Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

Vertex Standard Co., LTD.
4-8-8, Nakameguro, Meguro-ku, Tokyo 153-8644, Japan
81-(0) 3-5725-6122

MODEL: VX-900V/VX-600V
FCC ID: K66VX-900V-2

April 16, 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 22: 1998	PUBLIC MOBILES SERVICES
PART 90: 1998	PRIVATE LAND 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
RSS-119, Issue 5: 1996	LAND MOBILE AND FIXED RADIO TRANSMITTERS AND RECEIVERS27.41 TO 960.0 MHZ

FCC Rules Parts	Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
90.210	134-160 MHz	5.5	5 ppm	11K0F3E
90, 22	134-160 MHz	5.6	2.5 ppm	16K0F3E
90.210	134-160 MHz	1.2	5 ppm	11K0F3E
90, 22	134-160 MHz	1.2	2.5 ppm	16K0F3E
Canadian	**Frequency Range**	**Output Power (W)**	**Freq. Tolerance**	
RSS-119	134-160 MHz	5.5	5 ppm	16K0F3E
RSS-119	134-160 MHz	5.6	2.5 ppm	11K0F3E

REPORT PREPARED BY:

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Document Number: 2001104

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1 GENERAL INFORMATION

The following Report of a Type Certification is prepared on behalf of ***Vertex Standard Co., LTD*** in accordance with the Federal Communications Commissions and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the ***VX-600V/900V; FCC ID: K66VX-900V-2***. The test results reported in this document relate only to the item that was tested. **The VX-900V and the VX-600V are identical both electrically and mechanically. The only difference between both units is a LCD display that is removed from the VX-900V to form the VX-600V. The VX-600V/900V supports 5 watt, and 1 watt. It was determined during testing that the VX-900V 5 watt was the worst-case. Hence throughout this report the VX-900V was used for testing. The manufacturer intends to remove the LCD display measured at 1 inch by 0.5 inch leaving all other electronic and mechanical supporting components.**

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 TEST FACILITY

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

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application report.

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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 22: 1998	Public Mobiles Services
Part 90: 1998	Private Land 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
RSS-119, Issue 5: 1996	Land Mobile and Fixed Radio Transmitters and Receivers27.41 to 960.0 MHz

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Canadian	**Frequency Range**	**Output Power (W)**	**Freq. Tolerance**	
RSS-119	134-160 MHz	5.5	5 ppm	16K0F3E
RSS-119	134-160 MHz	5.6	2.5 ppm	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 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 90 and Industry Canada RSS-119 Certification methodology.

Signature: ________________ Date: April 16, 2001

Typed/Printed Name: Bruno Clavier Position: Vice President of Operations (NVLAP Signatory)

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

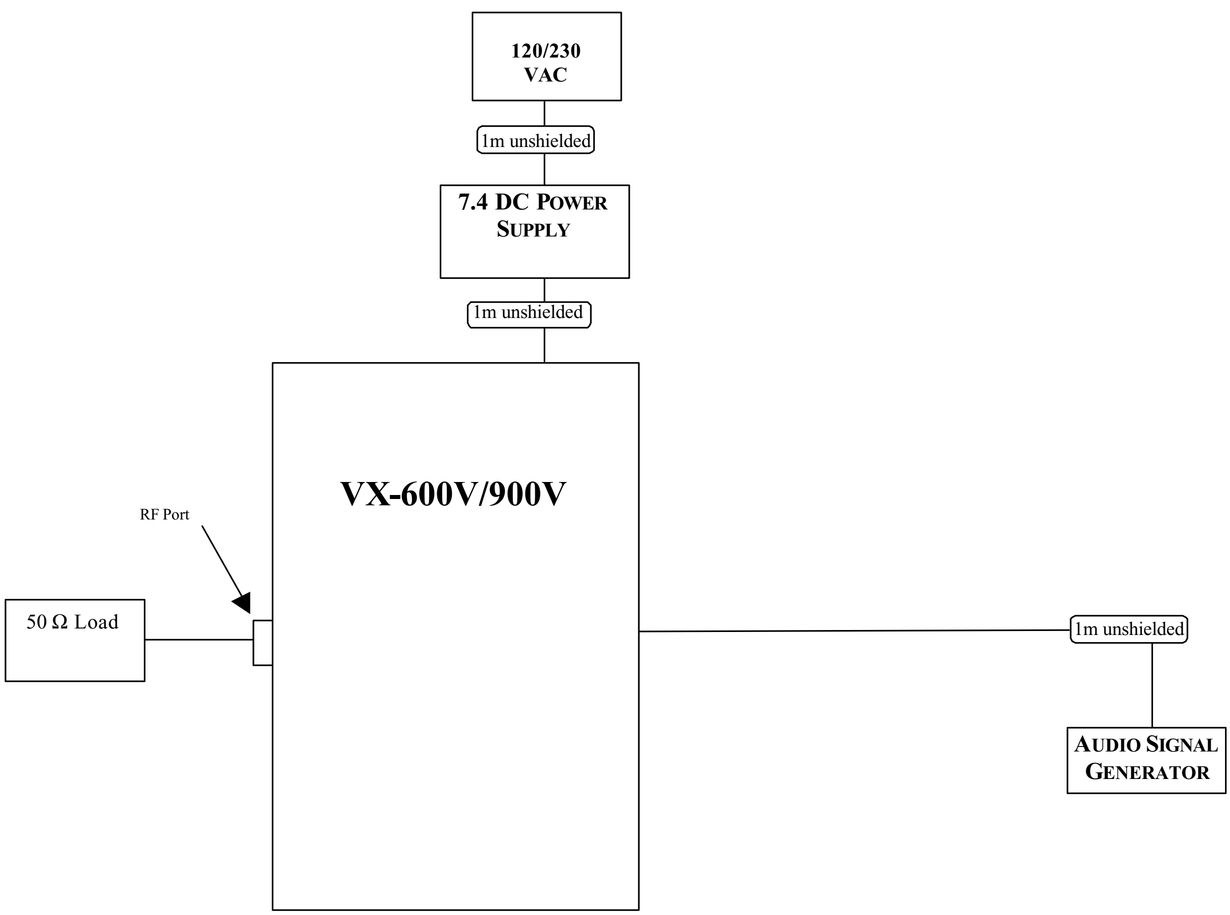
Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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.

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	RHEINTECH BARCODE
EUT: RADIO	**VERTEX**	**VX-600V/900V**	**N/A**	**K66VX-900V-2**	**13249**
ANTENNA WHIP	VERTEX	ATV-6C	N/A	N/A	13250
ANTENNA WHIP	VERTEX	ATV-6B	N/A	N/A	13247
ANTENNA WHIP	VERTEX	ATV-6A	N/A	N/A	13246
AUDIO TEST CABLE	VERTEX	N/A	N/A	N/A	N/A
BATTERY	VERTEX	FNB-V69LI	N/A	N/A	13243
MICROPHONE / SPEAKER	VERTEX	MH-50	9N001	N/A	13226
RAPID DESKTOP CHARGER	YAESU MUSEN CO., LTD	CD-16	CA-29	N/A	13237
AC ADAPTER	YAESU MUSEN CO., LTD.	481609003CT	PA-23B	N/A	13238

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 CONDUCTED MEASUREMENT TEST RESULTS

NEUTRAL SIDE (Line 1) 147.05MHz; high power; wide band

Temperature: 74°F Humidity: 34%						
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.480	Pk	19.4	0.7	20.1	48.0	-27.9
1.600	Pk	16.0	1.0	17.0	48.0	-31.0
6.600	Pk	16.6	2.0	18.6	48.0	-29.4
9.140	Pk	18.8	2.2	21.0	48.0	-27.0
12.950	Pk	17.3	2.7	20.0	48.0	-28.0
19.210	Pk	15.6	3.4	19.0	48.0	-29.0

HOT SIDE (Line 2) 147.05 MHz; high power; wide band

Temperature: 74°F Humidity: 34%						
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.630	Pk	20.2	0.7	20.9	48.0	-27.1
1.630	Pk	19.2	1.0	20.2	48.0	-27.8
1.630	Pk	19.2	1.0	20.2	48.0	-27.8
8.160	Pk	17.1	2.2	19.3	48.0	-28.7
15.930	Pk	18.0	3.2	21.2	48.0	-26.8
22.970	Pk	17.7	3.5	21.2	48.0	-26.8

Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Signature: ________________ **Date:** April 16, 2001

Typed/Printed Name: Daniel Baltzell

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.

