TYPE OF EXHIBIT: LIST OF ATTACHED EXHIBITS

FCC PART: 2.1033(c)(14)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

The following exhibits are contained in this file:

TYPE OF EXHIBIT: LIST OF TEST EQUIPMENT USED

FCC PART: 2.947(d)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

All measurements were conducted with one or more of the following pieces of equipment:

Item	Manufacturer	Model No.	Serial No.	Calibration	Next Calibration
DC Power Supply	Gw Instek	GPR7550D	EG902438	N/A	N/A
Multimeter	Fluke	45	6723040	N/A	N/A
Multimeter	BK Precision	2704A	234-008459	N/A	N/A
RF Test Set	HP	8920AB	US39225560	6/22/2012	6/22/2013
Spectrum Analyzer	Advantest	R3265A	75060189	6/22/2012	6/22/2013
Spectrum Analyzer	HP	8560E	3720A02980	6/22/2012	6/22/2013
Storage Scope	Fluke/Philips	PM3335	DM630034	N/A	N/A
Temp. Chamber	Delta Design	3900 CL	0-52-R	N/A	N/A
Audio Test Set	Audio Precision	SYS-322A	SYS1-33641		
Thermocouple	Triplett	320-G/P		N/A	N/A
Log Periodic Ant.	Electo-Metrics LPA-25	8-102		5/20/2011	5/20/2013
Dipole Ant. Set	Ritron Inc.	N/A		5/20/2011	5/20/2013
Microwave Horn	EMCO 3105			5/20/2011	5/20/2013

Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: DESCRIPTION OF MEASUREMENT FACILITY

FCC PART: 2.947(d)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

The Field Strength measurements filed with this application were made on a site certified by RITRON, Inc. Data pertaining to this side are on file with the FCC and Industry Canada and are current.

Firm Registration Number:	536261
Firm FRN:	0004-3348-76
FCC Reference:	ANSI STD C63.4-2003
Industry Canada Radio Standard;	Procedure 212

This site is used on a continuing basis exclusively by RITRON, Inc. and is utilized only for RF Field Strength measurements of equipment designed and manufactured by RITRON, Inc. It is not used for measurements by, or for, any other party on a contract basis or otherwise.

All other measurements were taken at RITRON's Engineering Laboratory in Carmel, IN.

Sam L. Dulaney - Chief Engineer
RITRON, Inc.

TYPE OF EXHIBIT: RADIO FREQUENCY OUTPUT POWER

FCC PART: 2.1046(a)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

Procedure:

1. The PT-150M was aligned for transmitter operation at 2 Watts for frequencies 151.820MHz, 151.940MHz, and 154.600MHz.

2. 7.4VDC(Vsupply) was supplied to the PT-150M by a GW Instek GPR-7550D Power Supply. The PT-150M was connected to a HP8920B Test Set used to measure the RF carrier power. The input to the Test Set provides a resistive 50-ohm termination at the frequencies and power levels used for this test.

3. A B&K Digital Multimeter was connected in series with the supply lead of the RF Power device and set to measure current (Id).

TYPE OF EXHIBIT: RADIO FREQUENCY OUTPUT POWER

FCC PART: 2.1046(a)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

Results:

Frequency (MHz)	Po (W)	Id (A)	Vsupply (V)	Pin (W)
151.820	1.96	0.81	7.40	5.99
151.940	1.96	0.81	7.40	5.99
154.600	1.91	0.79	7.40	5.85

Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: AUDIO FREQUENCY RESPONSE

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Procedure:

1. The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.
2. The frequency response of the audio modulation part is adjusted to get 20% of the rated system deviation.
3. The deviations obtained over the frequency range from 100Hz to 5000Hz are recorded and compared with the reference deviation as follows:

   Audio Frequency Response = 20log[DEV Freq / DEVref]

