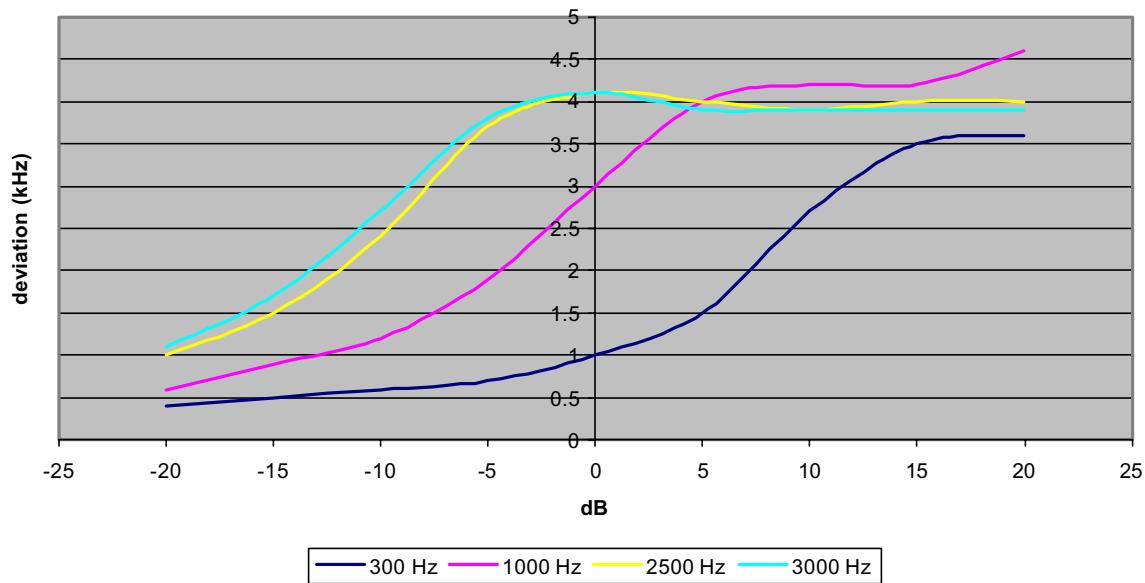
### 10.2 TEST DATA



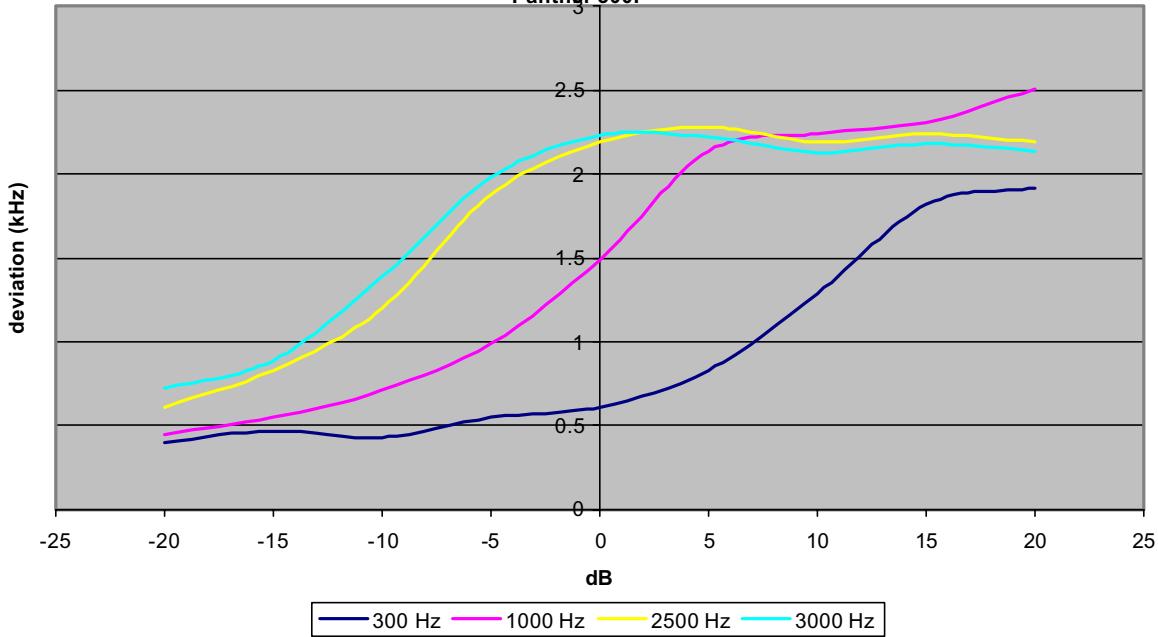


360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

**Modulation Limiting (- peak)**  
Channel 1  
Panther 300P



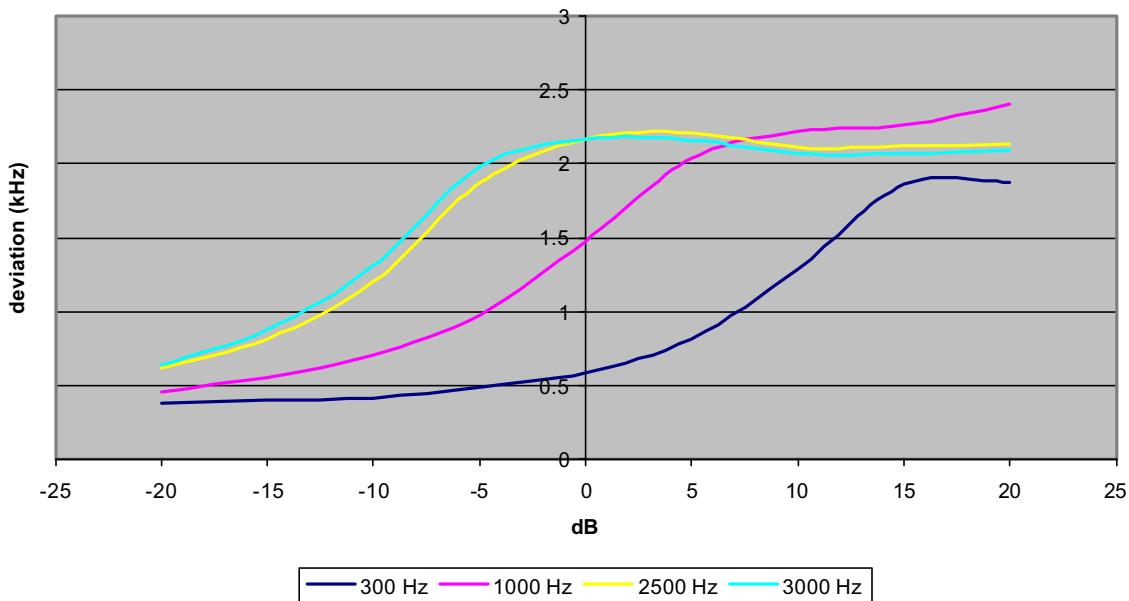
**Modulation Limiting (+ peak)**  
Channel 4  
Panther 300P





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

**Modulation Limiting (- peak)**  
**Channel 4**  
**Panther 300P**



### 10.3 TEST EQUIPMENT

Audio generator	HP3336B	s/n 2127A00559
Modulation analyzer	HP8901A	s/n 2545A04102



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

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

### 11.1 TEST PROCEDURE

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

### 11.2 TEST DATA

#### Limits:

Requirements for EUT with 25 kHz channel spacing:

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

Requirements for EUT with 12.5 kHz channel spacing:

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<sub>on</sub> is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.  
t<sub>1</sub> is the time period immediately following t<sub>on</sub>.

t<sub>2</sub> is the time period immediately following t<sub>1</sub>.

t<sub>3</sub> is the time period from the instant when the transmitter is turned off until t<sub>off</sub>.

t<sub>off</sub> is the instant when the 1 kHz test signal starts to rise.

(\*\*) During the time from the end of t<sub>2</sub> to the beginning of t<sub>3</sub>, 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.

#### Maximum frequency difference between time T2 and T3: Calculation for Channel 6:

The frequency stability is required to be 2.5 ppm.

Calculation for Channel 6:

4 div. on scope represent 12.5kHz for narrow band channel.

Therefore, 511.972 MHz times 2.5 ppm times +/- 4 Divisions divided by 12.5kHz equals about +/- 0.4 division.