7 FCC RULES AND REGULATIONS 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: 134.05, 147.05, 159.95

CARRIER OUTPUT POWER (UNMODULATED)

Channel	TX Freq (MHz)	Ch Spacing (kHz)	Power measured (W)
1	134.05	25	5.5
2	147.05	25	5.5
3	159.95	25	5.5
4	134.05	25	1.2
5	147.05	25	1.1
6	159.95	25	1.1
7	134.05	12.5	5.4
8	147.05	12.5	5.6
9	159.95	12.5	5.5
10	134.05	12.5	1.2
11	147.05	12.5	1.1
12	159.95	12.5	1.1

*Measurement accuracy: +/- 3%

Rated Power:

Power Setting	Rated Power (W)
Low	2.5/1/0.25 (Selectable)
High	5

7.3 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)

8 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:

- High Power: 5 Watt delivered to antenna
- 5W VX-600V/900V radiated power measurements (3 meter)

Channel 2 (25 kHz channel spacing)

ERP Substitution method

Channel 2						
Frequency (MHz)	**Signal Generator Level (dBm)**	**Cable Loss (dB)**	**Corrected Antenna Gain (dB)**	**Corrected Signal Generator Level (dBm)**	**ERP* (Watt)**	**Antenna Model**
147.05	27.0	2.3	-0.3	24.4	0.275	ATV-6A
147.05	29.2	2.3	-0.3	26.8	0.474	ATV-6B
147.05	29.3	2.3	-0.3	26.9	0.485	ATV-6C

*Measurement accuracy is +/- 1.5 dB

8.3 TEST EQUIPMENT

Spectrum Analyzer	HP8566B
Antenna	Roberts ½ wave dipoles

9 FCC RULES AND REGULATIONS 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.

9.2 TEST DATA

9.2.1 CFR 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))

The following channel (in MHz) was investigated: 400 in 5W mode for both 25KHz 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.

Channel 2 (147.05 MHz) – 5 Watt and 25 kHz Channel Bandwidth: Mask B (Limit –dBc=-50.5)

Frequency (MHz)	Level Measured (-dBc)	Margin (dB)
294.10	-101.4	-50.9
441.15	-73.2	-22.7
588.20	-94.9	-44.4
735.25	-93.9	-43.4
882.30	-122.9	-72.4
1029.35	-106.9	-56.4
1176.40	-124.6	-74.1
1323.45	-119.5	-69.0
1470.50	-113.2	-62.7

4.3 Test Equipment

Audio Generator:
Synthesized Level Generator HP3336B s/n 2127A00559
Selective Level Meter HP3585 s/n B032374

Spectrum Analyzer:
HP8564E s/n 3943A01719
HP8546A s/n 3525A00159

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.

5Watt and 25 kHz channel spacing					
Radiated Emissions (Channel 2 at 147.05 MHz) Substitution Method (limit=-50.5dBc)					
Frequency	**ERP S/G level (dBm)**	**Cable Loss***	**Difference in gain (ref. to 1/2 wave dipole)**	**Emission level (-dBc)**	**Margin (dB)**
294.10	-55.4	2.9	-0.6	-96.4	-45.9
441.15	-50.0	3.5	-0.5	-91.5	-41.0
588.20	-57.0	4.0	-1.0	-99.5	-49.0
735.25	-53.9	4.6	-1.1	-97.2	-46.7
882.30	-56.4	4.9	-1.0	-99.8	-49.3
1029.35	-42.3	5.4	0.1	-85.1	-34.6
1176.40	-54.6	5.5	1.6	-96.1	-45.6
1323.45	-56.0	6.1	3.0	-96.6	-46.1
1470.50	-52.4	6.3	4.4	-91.8	-41.3

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

10.3 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 3537A04301
Synthesized Sweeper HP83752A s/n 3610A00846

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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.

