Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR CERTIFICATION

PART 95(B) FRS

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

MODEL: TK - 514
FCC ID: 07KTK514

April 11, 2001

STANDARDS REFERENCED FOR THIS REPORT	
PART 2; 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15; 1999	RADIO FREQUENCIES DEVICES
PART 95; 1998	PERSONAL RADIO SERVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
ANSI/TIA/EIA 603-1; 1998	ADDENDUM TO ANSI/TIA/EIA 603-1992
RSS-210; Issue 4; 2000	LOW POWER LICENCE-EXEMPT RADIOCOMMUNICATION DEVICES (ALL FREQUENCY BANDS)
RSS-102; Issue 1; 1999	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS WITH RESPECT TO HEALTH CANADA'S SAFETY CODE 6 FOR EXPOSURE OF HUMANS TO RADIO FREQUENCY FIELDS

FREQUENCY RANGE MHZ	OUTPUT POWER (W) ERP	FREQUENCY TOLERANCE	EMISSION DESIGNATOR
462.5625-467.7125	0.360	0.00025%	11K0F3E

REPORT PREPARED BY:

Test Engineer: Daniel Baltzell
Administrative/Technical Writer: Melissa Fleming

Rhein Tech Laboratories, Inc.

Document Number: 2001037

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

Table of Contents

1 GENERAL INFORMATION

The following Application for FCC Type Certification of a Scanning Receiver is prepared on behalf of ***Topaz3, LLC*** in accordance with Part 2, and Part 95(B) of the Federal Communications Commissions rules and regulations and Industry Canada RSS-210 and RSS-119. The Equipment Under Test (EUT) was the ***TK-514, FCC ID: O7KTK514***. The test results reported in this document relate only to the item that was tested.

1.1 MODIFICATIONS

No modifications were made to the EUT during testing.

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original certification submission.

1.3 TEST FACILITY

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

2 SYSTEM TEST CONFIGURATION

2.1 POWER CAPABILITY

The EUT meets the following condition as specified in FCC Rules and Regulation Part 95 Section 95.639:

1. The operating power is fixed at the factory.
2. The antenna is fixed and non-adjustable.

3 CONFORMANCE STATEMENT

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PART 2; 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
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FREQUENCY RANGE MHZ	OUTPUT POWER (W)	FREQUENCY TOLERANCE	EMISSION DESIGNATOR
462.5625-467.7125	0.360	0.00025%	11K0F3E

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. Modifications were not made during testing to the equipment in order to achieve compliance with these standards.

Signature: 

Date: February 14, 2001

Typed/Printed Name: Desmond A. Fraser

Position: President
(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.