0.4 Div. correspond to 1.280 kHz



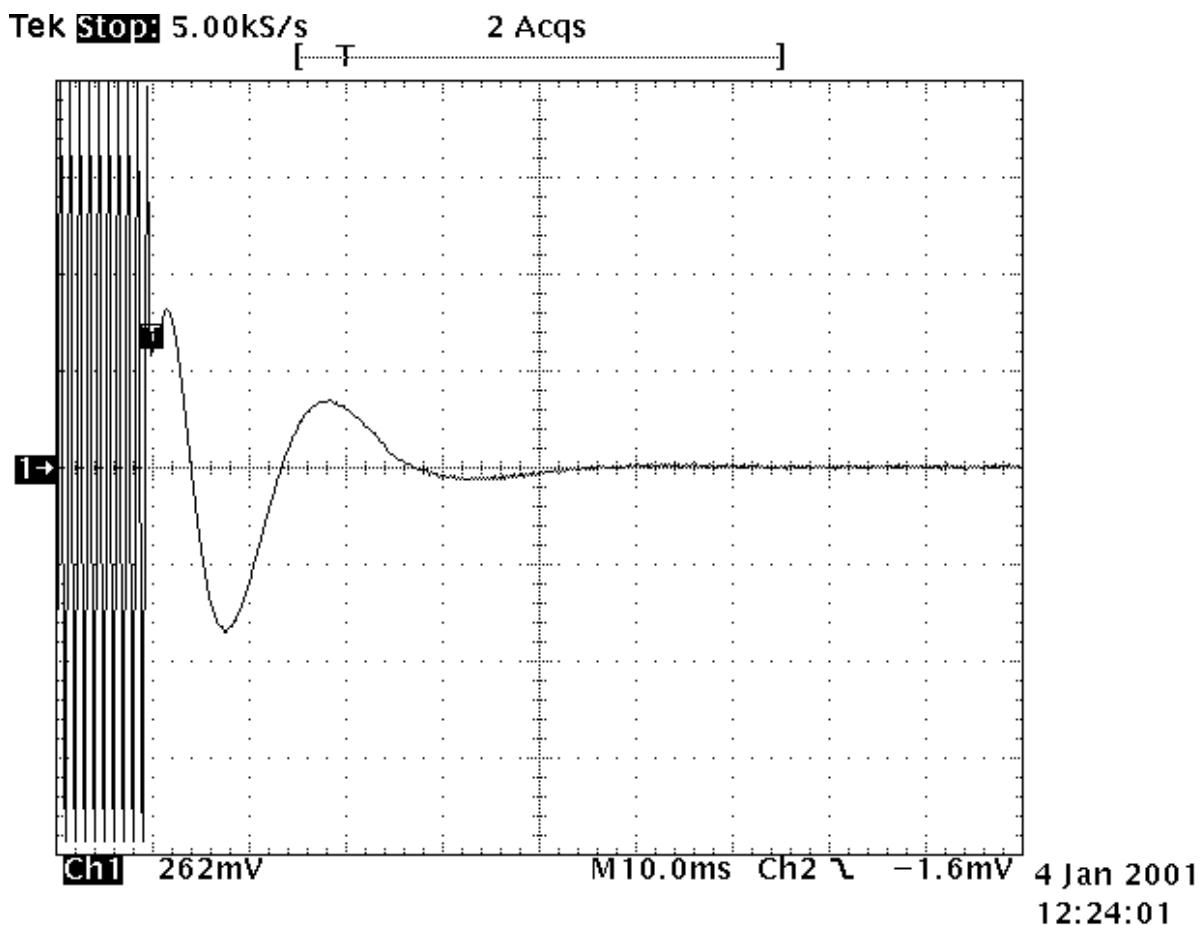
360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

Carrier ON time:

High Power: 4 W rated

Channel 6 : 511.972 MHz NB(12.5kHz)

