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W/O: 2001317 / Quote: QRTL01-351
Dates of Tests 11-26-2001 through 11-27-2001
FCC Part 95 Certification &
Industry Canada RSS-210

CERTIFICATE OF COMPLIANCE
FCC PART 95 CERTIFICATION &
INDUSTRY CANADA RSS-210 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	Maxon Telecom Ltd 459-23 Kasan-Dong Kumchon-Ku, Seoul / Korea Contact: J. H. Byun Phone: 82-2-2008-1605 Fax: 82-2-2008-1600

FCC ID:	AWWT4300	**FRN NUMBER:**	0005-8693-00
EQUIPMENT TYPE:	FRS radio	**MODEL(S):**	T-4300
RTL WORK ORDER NUMBER:	2001317	**RTL QUOTE NUMBER:**	QRTL01-351
DATE OF TEST REPORT:	January 3, 2002		

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 Non-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 95: Personal Radio Service
Industry Canada Standard:	RSS-210 December 2000: Low Power Licence-Exempt Radiocommunication Devices

Frequency Range (MHz)	Output Power (W)	Freq. Tolerance (ppm, %, or Hz)	Emission Designator
462.5625 – 467.7125	.394 W	2.5 ppm	10K7F3E

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 95, Industry Canada RSS-210, ANSI C63.4, ANSI/TIA/EIA603 and ANSI/TIA/EIA 603-1.

Signature: 

Date: January 8, 2002

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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TABLE OF CONTENTS

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TABLE INDEX

PLOT INDEX

APPENDIX INDEX

PHOTOGRAPH INDEX

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1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules Part 95: The rules in this subpart govern the licensing and operation of personal radio services.

IC RSS-210: This Radio Standards Specification (RSS) sets out standards for license-exempt low power devices.

All measurements contained in this application were conducted in accordance with the FCC Rules and Regulations CFR47, Industry Canada RSS-210 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. A DoC report is on file for the receiver section and digital interface for the EUT.

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2 EQUIPMENT INFORMATION

2.1 APPLICANT AND EQUIPMENT INFORMATION

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Frequency Range (MHz)	Output Power (W)	Freq. Tolerance (ppm, %, or Hz)	Emission Designator
462.5625 – 467.7125	.394 W	2.5 ppm	10K7F3E

2.2 JUSTIFICATION

To complete the test configuration required by the FCC the transmitter was tested at a high, mid, and low channel in the following frequency range (462.5625 MHz-467.7125 MHz). The following frequencies were tested: 462.5625 MHz, 462.7125 MHz and 467.7125 MHz. Each transmitter frequency was measured independently.

The final radiated data was taken with the EUT locked to a set frequency.

2.3 EXERCISING THE EUT

The transmitter was placed on a revolving table 1 meter high.

In order to activate the receiver circuitry for Part 15 testing digital/receiver tests; a signal was transmitted from a signal generator. This allowed the EUT to function in its typical state through out the course of all testing. The EUT's Intermediate frequencies (IF), Local Oscillators (LO), crystal oscillators and harmonics of each were investigated.

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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
FRS RADIO	MOTOROLA	T4300	N/A	AWWT4300	N/A	13935
FRS RADIO	MOTOROLA	T4300	N/A	AWWT4300	N/A	13934

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2.5 CONFIGURATION OF TESTED SYSTEM

PHOTOGRAPH 1: CONFIGURATION OF TESTED SYSTEM (FRONT VIEW)

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PHOTOGRAPH 2: CONFIGURATION OF TESTED SYSTEM (REAR VIEW)

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3 FCC RULES AND REGULATIONS PART 2 §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:
12.5kHz (NB channel) : Bn = 10K7F3E

Calculation:
Max modulation(M) in kHz : 2.862
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."

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4 RADIATED ERP - §95.639(D)

4.1 ANSI/TIA/EIA-603-1992, TEST PROCEDURE

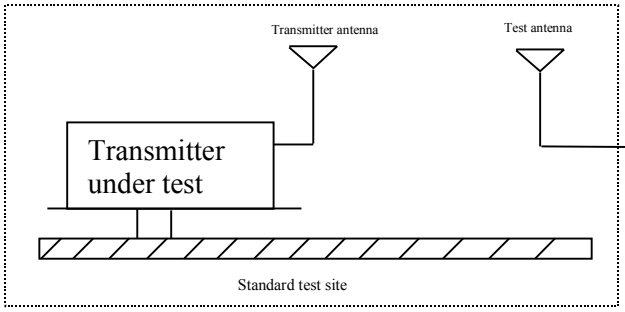

FIGURE 4-1: ILLUSTRATION OF EQUIPMENT SETUP

Connect the equipment as illustrated. Place the transmitter to be tested on the turntable in the standard test site. Raise and lower the test antenna from 1 m to 4 m in both horizontal and vertical polarities. Record the highest received signal with the transmitter rotated 360° and in all 3 polarities.