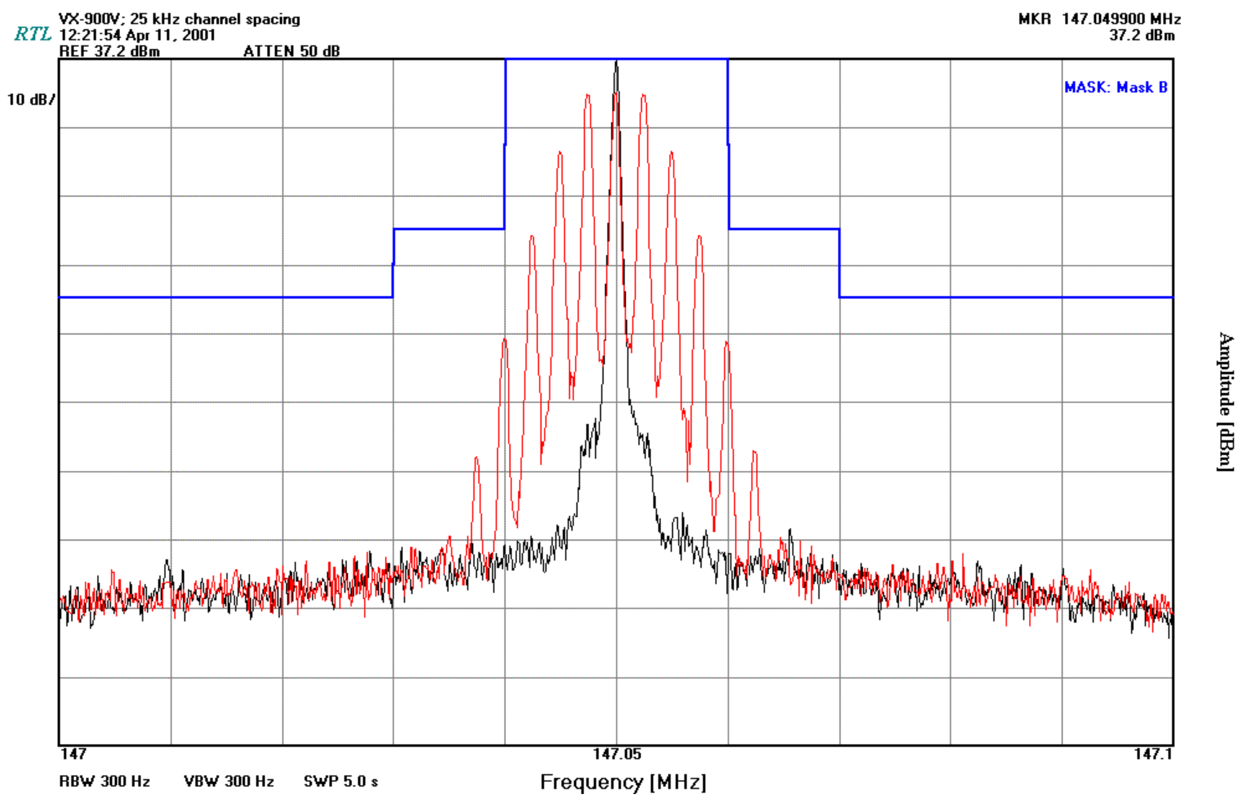
Device with digital modulation: N/A

11.2 TEST EQUIPMENT

Spectrum Analyzer HP8564E s/n 3943A01719

11.3 TEST DATA

11.3.1 CHANNEL 2: 5W FOR 25 KHZ CHANNEL BANDWIDTH: MASK B (AUDIO MODULATION: 2,500 HZ)



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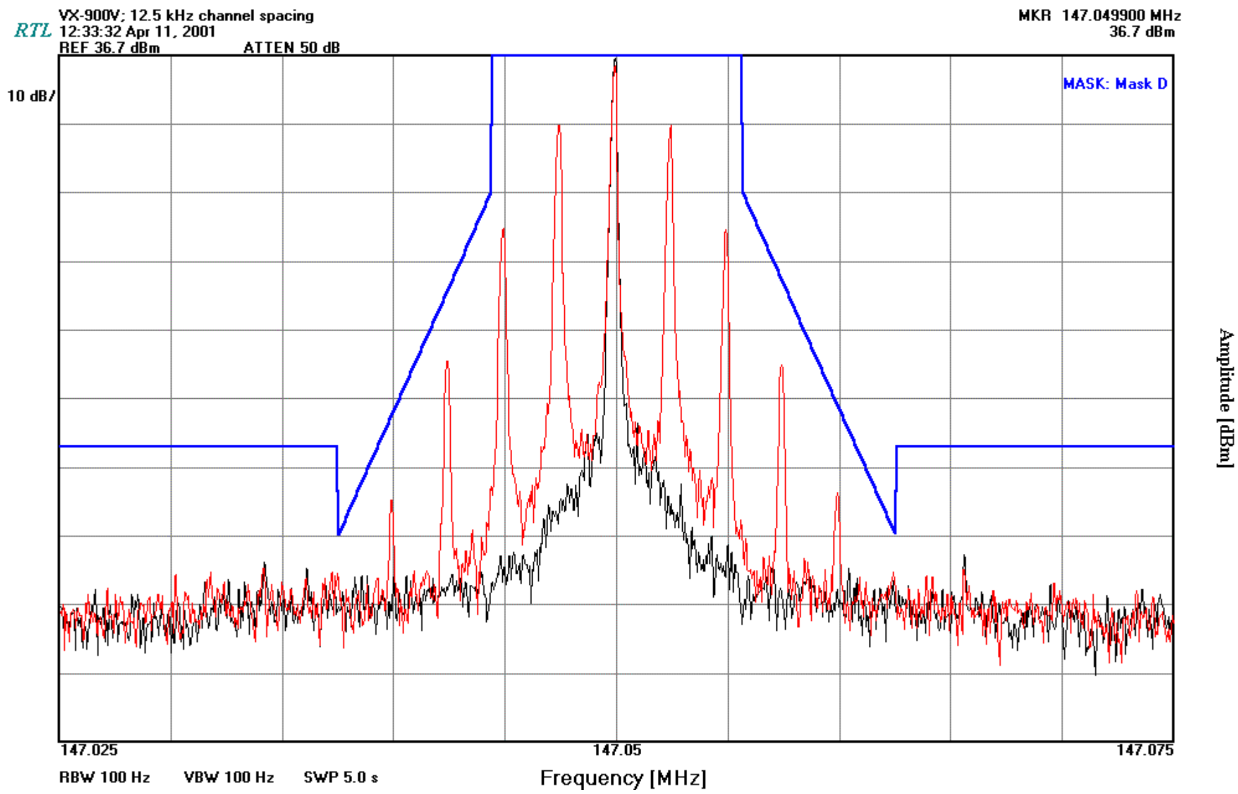
11.3.2 CHANNEL 8: 5 W FOR 12.5 KHZ CHANNEL BANDWIDTH: MASK D (AUDIO MODULATION: 2,500 HZ)



12 FCC RULES AND REGULATION 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.

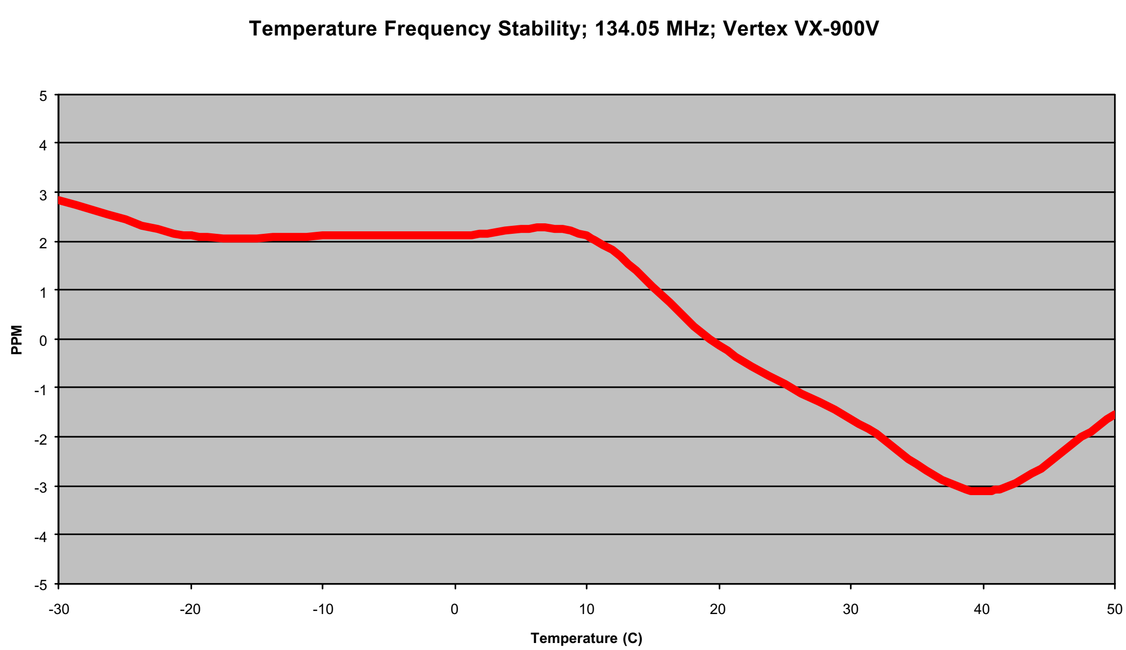
The worst-case test data are shown.

