TYPE OF EXHIBIT: TABLE OF CONTENTS

FCC PART: 2.1033(c)(14)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

TYPE OF EXHIBIT: LIST OF TEST EQUIPMENT USED

FCC PART: 2.947(d)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

ITEM	MAKE/MODEL	SERIAL NO.	CAL.	NEXT CAL.
DC Power Supply	HQ PS3010U	N/A	N/A	
Multimeter	HP3466A	N/A	N/A	
RF Test Set	HP 8920A	3352A03633	10/02/2013	10/02/2014
Spectrum Analyzer	Advantest R3265A	75060189	10/02/2013	10/02/2014
Spectrum Analyzer	HP 8560E	3720A02980	10/02/2013	10/02/2014
Storage Scope	Fluke PM3335	DM630034	N/A	N/A
Temp. Chamber	Delta Design 3900	0-52-R	N/A	N/A
Thermocouple	Triplett 320-G/P		N/A	N/A
Log Periodic	Electro-Metrics LPA-25	8-102	05/17/2011	05/17/2014
Adjustable Dipoles	Electro-Metrics EM-6924	291	04/08/2014	04/08/2015
Adjustable Dipoles	Ritron		05/17/2011	05/17/2014
Gain Horn	Emco #3105	3105	10/21/2013	10/21/2015

TYPE OF EXHIBIT: MEASUREMENT METHODS

FCC PART: 2.947

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

All of the measurements made on this device and included in this report were made per ANSI/TIA-603-C-2004.

Kevin G. Matson
Senior Project Manager
RITRON, Inc.

TYPE OF EXHIBIT: DESCRIPTION OF MEASUREMENT FACILITY

FCC PART: 2.948

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

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.

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.

Kevin G. Matson
Senior Project Manager
RITRON, Inc.

TYPE OF EXHIBIT: RADIO FREQUENCY OUTPUT POWER

FCC PART: 2.1046(a)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 was aligned for transmitter operation at three power levels per the tune-up procedure outlined in the Maintenance manual for frequencies at the lower, middle, and upper band edges.

2. Power was supplied to the DTX-165 by an Astron VS-20M Power Supply. The DTX-165 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. The voltage across an internal shunt in series with the power supply lead of the RF Power Module was used with an Fluke 45 Digital Multimeter to measure current (Id). A B&K 2704A was used to measure the RF Power Module output stage power control voltage (Vcon) and drain voltage (Vd).

4. Measurements were taken at power levels 5 watts, 15 watts, and 30 watts.

TYPE OF EXHIBIT: RADIO FREQUENCY OUTPUT POWER

FCC PART: 2.1046(a)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

150.815 MHz

Pout(W)	Vcntl(V)	Vd(V)	Id(A)	Eff (%)
5	3.5	12.4	2.3	17.5
15	3.9	12.4	3.9	31.0
30	4.6	12.3	5.8	42.1

161.565 MHz

Pout(W)	Vcntl(V)	Vd(V)	Id(A)	Eff (%)
5	3.6	12.4	2.3	17.5
15	4.0	12.4	4.0	30.2
30	4.7	12.3	6.0	40.7

173.390 MHz

Pout(W)	Vcntl(V)	Vd(V)	Id(A)	Eff (%)
5	3.5	12.5	2.6	15.4
15	4.4	12.5	4.4	27.3
30	4.5	12.5	6.1	39.3

TYPE OF EXHIBIT: MODULATOR RESPONSE-12.5 kHz CHANNELS

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 modulator response was measured from the audio input to the modulator input.

2. The unit was swept in frequency from 100 Hz to 10 kHz and the results noted. Plots are shown for 12.5 kHz channel spacing operation for both flat and pre-emphasized modes and for 6.25 kHz channel spacing for flat mode. The frequency response is independent of carrier frequency.

TYPE OF EXHIBIT: MODULATOR RESPONSE-12.5 kHz CHANNELS

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

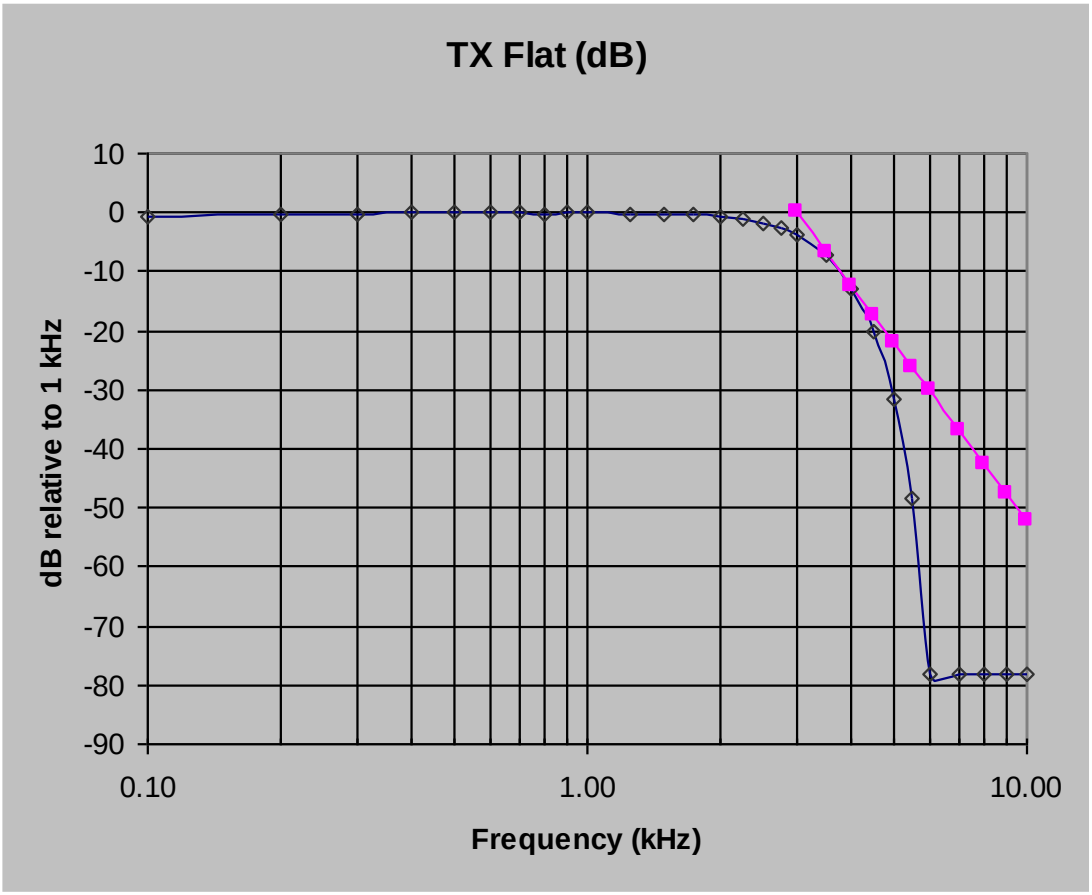
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Flat audio input



TYPE OF EXHIBIT: MODULATOR RESPONSE-12.5 kHz CHANNELS

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

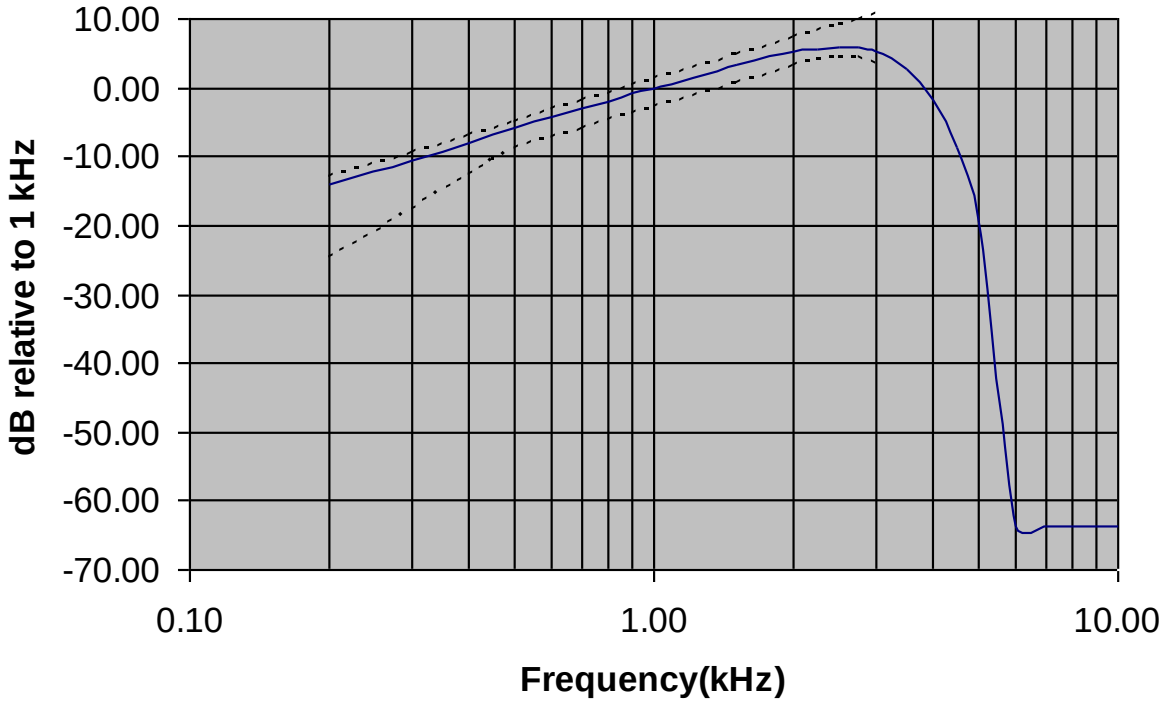
TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Pre-emphasized audio