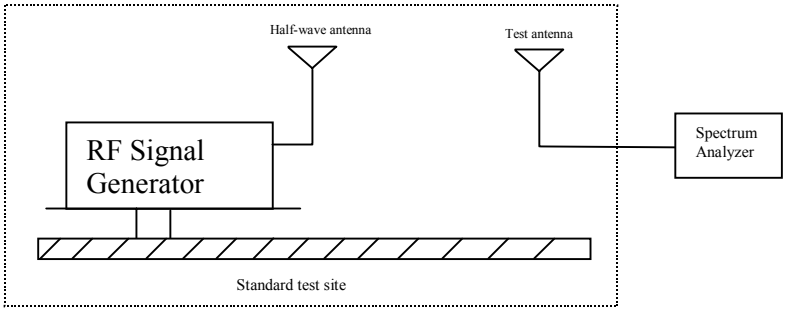

FIGURE 4-2: ILLUSTRATION SUBSTITUTION ANTENNA SETUP

Replace the transmitter under test with a half-wave antenna. The center of the antenna should be at the same location as the transmitter under test. Connect the antenna to a signal generator with a known output power and record the path loss in dB. Reference the antennas used to a half-wave dipole.

4.2 EFFECTIVE RADIATED POWER LIMITS - §95.639(D)

No FRS unit, under any condition of modulation, shall exceed 0.500 W effective radiated power (ERP)

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4.3 RADIATED POWER (ERP). TEST EQUIPMENT

TABLE 4-1: TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	Hewlett Packard	8566B	Spectrum Analyzer	3138A07771
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866
900154	Compliance Design Inc,	Roberts Dipole	Adjustable Elements Dipole Antenna (30-1000MHz)	
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz – 2 GHz)	2648

TABLE 4-2: RADIATED EFFECTIVE OUTPUT POWER DATA - §2.1046

Frequency Tuned	Signal Generator Level	Cable Loss	Dipole Gain	ERP of EUT Signal Generator Level - Cable Loss + Dipole Gain	
(MHz)	(dBm)	(dB)	(dBd)	(dBm)	Watts
462.5625	27.4	0.9	-0.6	26.0	0.394
462.7125	26.7	0.8	-0.6	25.4	0.343
467.7125	26.3	0.8	-0.6	25.0	0.313

Notes: ERP Measurements by Substitution Method.

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5 MODULATION CHARACTERISTICS - §2.1047

5.1 MODULATION CHARACTERISTICS - §2.1047 TEST PROCEDURE

5.2 MODULATION REQUIREMENTS - §95.637 MODULATION STANDARDS

A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz .

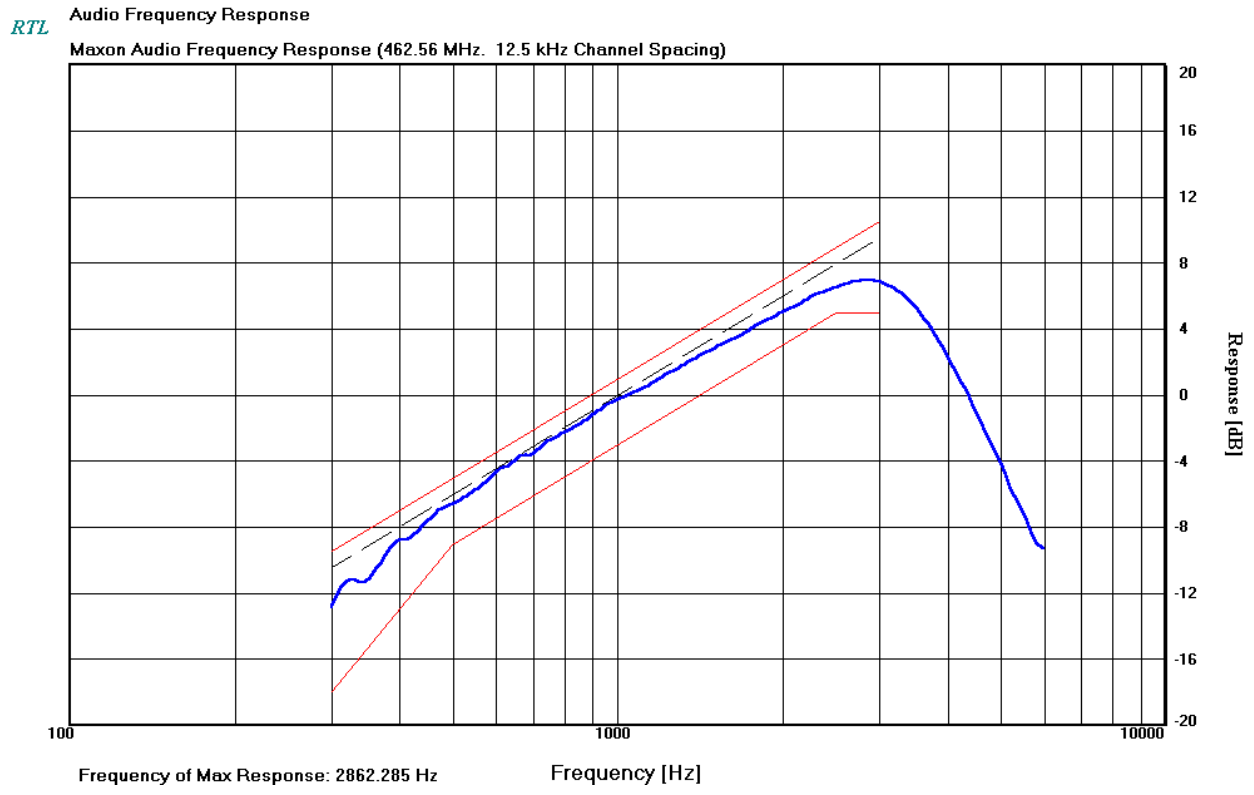
5.3 MODULATION CHARACTERISTICS TEST EQUIPMENT

TABLE 5-1: 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

5.4 MODULATION CHARACTERISTICS TEST DATA

Limit = 3.125 kHz. Measured Audio Frequency Response = 2.862 kHz



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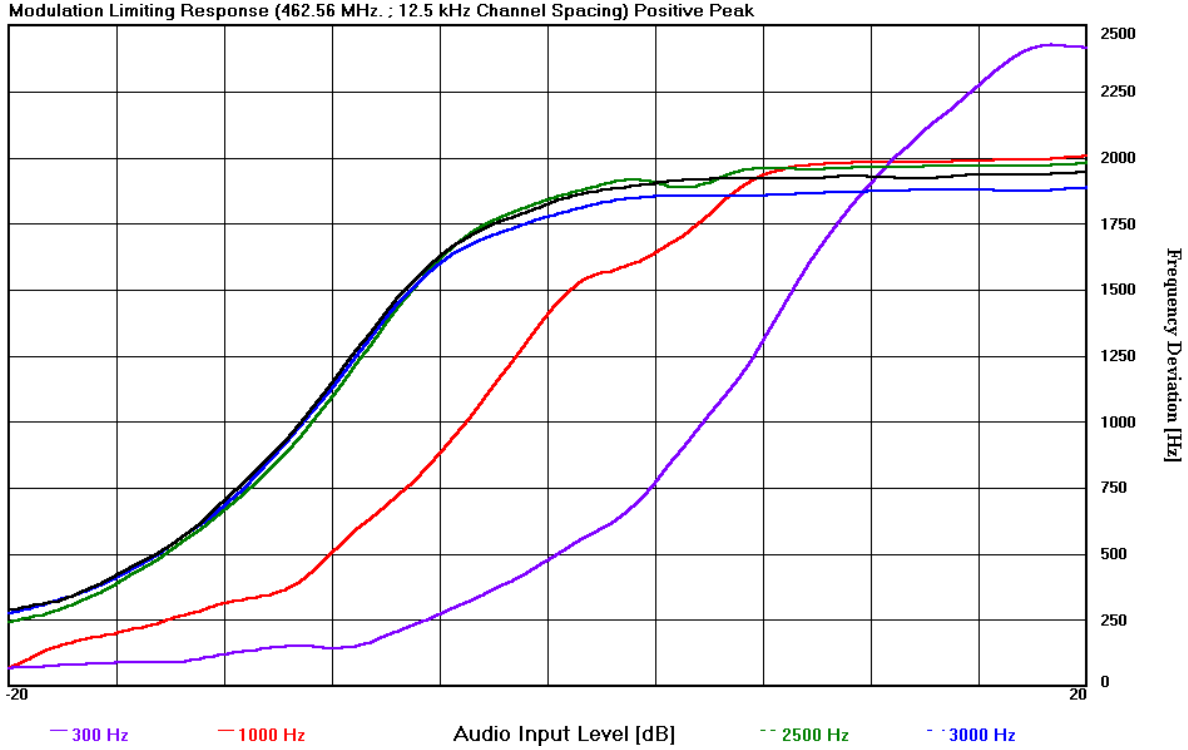
W/O: 2001317 / Quote: QRTL01-351
Dates of Tests 11-26-2001 through 11-27-2001
FCC Part 95 Certification &
Industry Canada RSS-210