RF Signal Generator: Modulation 12.5kHz deviation



Timebase: 10 ms/div

Trigger: On negative edge of Ch2, level -1.6mV

Ch1: 262mV/div, Probe 1.000:1

Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz



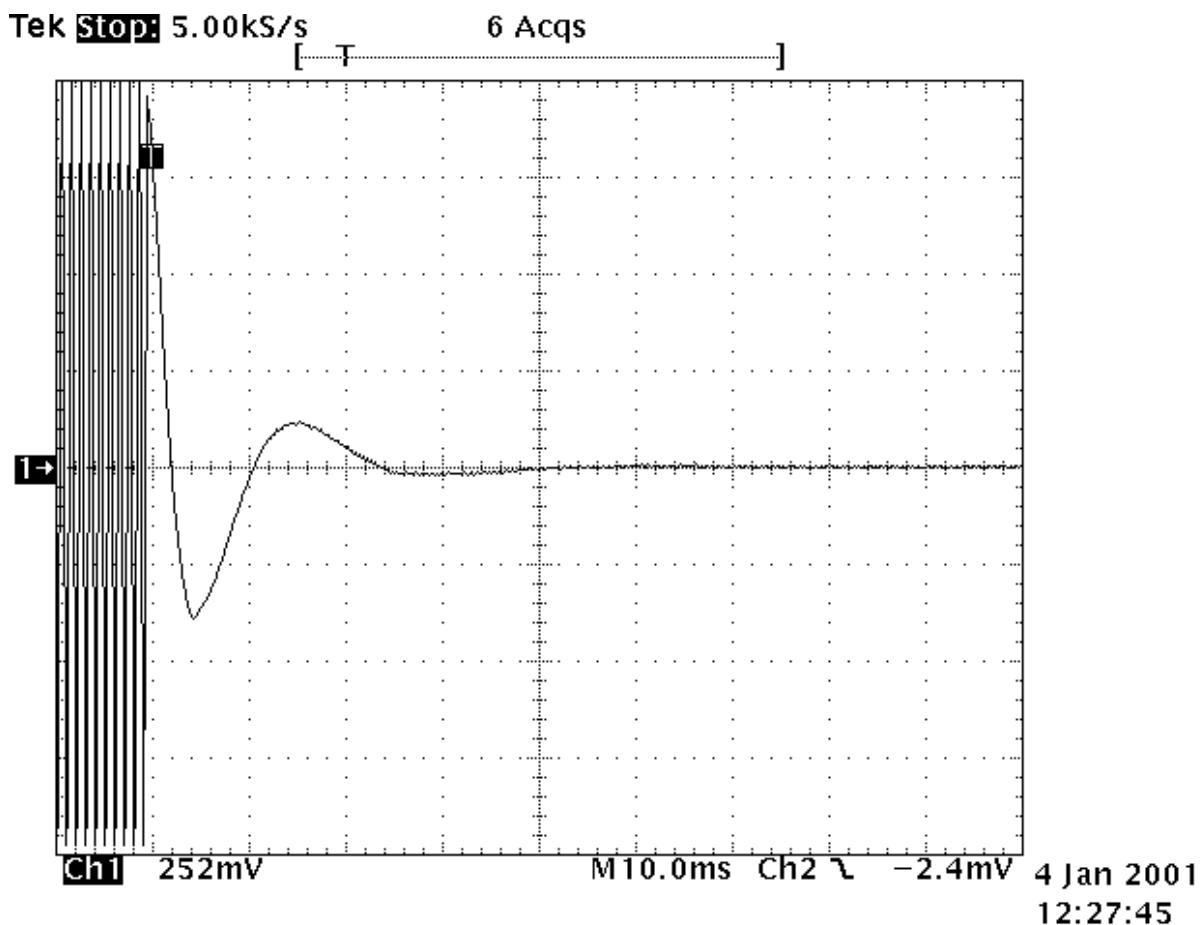
360 Herndon Parkway  
Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

Carrier ON Time:

High Power: 4 W rated

Channel 5 : 491.022 MHz NB(12.5kHz)