4 EMISSIONS EQUIPMENT LIST

RTL Asset Number	Manufacturer	Model	Part Type	Serial Number	Calibration due date
900969	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2412A00414	03/23/01
900929	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2811A01276	03/28/01
900901	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	3145A01599	11/02/01
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2521A00743	03/27/01
900042	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz – 40 GHz)	2521A01032	11/05/01
900924	Amplifier Research	75A220	Amplifier (10 kHz – 220 MHz)		N/A
900933	Hewlett Packard	11975A	Power Amplifier (2 - 8 GHz)	2304A00348	11/15/01
901067	Hewlett Packard	8903B	Audio Analyzer	2303A00307	06/28/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01
900926	Hewlett Packard	8753D	RF Vector Network Analyzer	3410A09659	03/28/01
901089	Hewlett Packard	HP875ET	Transmission/Reflection Network Analyzer	US39170052	N/A
900968	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2602A00160	03/23/01
900903	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2841A00614	11/02/01
900897	Hewlett Packard	8567A	Spectrum Analyzer (10 kHz – 1.5 GHz)	2727A00535	11/08/01
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	03/27/01
900912	Hewlett Packard	8568A	RF Spectrum Analyzer (100 Hz – 1.5 GHz)	2634A02704	08/02/01
900824	Hewlett Packard	8591E	RF Spectrum Analyzer (9 KHz – 1.8 GHz)	3710A06135	11/14/01
900724	ARA	LPB-2520	Log Periodic / Biconical Antenna (25-1000 MHz)	1037	2/1/01
900725	ARA	LPB-2520	Log Periodic / Biconical Antenna (25-1000 MHz)	1036	07/12/01
900967	A.H. Systems	TDS-206/535-1 through TDS-206/535-4	Tuned Dipole set (30 – 1000 MHz)	126, 128, 129, 132	12/15/00
900154	Compliance Design	Roberts Dipole	Adjustable Elements Dipole antenna (30-1000MHz)	N/A	7/26/01
900814	Electro-Metrics	RGA-60	Double Ridges Guide Antenna (1-18 GHz)	2310	2/26/01
900081	EMCO	3146	Log-Periodic Antenna (200-1000 MHz)	1850	
900800	EMCO	3301B	Active Monopole (Rod antenna) (30 Hz – 50 MHz)	9809-4071	05/02/01
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9kHz-30 MHz)	82825/019	05/26/01
900791	Schaffner – Chase	CSL6112	Bilog antenna (30 MHz – 2GHz)	2099	2/22/01
901053	Schaffner – Chase	CBL6112B	Bilog Chase antenna (200 MHz – 2 GHz)	2648	05/24/01
900060	Hewlett Packard	86634B	Auxiliary Section for External Pulse Modulator	1314A02913	11/08/01
901041	ACO Pacific	511E	Sound Level Calibrator	028751	In calibration
900970	Hewlett Packard	85662A	Spectrum Analyzer Display	254211239	03/23/01
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839	03/28/01
900911	Hewlett Packard	85662A	Spectrum Analyzer Display	2542A12739	08/02/01
900902	Hewlett Packard	85662A	Spectrum Analyzer Display	2848A17585	11/02/01
900896	Hewlett Packard	85662A	Spectrum Analyzer Display	2816A16471	11/02/01
900914	Hewlett Packard	8546OA	RF Filter Section, (100 KHz to 6.5 GHz)	3330A00107	11/07/01
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	06/21/01
900059	Hewlett Packard	8660C	Signal Generator (9 KHz – 3200 MHz)	1947A02956	11/08/01
900960	Hewlett Packard	8444A	Tracking Generator (0.5 – 1500MHz)	2325A07827	03/08/01
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 KHz – 3200 MHz)	3537A01741	03/28/01

RTL Asset Number	Manufacturer	Model	Part Type	Serial Number	Calibration due date
900821	Hewlett Packard	33120A	15 MHz Function / Arbitrary Waveform Generator	US36029992	11/14/01
900059	Hewlett Packard	8660C	Synthesized. Signal Generator (9 kHz –3200 MHz)	1947A02956	11/08/01
900195	Tektronix	CFG280	Function Generator (0.1 Hz – 11 MHz)	TW12167	N/A
900927	Tektronix	ASG 100	Audio Signal Generator	B03274 V2.3	N/A
900268	Taylor	5565	Hygrometer / Thermometer	N/A	09/05/01
901056	Hewlett Packard	8954A, Opt.H03	Transceiver Interface	2924A00830	06/02/01
901088	Hewlett Packard	8954A	Transceiver Interface	2146A00139	07/28/01
901082	AFJ International	AFJ LS16	LISN (9 kHz – 30 MHz)	16010020081	06/16/01
901083	AFJ International	AFJ LS16	LISN (9 kHz – 30 MHz)	16010020082	06/ 16/01
901084	AFJ International	AFJ LS16	LISN (9 kHz – 30 MHz)	16010020080	06/16/01
901090	Bajog electronic	4V-100/200	LISN (150 kHz – 30 MHz)	00-44-007	08/03/01
900726	Solar	7225-1	LISN	N/A	03/29/01
900727	Solar	7225-1	LISN	N/A	03/29/01
900078	Solar	7225-1	LISN	N/A	03/29/01
900077	Solar	7225-1	LISN	N/A	03/29/01
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	06/08/01
900793	Hewlett Packard	432A	Thermistor Power Meter	1848a22632	N/A
900721	Hewlett Packard	8447D	Preamplifier (0.1-1300 MHz)	2727A05397	N/A
900889	Hewlett Packard	85685A	RF Preselector for HP 8566B or 8568B (20Hz-2GHz)	3146A01309	11/14/01
900566	Amplifier Research	FP 2000	Isotropic Field Probe	20760	08/29/01
900854	Solar Electronics Co	9119-IN	RF Current Probe	972501	
900849	Solar Electronics Co	9121-IN	Injection Probe (10 MHz – 1 GHz)	953501	
900848	Solar Electronics Co	9320-IN	RF Current Probe	990521	
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	03/29/01