12.2 TEST DATA

12.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

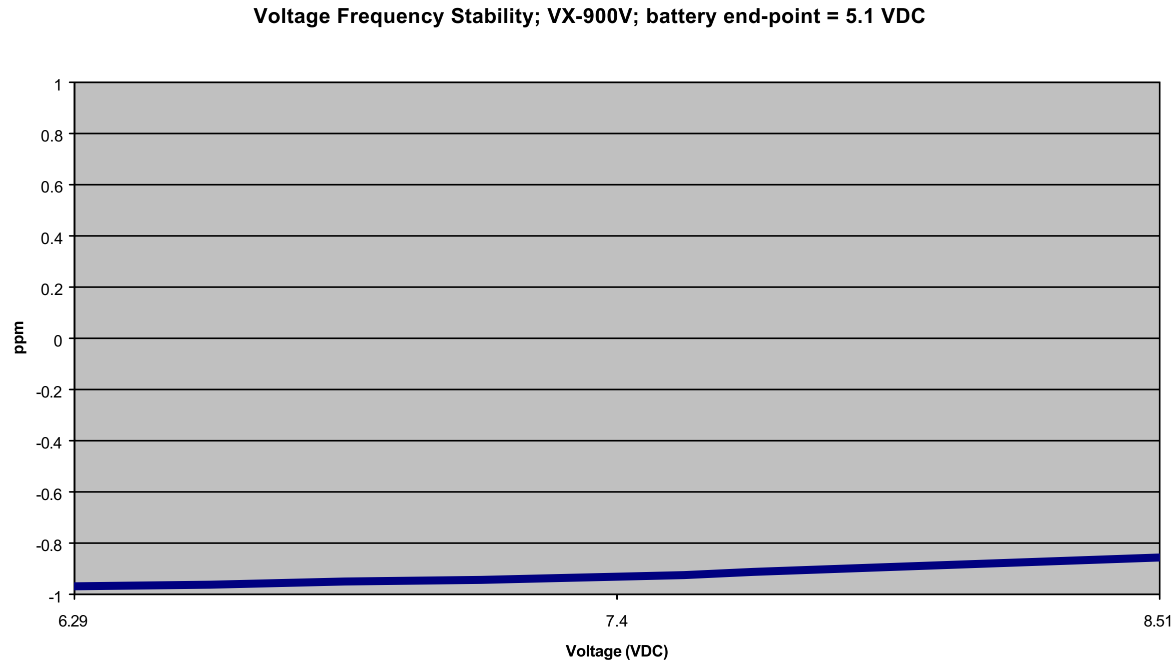
Limit is 2.5 ppm for device with a 12.5 kHz channel bandwidth
Limit is 5 ppm for device with a 25 kHz channel bandwidth

The VX-600V/900V 5Watt radios was tested with 25 kHz channel bandwidth. The worst-case temperature deviation is shown on the following plot.



12.2.2 FREQUENCY STABILITY/VOLTAGE VARIATION

Assigned Frequency 147.05 MHz



Voltage (7.4V +/- 85-115%)	Frequency (MHz)	ppm
6.29	134.049870	-0.97
7.4	134.049875	-0.93
8.51	134.049885	-0.86

Battery end point = 5.1V

12.3 TEST EQUIPMENT

Temperature Chamber Tenney TH65 s/n 11380

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

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

13.1 TEST PROCEDURE

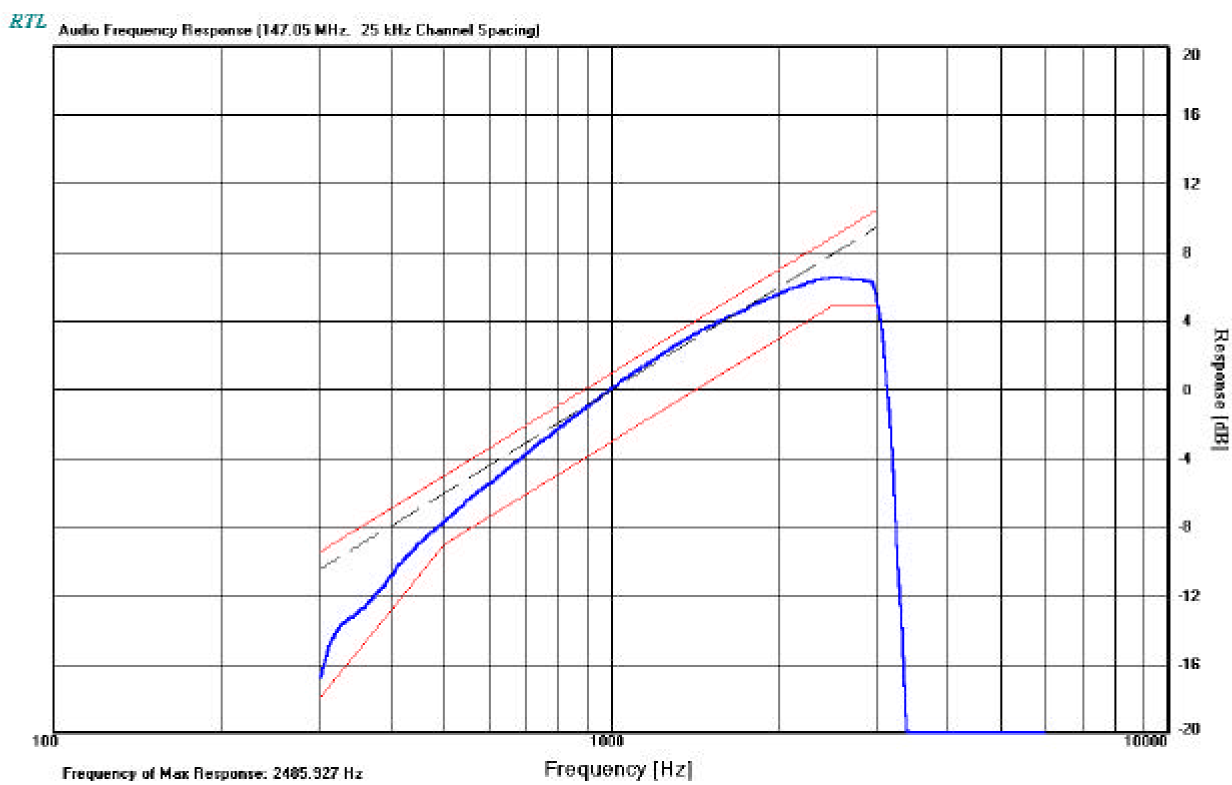
ANSI/TIA/EIA-603-1992, section 2.2.6

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 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)

13.2 TEST DATA



13.3 TEST EQUIPMENT

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

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

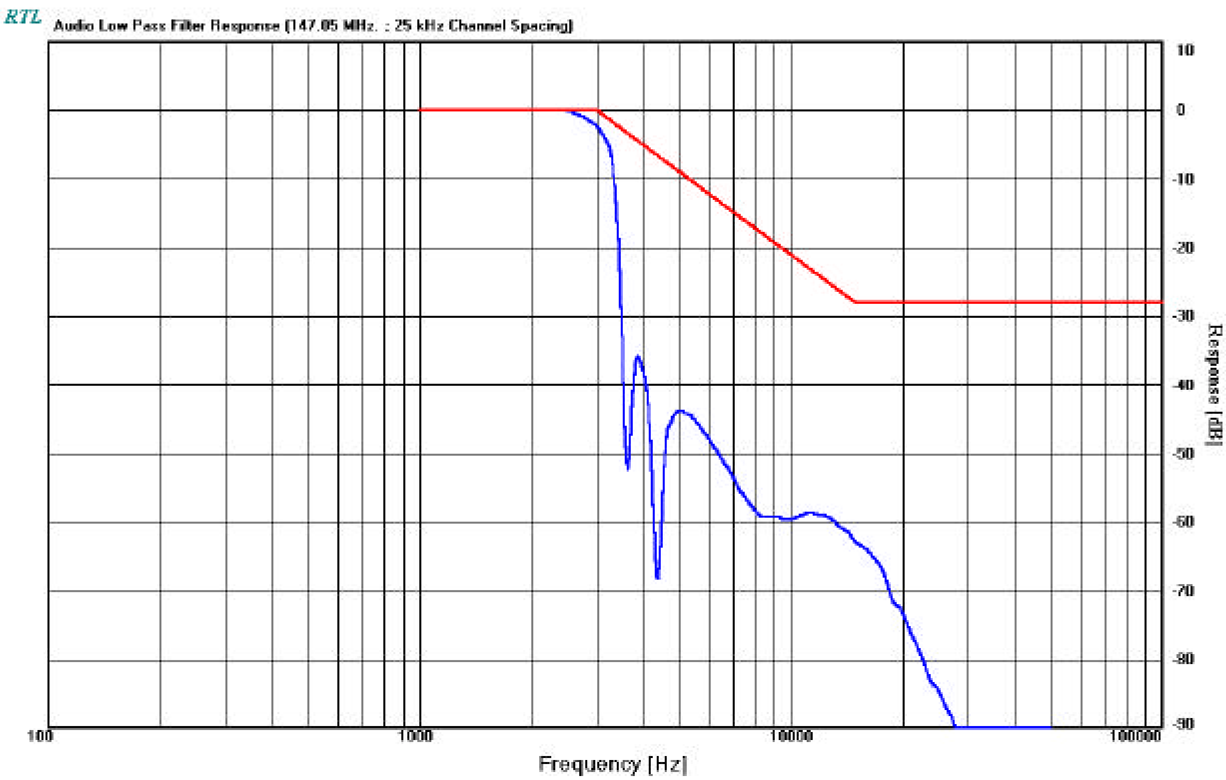
14.1 TEST PROCEDURE

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.