TX Pre-emphasized



TYPE OF EXHIBIT: MODULATOR RESPONSE-6.25 kHz CHANNELS

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

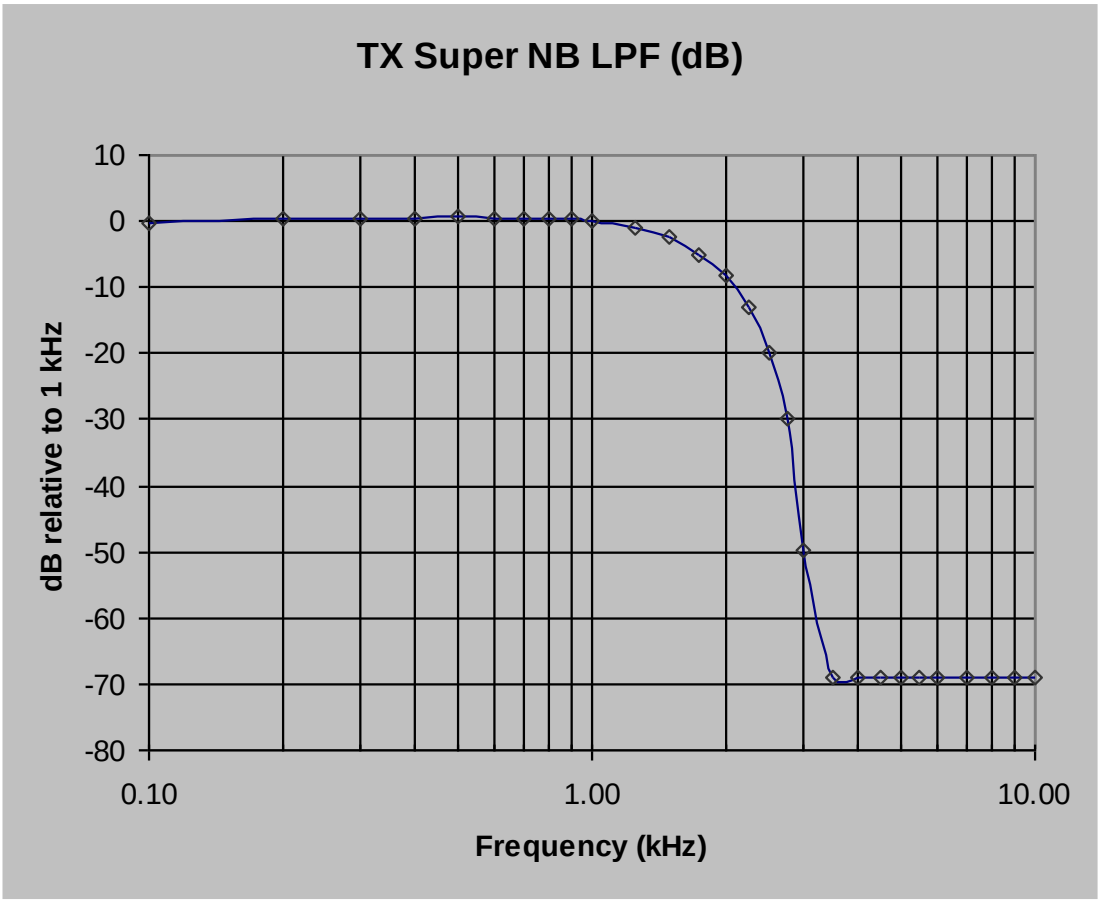
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Flat audio



TYPE OF EXHIBIT: CLIPPER FILTER RESPONSE

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The audio output of the audio test set was coupled into the audio input of the DTX-165. The flat input mode was selected. The audio input of the test set was connected to the input of the modulator.

2. The audio generator frequency was swept from 100 Hz to 10 kHz and the response for 12.5 kHz and 6.25 kHz channel spacing operation noted and plotted. The frequency response is independent of carrier frequency.

TYPE OF EXHIBIT: CLIPPER FILTER RESPONSE-12.5 kHz CHANNELS

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

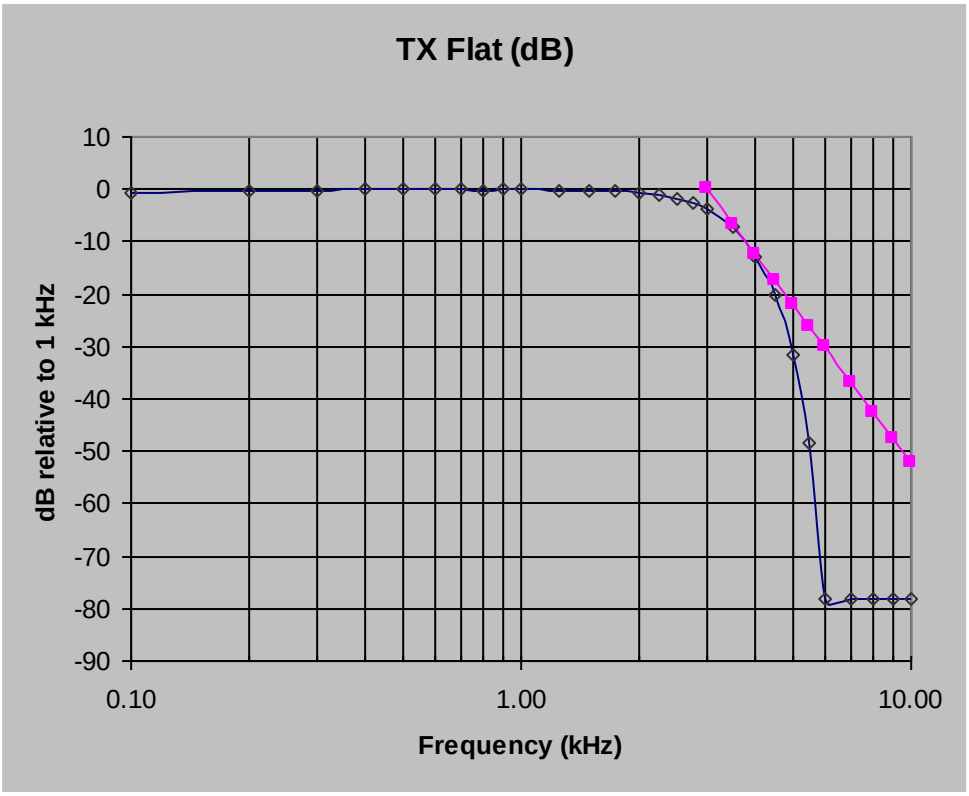
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:



TYPE OF EXHIBIT: CLIPPER FILTER RESPONSE-6.25 kHz CHANNELS

FCC PART: 2.1047(a)

MANUFACTURER: RITRON, Inc.