RTL

Modulation Limiting Positive Peak

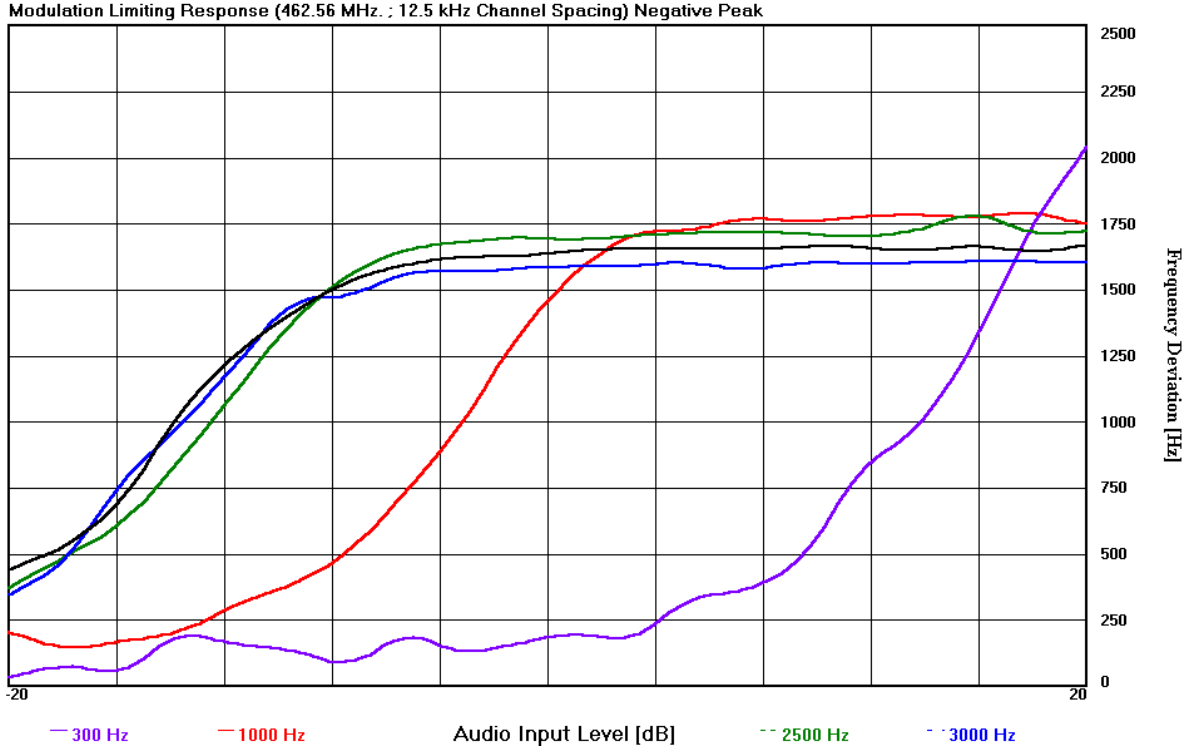
Modulation Limiting Response (462.56 MHz. ; 12.5 kHz Channel Spacing) Positive Peak



RTL

Modulation Limiting Negative Peak

Modulation Limiting Response (462.56 MHz. ; 12.5 kHz Channel Spacing) Negative Peak