TYPE OF EXHIBIT: AUDIO FREQUENCY RESPONSE

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

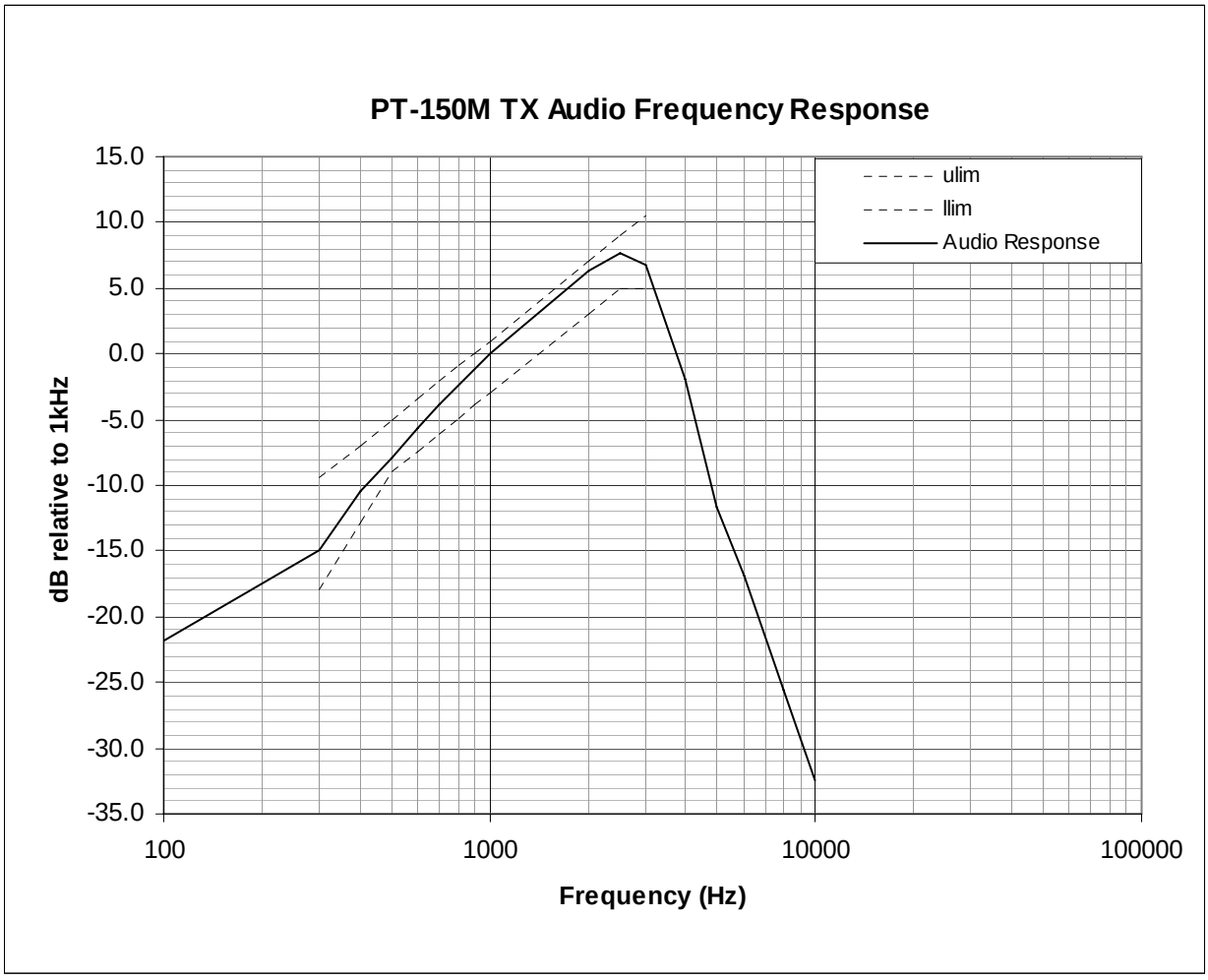
MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results: Operating Frequency: 151.940MHz



Signed:

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: AUDIO LOWPASS FILTER RESPONSE

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Procedure:

1. Connect the audio frequency generator as close as possible the input of the post limiter low pass filter within the transmitter under test.
2. Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.
3. Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.
4. Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as LEVREF.
5. Set the audio frequency generator to the desired test frequency between 100 Hz and the upper low pass filter limit.
6. Record audio spectrum analyzer levels, at the test frequency in step 5.
7. Record the dB level on the audio spectrum analyzer as LEVFREQ
8. Calculate the audio frequency response at the test frequency as: low pass frequency response = LEVFREQ – LEVREF.
9. Repeat steps 7) through 8) for all the desired test frequencies.

