TYPE OF EXHIBIT: LIST OF ATTACHED EXHIBITS

FCC PART: 2.1033(c)(14)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

TYPE OF EXHIBIT:	TEST EQUIPMENT LIST
FCC PART:	2.947 (d)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	DTX-142
TYPE OF UNIT:	VHF-FM Two Way Radio Transceiver Module
FCC ID:	AIERIT17-142
DATE:	May 30, 2003

The measured data in this report was obtained using one or more of the following pieces of equipment. The particular equipment used in any one test is detailed in the procedure for that test.

ITEM	**MANUFACTURER**	**MODEL NO.**	**SERIAL NO.**
Communications Test Set	Hewlett-Packard	HP8920A	3352A03633
Signal generator	Hewlett-Packard	HP8657B	3315V04378
Spectrum Analyzer	Hewlett-Packard	8559A	2010A 06979
Spectrum Analyzer	Hewlett-Packard	8560E	3720A02980
Power Supply	BK/Precision	1730	263-023610
Function Generator	BK Precision	4010	275-00280
Digital Oscilloscope	Philips	PM-3335	DM630034
Dual Display Multimeter	Protek	506	
Log Periodic Antenna	Electro-Metrics	LPA-25	8-102
Temperature Chamber	Delta Design	3900CL	0-52-R
Thermocouple	Triplet	320-G/O	
272 MHz high pass filter	Ritron		
Calibration Dipole set	Electro-Metrics	EM-6924	255

TYPE OF TEST: RADIO FREQUENCY POWER OUTPUT

FCC PART: 2.1046

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

POWER OUTPUT RANGE:

The VHF DTX-142 is designed to operate with an output power ranging from 1 watt to 5 watts. The following data show measured values under conditions of varying supply voltage and varying power adjustment setting.

PROCEDURE: The unit was set for 5.0 watts output power at 13.8 VDC. The supply voltage was varied in one-volt steps from 8 to 15 volts. The HP8920A wattmeter measured the RF output power at the different supply voltages. Then, a fixed supply voltage of 13.8 VDC was used and the power output potentiometer R222 was adjusted to obtain various output power levels.

RESULTS:

Power Supply (VDC)	Transmit Power (watts)	Transmit Current (Amps)	Radio TX Efficiency (%)
8	1.75	0.55	39.8
9	2.35	0.61	42.8
10	3.05	0.70	43.6
11	3.75	0.77	44.3
12	4.52	0.80	47.1
13	5.00	0.80	48.1
14	5.00	0.80	44.6
15	5.00	0.80	41.7

Transmit Power (watts)	Transmit Current (Amps)	Radio TX Efficiency (%)
1	0.32	22.6
2	0.44	32.9
3	0.54	40.3
4	0.62	46.8
5	0.77	47.1

TYPE OF TEST: Transmitter Audio Overall Response

FCC PART: 2.1047 (a)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

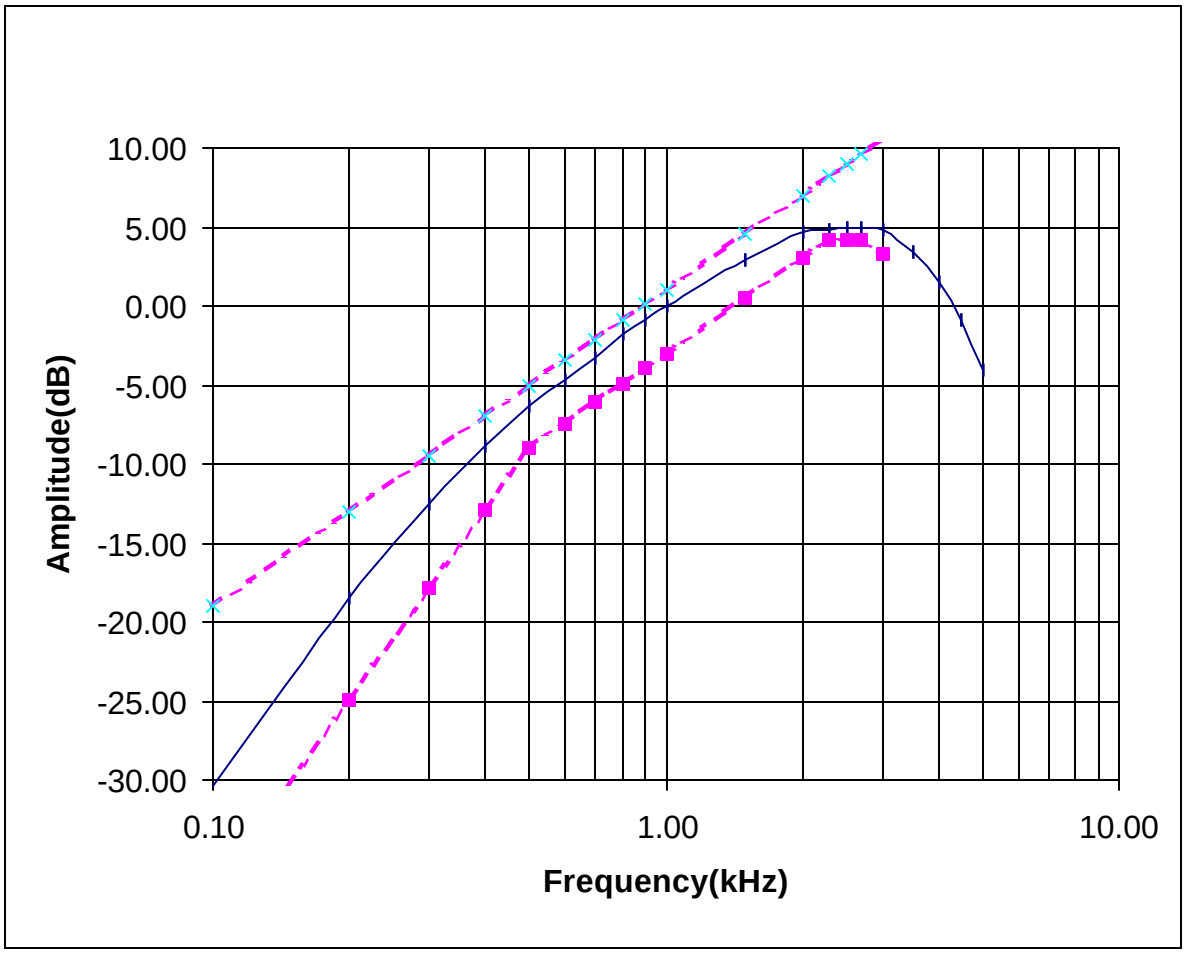
TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE: The constant deviation approach to measuring transmitter frequency response was used here (TIA-603-B). The HP8920A was used to generate and measure the audio tones. A constant deviation of 1.0 kHz was maintained by adjusting the input voltage amplitude. The output frequency response was calculated as –20 log(Vin/Vref) where the reference is 1 kHz. A 35 dB attenuator was used inserted in the microphone line to allow more accurate input measurements. TIA-603-B frequency response limits are shown.