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Dates of Tests 11-26-2001 through 11-27-2001
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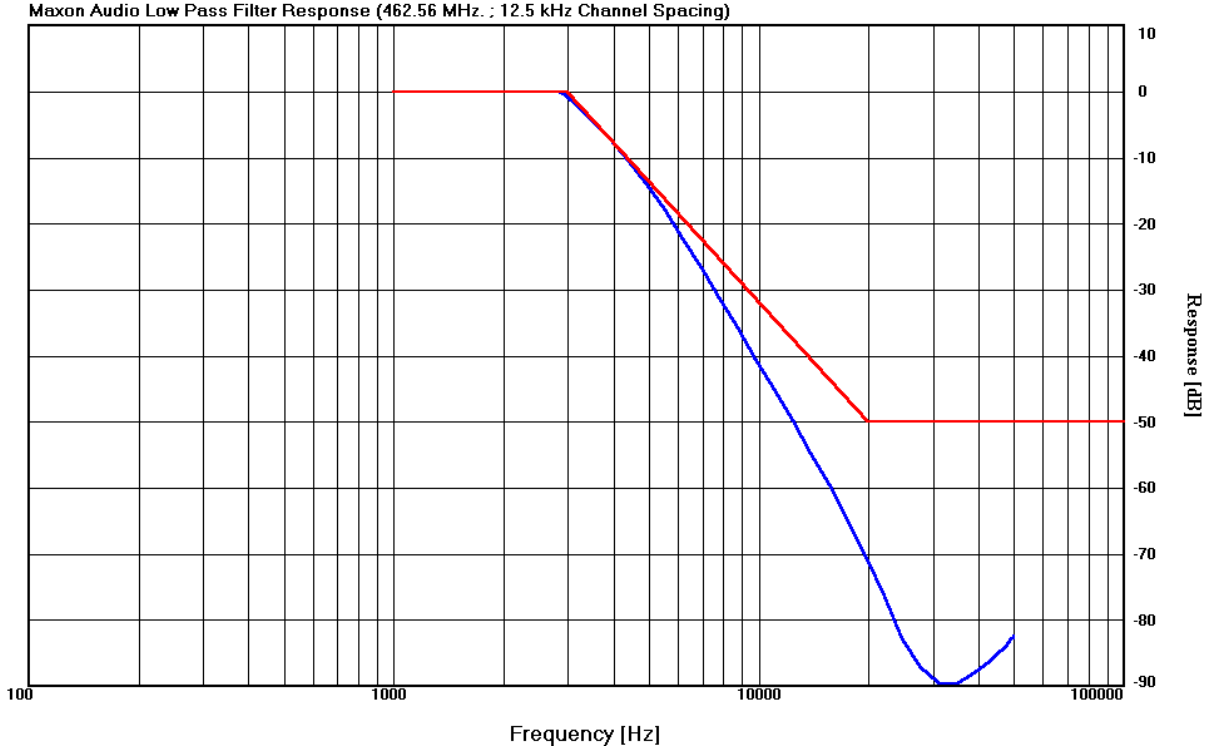
RTL

Audio Low Pass Filter Response

Maxon Audio Low Pass Filter Response (462.56 MHz. ; 12.5 kHz Channel Spacing)



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6 OCCUPIED BANDWIDTH - §2.1049

6.1 OCCUPIED BANDWIDTH - §2.1049 TEST PROCEDURE

The antenna output terminal of the EUT was connected to the input of a 50W spectrum analyzer through a matched 10dB attenuator. The radio transmitter was operating at maximum output power with and without internal data modulation. 100% of the in-band modulation was below the specified mask. Specified Limits:

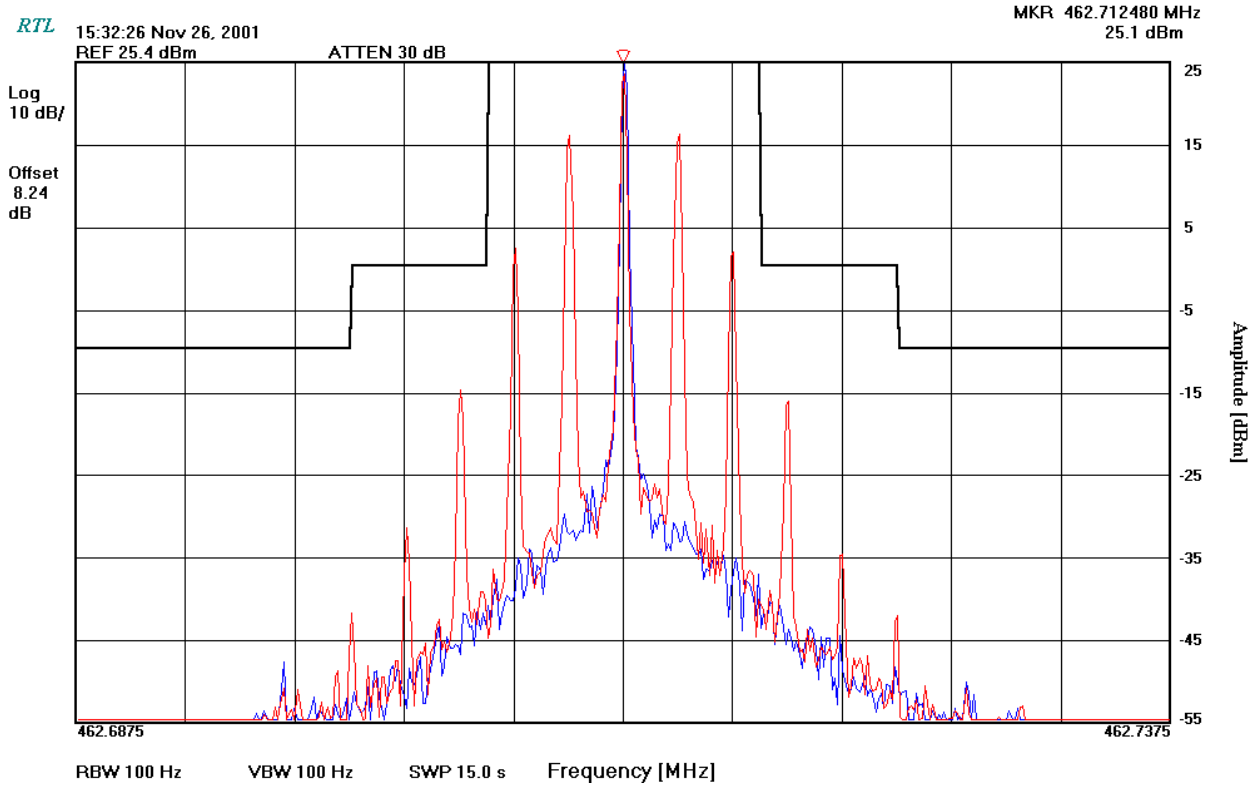
A. On any frequency more than 50%, up to and including 100% of the authorized bandwidth, 6.25-12.5 kHz, the sideband was at least 25dB below the carrier.
B. On any frequency more than 100%, up to and including 250% of the authorized bandwidth, 12.5-31.25 kHz, the sideband was at least 35dB below the carrier
C. On any frequency removed from the assigned carrier frequency by more than 250% of the authorized bandwidth, over 31.25 kHz, 43 + 10log (mean power output in Watts) dB, whichever was the smaller attenuation.

6.2 OCCUPIED BANDWIDTH TEST EQUIPMENT

TABLE 6-1: OCCUPIED BANDWIDTH TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901215	Hewlett Packard	8596EM	EMC Analyzer (9kHz-12.8GHz)	3826A00144

6.3 OCCUPIED BANDWIDTH TEST DATA



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7 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

7.1 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

The EUT was placed on the turntable with the transmitter transmitting. A receiving antenna located 3 meters from the turntable received any signal radiated from the transmitter and its operating accessories. The receiving antenna was varied from 1 to 4 meters and the polarization was varied to determine the worst-case emission level.

7.2 RADIATED SPURIOUS TEST EQUIPMENT

TABLE 7-1: RADIATED SPURIOUS TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz – 2 GHz)	2648
900932	Hewlett Packard	8449B OPT H02	Preamplifier 1-26.5 GHz	3008A00505
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 GHz – 20 GHz)	3610A00866
900154	Compliance Design Inc,	Roberts Dipole	Adjustable Elements Dipole Antenna (30-1000MHz)	
900814	Electro-Metrics	EM-6961 (RGA-60)	Double Ridge Guide Antenna 1-18 GHz	2310
900321	EMCO	3161-03	Horn Antenna, 4.0-8.2 GHz	9508-1020
900772	EMCO	3161-02	Horn Antenna, 2.0-4.0 GHz	9804-1044