5 CONDUCTED EMISSIONS

5.1 CONDUCTED EMISSIONS MEASUREMENTS

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 ***450 kHz to 30 MHz***. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

5.2 FCC PART 15.207: CONDUCTED EMISSION DATA

NEUTRAL SIDE (Line 1) {Channel: 1}

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.486	Pk	29.7	-0.7	29.0	48.0	-19.0
0.548	Pk	25.9	-0.7	25.2	48.0	-22.8
0.656	Pk	22.8	-0.7	22.1	48.0	-25.9
1.318	Pk	18.9	-0.9	18.0	48.0	-30.0
7.160	Pk	16.1	-1.9	14.2	48.0	-33.8
15.490	Pk	18.7	-2.8	15.9	48.0	-32.1
27.460	Pk	15.0	-3.5	11.5	48.0	-36.5

HOT SIDE (Line 2) {Channel:1}

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.456	Pk	27.9	-0.8	27.1	48.0	-20.9
0.584	Pk	26.7	-0.7	26.0	48.0	-22.0
1.783	Pk	17.4	-1.1	16.3	48.0	-31.7
6.450	Pk	15.1	-1.8	13.3	48.0	-34.7
13.130	Pk	15.1	-2.4	12.7	48.0	-35.3
24.830	Pk	14.8	-3.4	11.4	48.0	-36.6

TEST PERSONNEL:

Signature:_____ Date: February 14, 2001

Typed/Printed Name: Daniel Baltzell

6 RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one meter and three meter distances, 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. The spectrum was examined from 30 MHz to 1000 MHz using a Hewlett Packard 8566B spectrum analyzer, a Hewlett Packard 85650A quasi-peak adapter, and EMCO log periodic and biconical antenna. In order to gain sensitivity, a HP8447 preamplifier was connected in series between the antenna and the input of the spectrum analyzer.

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 spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. When any clock exceeds 108 MHz, the EUT was tested between 1 to 2 Gigahertz in peak mode with the resolution bandwidth set at 1 MHz as stated in ANSI C63.4. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

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

6.1 RADIATED EMISSION DATA

6.1.1 FCC PART 95.639 - EFFECTIVE RADIATED POWER (CHANNEL 1)

Emission Frequency (MHz)	Signal Generator Reading (dBm)	Cable Loss and TX Antenna Gain Correction (dB)	Corrected Signal Generator Level (dBm) ERP	Watt	Limit 95.639 (d) Watt
462.5625	28.8	-3.2	25.6	0.360	0.5

Measurement uncertainty = 0.5 dB

6.1.2 FCC §15.109: RADIATED EMISSIONS: (RECEIVER/DIGITAL)

Temperature: 76°F Humidity: 77%									
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)
141.151	Qp	V	30	1.0	30.5	-16.2	14.3	43.5	-29.2
282.302	Qp	H	265	1.0	49.3	-13.5	35.8	46.0	-10.2
423.453	Qp	H	30	1.0	39.3	-8.6	30.7	46.0	-15.3
564.604	Qp	H	0	1.6	34.9	-6.2	28.7	46.0	-17.3
705.755	Qp	H	0	1.0	45.7	-4.8	40.9	46.0	-5.1
846.906	Qp	H	180	1.0	46.8	-3.0	43.8	46.0	-2.2

**All readings are quasi-peak, unless stated otherwise.*

TEST PERSONNEL:

Signature:_____ Date: February 14, 2001

Typed/Printed Name: Daniel Baltzell

7 FCC §95.627(B): FREQUENCY TOLERANCE

Limit 0.00025 %

7.1 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY

7.1.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.2

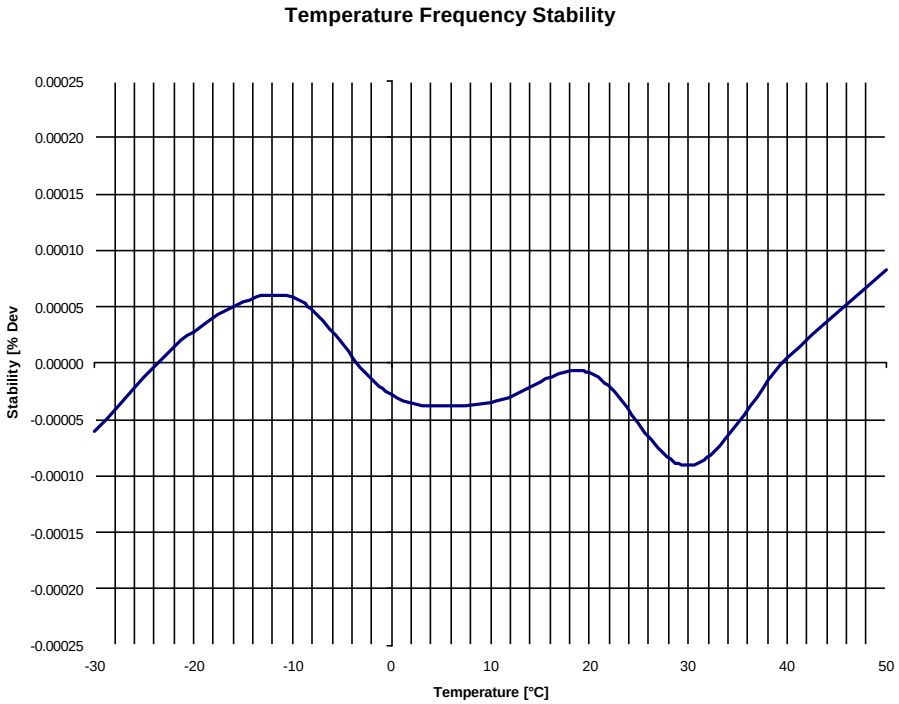
The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +50°C.

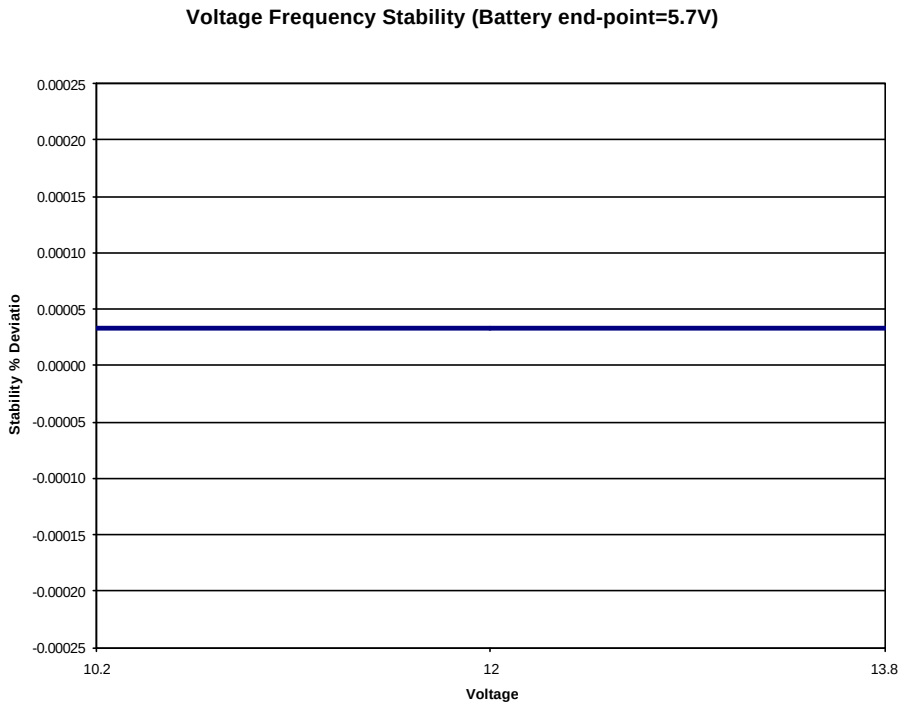
The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT.
The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A 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.