TYPE OF EXHIBIT: AUDIO LOWPASS FILTER RESPONSE

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

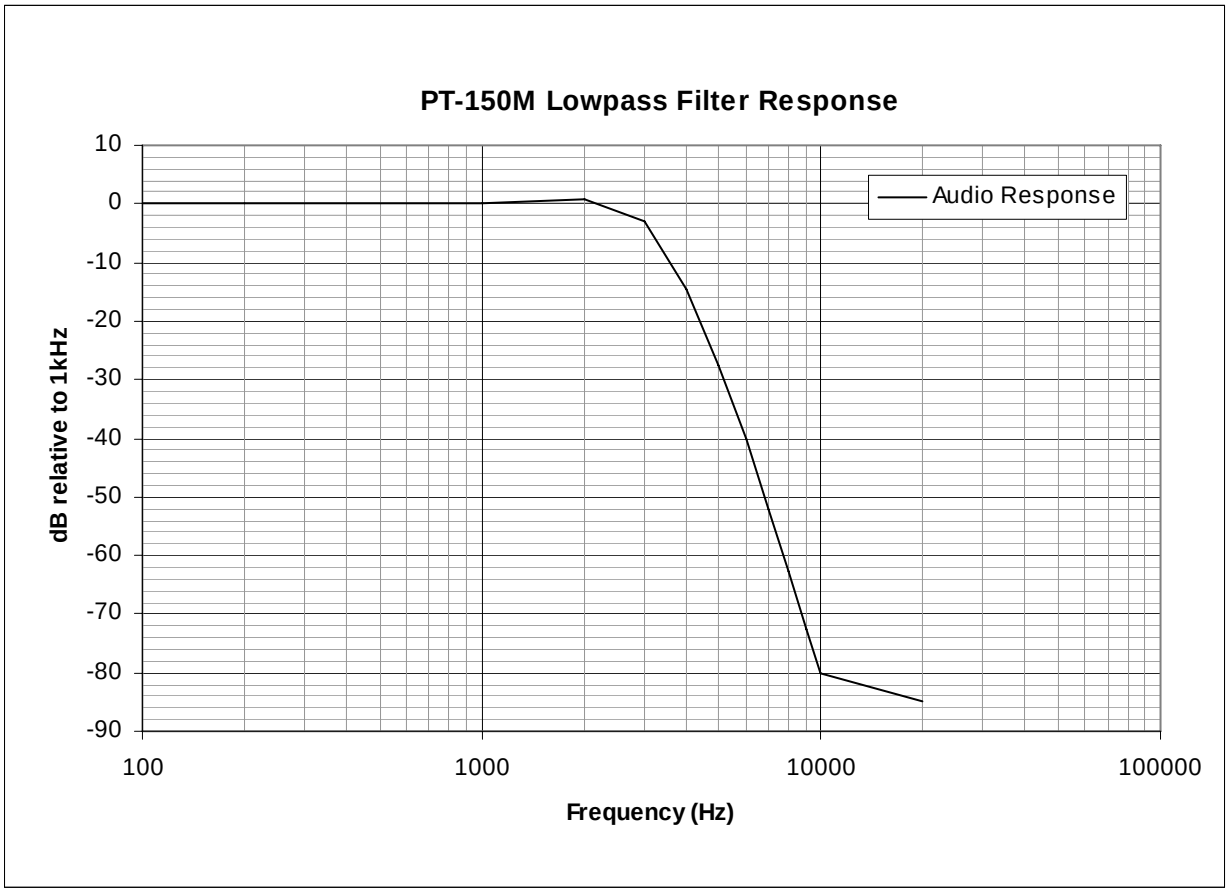
MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results: Operating Frequency: 151.940MHz



Signed:

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: MODULATION LIMITING

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Procedure:

1. Modulation limiting is the transmitter circuit's ability to limit the transmitter from producing deviations in excess of rated system deviation.
2. The modulation response is measured at certain modulation frequencies, related to 1000Hz reference signal.
3. The basic setting is 60% of full rated deviation which will be increased the audio generator level from –20 dB to 20 dB in nine steps.

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TYPE OF EXHIBIT: MODULATION LIMITING

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

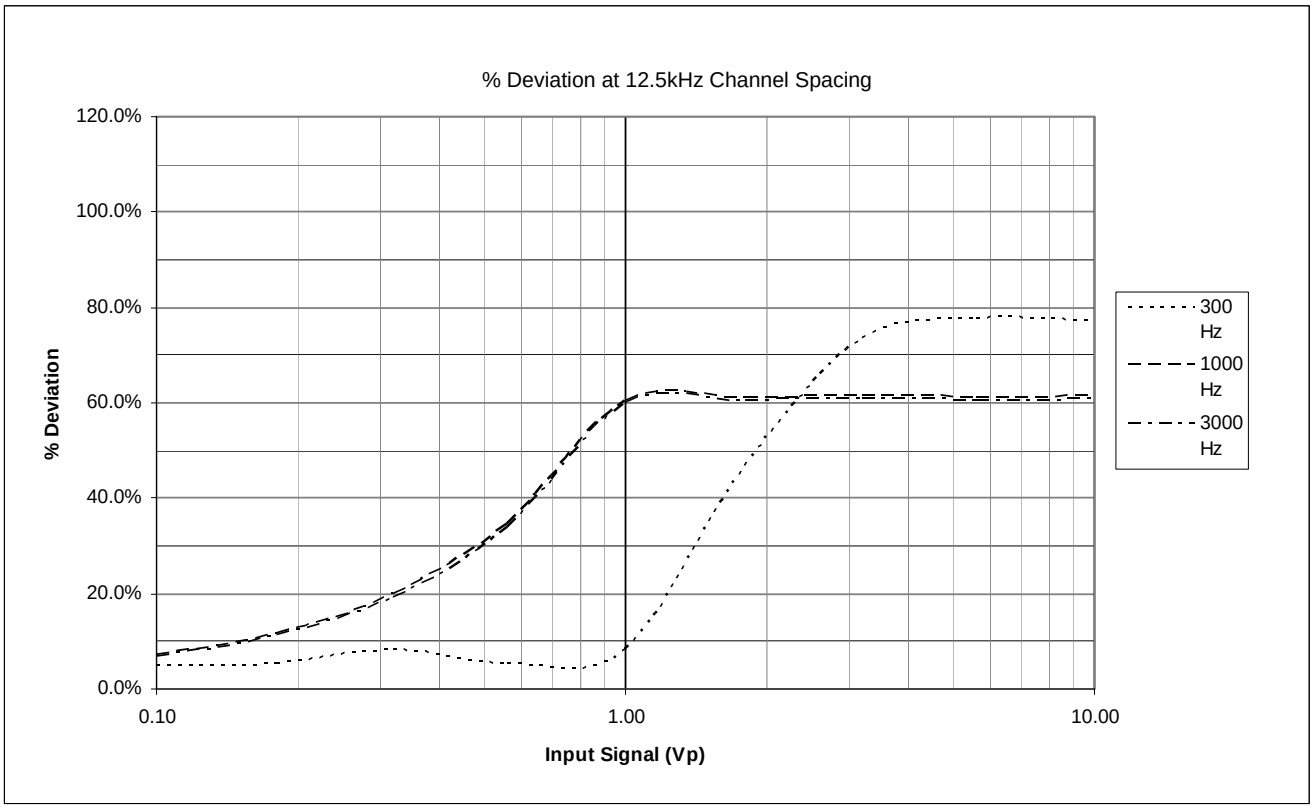
TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results: 12.5 Channel Spacing

