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Quote Number: QRTL01-324
Dates of Tests: November 10, 2001
FCC Part 90 Certification &
Industry Canada RSS-119

CERTIFICATE OF COMPLIANCE
FCC PART 90 CERTIFICATION & INDUSTRY CANADA CERTIFICATION

Test Lab:	Applicant Information
Rhein Tech Laboratories, Inc. 360 Herndon Parkway Suite 1400 Herndon, VA 20170 Phone: 703-689-0368 Fax: 703-689-2056 Web Site: www.rheintech.com	Topaz3, LLC 10828 NW Air World Drive Kansas City, MO 64153 USA

FCC Classification:	☐ TBC – Licensed Broadcast Station Transmitter ☐ TBF – Licensed Broadcast Transmitter Held to Face ☐ TBT – Licensed Broadcast Transmitter Worn on Body ☐ TNB – Licensed Non-Broadcast Station Transmitter ☐ TNE – Licensed Nono-Broadcast Transmitter Held to Ear ☒ TNF – Licensed Non-Broadcast Transmitter Held to Face ☐ TNT – Licensed Non-Broadcast Transmitter Worn on Body
FCC Rule Part(s):	Part 90: Private Land Mobile Radio Services
Industry Canada Standard:	RSS-119: Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz
FRN Number:	0005824115
FCC ID:	O7KPL5164
Model(s):	PL5164 Portable Radio
Date of Test Report:	December 19, 2001

Frequency Range	Output Power (W) Conducted	Freq. Tolerance (ppm)	Emission Designator
450-490 MHz	5.0	2.0	16K0F3E
450-490 MHz	1.3	2.0	16K0F3E
450-490 MHz	5.0	2.0	11K0F3E
450-490 MHz	1.3	2.0	11K0F3E

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. 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 15, FCC Part 90, Industry Canada RSS-119, ANSI C63.4, ANSI/TIA/EIA603 and ANSI/TIA/EIA 603-1.

Signature: 

Date: December 19, 2001

Typed/Printed Name: Bruno Clavier

Position: Vice President of Operations
(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.

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1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules and Regulations CFR 47 Part 90: This part states the conditions under which radio communications systems may be licensed and used in the Public Safety, Special Emergency, Industrial, Land Transportation and Radiolocation Radio Services. These rules do not govern radio systems employed by agencies of the Federal Government.

Industry Canada RSS-119: This document sets out standards for radio transmitters and receivers for the land mobile and fixed services in bands allocated within the 24.41 MHz to 960 MHz range. The equipment is subject to licensing, pursuant to subsection 4(1) of the Radiocommunication Act.

All measurements contained in this application were conducted in accordance with the FCC Rules and Regulations CFR47, Industry Canada RSS-119 and ANSI/TIA/EIA603-1992/-1-1998 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards. 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.

1.2 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 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).

1.3 RELATED SUBMITAL(S)/GRANT(S)

This is an original application for Certification.

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2 EQUIPMENT INFORMATION

2.1 APPLICANT AND EQUIPMENT INFORMATION

Topaz3, LLC
10828 NW Air World Drive
Kansas City, MO 64153
USA

FCC Classification:	☐ TBC – Licensed Broadcast Station Transmitter ☐ TBF – Licensed Broadcast Transmitter Held to Face ☐ TBT – Licensed Broadcast Transmitter Worn on Body ☐ TNB – Licensed Non-Broadcast Station Transmitter ☐ TNE – Licensed Nono-Broadcast Transmitter Held to Ear ☒ TNF – Licensed Non-Broadcast Transmitter Held to Face ☐ TNT – Licensed Non-Broadcast Transmitter Worn on Body
FCC Rule Part(s):	Part 90: Private Land Mobile Radio Services
Industry Canada Standard:	RSS-119: Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz
FRN Number:	0005824115
FCC ID:	O7KPL5164
Model(s):	PL5164 Portable Radio
Date of Test Report:	December 19, 2001

Frequency Range	Output Power (W) Conducted	Freq. Tolerance (ppm)	Emission Designator
450-490 MHz	5.0	2.0	16K0F3E
450-490 MHz	1.3	2.0	16K0F3E
450-490 MHz	5.0	2.0	11K0F3E
450-490 MHz	1.3	2.0	11K0F3E

2.2 JUSTIFICATION

There was no deviation from the standards mentioned in the report.

2.3 EXERCISING THE EUT

The EUT was exercised in accordance with the standards mentioned in this report.

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2.4 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are:

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
PORTABLE RADIO	TOPAZ3, LLC	PL5164	N/A	O7KPL5164	N/A	13809

TABLE 2-2: EXTERNAL COMPONENTS IN TEST CONFIGURATION

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
BATTERY CHARGER	TOPAZ3, LLC	N/A	N/A	N/A	N/A	013355

2.5 CONFIGURATION OF TESTED SYSTEM

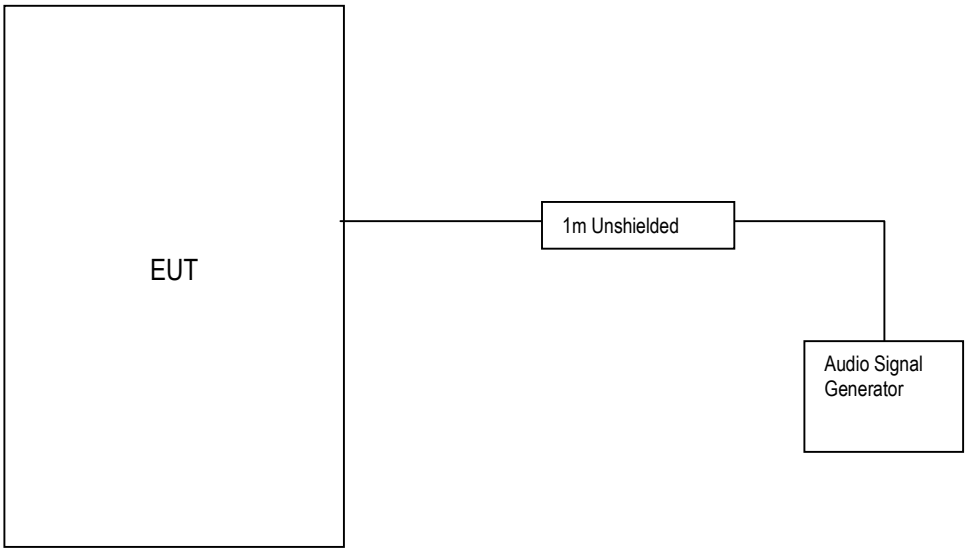

FIGURE 2-1: CONFIGURATION OF TESTED SYSTEM

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3 NECESSARY BANDWIDTH AND EMISSION BANDWIDTH - §2.202

Type of Emission: F3E

Necessary Bandwidth and Emission Bandwidth:
12.5kHz (NB channel) : Bn = 11K0F3E
25kHz (WB channel): Bn = 16K0F3E

Calculation:
Max modulation(M) in kHz : 3
Max deviation (D) in kHz: 2.5 (NB) and 5 (WB)
Constant factor (K) : 1
Bn = 2xM+2xDK

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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4 DC VOLTAGE AND CURRENT AT FINAL AMPLIFIER STAGE - §2.1033

TABLE 4-1: DC VOLTAGE AND CURRENT AT FINAL AMPLIFIER STAGE

DC Voltage	7.17
Current	1.65

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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5 RF POWER OUTPUT - §2.1046

5.1 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.

5.2 TEST DATA

The following channels (in MHz) were tested: 450.0125, 460.0125, 470.0125, and 489.9875
The worst-case Output Power (highest and lowest) levels are shown.