7.1.1.1 Temperature Frequency Stability



7.1.1.2 Voltage Frequency Stability



8 FCC §95.633: EMISSION BANDWIDTH

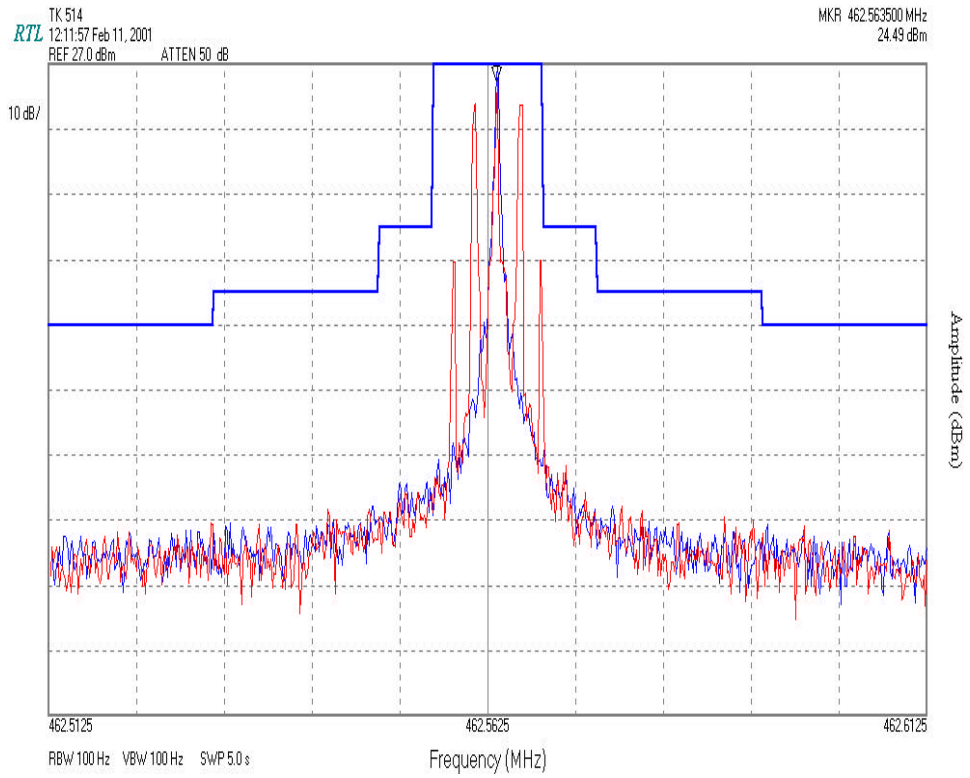
8.1 FCC RULES AND REGULATIONS PART 2 §2.1049 (C) (1): OCCUPIED BANDWIDTH

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

8.2 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.



9 FCC RULES AND REGULATIONS PART 2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

FCC Part 95.631 and FCC 95.193:

FCC Part 95.631 (d): Emission Types

"An FRS unit may transmit only emission type F3E."

Type of Emission: F3E

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

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

FCC Part 95.633 (c) Emission Bandwidth

"The authorized bandwidth for emission type F3E transmitted by a FRS unit is 12.5 kHz."

10 FCC §95.635: UNWANTED 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.

10.2 TEST DATA

Frequency (MHz)	dBuV/m @ 3 m	Signal Generator (dBm)	Cable Loss (dB)	Corrected Antenna Gain (dB)	Corrected Signal Generator Level (dBm)	Limit (dBm)	Margin (dB)
925.126	43.4	-49.3	4.2	-1.1	-54.6	-13.0	-41.6
1387.689	48.5	-43.6	6.5	3.6	-46.5	-13.0	-33.5
1850.252	37.1	-47.1	7.5	4.8	-49.8	-13.0	-36.8
2312.815	32.9	-21.5	10.4	5.0	-26.9	-13.0	-13.9
2775.378	29.4	-13.9	12.0	5.8	-20.1	-13.0	-7.1
3237.941	30.5	-9.8	13.3	6.2	-16.9	-13.0	-3.9
3700.504	23.7	-24.2	15.8	6.0	-34.0	-13.0	-21.0
4163.067	12.7	-26.6	17.9	6.3	-38.2	-13.0	-25.2
4625.630	23.1	-17.0	19.8	7.1	-29.7	-13.0	-16.7