14.2 TEST DATA

Audio Low Pass Filter Response



14.3 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

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

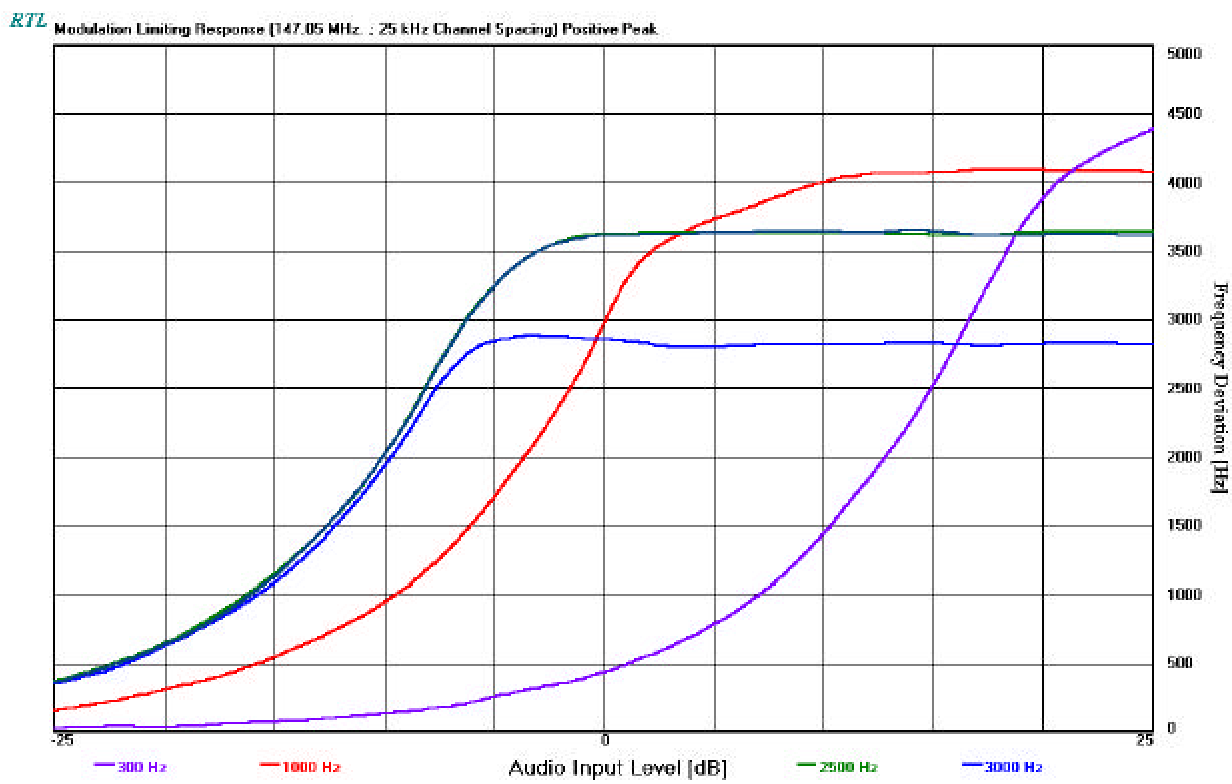
15.1 TEST PROCEDURE

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.

15.2 TEST DATA

Modulation Limiting: 147.05 MHz; 25 kHz channel spacing (Positive Peak)



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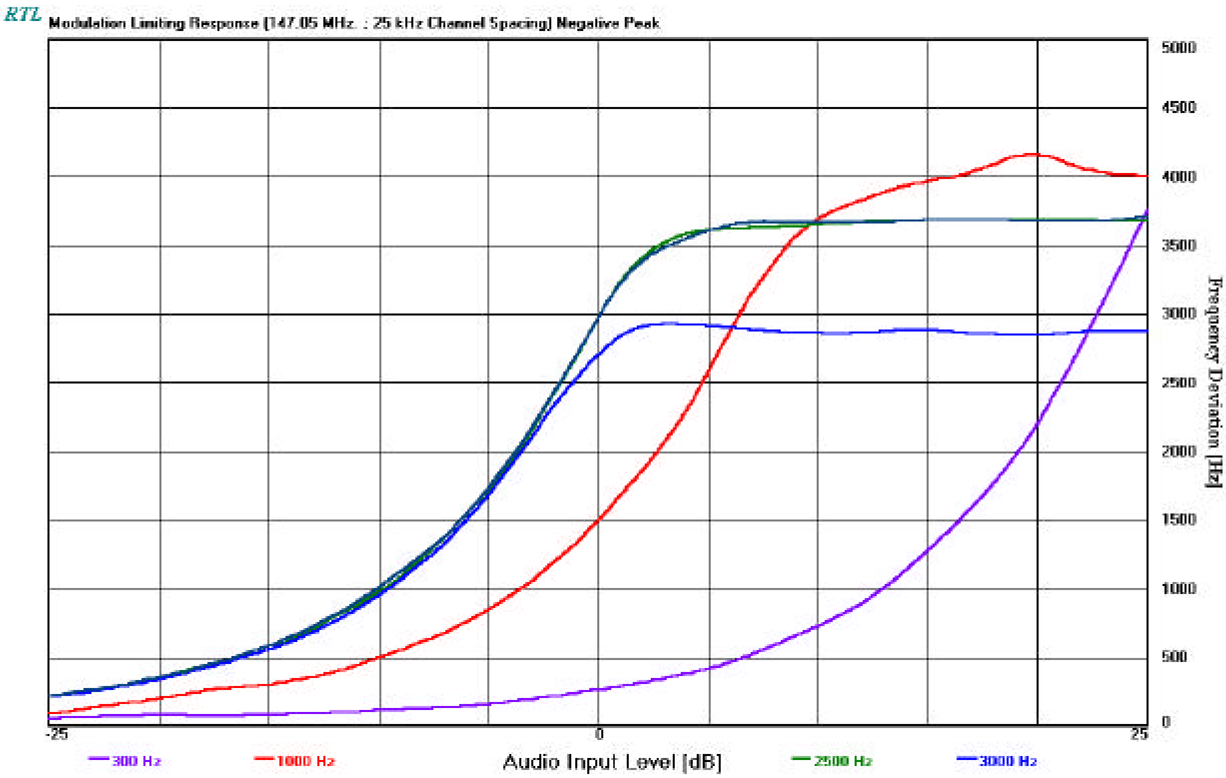
Modulation Limiting: 147.05 MHz; 25 kHz channel spacing (Negative Peak)