CARRIER OUTPUT POWER (UNMODULATED)

5.3 RF POWER OUTPUT TEST EQUIPMENT

TABLE 5-1: RF POWER OUTPUT TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900770	Hewlett Packard	437B	Power Meter	2949A02966
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102
900769	Hewlett Packard	8481B	Power Sensor	2702A05059
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102

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5.4 EFFECTIVE RADIATED POWER OUTPUT TEST DATA- §2.1046

TABLE 5-2: POWER OUTPUT DATA - §2.1046 (HIGH POWER)

Channel	Frequency (MHz)	RF Power measured (Watt)*
1	450.0125	5.0
2	460.0125	4.9
3	470.0125	5.0
4	489.9875	5.0
5	450.0125	1.2
6	460.0125	1.2
7	470.0125	1.2
8	489.9875	1.0

* Measurement accuracy: +/- 3%

RF Power Output (Rated Power)

Rated Power (W)
5.0

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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6 MODULATION CHARACTERISTICS - §2.1047

6.1 AUDIO FREQUENCY RESPONSE - §2.1047(A) 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)

6.2 MODULATION CHARACTERISTICS TEST EQUIPMENT

TABLE 6-1: MODULATION CHARACTERISTICS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892

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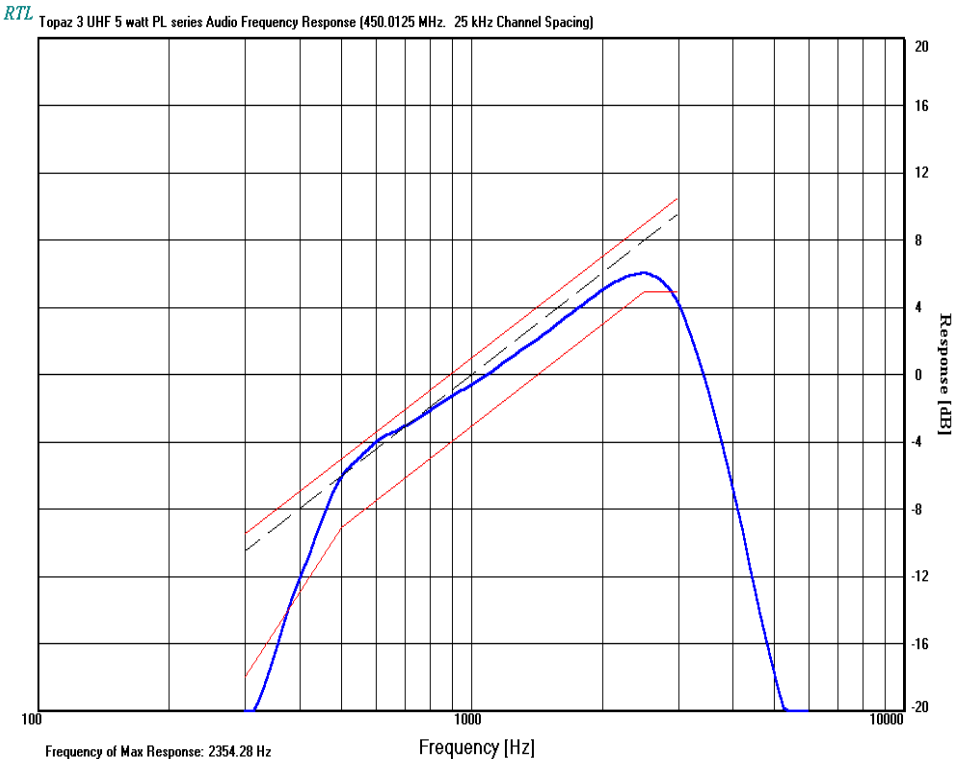
6.3 MODULATION CHARACTERISTICS TEST DATA

PLOT 6-1: MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE {25 KHZ CHANNEL BANDWIDTH}



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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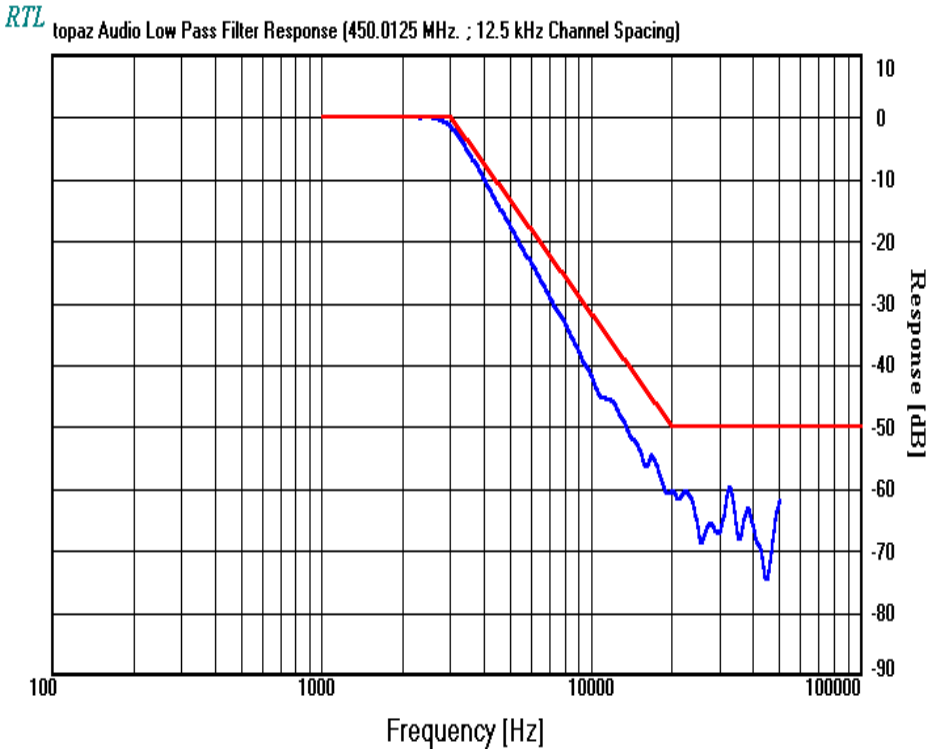
6.4 AUDIO LOW PASS FILTER - §2.1047(A) TEST PROCEDURE

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.

PLOT 6-2: MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER



TEST PERSONNEL:

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Test Technician/Engineer	Signature	Date Of Test

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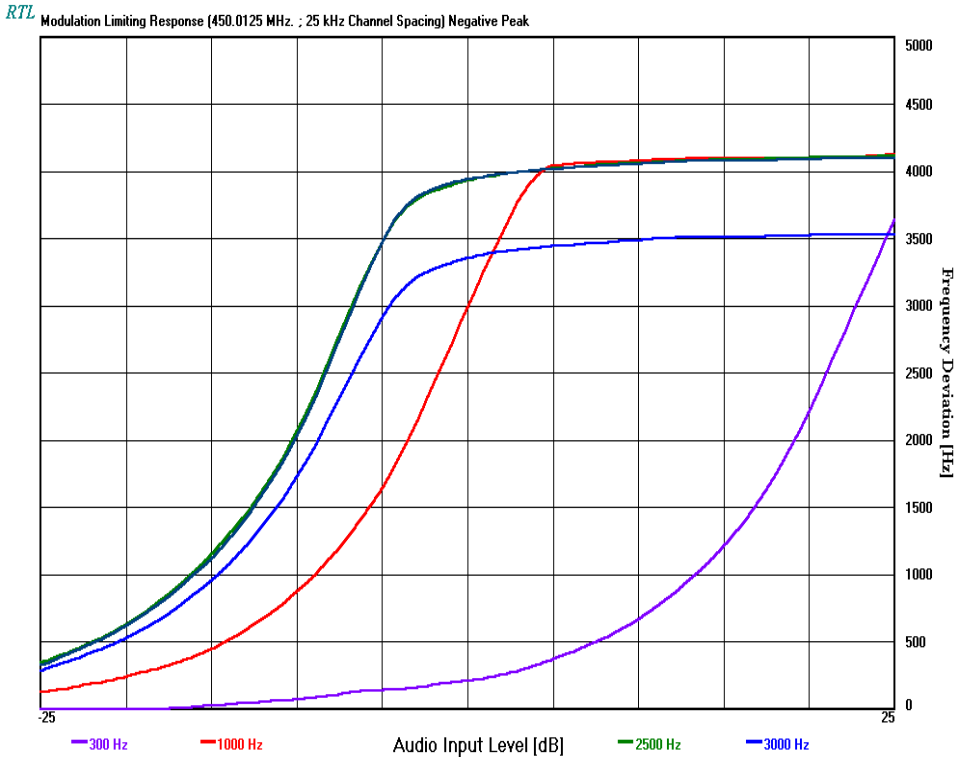
6.5 MODULATION LIMITING - §2.1047(B) TEST PROCEDURE

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. Test Data
The CTCSS mode has also been tested

PLOT 6-3: MODULATION CHARACTERISTICS – MODULATION LIMITING: WIDE BAND NEGATIVE PEAK



TEST PERSONNEL:

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Test Technician/Engineer	Signature	Date Of Test

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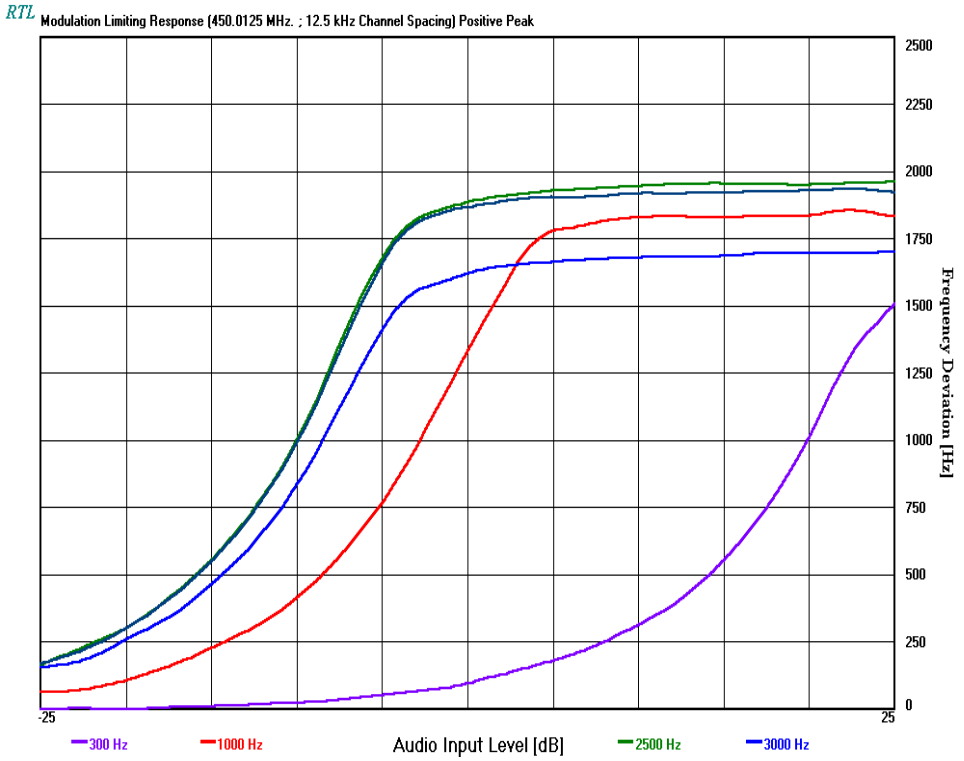
PLOT 6-4: MODULATION LIMITING: WIDE BAND POSITIVE PEAK



TEST PERSONNEL:

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Test Technician/Engineer	Signature	Date Of Test

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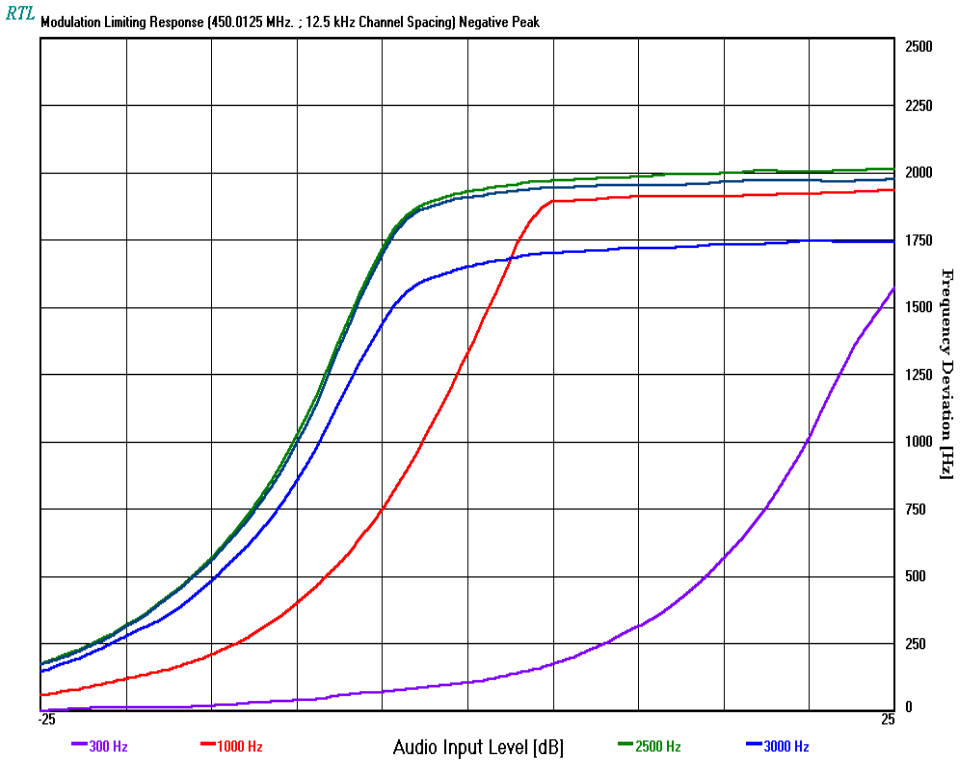
PLOT 6-5: MODULATION LIMITING: NARROW BAND NEGATIVE PEAK



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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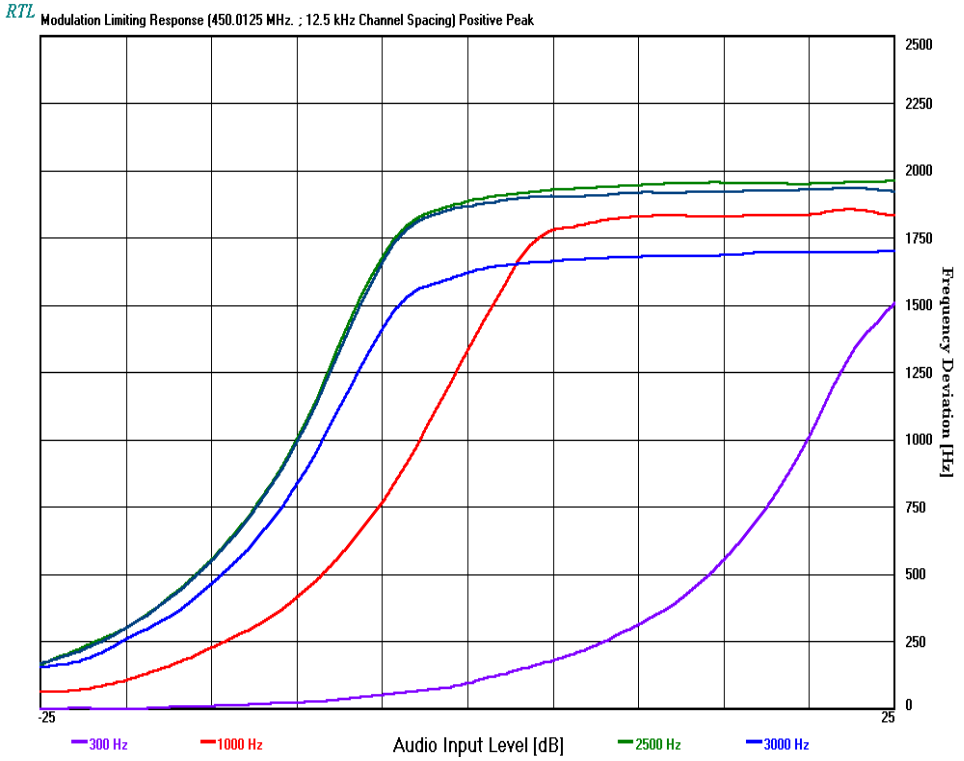
PLOT 6-6: MODULATION LIMITING: NARROW BAND POSITIVE PEAK