Operating Frequency: 151.940MHz



100% = +/-2.5kHz deviation

Signed:

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: MODULATION LIMITING

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

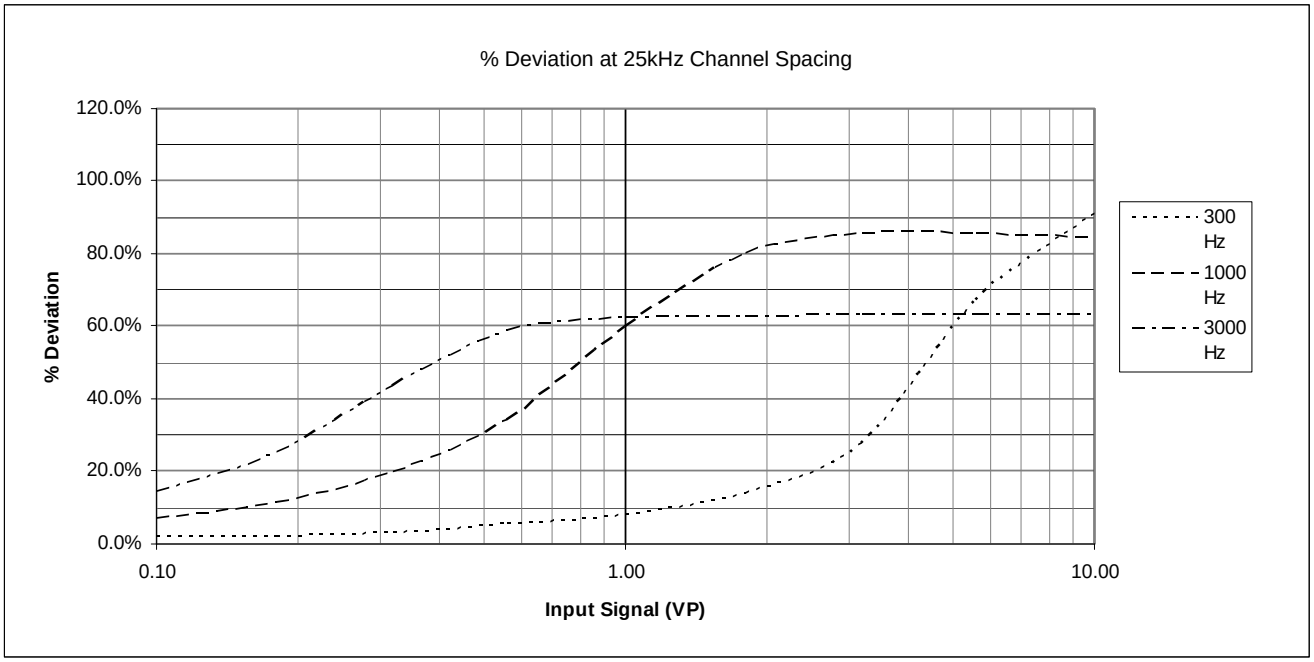
TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results: 25kHz Channel Spacing

Operating Frequency: 151.940MHz



100% = +/-5kHz Deviation

Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: OCCUPIED BANDWIDTH

FCC PART: 2.1049(c)(1), 95.633

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

PROCEDURE:

1. The PT-150M was aligned for transmitter operation on 151.940MHz and 154.600MHz for 2 Watts or RF Output Power.

2. On 151.940MHz the transmitter was modulated with a 2500 Hz tone at a level 16 dB greater than that required to produce 50% maximum deviation of +/- 2.5 kHz.

3. On 151.940MHz the transmitter was modulated with a 2500 Hz tone at a level 16 dB greater than that required to produce 50% maximum deviation of +/- 5.0 kHz.

4. The RF output was connected to an HP 8560E spectrum analyzer through a 30 dB, 100-watt and 10dB, 1 Watt 50 ohm RF attenuator. The center frequency of the spectrum analyzer was set to the transmitter frequency.

5. For 12.5kHz bandwidth on 151.940MHz the sweep span was set for 100 kHz and the resolution and video bandwidth set for 100 kHz.