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7.3 FIELD STRENGTH OF SPURIOUS RADIATION TEST DATA - §2.1053

Operating Frequency (MHz): 462.7125
Channel: 7
Measured ERP (dBm): 25.35
Modulation: Analog
Distance: 3 meter
Limit: 43 + 10 Log (W) = 38.35 dBc

TABLE 7-2: FIELD STRENGTH DATA §2.1053

Frequency (MHz)	Emissions of Spurious Radiation (dBuV)	Horn Forward Cond. Pwr. (dBm)	Standard Gain Horn Antenna Gain (dBi)	POL (H/V)	EIRP (dBm)	ERP (dBm)	dBc
925.4250	44.5	-27.7	1.00	V	-26.70	-28.85	54.25
1388.1375	31.1	-42.0	5.73	V	-36.27	-38.42	63.82
1850.8500	20.5	-48.5	6.94	V	-41.56	-43.71	69.11
2313.5625	26.5	-60.5	7.19	H	-53.31	-55.46	80.86
2776.2750	24.6	-57.2	7.91	H	-49.29	-51.44	76.84
3238.9875	36.0	-49.1	8.25	H	-40.85	-43.00	68.40
3701.7000	43.0	-41.0	8.05	H	-32.95	-35.10	60.50
4164.4125	37.6	-39.7	8.39	H	-31.31	-33.46	58.86
4627.1250	26.6	-48.3	9.17	H	-39.13	-41.28	66.68

The spectrum analyzer was set to the following settings:

1. Resolution Bandwidth ≤100 kHz
2. Video Bandwidth 10 Hz
3. Sweep Speed 5 Second
4. Detector Mode = Positive Peak

Notes:

ERP Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A half-wave dipole was substituted in place of the EUT. The dipole was fed through a directional coupler and the power at the coupler port was monitored. A signal generator and power amplifier controlled the dipole, and the input level of the dipole was adjusted to the same field strength level as the EUT. The feed point for the dipole was then connected to a calibrated power meter and the power adjusted to read the same as the coupler port previously recorded, this is to account for any mismatch in impedance, which may occur at the dipole antenna. The conducted power at the antenna feed point was recorded. The forward power for the dipole was then determined and the ERP level was determined by adding the forward dipole power and the dipole gain in dB. For readings above 1GHz the above method is repeated using standard gain horn antennas.

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8 FREQUENCY STABILITY / TEMPERATURE VARIATION - §2.1055

8.1 MEASUREMENT METHOD:

The frequency stability of the transmitter was measured by:

1. Temperature: The temperature was varied from -30°C to +50°C at intervals no more than 10°C throughout the temperature range using an environmental chamber. A period of time sufficient to stabilize all of the components in the equipment shall be allowed prior to each frequency measurement.
2. Primary Supply Voltage: The primary supply voltage was varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied. The EUT was tested down to the battery endpoint.

8.2 TIME PERIOD AND PROCEDURE:

1. The carrier frequency of the transmitter was measured at 20°C to provide a reference.
2. The equipment was subjected to a 3 hour “soak” at -30°C without any power applied.
3. After the “soak” at -30°C, the measurement of the carrier frequency of the transmitter was made within a three-minute interval after applying power to the transmitter.
4. Frequency measurements were made at 10°C intervals up to +50°C. A minimum period of one hour was provided to allow stabilization of the equipment at each temperature level.

8.3 FREQUENCY TOLERANCE §95.627(B):

Each FRS unit must be maintained within a frequency tolerance of 0.00025%. This transmitter is only capable of transmitting on the following channels: 462.5625, 462.5875, 462.6125, 642.6375, 462.6625, 462.6875, 462.7125, 467.5625, 467.5875, 467.6125, 467.6375, 467.6625, 467.6875 and 467.7125.