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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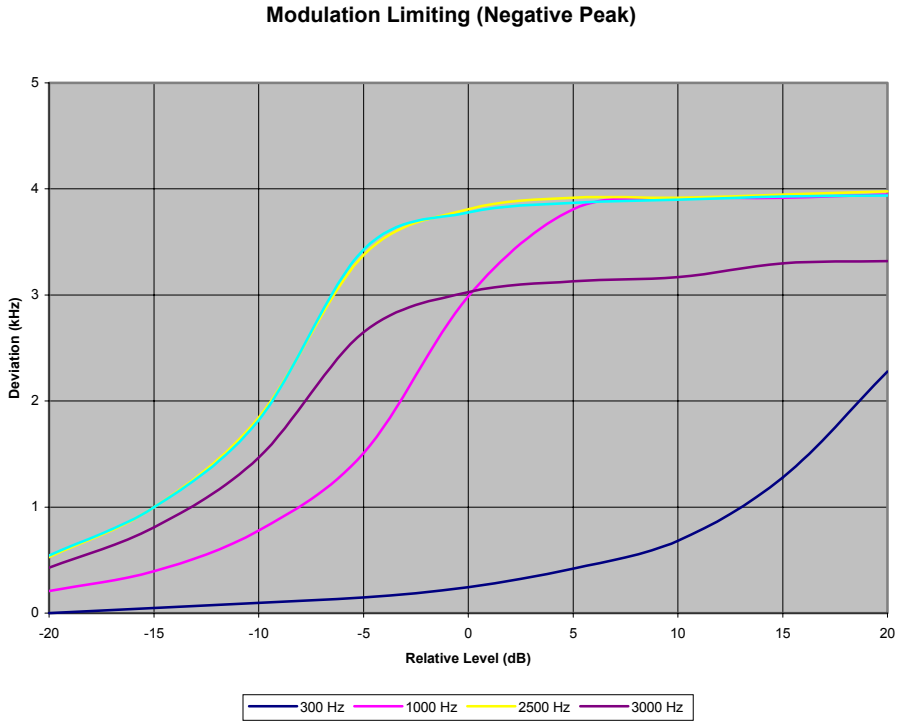
PLOT 6-7: MODULATION LIMITING: WIDE BAND NEGATIVE PEAK



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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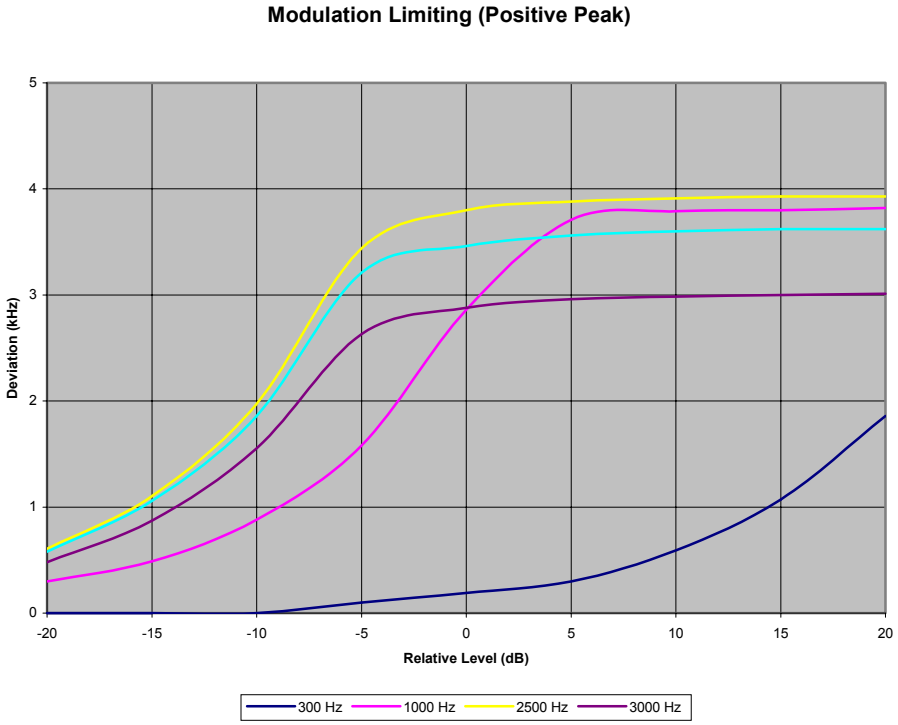
PLOT 6-8: MODULATION LIMITING: WIDE BAND NEGATIVE PEAK



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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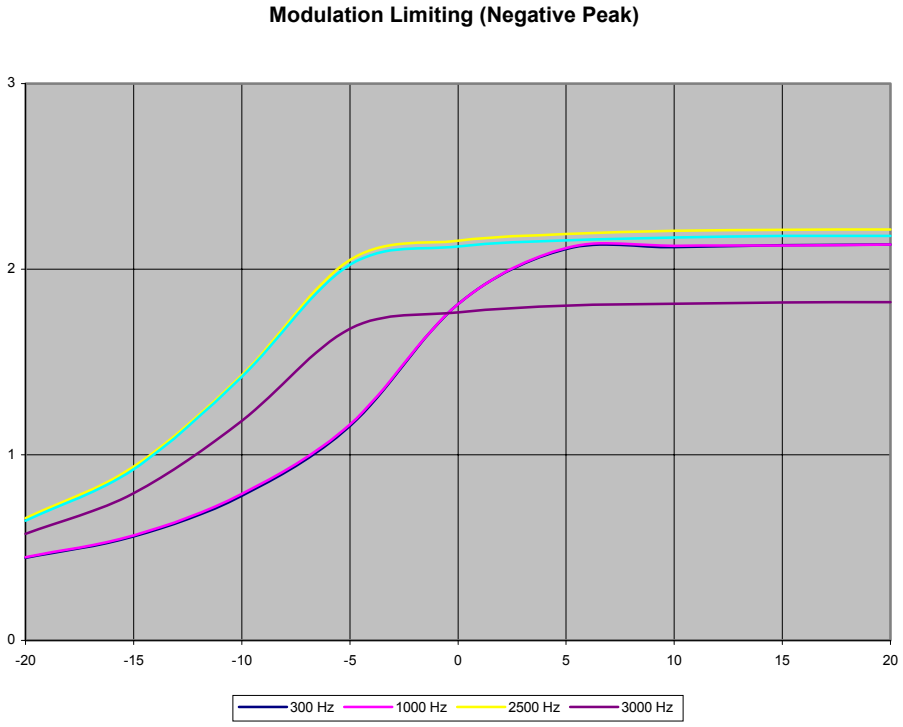
PLOT 6-9: MODULATION LIMITING: NARROW BAND NEGATIVE PEAK



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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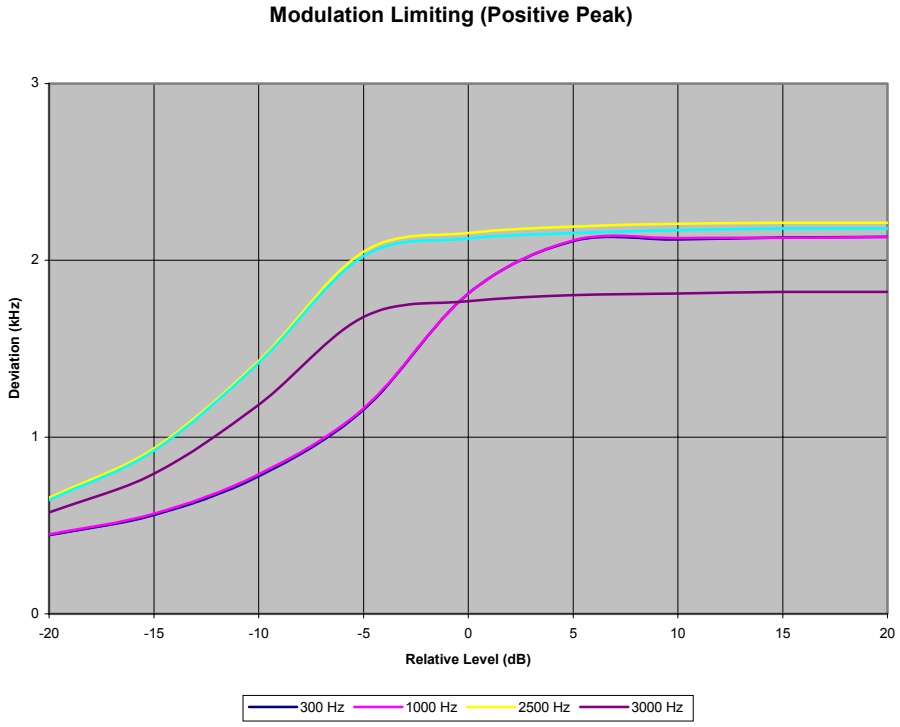
PLOT 6-10: MODULATION LIMITING: NARROW BAND NEGATIVE PEAK



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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7 OCCUPIED BANDWIDTH - §2.1049

7.1 OCCUPIED BANDWIDTH - §2.1049 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.
The device was also tested in CTCSS mode.