6. For 25kHz bandwidth on 154.600MHz the sweep span was set for 300 kHz and the resolution and video bandwidth set for 300 kHz.

7. The PT-150M transmitter was keyed and the reference level for the spectrum analyzer set to the maximum level of the RF input signal. The resolution bandwidth and video bandwidth were set as described above and the results plotted along with emission mask B for 25kHz Channel Bandwidth and mask D for 12.5kHz Channel Bandwidth.

TYPE OF EXHIBIT: OCCUPIED BANDWIDTH

FCC PART: 2.1049(c)(1), 90.210(d)

MANUFACTURER: RITRON, Inc.

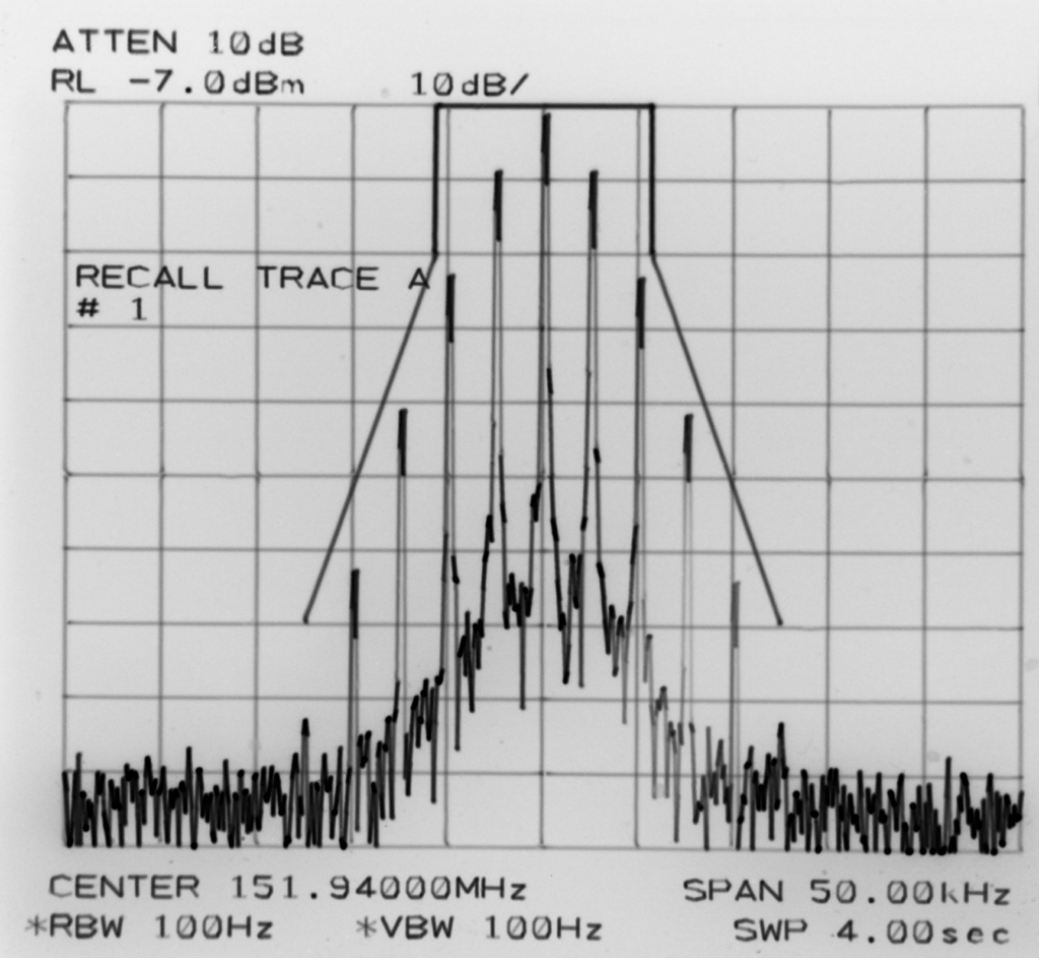
MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results: 12.5 kHz channel operation



Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: OCCUPIED BANDWIDTH

FCC PART: 2.1049(c)(1), 90.210(d)

MANUFACTURER: RITRON, Inc.