8.4 FREQUENCY STABILITY TEST EQUIPMENT

TABLE 8-1: 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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8.5 FREQUENCY STABILITY TEST DATA - §2.1055

Operating Frequency:	462,712,500	Hz		
Channel:	7			
Reference Voltage:	6	VDC		
Deviation Limit:	± 0.00025	%	or 2.5	ppm

TABLE 8-2: FREQUENCY STABILITY DATA - §2.1055

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	DEVIATION (%)
100 %	6.0	+ 20 (ref)	462,712,500	0.000000
100 %		-30	462,712,925	0.000092
100 %		-20	462,713,155	0.000142
100 %		-10	462,712,215	-0.000062
100 %		0	462,711,795	-0.000152
100 %		+ 10	462,712,325	-0.000038
100 %		+ 20	462,712,365	-0.000029
100 %		+ 30	462,712,245	-0.000055
100 %		+ 40	462,712,345	-0.000033
100 %		+ 50	462,712,695	0.000042
85 %	5.10	+ 20	462,712,525	0.000005
115 %	6.90	+ 20	462,712,513	0.000003
BATT. ENDPOINT	4.50	+ 20	462,712,488	-0.000003

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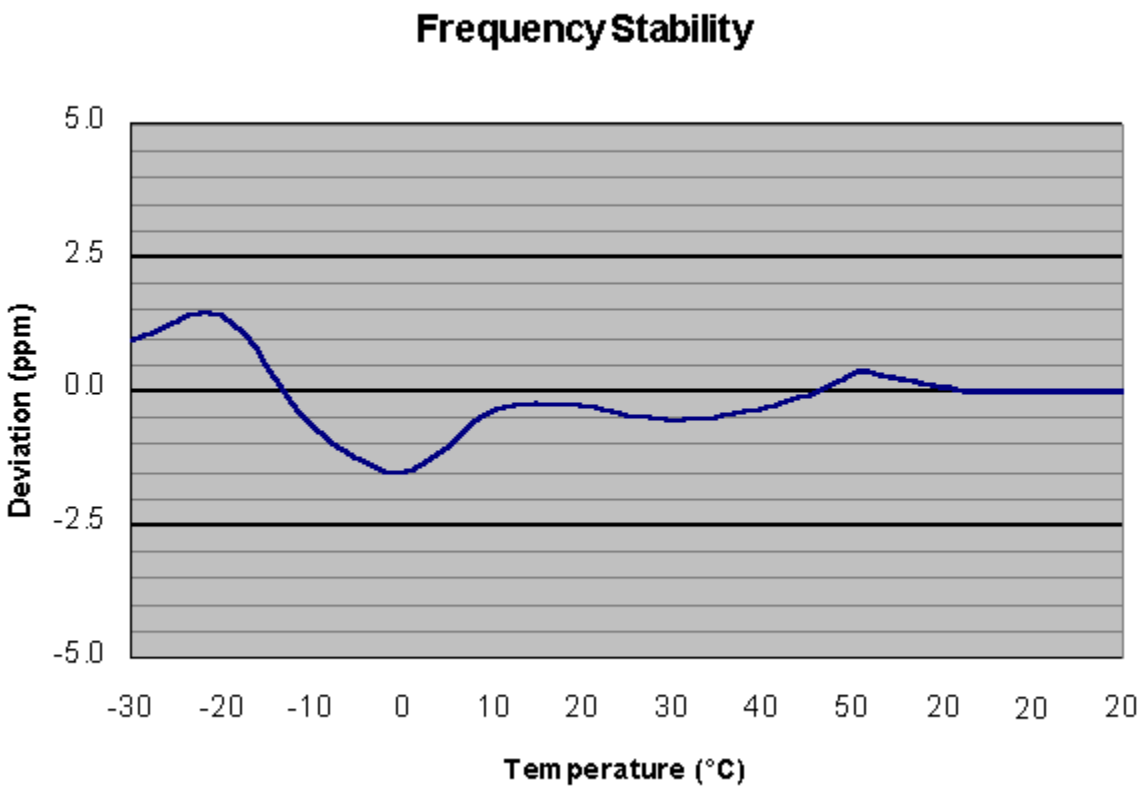

PLOT 8-1: FREQUENCY STABILITY - §2.1055

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9 FRS UNIT AND R/C TRANSMITTER ANTENNAS - §95.647

The antenna is an integral part of the transmitter. The antenna has no gain compared to a half-wave dipole and is vertically polarized.

10 CONCLUSION

Test Lab:	Applicant Information
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Frequency Range (MHz)	Output Power (W)	Freq. Tolerance (ppm, %, or Hz)	Emission Designator
462.5625 – 467.7125	.394 W	2.5 ppm	10K7F3E

The data in this measurement report shows that the EUT complies with all the requirements of Parts 2 and 95 of the FCC Rules and Industry Canada RSS-210.