Device with digital modulation: N/A

7.2 OCCUPIED BANDWIDTH TEST EQUIPMENT

TABLE 7-1: OCCUPIED BANDWIDTH TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9kHz – 40 GHz)	3943A01719

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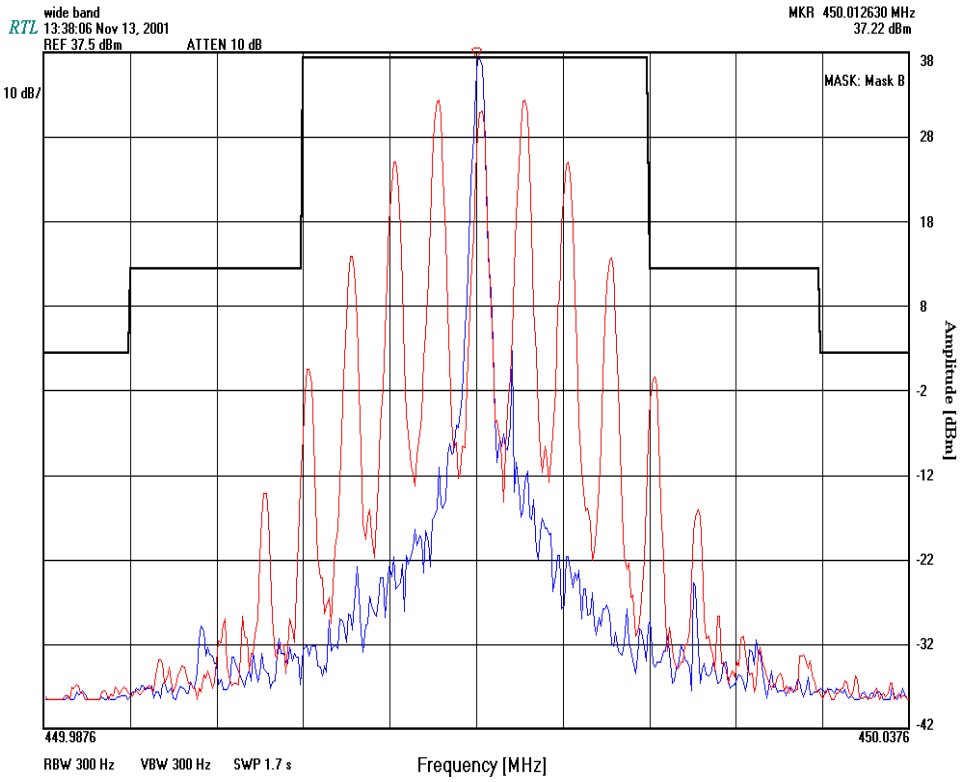
7.3 OCCUPIED BANDWIDTH TEST DATA

PLOT 7-1: OCCUPIED BANDWIDTH – 25 KHZ CHANNEL BANDWIDTH: MASK B (AUDIO MODULATION: 2,500 HZ)



TEST PERSONNEL:

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Test Technician/Engineer	Signature	Date Of Test

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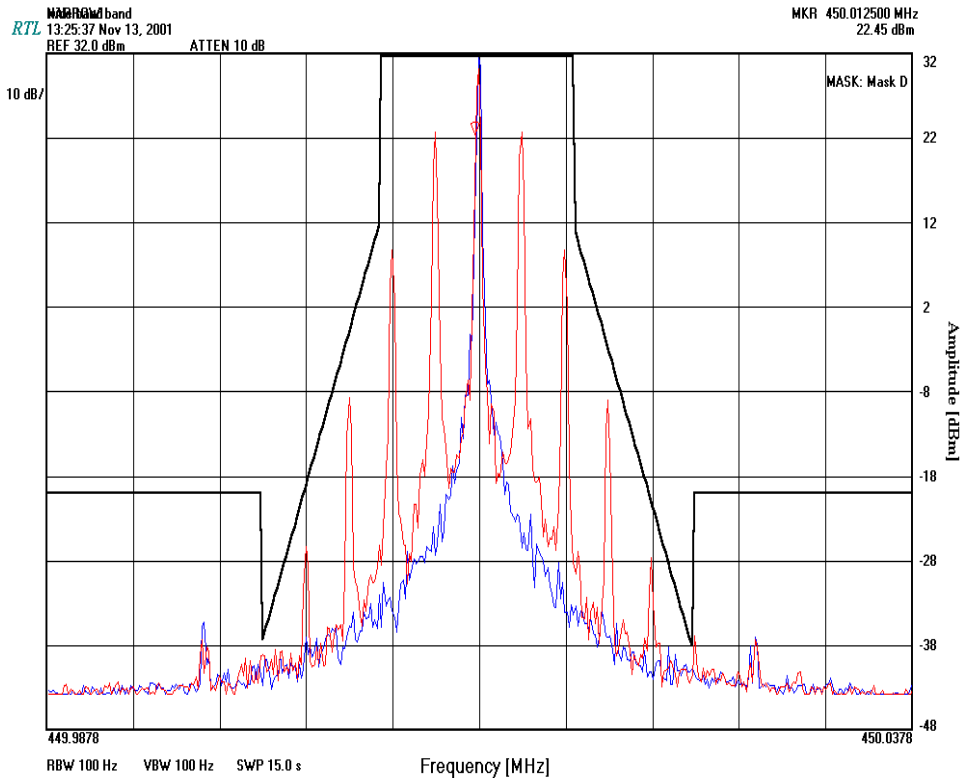
PLOT 7-2: OCCUPIED BANDWIDTH –12.5 KHZ CHANNEL BANDWIDTH



TEST PERSONNEL:

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Test Technician/Engineer	Signature	Date Of Test

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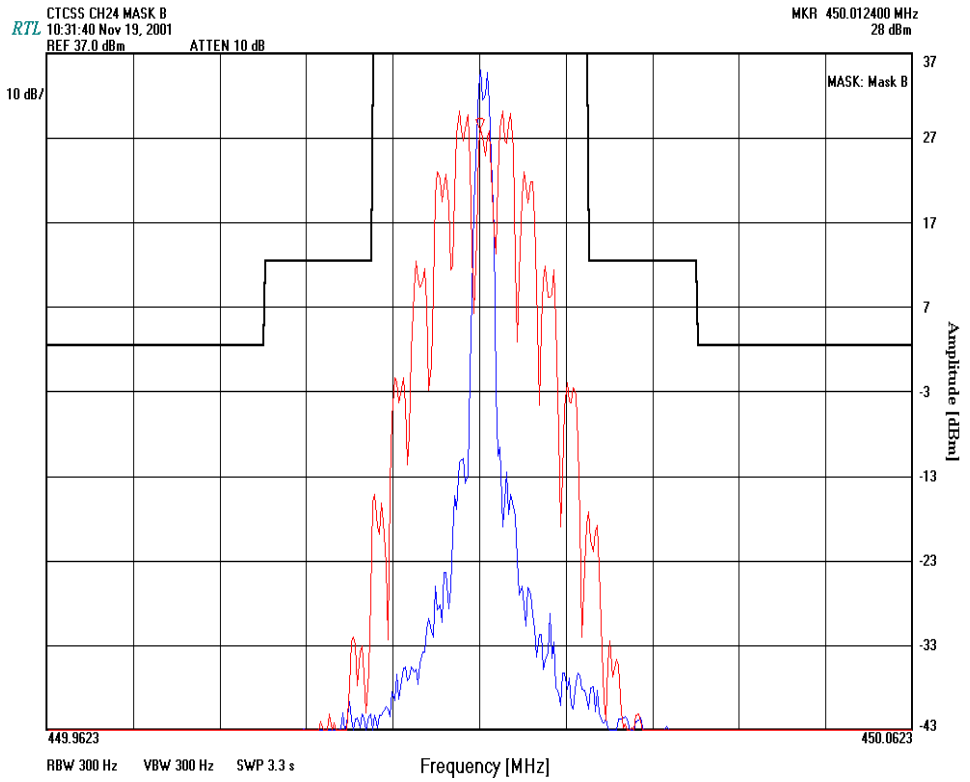
PLOT 7-3: OCCUPIED BANDWIDTH –25 KHZ CTCSS CHANNEL BANDWIDTH: MASK B (AUDIO MODULATION: 2,500 HZ)