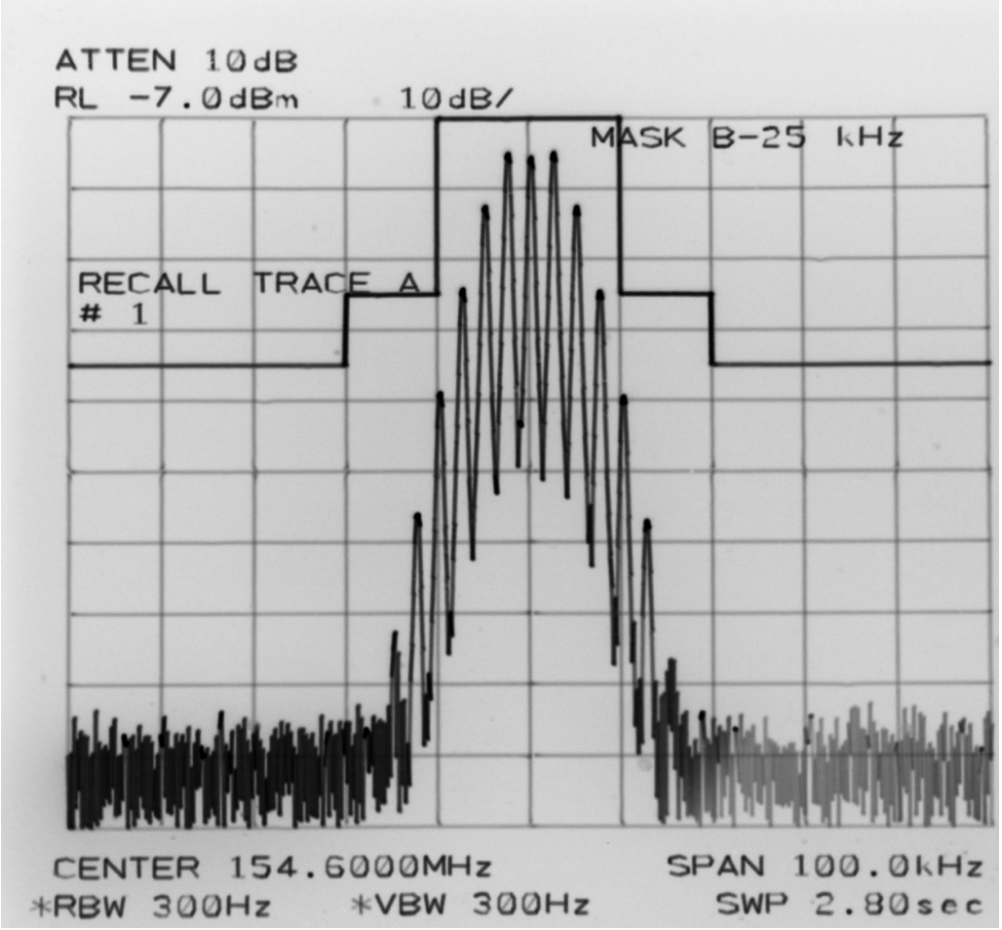
MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results: 25 kHz channel operation



Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: BANDWIDTH CALCULATION/MODULATION TYPE

FCC PART: 2.1049(c)(1), 95.631(j)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results:

Modulation:

This device used direct frequency modulation with a nominal maximum deviation of 2.5 kHz for 12.5 kHz channel operation and 5 kHz for 25 kHz channel operation.

Occupied Bandwidth:

By Carson's rule, the occupied bandwidth for an FM signal may be calculated by:

$BW = 2(f_\Delta + f_m)$ where f_Δ is the frequency deviation and f_m is the modulating frequency.

12.5 kHz channel operation:
The necessary bandwidth for the narrowband voice channels is:

Maximum modulation frequency (f_m) in kHz = 3
Maximum deviation (f_Δ) in kHz = 2.5
Necessary bandwidth for **narrowband** in kHz = 2(2.5 + 3) = 11

Narrowband emissions designator applied for is 11K0F3E.

25 kHz channel operation:
The necessary bandwidth for the wide band voice channels is:

Maximum modulation frequency (f_m) in kHz = 3
Maximum deviation (f_Δ) in kHz = 5
Necessary bandwidth for **wideband** in kHz = 2(5 + 3) = 16

Wideband emissions designator applied for is 16K0F3E.

TYPE OF EXHIBIT: CONDUCTED SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1051, 95.635(e)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

Procedure:

1. The PT-150M was aligned for transmitter operation at the band edges and the band center for 2 watts. The transmitter was modulated with a 2500 Hz tone at a level 16 dB greater than that required to produce 50% maximum deviation at the modulation frequency of maximum deviation. The maximum deviation was set for +/- 2.5 kHz.

2. The RF output was connected to an HP 8560E spectrum analyzer through a 30 dB, 100 watt, and a 10dB, 1 Watt 50 ohm RF attenuator. The center frequency of the spectrum analyzer was set to the transmitter frequency. The frequency span and resolution and video bandwidths were set to 100 kHz. The transmitter was keyed and the reference level on the analyzer noted.

3. A RF highpass filter was inserted into the path from the attenuator to the spectrum analyzer. The transmitter was keyed and the output spectrum was examined from 9 kHz to 10 times the operating frequency, except within 100 kHz of the operating frequency. The attenuation of the highpass filter at the transmitter spurious frequencies was measured and factored into the attenuator calculations.