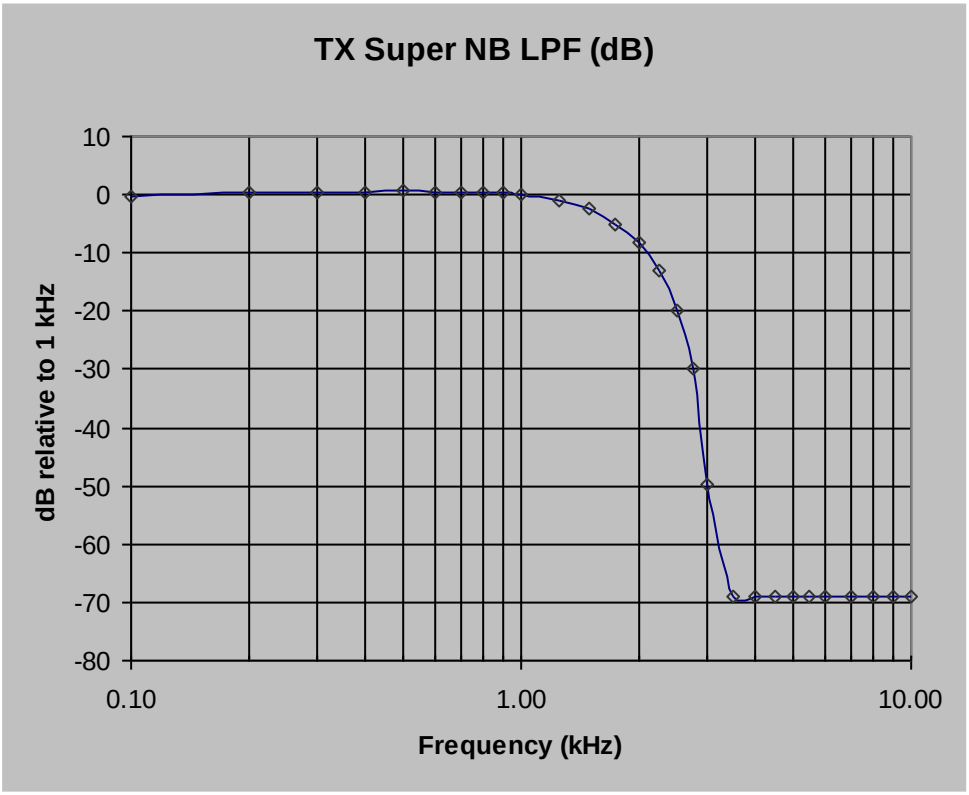
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:



TYPE OF EXHIBIT: MODULATION LIMITING CURVES

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 was aligned for transmitter operation on per the tune-up procedure outlined in the Maintenance manual.

2. The RF output was connected to the RF input of a radio Test Set configured to measure FM deviation. The audio output of the audio test set was routed to the audio input of the DTX-165.

3. The frequency of the audio generator was adjusted on each transmit filter to find the frequency of maximum response and percentage modulated deviation was calculated relative to this. The DTX-165 transmit deviation was adjusted for 2.4 kHz maximum deviation for 12.5 kHz channel spacing and 1.1 kHz for 6.25 kHz channel spacing.

4. Percentage modulation plots are given for the narrowband and super narrowband. Both flat and pre-emphasized are shown for narrowband, and only flat was shown for super narrowband since super narrowband cannot support analog voice.

5. Three varying audio frequencies with increasing input level were used in each plot to show the limiting characteristics.

TYPE OF EXHIBIT: MODULATION LIMITING CURVES-12.5 kHz CHANNELS

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

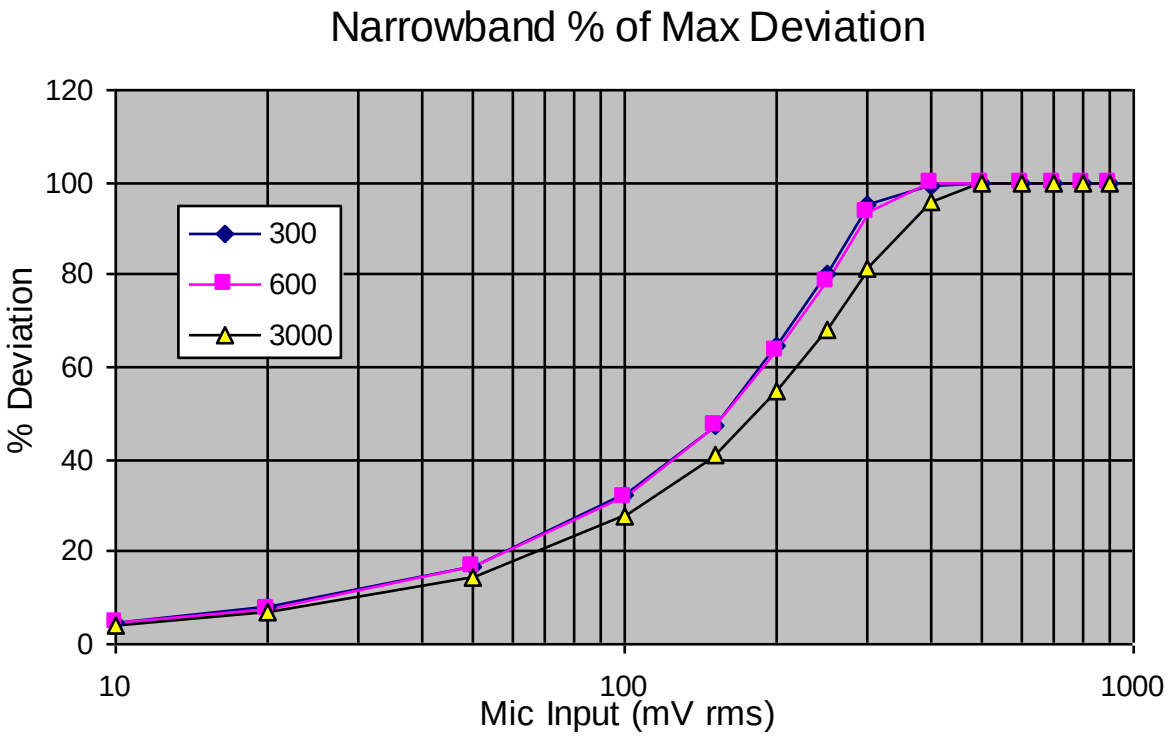
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Flat audio input



TYPE OF EXHIBIT: MODULATION LIMITING CURVES-12.5 kHz CHANNELS

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

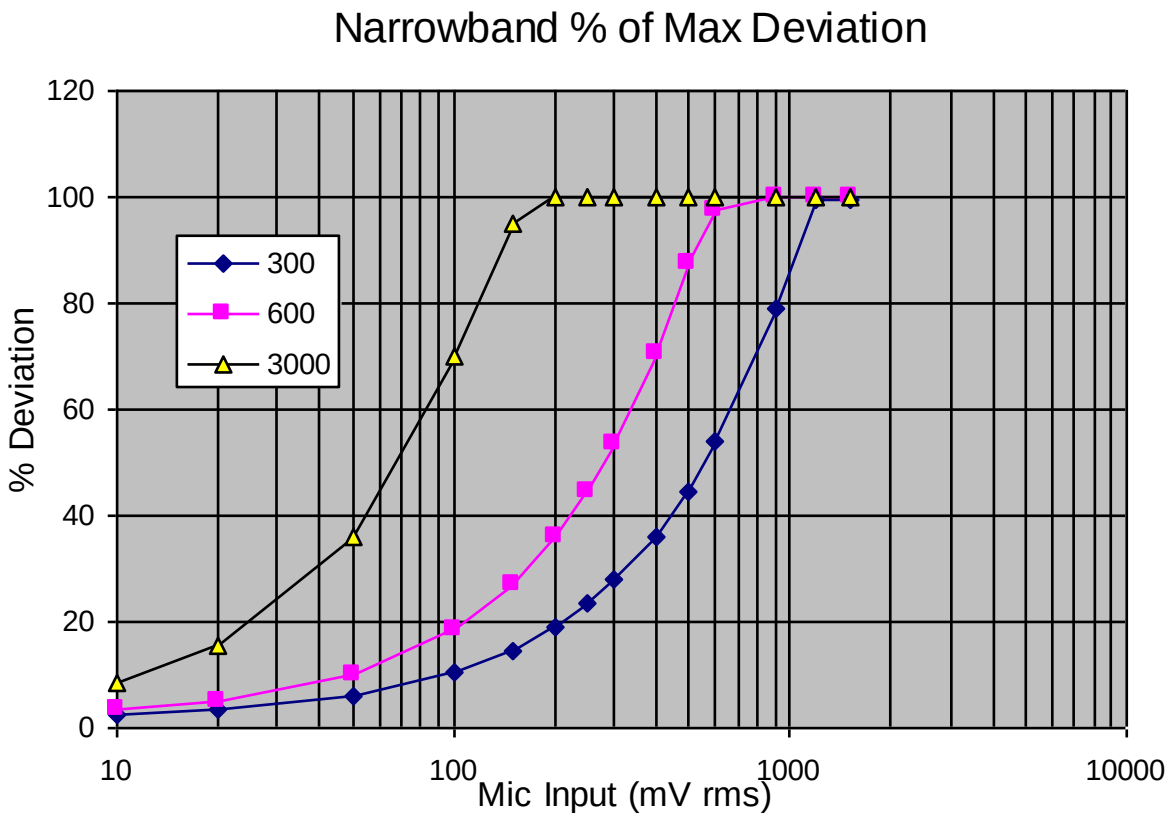
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Pre-emphasized audio input



TYPE OF EXHIBIT: MODULATION LIMITING CURVES-6.25 kHz CHANNELS

FCC PART: 2.1047(b)

MANUFACTURER: RITRON, Inc.