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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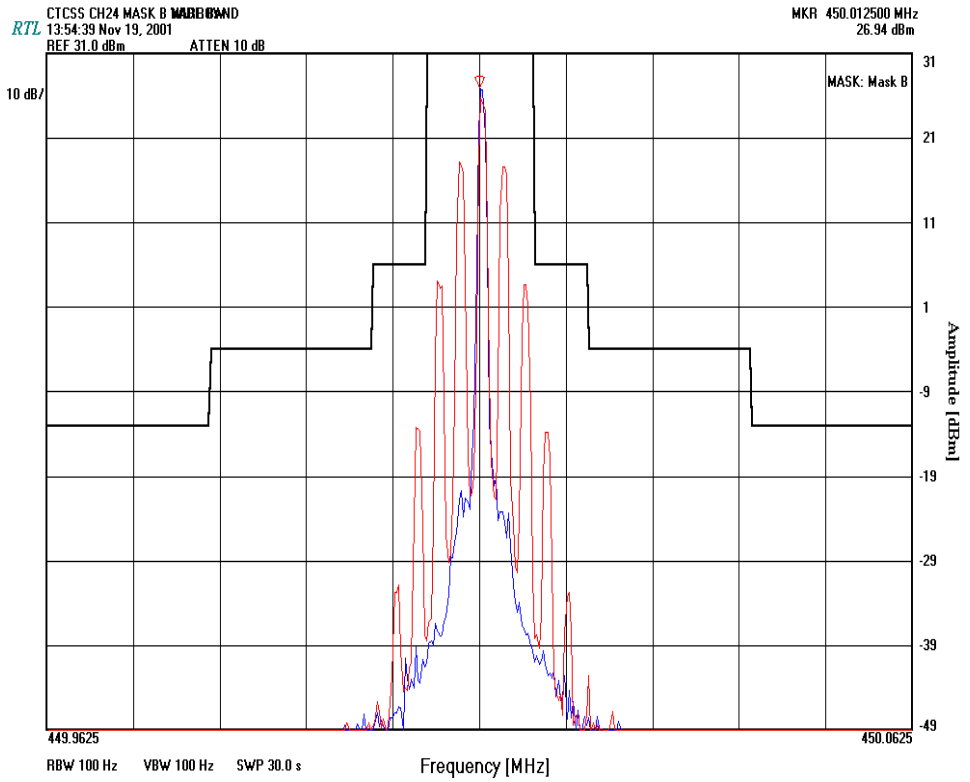
PLOT 7-4: OCCUPIED BANDWIDTH –12.5 KHZ CTCSS CHANNEL BANDWIDTH: MASK D (AUDIO MODULATION: 2,500 HZ)



TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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8 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051

8.1 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051 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.

8.2 SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT

TABLE 8-1: SPURIOUS EMISSIONS AT ANTENNA TERMINAL TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900927	Tektronix	ASG 100	Audio Signal Generator	B03274 V2.3
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159

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8.3 SPURIOUS EMISSIONS TEST DATA

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))

The following channel (in MHz) were investigated: 450.0125, 470.0125, and 489.9875
The worst case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 8-2: SPURIOUS EMISSIONS – {CHANNEL 1 (450.0125 MHZ); 25K CH SP; 5.0 W}: CONDUCTED POWER = 5.0W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
900.03	63.8	56.9	-6.9
1350.04	73.4	56.9	-16.5
1800.05	65.8	56.9	-8.9
2250.07	78.6	56.9	-21.7
2700.08	82.5	56.9	-25.6
3150.09	92.5	56.9	-35.6
3600.10	79.8	56.9	-22.9
4050.01	102.3	56.9	-45.4
4500.13	91.4	56.9	-34.5

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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TABLE 8-3: SPURIOUS EMISSIONS {CHANNEL 3 (470.0125 MHZ); 25.K CH SP; 5.0W}: CONDUCTED POWER = 4.9W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
940.03	75.6	56.9	-18.7
1410.00	81.8	56.9	-24.9
1880.50	69.0	56.9	-12.1
2350.06	82.9	56.9	-26.0
2820.08	84.5	56.9	-27.6
3290.00	89.5	56.9	-32.6
3760.10	88.1	56.9	-31.2
4230.11	90.0	56.9	-33.1
4700.13	99.4	56.9	-42.5

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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TABLE 8-4: SPURIOUS EMISSIONS {CHANNEL 4 (489.98 MHZ); 25.0K CH SP; 5.0 W}: CONDUCTED POWER = 5.0W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
979.98	74.1	56.9	-17.2
1469.96	86.5	56.9	-29.6
1959.95	72.3	56.9	-15.4
2449.93	88.9	56.9	-32.0
2939.92	89.2	56.9	-32.3
3429.91	96.7	56.9	-39.8
3919.91	100.4	56.9	-43.5
4469.80	100.6	56.9	-43.7
4899.88	96.9	56.9	-40.0

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test

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9 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

9.1 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

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.

9.2 RADIATED SPURIOUS TEST EQUIPMENT

TABLE 9-1: RADIATED SPURIOUS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900791	Schaffner@Chase	CBL6112	Antenna (25MHz – 2GHz)	2099
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 KHz to 3200 MHz)	3537A01741
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866

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9.3 FIELD STRENGTH OF SPURIOUS RADIATION TEST DATA - §2.1053

9.3.1 CFR 47 PART 90.210 REQUIREMENTS

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 9-2: FIELD STRENGTH OF SPURIOUS RADIATION {(CHANNEL 4 AT 489.9875MHZ, 5 W) SUBSTITUTION METHOD}: CONDUCTED POWER = 5.0W

Frequency	S/G level (dBm)	Cable Loss*	Difference in gain (ref. To 1/2 wave dipole)	Emission level (dBc)	Limit (dBc) Mask D	Margin (dB)
979.969	-31.5	0.9	0.8	68.5	57.0	-11.5
1469.959	-35.3	1.1	6.7	66.6	57.0	-9.6
1959.950	-40.1	1.3	7	71.3	57.0	-14.3
2449.990	-39.6	-2	7.3	71.2	57.0	-14.2
2939.927	-43.7	-2.2	8.4	74.4	57.0	-17.4
3429.900	-51.4	-2.7	8.1	82.9	57.0	-25.9
3919.900	<-50.0			>80.0		
4409.888	<-50.0			>80.0		
4899.875	<-50.0			>80.0		

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

TEST PERSONNEL:

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10 FREQUENCY STABILITY / TEMPERATURE VARIATION - §2.1055

10.1 FREQUENCY STABILITY 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.

10.2 FREQUENCY STABILITY/TEMPERATURE VARIATION

Limit is 2.5 ppm for device with a 12.5 kHz channel bandwidth
Limit is 5 ppm for device with a 25 kHz channel bandwidth

The 5 Watt radio was tested with 12.5kHz and 25 kHz channel bandwidth.
The channel selected for temperature stability is representative of all the channels since the device uses similar circuitry for all the channels.

10.3 FREQUENCY STABILITY TEST EQUIPMENT

TABLE 10-1: FREQUENCY STABILITY TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102

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10.4 FREQUENCY STABILITY TEST DATA - §2.1055