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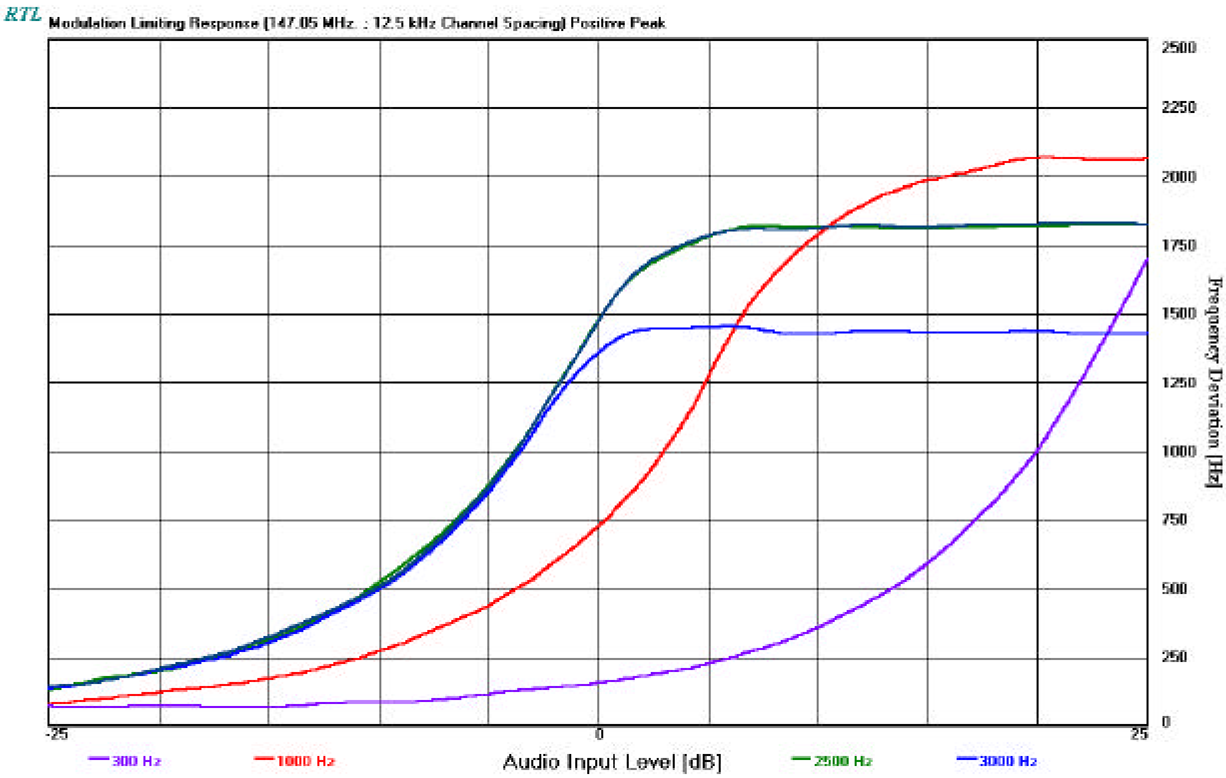
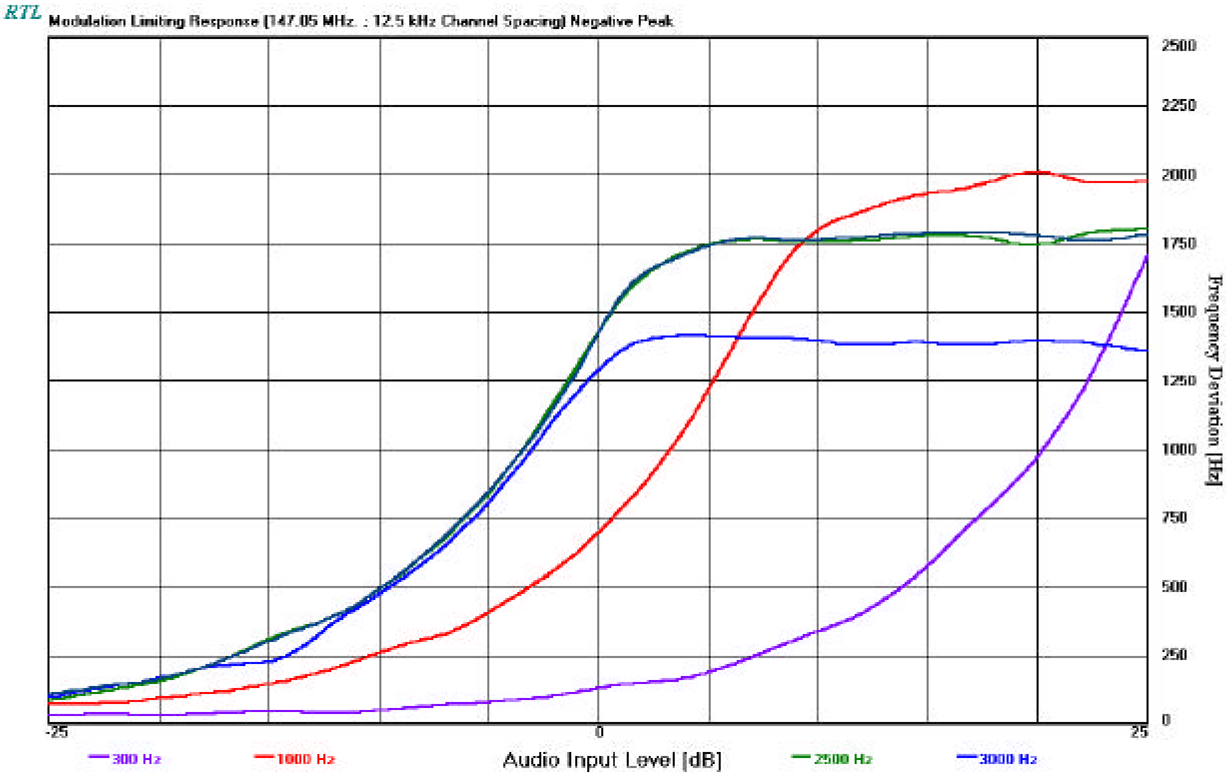
Modulation Limiting: 147.05 MHz; 12.5 kHz channel spacing (Positive Peak)



Modulation Limiting: 147.05 MHz; 12.5 kHz channel spacing (Negative Peak)