11 FCC §95.637: MODULATION STANDARDS

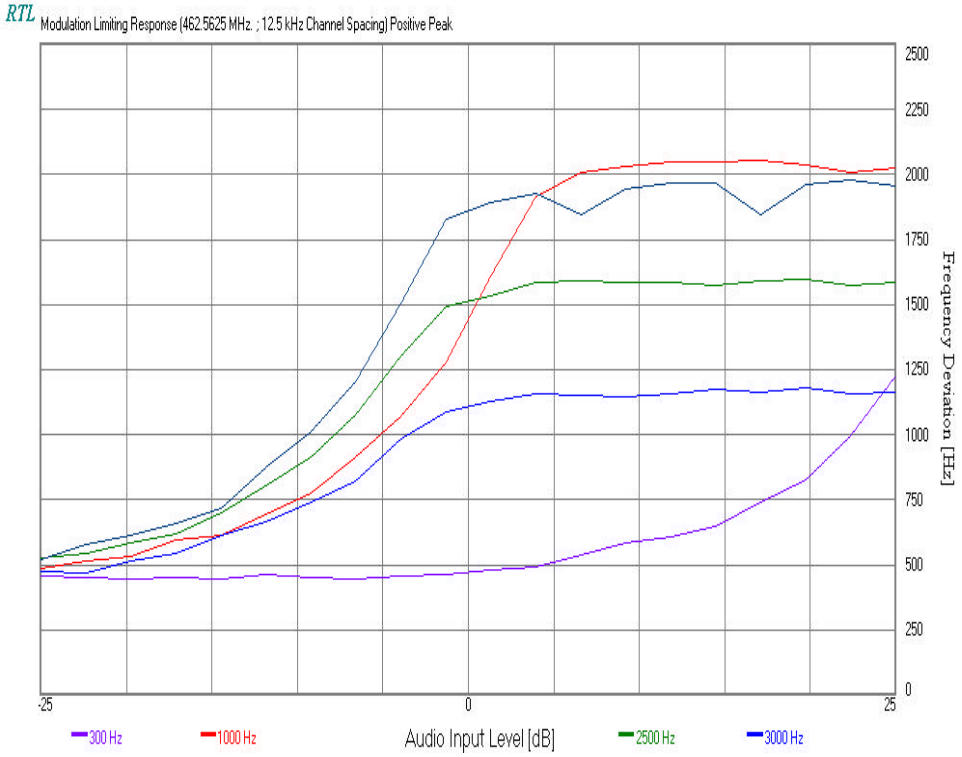
11.1 FCC RULES AND REGULATIONS PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING

11.1.1 TEST PROCEDURE

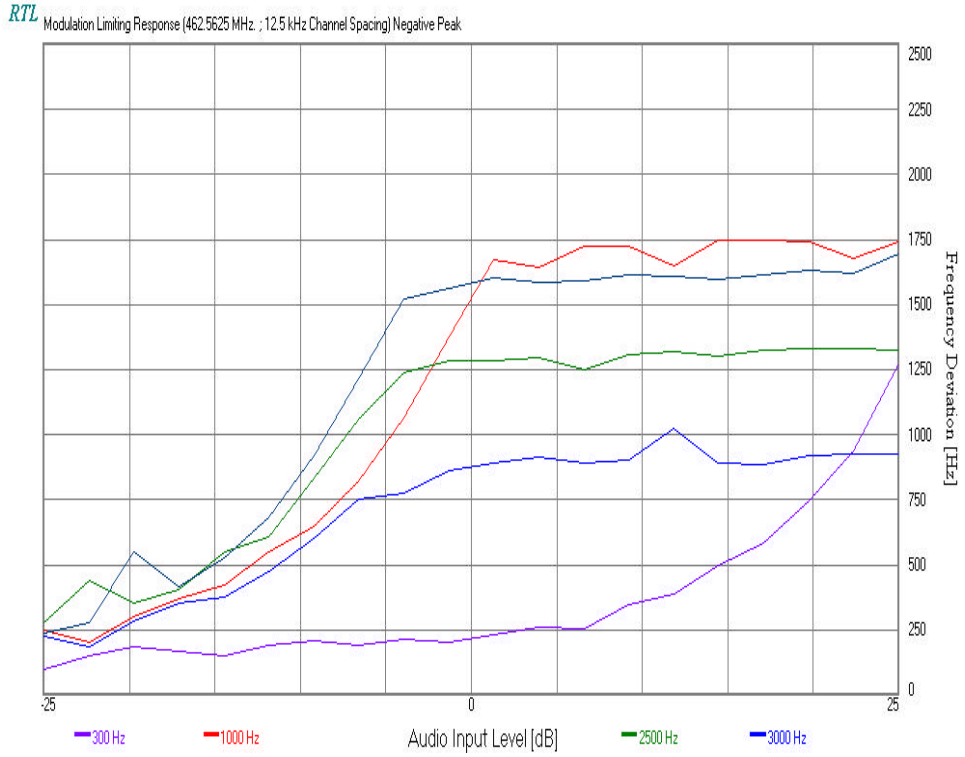
ANSI/TIA/EIA-603-1992, section 2.2.3

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 +25 dB above it and –25 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.

11.1.1.1 Modulation Limiting Positive Peak



11.1.1.2 Modulation Limiting Negative Peak



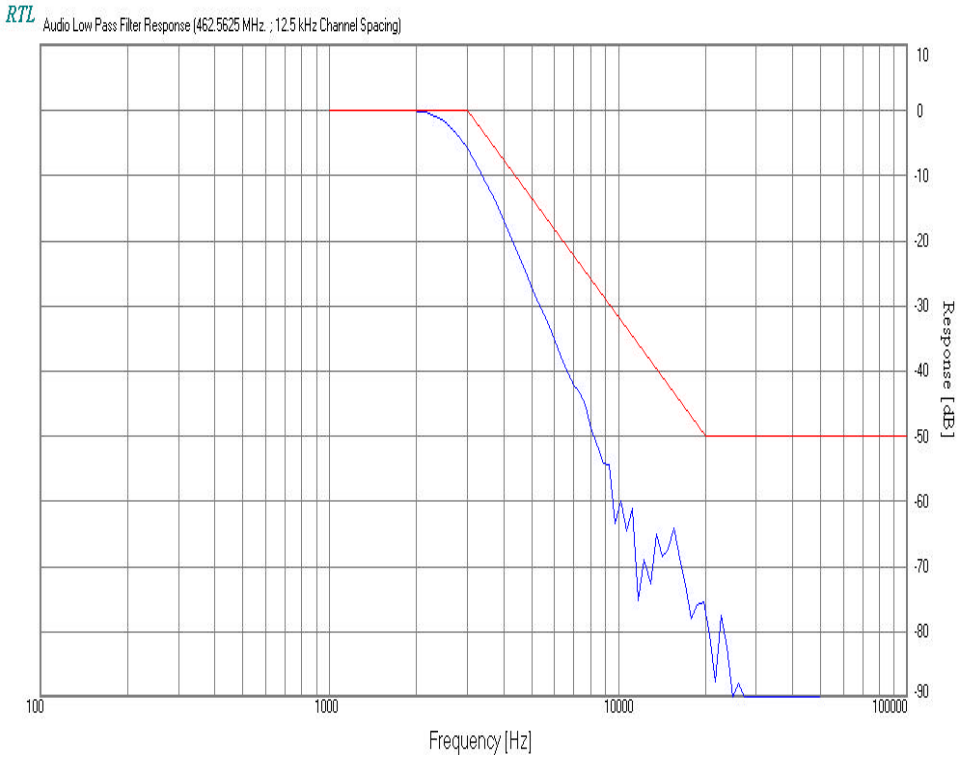
11.2 FCC RULES AND REGULATIONS PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO LOW PASS FILTER RESPONSE

11.2.1 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.

11.2.1.1 Audio Low Pass Filter Response



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

11.3.1 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)

11.3.1.1 Audio Frequency Response