RF Signal Generator: Modulation 12.5kHz deviation



Timebase: 10 ms/div

Trigger: On negative edge of Ch2, level -2.4mV

Ch1: 252 mV/div, Probe 1.000:1

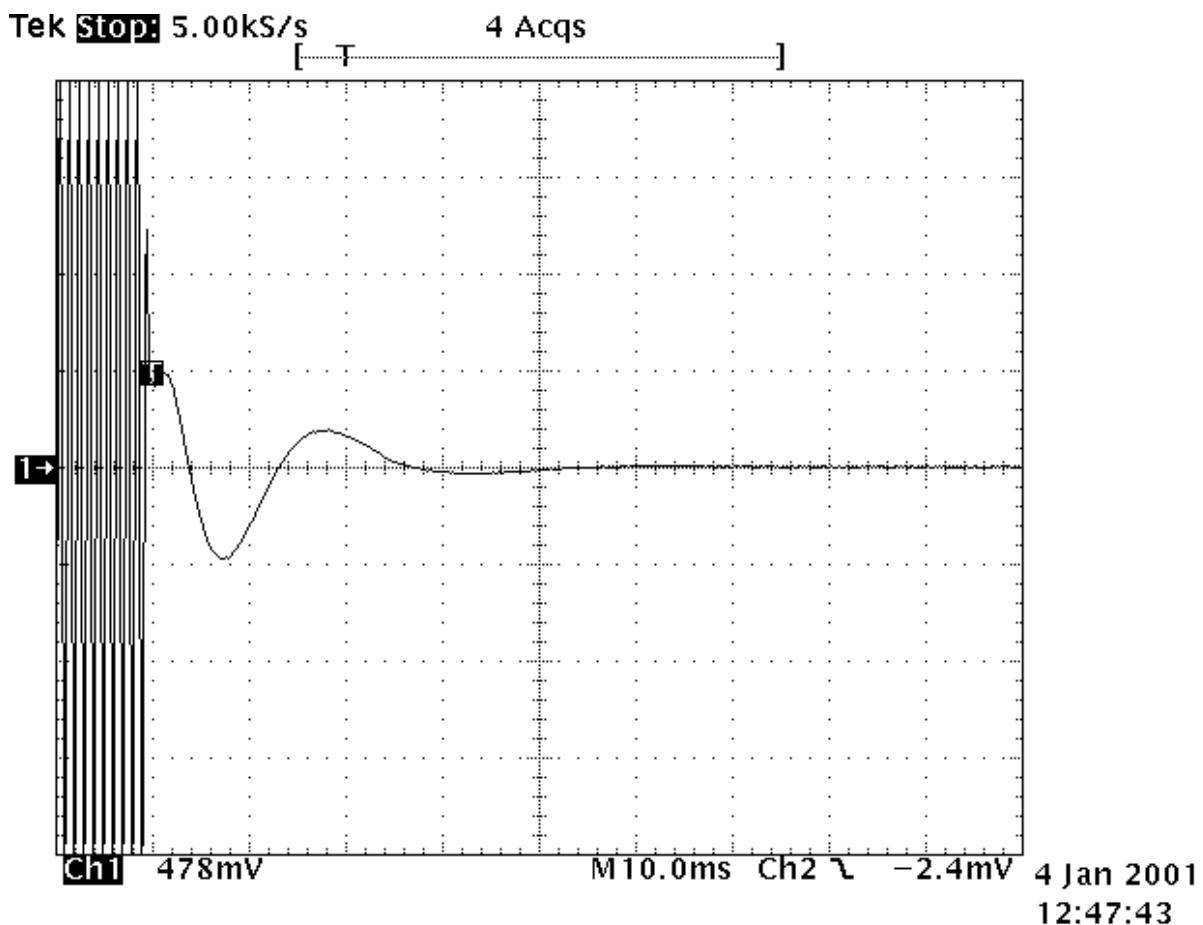
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz



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

Carrier ON time:

High Power: 4 W rated  
Channel 3 : 511.972 MHz WB(25kHz)  
RF Signal Generator: Modulation 25kHz deviation