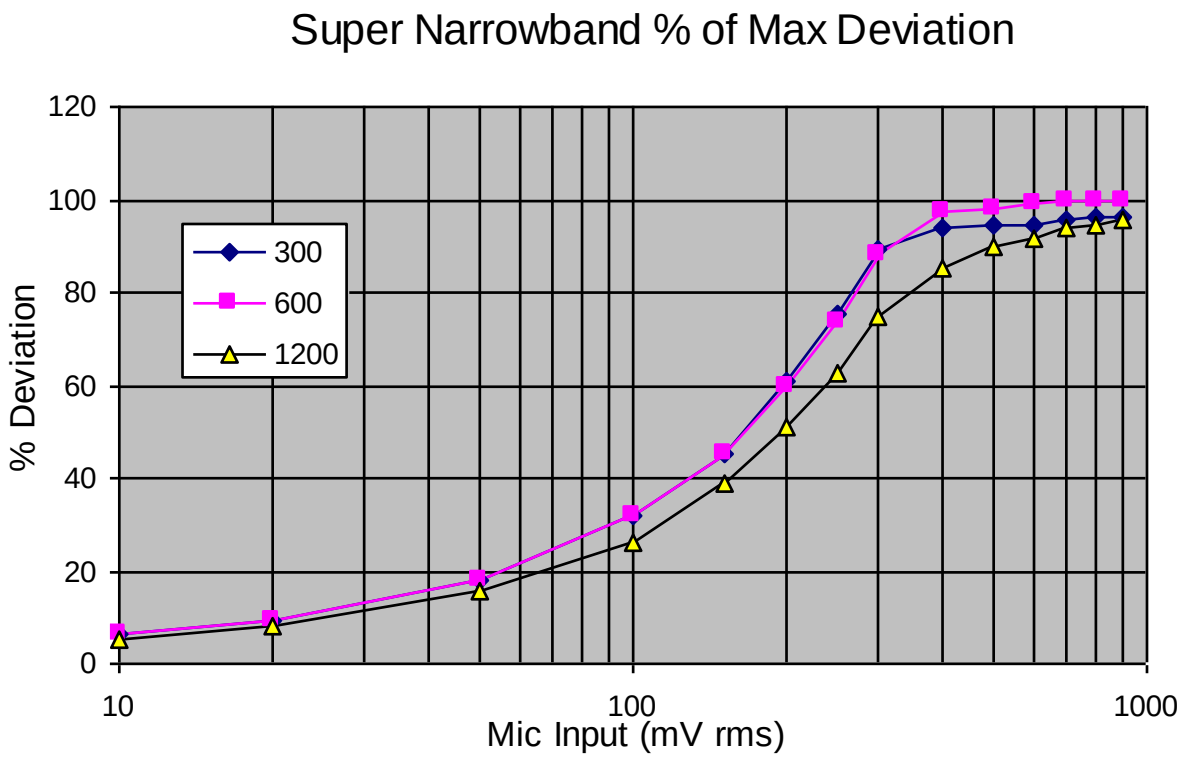
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:



TYPE OF EXHIBIT: OCCUPIED BANDWIDTH

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

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. For 12.5 kHz channel voice operation, a 2.5 kHz audio signal was applied to the microphone input of the unit. Its level was adjusted to be 16 dB above that required to produce 50% of peak deviation at the frequency of maximum deviation. The deviation adjustment was set for 2.4 kHz maximum deviation for 12.5 kHz channel operation and a spectrum analyzer was connected to the RF output through an RF power attenuator. The analyzer was set to sweep +/-25 kHz of carrier with a reference level set to that of an unmodulated carrier.

2. For 12.5 kHz digital voice operation, an external 2400 bps 4 level FSK pseudo random code generator was applied to the input and set to +/-2.4 kHz deviation. The analyzer was set to sweep +/-25 kHz of carrier with a reference level set to that of the unmodulated carrier. Digital voice and data are indistinguishable when viewed on a spectrum analyzer and therefore, will be shown as one plot.

3. For 6.25 kHz digital voice operation, the deviation was decreased to +/-1.1 kHz and the analyzer set to sweep +/-10 kHz either side of the carrier. Digital voice and data are indistinguishable when viewed on a spectrum analyzer and therefore, will be shown as one plot. Also, digital and voice and data can also be combined as a common signal with the plot appearing the same as data or digitized voice.

4. The spectrum for the transmission of a continuous wave identification tone for 6.25 kHz digital operation is also shown as well as that for 12.5 kHz audio frequency shift keyed data (2400 bps, pn sequence, 1200/2400 Hz tones).

The occupied bandwidth plots are independent of carrier frequency, therefore, only the plots for 161 MHz are shown.

TYPE OF EXHIBIT: OCCUPIED BANDWIDTH-12.5 kHz CHANNELS

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

MANUFACTURER: RITRON, Inc.

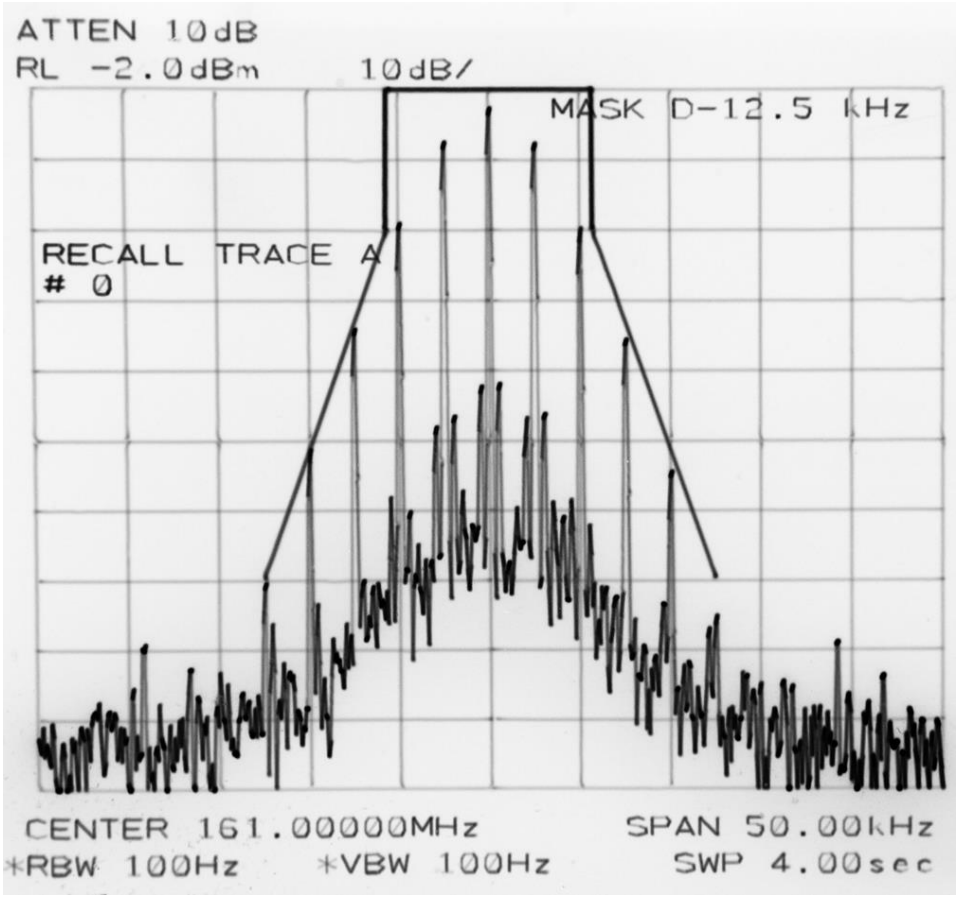
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Analog Voice Modulation (2.5 kHz)



TYPE OF EXHIBIT: OCCUPIED BANDWIDTH-12.5 kHz CHANNELS

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

MANUFACTURER: RITRON, Inc.