TYPE OF EXHIBIT: CONDUCTED SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1051, 95.635(e)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results:

Spur Pwr(dBm) = Spur level @ analyzer(dBm) + Attenuator loss(dB)
Corr. Spur(dBc) = Spur Pwr(dBm) + 33dBm(2 Watts)

Output Power = 2 watts (33dBm)

Frequency (MHz)	Spur Frequency (MHz)	Analyzer (dBm)	Spur Pwr (dBm)	Corr. Spur (dBc)	Limit (dBc)	dB Below (dBc)
151.820	455.460	-77	-37	-70	-53	17
	607.280	-67	-27	-60	-53	7
	759.100	-73	-33	-66	-53	13
	910.920	-78	-38	-71	-53	18
	1062.740	-74	-34	-67	-53	14
151.940	455.820	-78	-38	-71	-53	18
	607.760	-64	-24	-57	-53	4
	759.700	-74	-34	-67	-53	14
	911.640	-79	-39	-72	-53	19
	1063.580	-75	-35	-68	-53	15
154.600	618.400	-65	-25	-58	-53	5
	773.000	-76	-36	-69	-53	14
	927.600	-78	-38	-71	-53	18
	1082.200	-71	-31	-64	-53	11

All unreported emissions were more than 20dB below the FCC Limit.

Signed:

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

PROCEDURE:

1. The measurements for field strength of spurious emissions were taken at the RITRON, Inc. 3-meter test site, details of which are on file with the FCC and Industry Canada.

2. The PT-150M was aligned for transmitter operation on 151.820MHz, 151.940MHz, and 154.600MHz at the 2 watt maximum output power. The unit was then terminated at the antenna port with a non-radiating 50-ohm load.

3. All field strength measurements were made with the Hewlett-Packard Model 8560E and 8559A Spectrum Analyzers and either a log periodic antenna, dipoles, or a microwave horn antenna depending upon frequency.

4. The transmitter was keyed and the spectrum searched from 30 MHz to the 10^{th} harmonic of the transmit carrier. When a spurious emission was found, the height and polarization of the field strength measurement antenna and orientation of the PT-150M were varied to provide maximum field strength.

5. A substitution antenna, a calibrated dipole, was substituted for the PT-150M at the PT-150M location. An RF signal generator was set for the frequency of the PT-150M with the level at the substitution antenna noted.

6. The polarization of the substitution antenna was adjusted for maximum signal strength at the field strength measuring antenna. The level at the field strength antenna was noted.

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

EQUATIONS:

The spurious emission level is:

Spur(dBm) = Pspur(dBm) + Pgen(dBm) – Pref(dBm)

Where:

Pspur is the power level of the radio's emission at the receiving antenna output.

Pgen is the RF signal generator level at the substitution antenna input.

Pref is the power level of the substitution antenna emission at the receiving antenna output.

Spur Level = Pref + 33dBm(2 watts)

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

RESULTS:

Horizontal Polarization – 2 Watts

Freq. (MHz)	Spur Freq. (MHz)	Pspur (dBm)	Pgen (dBm)	Pref (dBm)	Spur Level (dBc)	Limit (dBc)	dB Below Limit
151.820	1062.740	-71.2	0.0	-40.8	-63.4	-53.0	10.4
151.940	1063.580	-70.7	0.0	-41.2	-62.5	-53.0	9.5
154.600	927.600	-75.2	0.0	-35.7	-72.5	-53.0	19.5
	1082.200	-64.8	0.0	-41.8	-56.0	-53.0	3.0

Vertical Polarization – 2 Watts

Freq. (MHz)	Spur Freq. (MHz)	Pspur (dBm)	Pgen (dBm)	Pref (dBm)	Spur Level (dBc)	Limit (dBm)	dB Below Limit
151.820	1062.740	-77.2	0.0	-45.7	-64.5	-53.0	11.5
151.940	1063.580	-77.2	0.0	-47.3	-62.9	-53.0	9.9
154.600	618.400	-74.2	0.0	-34.7	-72.5	-53.0	19.5
	1082.200	-69.8	0.0	-46.0	-56.8	-53.0	3.8

All unreported emissions were more than 20dB below the FCC Limit.

Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: FREQUENCY STABILITY VS TEMPERATURE

FCC PART: 2.1055(a)(1), 95.632

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Procedure:

1. The PT-150M was aligned for transmitter operation at 151.940 MHz at 2 Watts.

2. The PT-150M was placed in a Delta Design Model 3900 CL Temperature Chamber. The RF output of the PT-150M was connected to an HP 8920 Test Set to monitor the transmitter frequency. A Gw Instek GPR-7550D Power Supply was adjusted for a nominal voltage of 7.4 VDC and connected to the battery contacts of the PT-150M. A Triplett Model 320-G/P Thermocouple was used to monitor the temperature inside the chamber.

3. The chamber and the PT-150M were heated to +50 degrees C and allowed to stabilize for 30 minutes for the first measurement and 30 minutes for each 10 degree decrement in temperature until the unit reached a temperature of –30 degrees C.

4. The RF frequency at each temperature was recorded and compared with the frequency at 25 degrees C.

Temp C	Frequency (MHz)	Error (ppm)
-30	151.940217	1.43
-20	151.940196	1.29
-10	151.940194	1.28
0	151.940159	1.05
10	151.940085	0.56
20	151.940025	0.16
25	151.940000	0.00
30	151.939872	-0.84
40	151.939977	-0.15
50	151.939993	-0.05

TYPE OF EXHIBIT: FREQUENCY STABILITY VS TEMPERATURE

FCC PART: 2.1055(a)(1), 95.632

MANUFACTURER: RITRON, Inc.