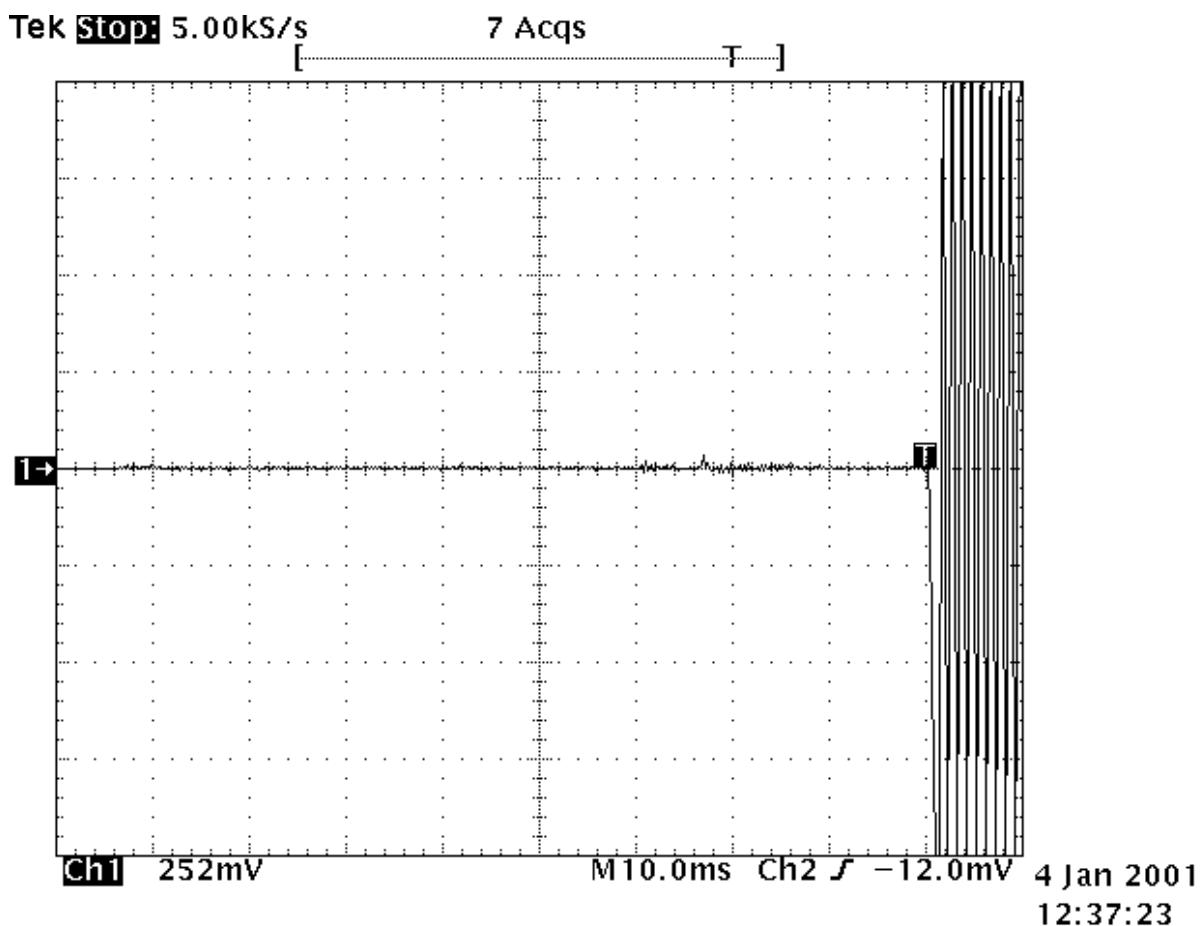
Timebase: 10 ms/div  
Trigger: On negative edge of Ch2, level -2.4mV  
Ch1: 478mV/div, Probe 1.000:1  
Vertical scale: +/- 4 div. corresponds to +/- 25 kHz



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

Carrier OFF time:

High Power: 4 W rated  
Channel 6 : 511.972 MHz NB(12.5kHz)  
RF Signal Generator: Modulation 12.5kHz deviation