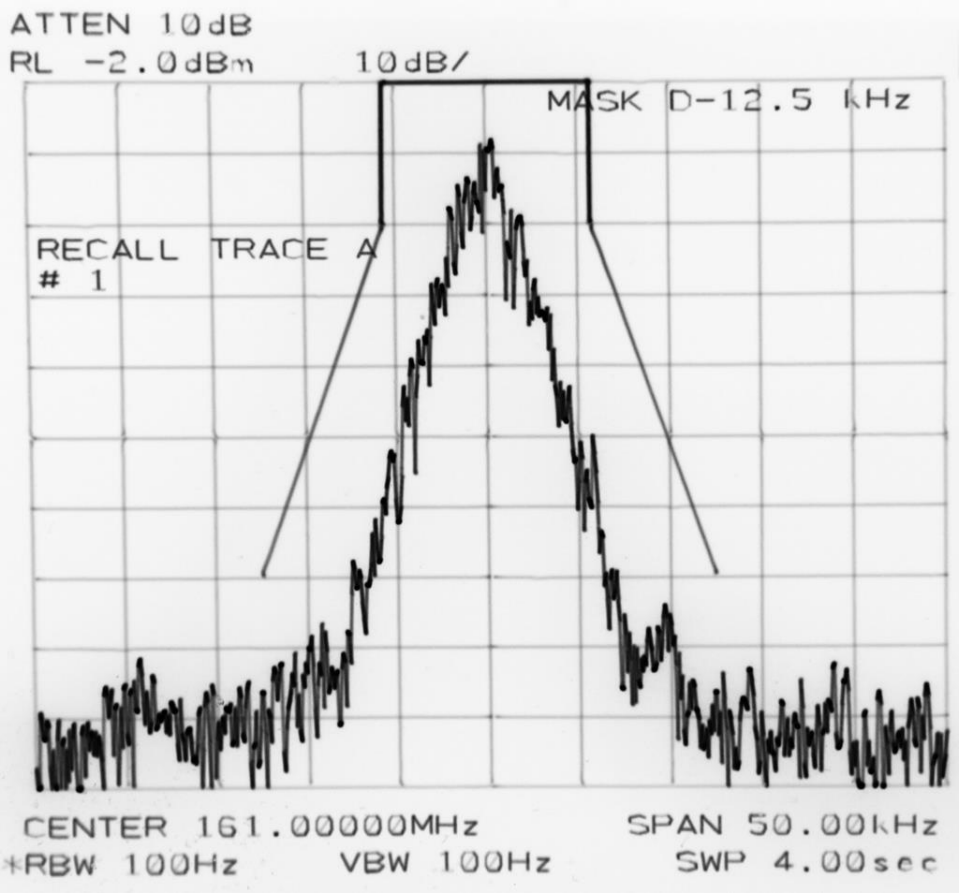
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Digital Voice/Data Modulation (9600 bps)



TYPE OF EXHIBIT: OCCUPIED BANDWIDTH-12.5 kHz CHANNELS

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

MANUFACTURER: RITRON, Inc.

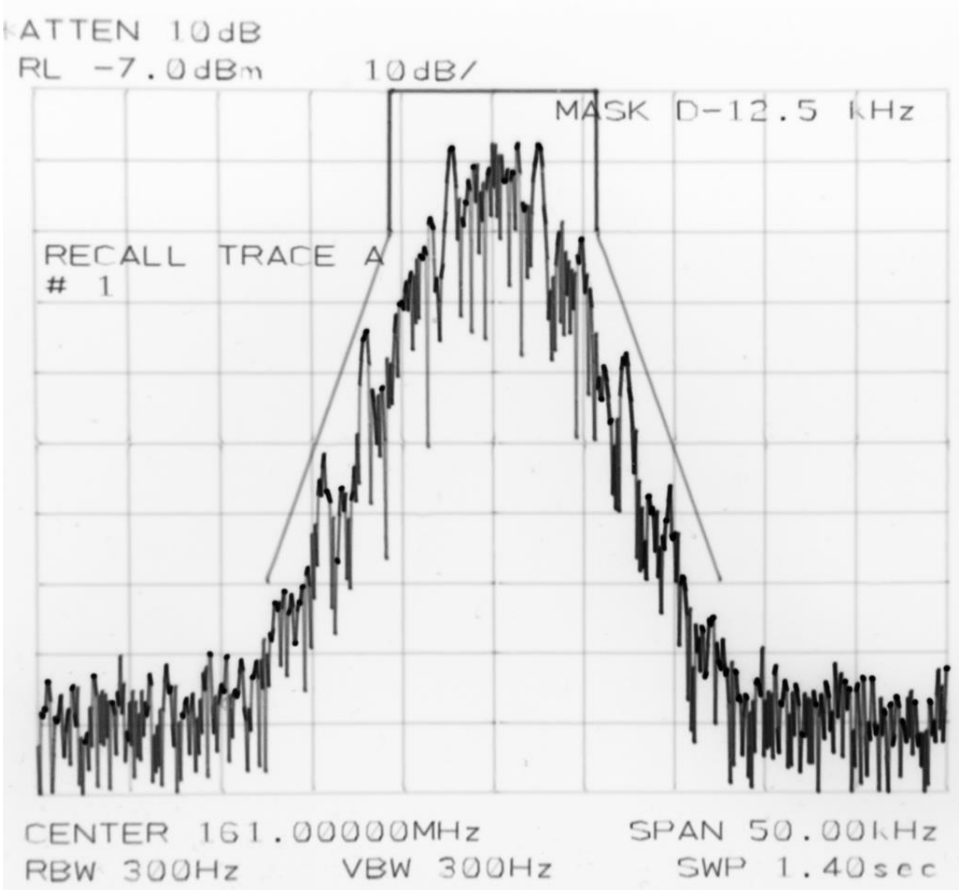
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: AFSK Data Modulation (2400bps)



TYPE OF EXHIBIT: OCCUPIED BANDWIDTH-6.25 kHz CHANNELS

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

MANUFACTURER: RITRON, Inc.

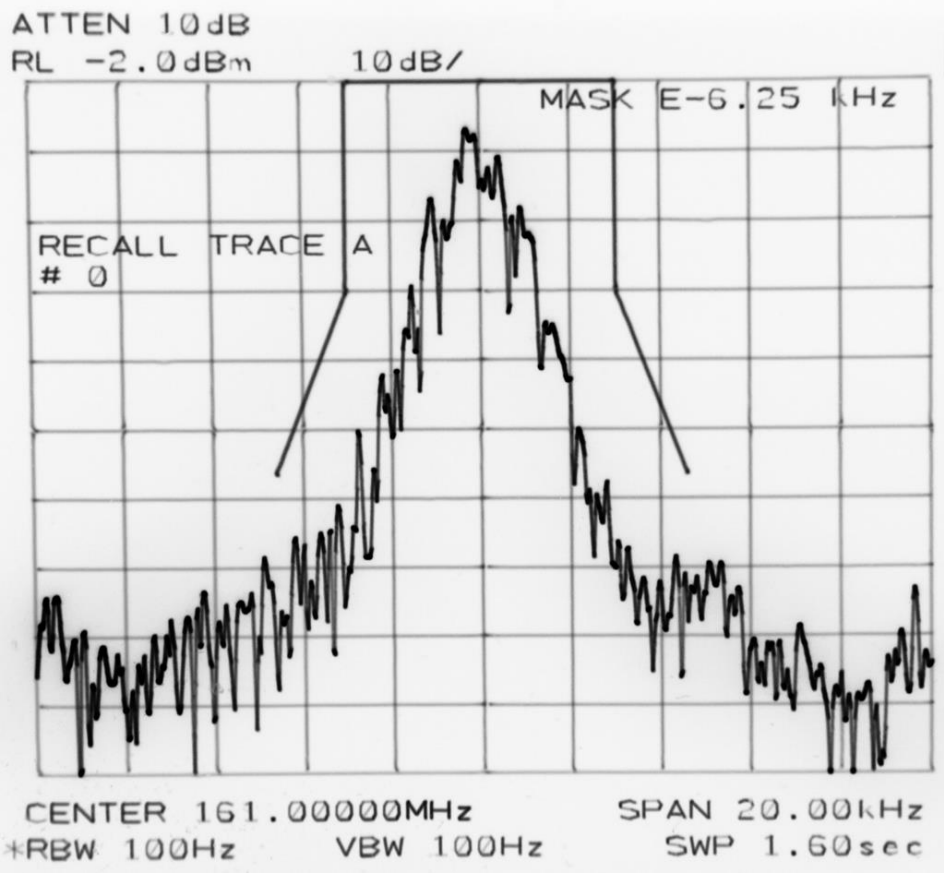
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Digital Voice/Data Modulation (4800 bps)



TYPE OF EXHIBIT: OCCUPIED BANDWIDTH-6.25 kHz CHANNELS

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

MANUFACTURER: RITRON, Inc.