PLOT 10-1: TEMPERATURE FREQUENCY STABILITY

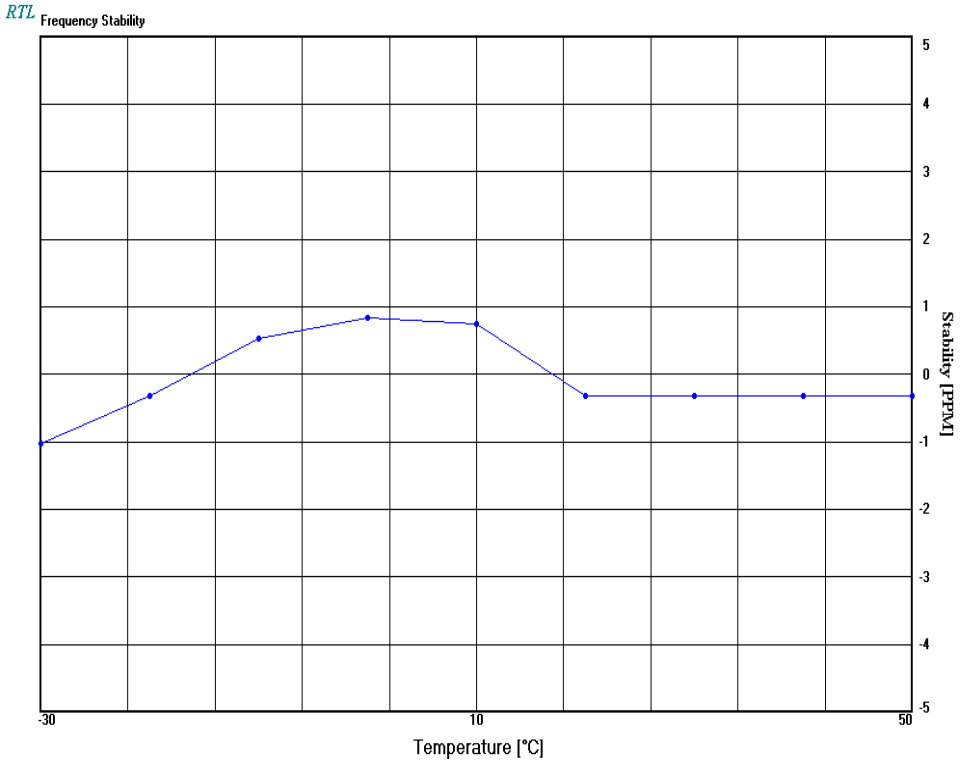

TABLE 10-2: TEMPERATURE FREQUENCY STABILITY

Temperature (C)	Frequency Measured (MHz)	ppm
-30	450.012040	-1.0222
-20	450.012360	-0.3111
-10	450.012740	0.53332
0	450.012880	0.84442
10	450.012840	0.75553
20	450.012360	-0.3111
30	450.012360	-0.3111
40	450.012360	-0.3111
50	450.012360	-0.311102

TEST PERSONNEL:

Rachid Sehb		11/10/2001
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PLOT 10-2: FREQUENCY STABILITY/VOLTAGE VARIATION

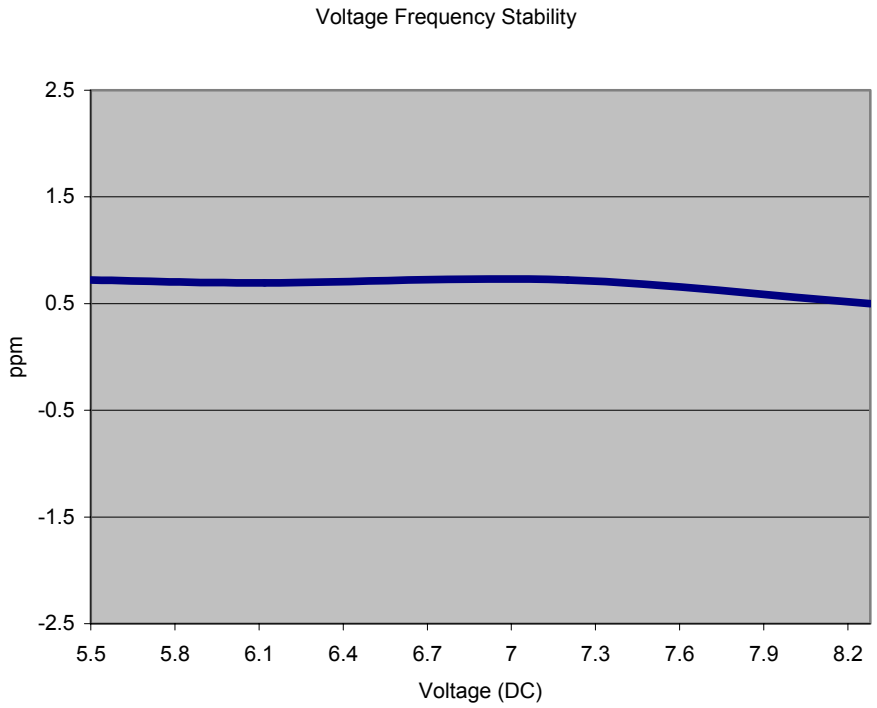

TABLE 10-3: FREQUENCY STABILITY/VOLTAGE VARIATION

Battery endpoint is measured at 3.1 VDC, the worst case variation of 0.72 ppm

Voltage (VDC)	Frequency Measured (MHz)	ppm
5.5	450.012825	0.722202
6.12	450.012813	0.695536
7.2	450.012825	0.722202
8.28	450.012725	0.499986

TEST PERSONNEL:

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11 TRANSIENT FREQUENCY BEHAVIOR - §90.214

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

11.1 TRANSIENT FREQUENCY BEHAVIOR TEST EQUIPMENT

TABLE 11-1: TRANSIENT FREQUENCY BEHAVIOR TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892

11.2 TRANSIENT FREQUENCY BEHAVIOR TEST DATA

11.2.1 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 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.

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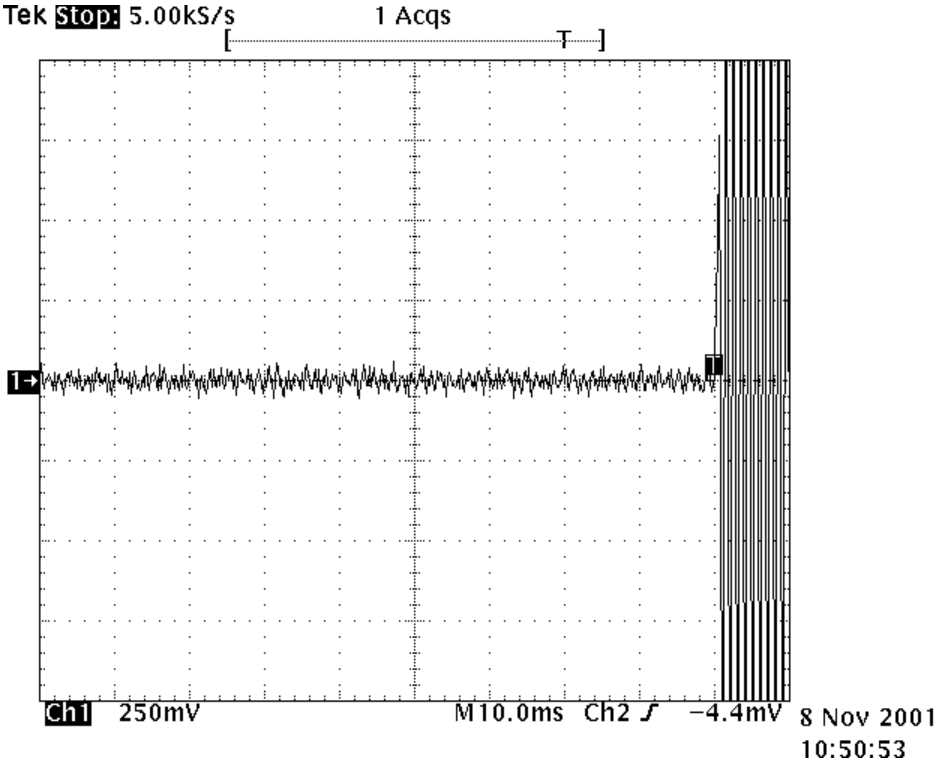
11.2.2 MAXIMUM FREQUENCY DIFFERENCE BETWEEN TIME T2 AND T3: CALCULATION:

The frequency stability is required to be 2.5ppm.
Calculation:
4 div. on scope represent 12.5kHz for narrow band channel.
Therefore, 464.55M times 2.5 ppm times +/- 4 Divisions divided by 12.5kHz equals about +/- 0.4 division. 0.4 Div. correspond to 1.161 kHz

PLOT 11-1: TRANSIENT FREQUENCY BEHAVIOR {CARRIER OFF TIME} CHANNEL 5 : NB (12.5KHZ) 1 W RATED

RF Signal Generator: Modulation 12.5kHz deviation



Timebase: 10 ms/div
Trigger: On positive edge of Ch2, level –4mV
Ch1: 250mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz

TEST PERSONNEL:

Rachid Sehb		11/10/2001
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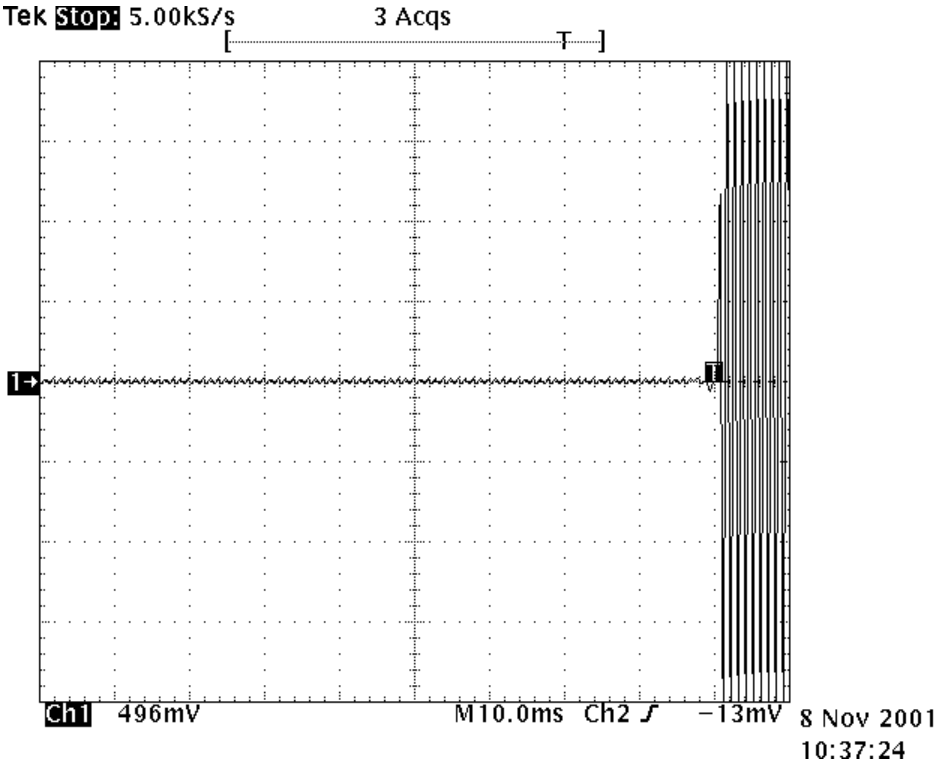
PLOT 11-2: TRANSIENT FREQUENCY BEHAVIOR {CARRIER OFF TIME} CHANNEL 1: WB(25KHZ); 5 W RATED

RF Signal Generator: Modulation 25kHz deviation



Timebase: 10 ms/div
Trigger: On positive edge of Ch2, level –13muV
Ch1: 500mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 25 kHz

TEST PERSONNEL:

Rachid Sehb		11/10/2001
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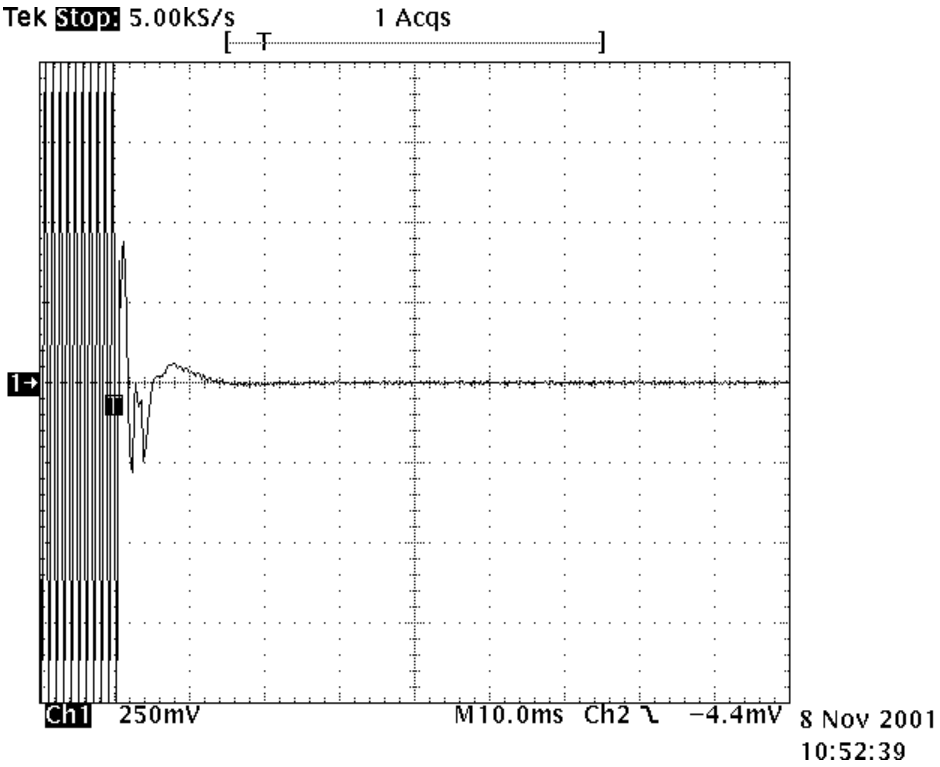
PLOT 11-3: TRANSIENT FREQUENCY BEHAVIOR {CARRIER ON TIME} CHANNEL 5 : NB(12.5KHZ) 1 W RATED

RF Signal Generator: Modulation 12.5kHz deviation



Timebase: 10 ms/div
Trigger: On negative edge of Ch2, level –4.0mV
Ch1: 250 mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 12.5 kHz

TEST PERSONNEL:

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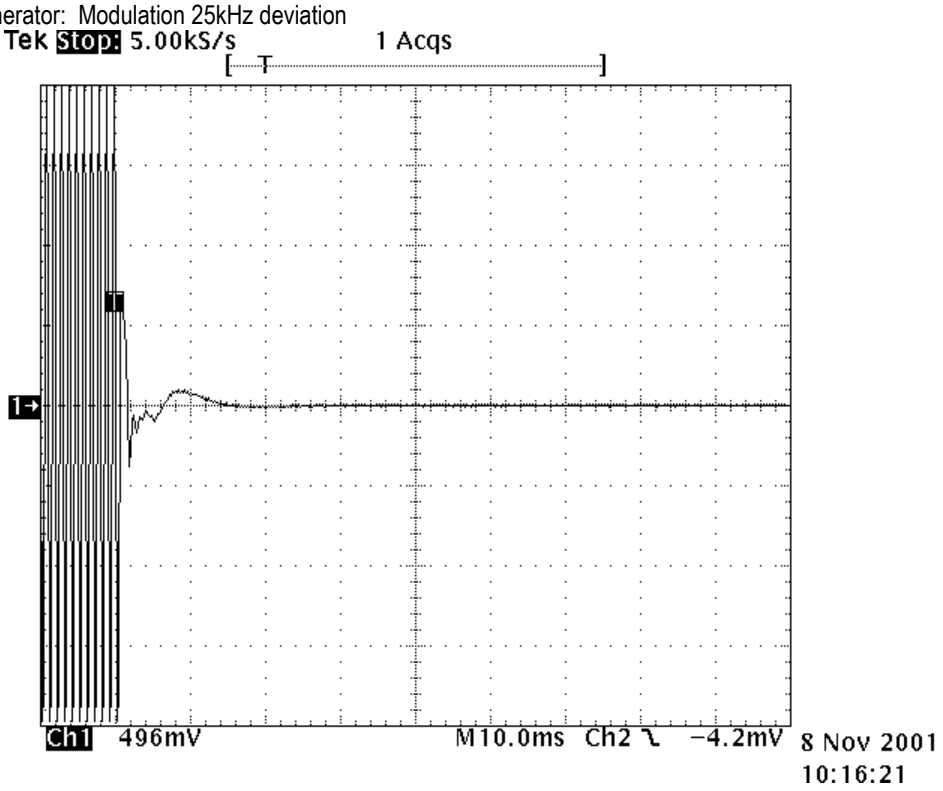
PLOT 11-4: TRANSIENT FREQUENCY BEHAVIOR {CARRIER ON TIME}CHANNEL 1 : WB (25KHZ) 5 W RATED

RF Signal Generator: Modulation 25kHz deviation



Timebase: 10 ms/div
Trigger: On negative edge of Ch2, level –4.2mV
Ch1: 500 mV/div, Probe 1.000:1
Vertical scale: +/- 4 div. corresponds to +/- 25 kHz

TEST PERSONNEL:

Rachid Sehb		11/10/2001
Test Technician/Engineer	Signature	Date Of Test