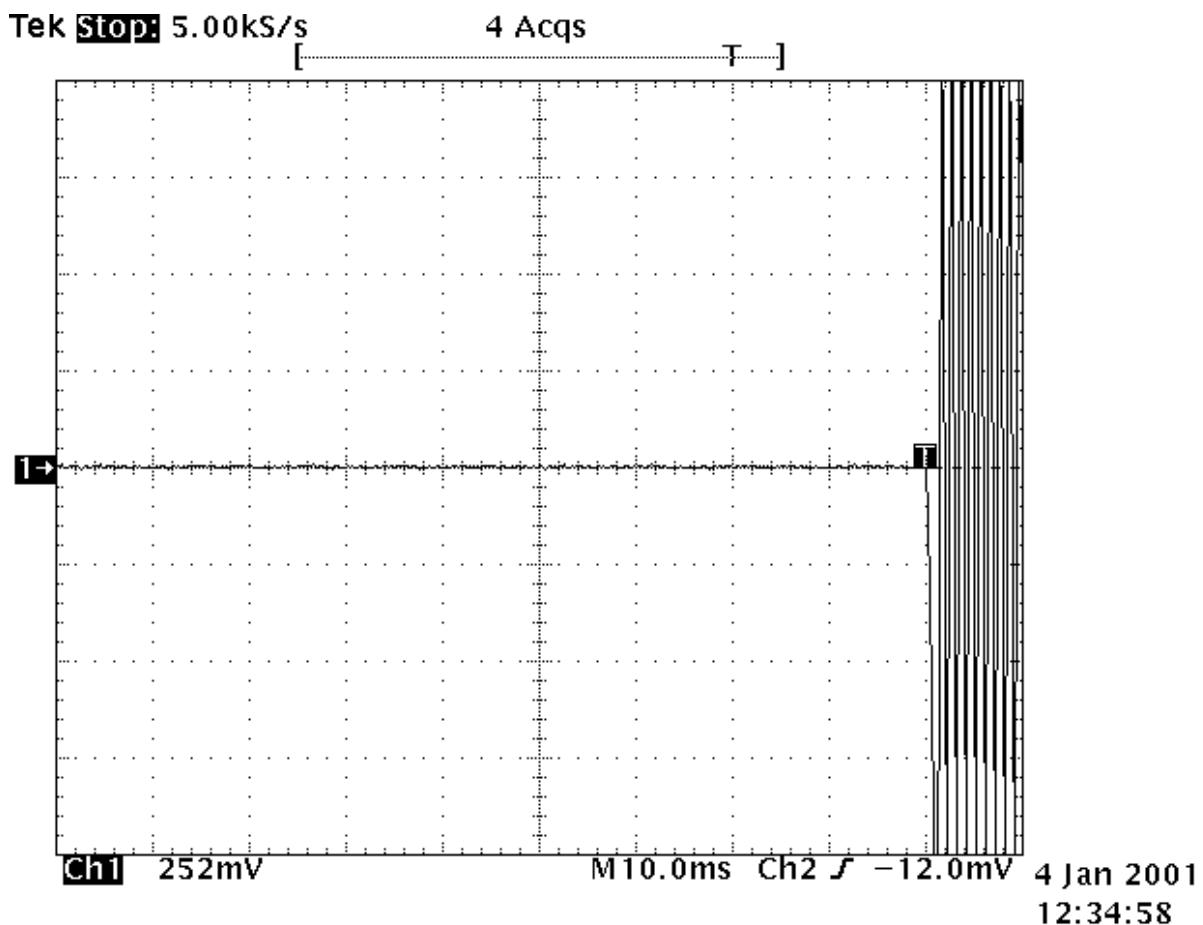
Timebase: 10 ms/div  
Trigger: On negative edge of Ch2, level -8mV  
Ch1: 252mV/div, Probe 1.000:1  
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz



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

Carrier OFF Time:

High Power: 4 W rated  
Channel 5 : 491.022 MHz NB(12.5kHz)  
RF Signal Generator: Modulation 12.5kHz deviation