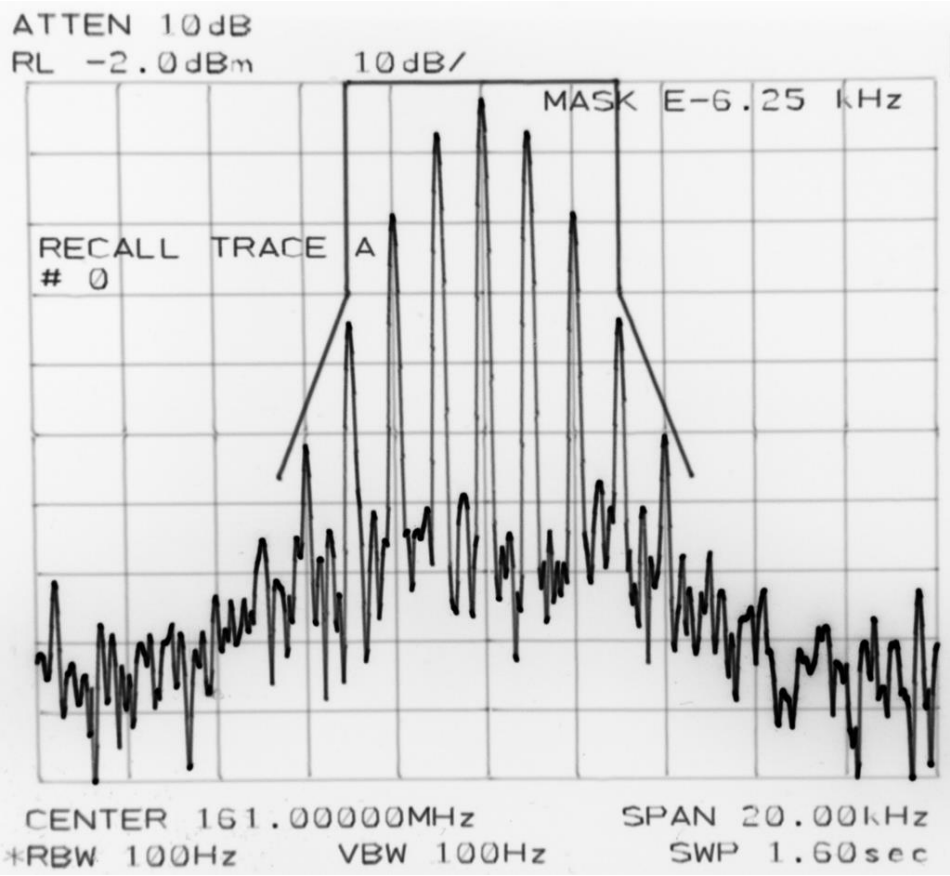
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: CW ID tone modulation



TYPE OF EXHIBIT: BANDWIDTH CALCULATION/MODULATION TYPE

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

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

Modulation:

Voice

Analog voice signals directly modulate the transmitter carrier with a maximum peak deviation which is dependant upon the channel spacing. Voice signals are pre-emphasized, limited, and filtered prior to being sent to the modulator. Digital voice signals represent the 4-level (4FSK) output of a digital voice encoder and directly modulate the transmitter carrier. The maximum deviation is dependant upon the channel spacing.

Data-4FSK

The 4FSK data stream is encoded into dibits at half the original data rate and used to create a 4-level audio signal which passes through a root-raised cosine filter and is then used to directly modulate the transmitter carrier. The maximum deviation is dependent upon the channel spacing.

CW ID Tone

The on-off (OOK) CW sequence modulates an audio subcarrier, which then frequency modulates the radio. The maximum deviation is dependent upon the channel spacing.

Data-AFSK

The AFSK data stream is used to frequency an audio subcarrier at 1800 Hz. The peak audio deviation is +/-600 Hz. This signal is in turn filtered and used to directly frequency modulate the transmitter carrier with a peak deviation dependent upon the channel spacing.

TYPE OF EXHIBIT: BANDWIDTH CALCULATION/MODULATION TYPE

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

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

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.

Modulation	f_Δ	f_m	BW	Emissions Designator
Analog Voice				
12.5 kHz	2.5	2.5	10.0	10K0F3E
Digital Voice				
6.25 kHz	1.05	0.95	4.0	4K00F1E
12.5 kHz	2.10	1.90	8.0	8K00F1E
4FSK Data				
6.25 kHz	1.05	0.95	4.0	4K00F1D
12.5 kHz	2.10	1.90	8.0	8K00F1D
Digital Voice/Data Combination				
6.25 kHz	1.05	0.95	4.0	4K00F7W
12.5 kHz	2.10	1.90	8.0	8K00F7W

TYPE OF EXHIBIT: BANDWIDTH CALCULATION/MODULATION TYPE

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

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Cont.

Modulation	f_Δ	f_m	BW	Emissions Designator
CW ID Tone				
6.25 kHz	1.0	1.0	4.0	4K00F2D
AFSK Data				
12.5 kHz	2.5	1.8	8.6	8K60F2D

TYPE OF EXHIBIT: CONDUCTED SPURIOUS EMISSIONS

FCC PART: 2.1051, 90.210(d)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 was aligned for transmitter operation at the band edges at power levels 5, 15, and 30 watts per the tune-up procedure outlined in the Maintenance manual. The transmitter was modulated in a manner consistent with the type of signal to be transmitted.

2. The RF output was connected to an HP 8560E spectrum analyzer through a 30 dB, 100 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 show spurious emissions at least 80 dB below the unmodulated carrier level. The transmitter was keyed and the reference level on the analyzer noted.

3. For the transmitter harmonics, an RF highpass filter was inserted into the path from the attenuator to the spectrum analyzer.

4. 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 harmonic frequencies was measured and factored into the absolute dBm results.

5. All spurious 20 dB below the FCC specification of were not reported.

TYPE OF EXHIBIT: CONDUCTED SPURIOUS EMISSIONS

FCC PART: 2.1051, 90.210(d)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

150.815 MHz (5 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
150	fund.	37.0	NA	NA

All harmonics were 20dB below the FCC limit of -62dBc

161 MHz (5 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
161	fund.	37.0	NA	NA
322	2nd	-38.0	-75.0	-62
966	6^{th}	-41.0	-78.0	-62

173.390 MHz (5 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
174	fund.	37.0	NA	NA

All harmonics were 20dB below the FCC limit of -62dBc

150.815 MHz (15 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
150	fund.	42.0	NA	NA

All harmonics were 20dB below the FCC limit of -62dBc

161 MHz (15 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
161	fund.	42.0	NA	NA
966	6th	-38.0	-80.0	-66.8

TYPE OF EXHIBIT: CONDUCTED SPURIOUS EMISSIONS

FCC PART: 2.1051, 90.210(d)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

173.390 MHz (15 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
174	fund.	42.0	NA	NA

All Harmonics were 20dB below the FCC limit of -66.8dBc

150.815 MHz (30 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
150	fund.	45.0	NA	NA
750	5th	-42.0	-87.0	-70
900	6^{th}	-30.0	-75.0	-70
1050	7^{th}	-41.0	-86.0	-70

161 MHz (30 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
161	fund.	45.0	NA	NA

All harmonics were 20dB below the FCC limit of -70dBc

173.390 MHz (30 Watts)

Spur Freq(MHz)	Harmonic	Spur level(dBm)	Rel. Spur(dBc)	Limit(dBc)
174	fund.	45.0	NA	NA

All harmonics were 20db below the FCC limit of -70dBc

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

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 DTX-165 was aligned and programmed for transmitter operation at the band edges and middle of 150MHz to 174 MHz at a 5 and 30 watt power level per the tune-up procedure outlined in the Maintenance manual.

3. The unit was then terminated at the antenna port with a non-radiating 50-ohm load.

4. All field strength measurements were made with the Hewlett-Packard Model 8560E Spectrum Analyzers and a log periodic antenna.

5. The transmitter was keyed and the spectrum searched from 9 kHz 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 DTX-165 were varied to provide maximum field strength.

6. A substitution antenna, a calibrated dipole, was substituted for the DTX-165 at the DTX-165's location. An RF signal generator was set for the frequency of the DTX-165 with the level at the substitution antenna noted.

7. 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: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

EQUATIONS:

The spurious level is referenced to the carrier level of the transmitter, which for 5 watts is (37dBm) and for 30 watts is (44.8 dBm), maximum. The equation for spurious levels relative to carrier level is:

Pspur (dBc) = Pcarr (dBm) – Pspur (dBm)

For radiated emissions testing, Pspur (dBm) is the spurious emissions level as measured at the range receiving antenna. The reference level at the range receiving antenna for a 30 watt transmitter is:

Pcarr (dBm) = 44.8 dBm – Pgen (dBm) + Lcab (dB) + Pref (dBm)

Where:

Pcarr is the calculated level of a 30 watt transmitter into the substitution antenna.

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

Lcab is the cable loss from the substitution signal generator to the substitution antenna.