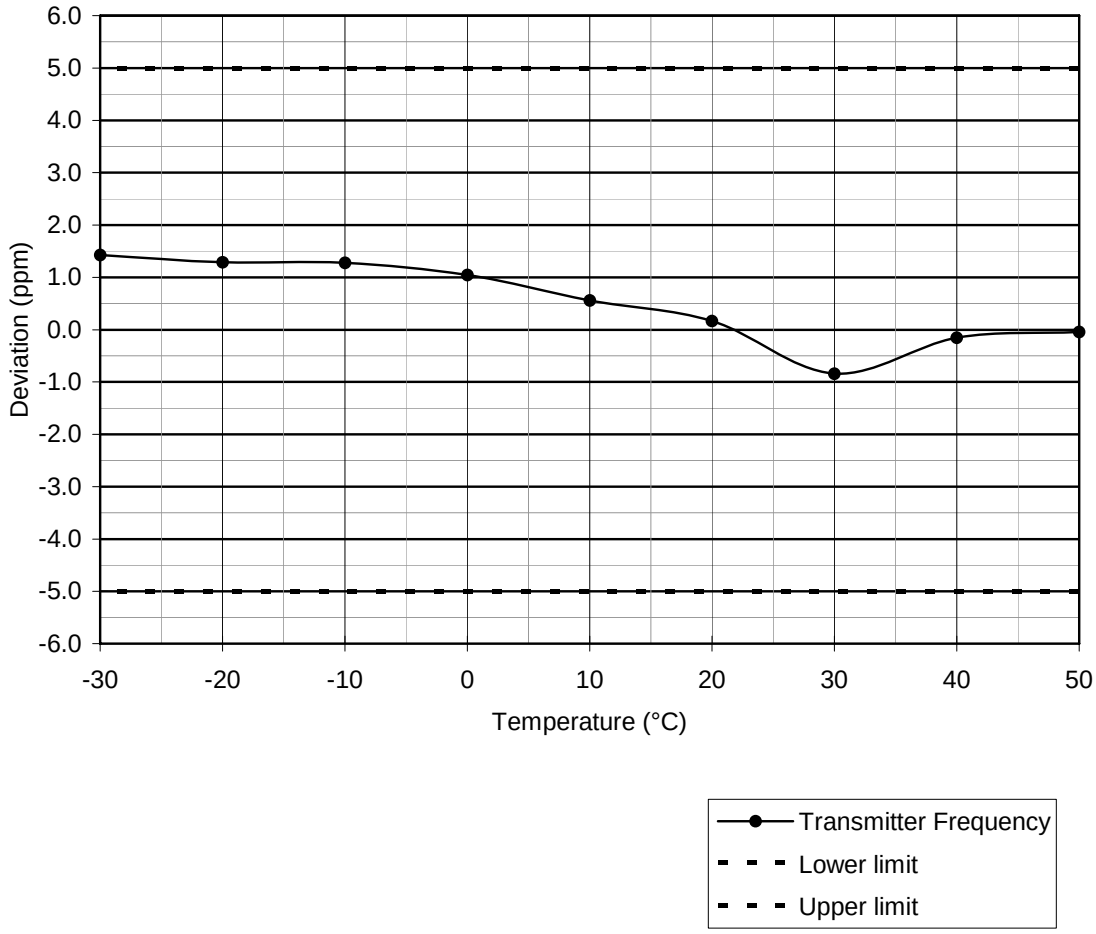
MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: October 18, 2012

Results:



Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager

TYPE OF EXHIBIT: FREQUENCY STABILITY VS SUPPLY VOLTAGE

FCC PART: 2.1055(d)(1)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

Procedure:

1. The PT-150M was aligned for transmitter operation at 151.940 MHz at full rated power.

2. The RF output of the PT-150M was connected to an HP 8920B Test Set to monitor the transmitter frequency. A Gw Instek GPR-7550D Power Supply was adjusted for a nominal voltage of 7.4 VDC and connected to the DC power supply input of the PT-150M. The output frequency of the PT-150M was noted and used as the reference for the results in paragraph 3 below.

3. The voltage out of the DC power supply was adjusted to between 85% and 115% of nominal (7.4 VDC) and the output frequency noted.

TYPE OF EXHIBIT: FREQUENCY STABILITY VS SUPPLY VOLTAGE

FCC PART: 2.1055(d)(1)

MANUFACTURER: RITRON, Inc.

MODEL: PT-150M

TYPE OF UNIT: VHF-MURS Transceiver

FCC ID: AIERIT29-150M

DATE: September 26, 2012

Results:

VDC	Condition	Frequency (Mhz)	Error (ppm)
6.29	Battery @ 85%	151.940002	0.00
7.40	Battery Nominal	151.940000	0.00
8.51	Battery @ 115%	151.940001	0.00

Signed: Kevin G. Matson

Kevin G. Matson - Senior Project Manager