15.3 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

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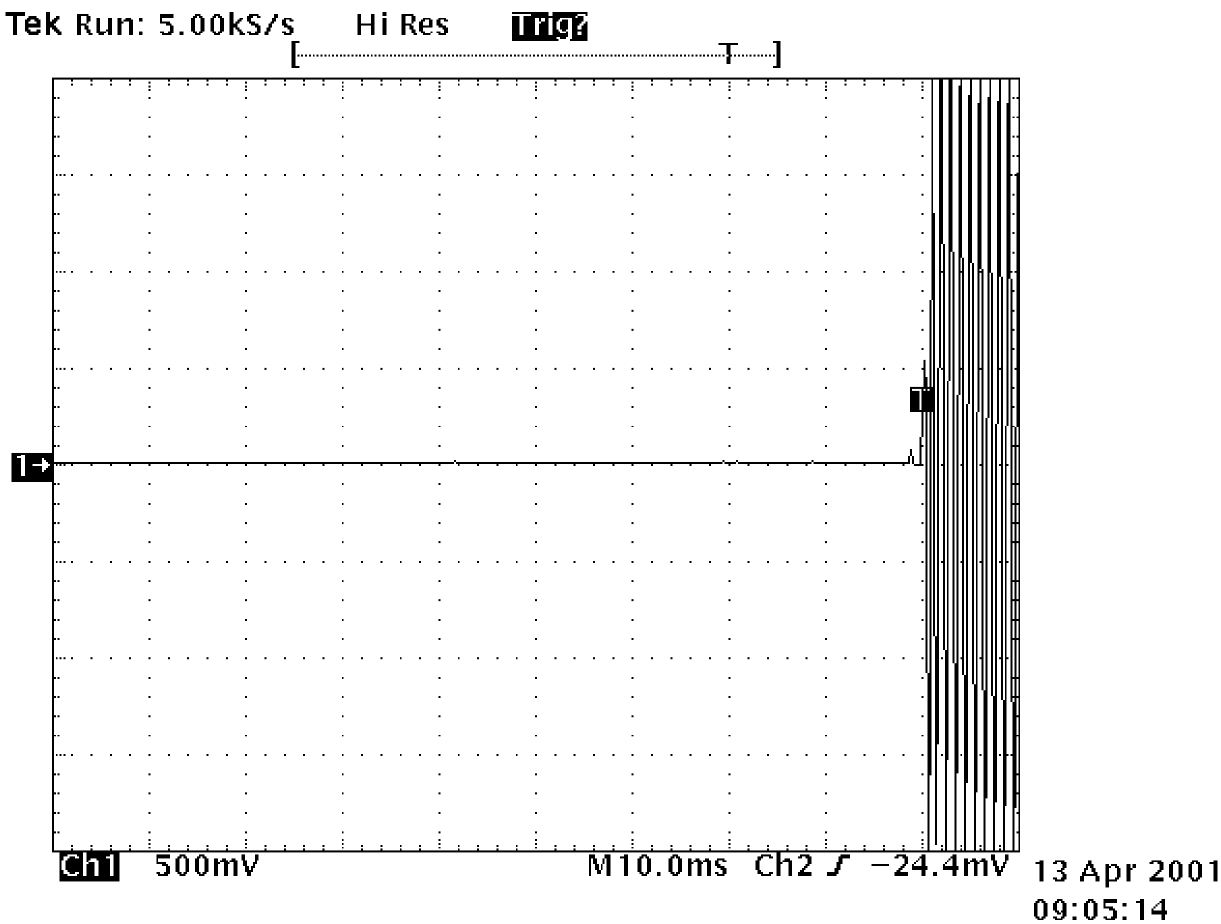
16 FCC RULES AND REGULATIONS PART 90 §90.214 : TRANSIENT FREQUENCY BEHAVIOR