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

The overall equation thus becomes:

Pspur (dBc) = -44.8 dBm + Pgen (dBm) - Lcab (dB) - Pref (dBm)+ Pspur (dBm)

For an absolute level of the spur, the equation is:

Spur Level(dBm) = Pspur (dBm) - Pref (dBm) + Pgen (dBm) - Lcab (dB)

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

For the frequencies tested, the spurious response within 20 dB of the absolute FCC limit of -25 dBm (relative level of -62.8 dBc) are stated below:

150.815 MHz: 5 Watts

	Horizontal		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
603.260	-42.6	-25	17.6
904.890	-28.7	-25	3.7
1055.705	-38.8	-25	13.8
1357.335	-38.0	-25	13.0
1508.150	-34.9	-25	9.9

	Vertical		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
301.630	-39.2	-25	14.2
452.445	-36.8	-25	11.8
603.260	-42.5	-25	17.5
904.890	-28.8	-25	3.8
1055.705	-27.4	-25	2.4
1357.335	-39.9	-25	14.9
1508.150	-29.0	-25	4.0

150.815 MHz: 30 Watts

	Horizontal		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
301.630	-38.3	-25	13.3
452.445	-42.1	-25	17.1
904.890	-33.5	-25	8.5
1055.705	-31.1	-25	6.1
1508.150	-32.0	-25	7.0

	Vertical		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
301.630	-36.8	-25	11.8
452.445	-33.4	-25	8.4
603.260	-39.5	-25	14.5
904.890	-38.6	-25	13.6
1055.705	-33.7	-25	8.7
1206.520	-34.2	-25	9.2
1357.335	-35.4	-25	10.4

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

161.565 MHz: 5 Watts

	Horizontal		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
323.130	-42.4	-25	17.4
484.685	-38.7	-25	13.7
646.260	-41.5	-25	16.5
807.825	-41.4	-25	16.4
969.390	-39.5	-25	14.5
1130.955	-30.2	-25	7.2
1454.085	-35.5	-25	10.5

	Vertical		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
484.685	-32.4	-25	7.4
646.260	-39.0	-25	14.0
807.825	-32.7	-25	7.7
969.390	-29.2	-25	4.2
1130.995	-28.5	-25	3.5
1454.085	-30.1	-25	5.1
1728	-29.4	-25	4.4

161.565 MHz: 30 Watts

	Horizontal		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
323.130	-38.1	-25	13.1
484.695	-43.7	-25	18.7
646.260	-39.1	-25	14.1
807.825	-36.6	-25	11.6
1130.955	-38.8	-25	13.8
1454.085	-39.1	-25	14.1
1615.650	-34.8	-25	9.8

	Vertical		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
323.130	-37.7	-25	12.7
484.695	-41.6	-25	16.6
646.260	-42.0	-25	17.0
807.825	-32.5	-25	7.5
969.390	-29.2	-25	4.2
1130.955	-27.7	-25	2.7
1292.520	-35.8	-25	13.8
1454.085	-28.3	-25	3.3
1615.650	-29.8	-25	4.8

TYPE OF EXHIBIT: FIELD STRENGTH OF SPURIOUS EMISSIONS-TRANSMITTER

FCC PART: 2.1053(a), (b)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

173.390 MHz: 5 Watts

	Horizontal		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
346.780	-43.4	-25	18.4
520.170	-36.8	-25	11.8
693.560	-35.6	-25	10.6
866.950	-35.4	-25	10.4
1387.120	-35.1	-25	10.1
1733.900	-36.4	-25	11.4

	Vertical		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
346.780	-38.0	-25	13.0
520.170	-40.3	-25	15.3
693.560	-35.3	-25	10.3
866.950	-28.6	-25	3.6
1040.340	-35.6	-25	10.6
1213.730	-37.0	-25	12.0
1387.120	-29.5	-25	4.5
1733.900	-29.4	-25	4.4

173.390 MHz: 30 Watts

	Horizontal		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
346.780	-41.7	-25	16.7
520.170	-37.7	-25	12.7
693.560	-38.6	-25	13.6
866.950	-32.3	-25	7.3
1387.120	-35.4	-25	10.4
1733.900	-37.2	-25	12.2

	Vertical		
	Max Spur	FCC	FCC
Freq(MHz)	ERP(dBm)	Limit(dBm)	Margin(dB)
346.780	-38.5	-25	13.5
520.170	-36.5	-25	11.5
693.560	-34.3	-25	9.3
866.950	-29.6	-25	4.6
1040.340	-41.3	-25	16.3
1213.730	-33.8	-25	8.8
1387.120	-33.3	-25	8.3
1733.900	-29.7	-25	4.7

TYPE OF EXHIBIT: FREQUENCY STABILITY VS TEMPERATURE

FCC PART: 2.1055(a)(1), 90.213

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 was aligned for transmitter operation at 161 MHz at full rated power per the tune-up procedure outlined in the Maintenance manual.

2. The DTX-165 was placed in a Delta Design Model 3900 CL Temperature Chamber. The RF output of the DTX-165 was connected to an HP 8920 Test Set to monitor the transmitter frequency. An Astron VS-20M Power Supply was adjusted for a nominal voltage of 12.5 VDC and connected to the DC power supply input of the DTX-165. A Triplett Model 320-G/P Thermocouple was used to monitor the temperature inside the chamber.

3. The chamber and the DTX-165 were heated to 60 degrees C and allowed to stabilize for 60 minutes for the first measurement and then cooled for 30 minutes for each 10 degree increment 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 20 degrees C.

5. The DTX-165 was set for +/-12.5 kHz(narrow) mode and the carrier was unmodulated. The frequency stability remained unchanged at different emission modes, therefore, only the unmodulated data is shown.

TYPE OF EXHIBIT: FREQUENCY STABILITY VS TEMPERATURE

FCC PART: 2.1055(a)(1), 90.213

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

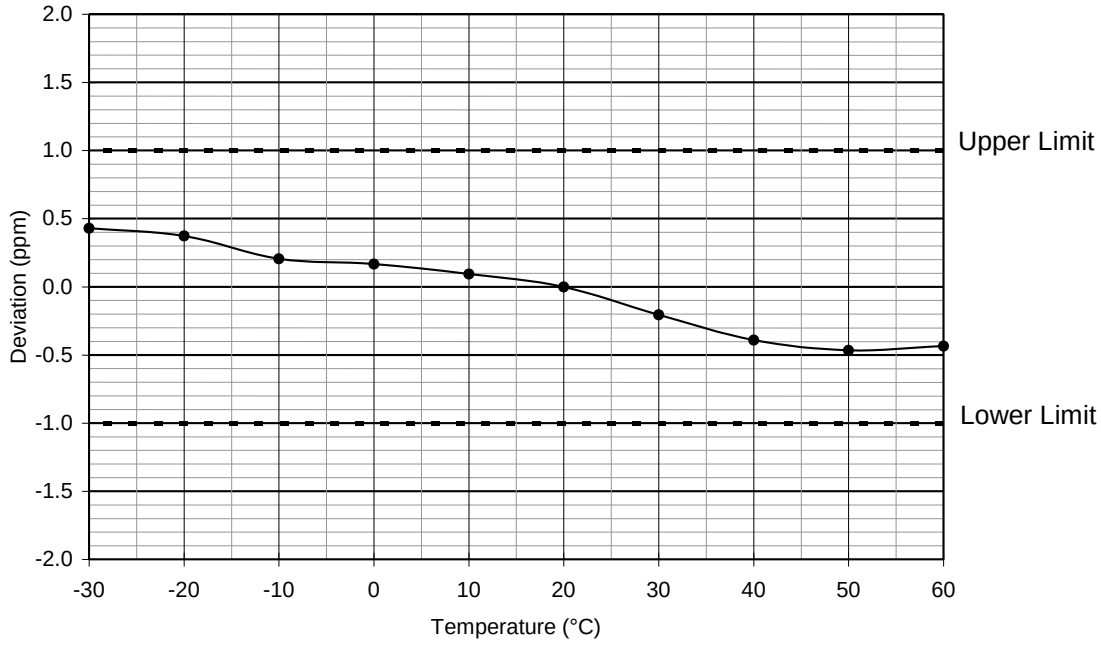
TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

Temperature (°C)	Frequency (MHz)	Deviation (Hz)	Deviation (ppm)
60	160.999775	-70	-0.43
50	160.999770	-75	-0.47
40	160.999782	-63	-0.39
30	160.999812	-33	-0.20
20	160.999845	0	0.00
10	160.999860	15	0.09
0	160.999872	27	0.17
-10	160.999878	33	0.20
-20	160.999905	60	0.37
-30	160.999914	69	0.43



TYPE OF EXHIBIT: FREQUENCY STABILITY VS SUPPLY VOLTAGE

FCC PART: 2.1055(d)(1)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 was aligned for transmitter operation at 161 MHz at full rated power per the tune-up procedure outlined in the Maintenance manual.

2. The RF output of the DTX-165 was connected to an HP 8920B Test Set to monitor the transmitter frequency. An Astron VS-20M Supply was adjusted for a nominal voltage of 12.5 VDC and connected to the DC power supply input of the DTX-165. The output frequency of the DTX-165 was noted and used as the reference for the results in paragraph 3 below.

3. The power supply voltage was set to 85% nominal and 115% nominal and the frequency noted.

4. The DTX-165 was set for +/-12.5 kHz(narrow) mode and the carrier was unmodulated. The frequency stability remained unchanged at different emission modes, therefore, only the unmodulated data is shown.