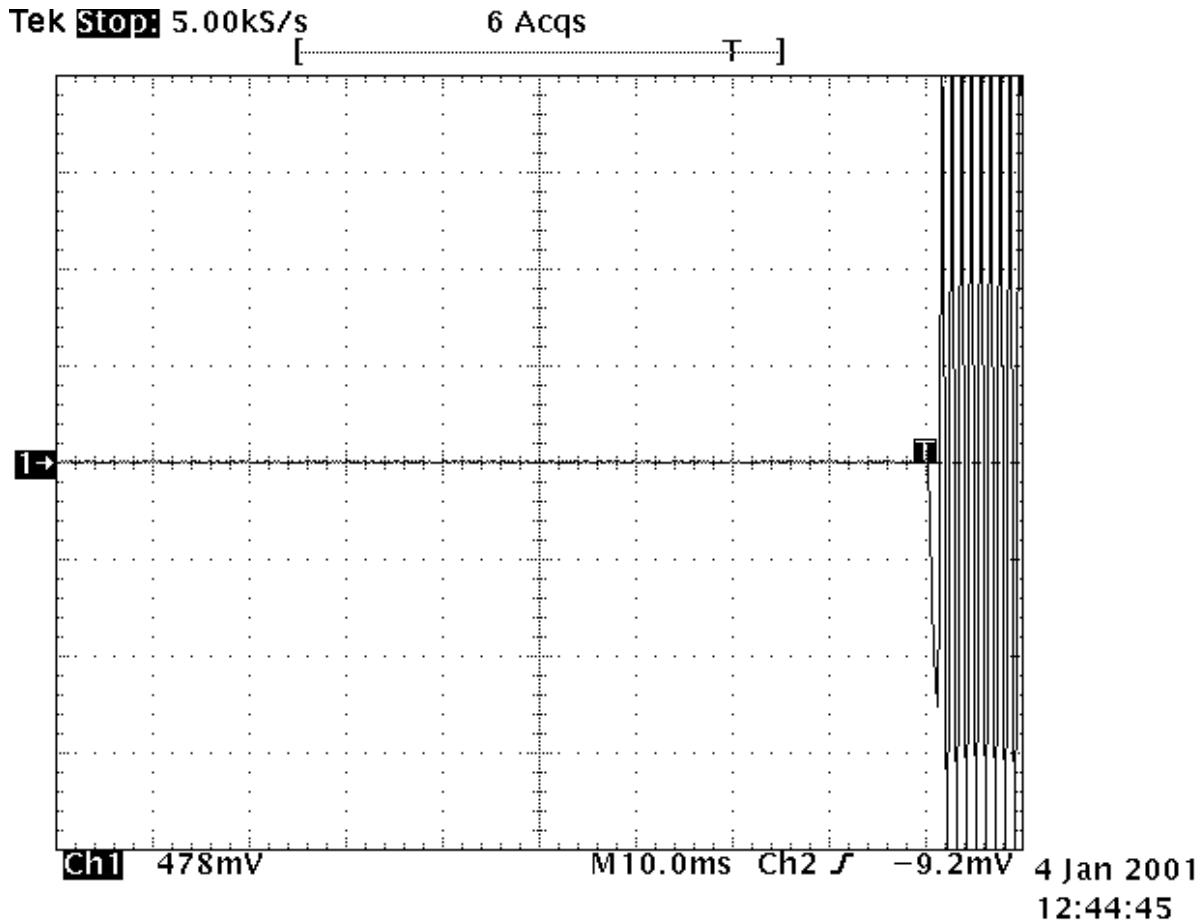
Timebase: 10 ms/div  
Trigger: On negative edge of Ch2, level -12.0 mV  
Ch1: 252 mV/div, Probe 1.000:1  
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz



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

Carrier OFF time:

High Power: 4 W rated  
Channel 3 : 511.972 MHz WB(25kHz)  
RF Signal Generator: Modulation 25kHz deviation



Timebase: 10 ms/div  
Trigger: On negative edge of Ch2, level -9.2mV  
Ch1: 478 mV/div, Probe 1.000:1  
Vertical scale: +/- 4 div. corresponds to +/- 25 kHz

### 11.3 TEST EQUIPMENT

Detector: HP8471D s/n 2952A  
RF signal generator: HP8648C s/n 3537A01741  
Modulation Analyzer: HP8901A s/n 2545A04102  
Oscilloscope: Tektronix TDS540B s/n B020129  
Receiver: HP 8546A s/n 3525A00159



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

## **12 FCC RULES AND REGULATIONS PART 2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH**

Type of Emission: F3E

Necessary Bandwidth and Emission Bandwidth:

12.5kHz (NB channel) :  $B_n = 11K0F3E$

25kHz (WB channel):  $B_n = 16K0F3E$

Calculation:

Max modulation(M) in kHz : 3

Max deviation (D) in kHz: 2.5 (NB) and 5 (BB)

Constant factor (K) : 1

$B_n = 2xM+2xDK$

## **13 FCC RULES AND REGULATIONS PART 1.1307, 1.1310, 2.1091, 2.1093: RF EXPOSURES COMPLIANCE**

The SAR Test Report is provided in the RF exposure exhibit.