16.1 TEST PROCEDURE

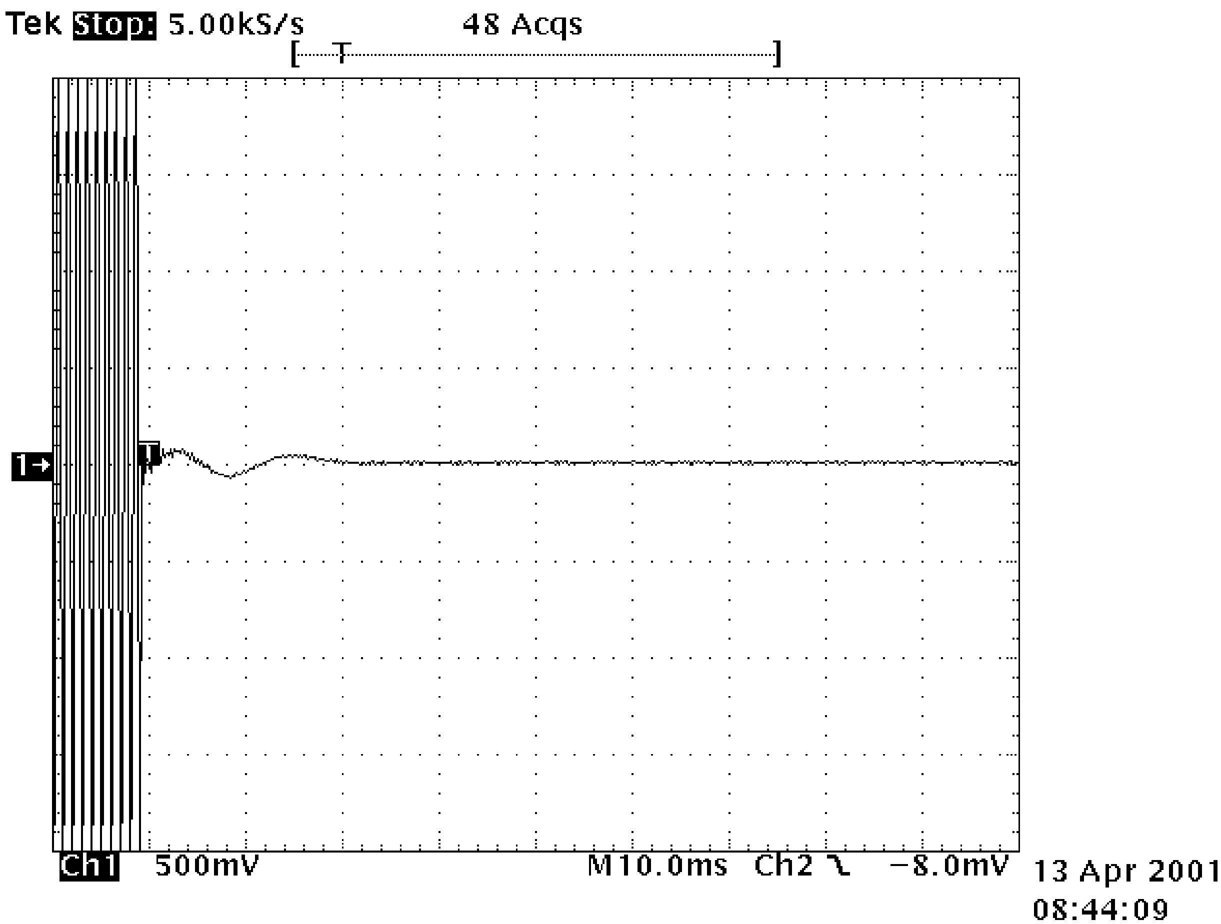
ANSI/TIA/EIA-603-1992, section 2.2.19

16.2 TEST DATA WIDE BAND

25 kHz channel spacing ; off time; 147.05 MHz

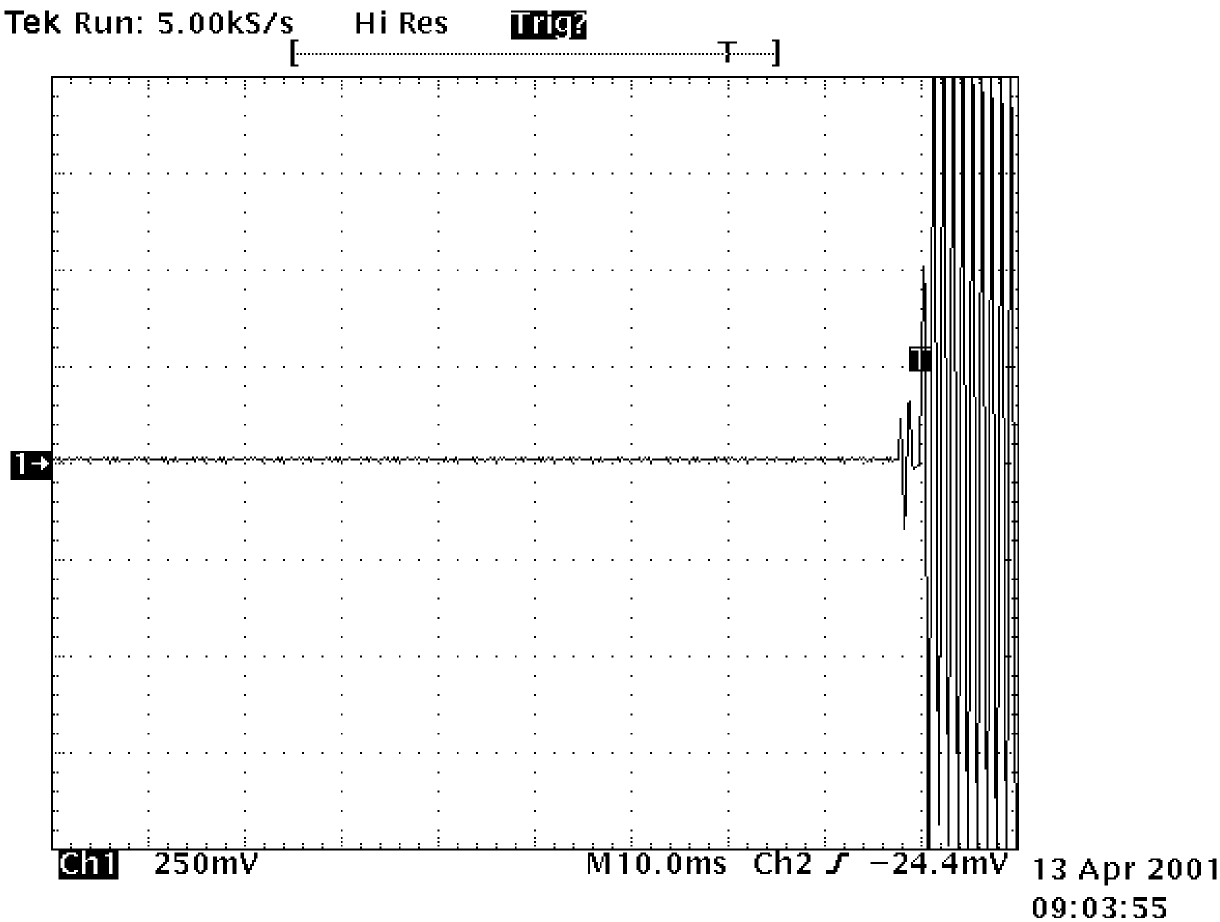


25 kHz channel spacing; on time; 147.05 MHz



16.3 TEST DATA NARROW BAND

12.5 kHz channel spacing ; off time; 147.05 MHz



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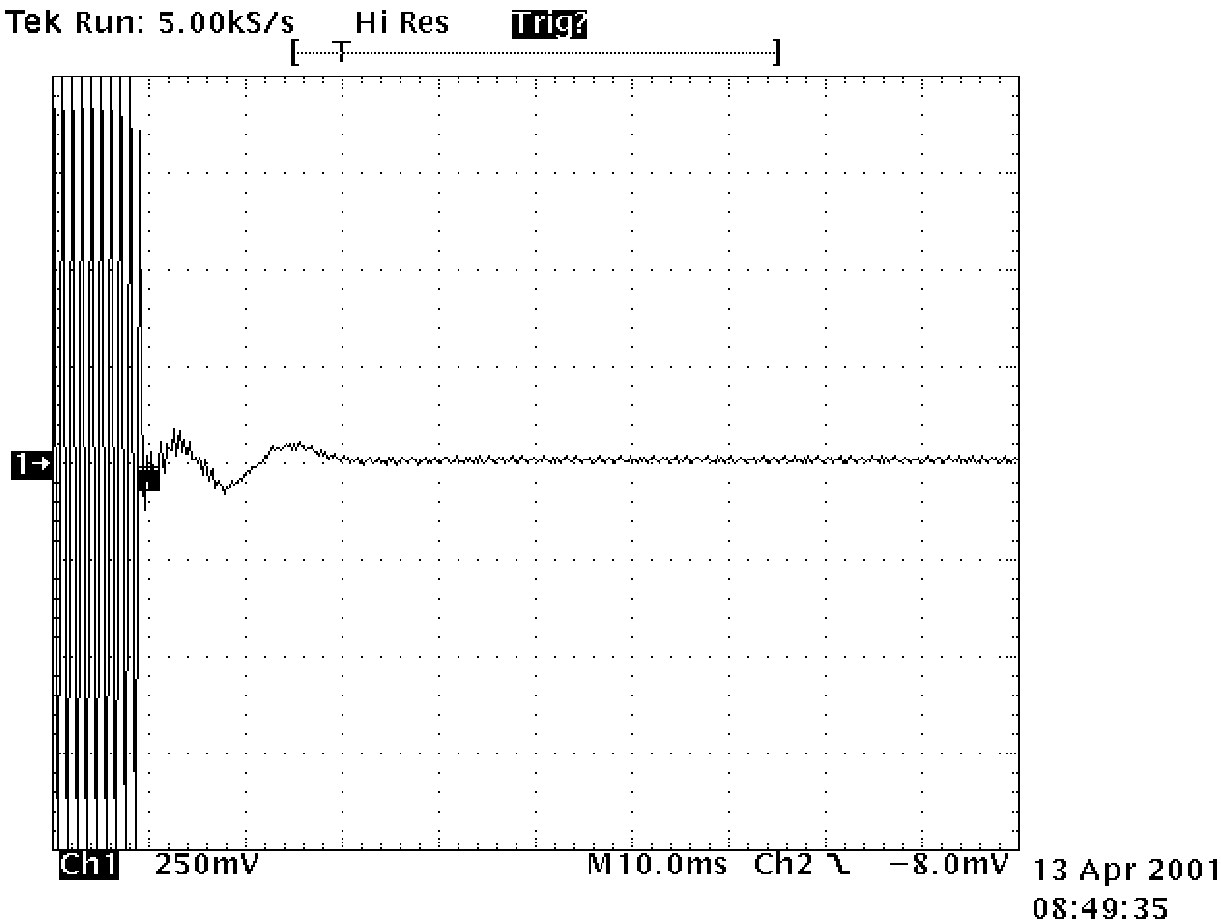
12.5KHz channel spacing; on time; 147.05 MHz



Limits:

Requirements for EUT with 25 kHz channel spacing:

Time Intervals (*)(**)	Maximum Frequency Difference(***)	150-430 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(***)	150-430 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 7:
4 div. on scope represent 12.5kHz for narrow band channel.
Therefore, 147.05M times 2.5 ppm times +/- 4 Divisions divided by 12.5kHz equals about +/- 0.3 division. 0.3 Div. correspond to 1.333 kHz

16.4 TEST EQUIPMENT

Detector: HP8471D s/n 2952A
RF signal generator: HP8648C s/n 3537A04301
Modulation Analyzer: HP8901A s/n 2545A04102
Oscilloscope: Tektronix TDS540B s/n B020129
Receiver: HP 8546A s/n 3525A00159

17 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) : Bn = 11K0F3E
25kHz (WB channel): Bn = 16K0F3E

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

18 RECEIVER DATA

Temperature: 45°F Humidity: 35%									
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)
112.000	Qp	H	0	1.0	31.1	-16.1	15.0	43.5	-28.5
224.000	Qp	V	30	1.0	30.9	-17.1	13.8	46.0	-32.2
336.000	Qp	V	120	1.0	30.3	-12.5	17.8	46.0	-28.2
448.000	Qp	V	0	2.0	28.9	-9.2	19.7	46.0	-26.3
560.000	Qp	V	0	1.0	29.6	-5.8	23.8	46.0	-22.2
672.000	Qp	V	0	1.0	28.3	-5.1	23.2	46.0	-22.8