TYPE OF EXHIBIT: FREQUENCY STABILITY VS SUPPLY VOLTAGE

FCC PART: 2.1055(d)(1)

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS:

% Nominal(%)	Voltage(VDC)	ΔF(Hz)	ΔF(ppm)
85	10.6	-2	-0.01
100	12.5	0	0.00
115	14.4	2	0.01

TYPE OF TEST: TRANSIENT FREQUENCY BEHAVIOR

FCC PART: 90.214

MANUFACTURER: RITRON, Inc.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

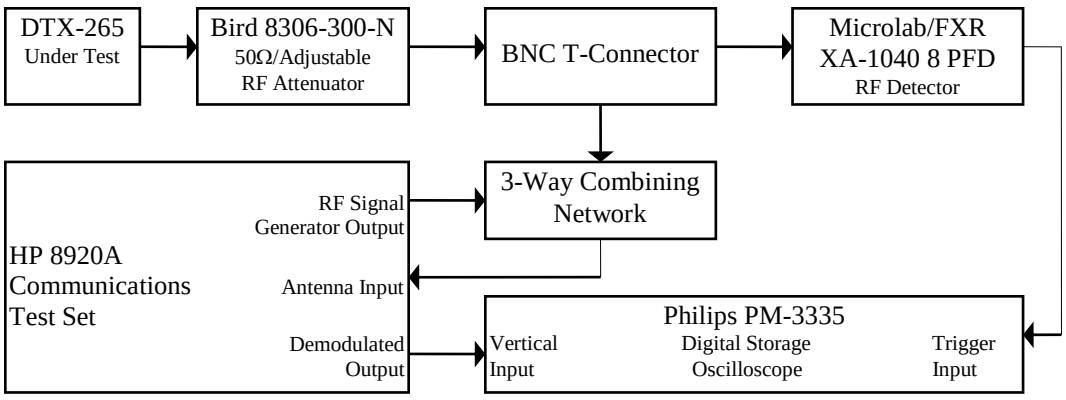
FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE:

1. The DTX-165 was aligned for transmitter operation on 161 MHz at full rated power per the tune-up procedure outlined in the Maintenance Manual.

2. The test equipment was connected per the following diagram:



3. The HP 8920A Receiver was set to measure FM deviation with the audio bandwidth set at <50 Hz to greater than 15 kHz with the RF frequency set to 161 MHz. The attenuator was set for 10 dB.

4. The DTX-165 transmitter under test was activated and the HP 8920A Spectrum Analyzer was used to measure the RF power level through the test network.

TYPE OF TEST: TRANSIENT FREQUENCY BEHAVIOR

FCC PART: 90.214

MANUFACTURER: RITRON, INC.

MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

PROCEDURE (continued):

5. The DTX-165 transmitter was turned off. The HP 8920A RF Signal Generator was set to 161 MHz at an RF level at the HP 8920A which was 30 dB below that measured in step 3 and modulated with a 1 kHz tone at +/-6.25 kHz deviation.

6. The Philips PM-3335 Digital Oscilloscope Horizontal Sweep Rate was set to 10 msec/div. The Vertical Amplitude Control was adjusted to display the 1000 Hz demodulated audio from the Signal Generator at +/-4 divisions, vertically centered on the screen.

7. The Philips PM-3335 Digital Oscilloscope was set to trigger at 1 division from the left side of the display when the RF Detector sensed RF power from the DTX-165 transmitter.

8. The DTX-165 transmitter was activated and the resulting waveform on the oscilloscope display was stored and plotted. The FCC limits per Part 90.214 were added to the plot. The resulting plot is labeled “Switch On Condition” and shows compliance with FCC Part 90.214/IC RSS-119, section 6.5.

9. The Philips PM-3335 Digital Oscilloscope was set to trigger at 1 division from the right side of the display when the RF Detector senses loss of RF power from the DTX-165 transmitter.

10. The DTX-165 transmitter was turned off and the resulting waveform on the oscilloscope display was stored and plotted. The limits per FCC Part 90.214/RSS-119, section 6.5 were added to the plot in the same manner illustrated in EIA-603 Part 3.2.19.2. The resulting plot is labeled “Switch Off Condition” and shows compliance.

11. Since this product supports 6.25 kHz and 12.5 kHz channel operation, the more stringent 6.25 kHz limits are shown.

TYPE OF TEST: TRANSIENT FREQUENCY BEHAVIOR

FCC PART: 90.214

MANUFACTURER: RITRON, INC.

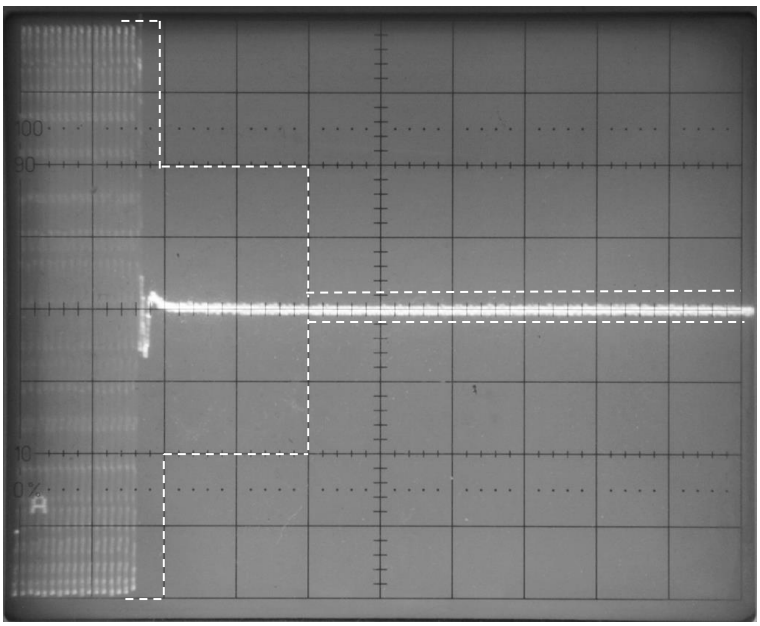
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Switch-On Condition



+6.25 kHz

+3.125 kHz

Assigned Frequency

-3.125 kHz

-6.25 kHz

10 ms/div

TYPE OF TEST: TRANSIENT FREQUENCY BEHAVIOR

FCC PART: 90.214

MANUFACTURER: RITRON, INC.

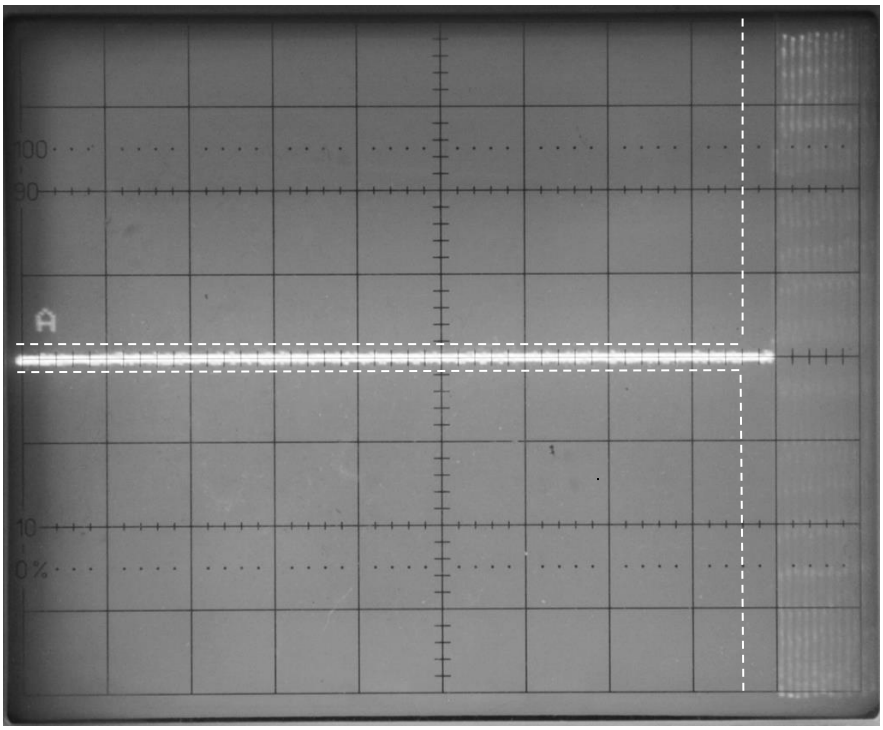
MODEL: DTX-165

TYPE OF UNIT: VHF Transceiver Module

FCC ID: AIERIT34-1650

DATE: May 12, 2014

RESULTS: Switch-Off Condition



+6.25 kHz

+3.125 kHz

Assigned Frequency

-3.125 kHz

-6.25 kHz

10 ms/div