RESULTS:



TYPE OF TEST: Transmitter Low Pass Filter

FCC PART: 2.1047 (a)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

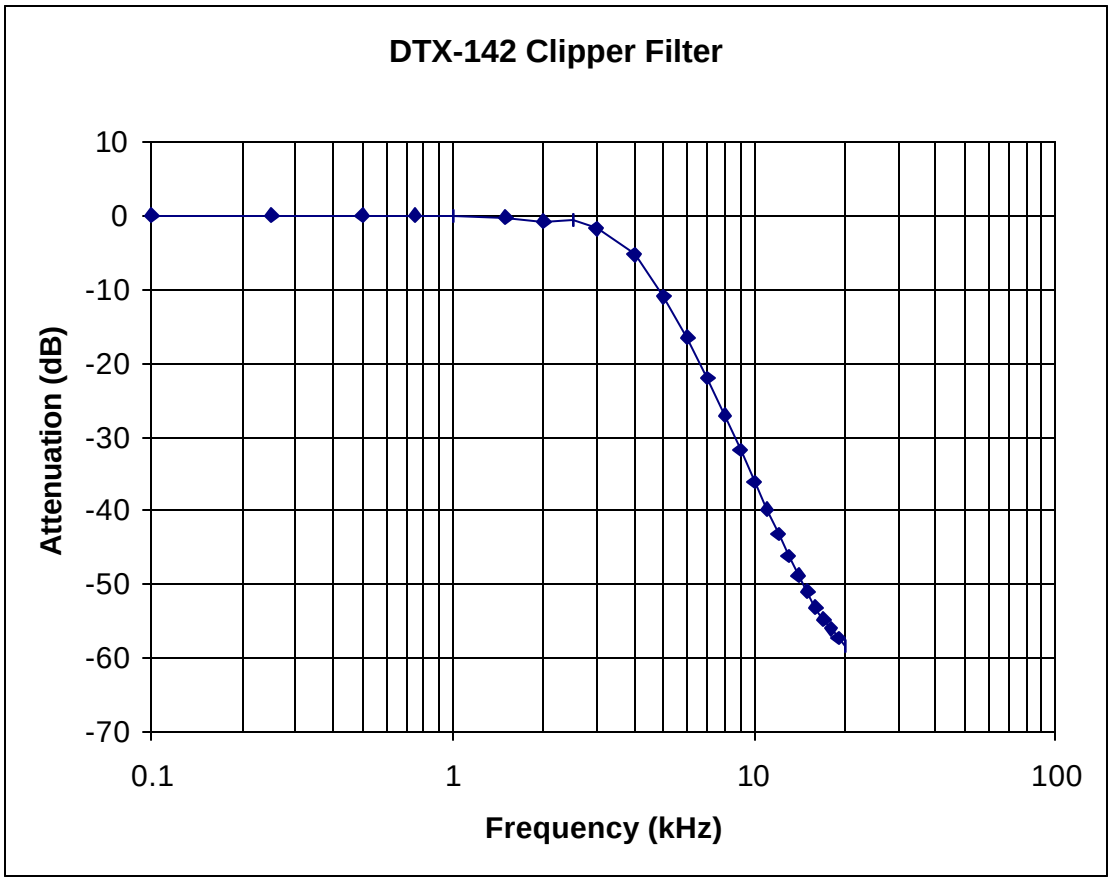
TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE: An audio tone ranging from 100 Hz to 20 kHz are inserted at the input of the DTX-142 low pass filter through a 100 uf cap at the junction of R369 and R374. The audio test tone amplitudes were fixed at 1250 mV rms keeping the filter in an unsaturated mode. The clipper filter output signal at R385 was then read on the HP8920A. The response was then calculated as 20 log(Vin/Vref).

RESULTS:



TYPE OF TEST: MODULATION LIMITING

FCC PART: 2.1047 (b)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

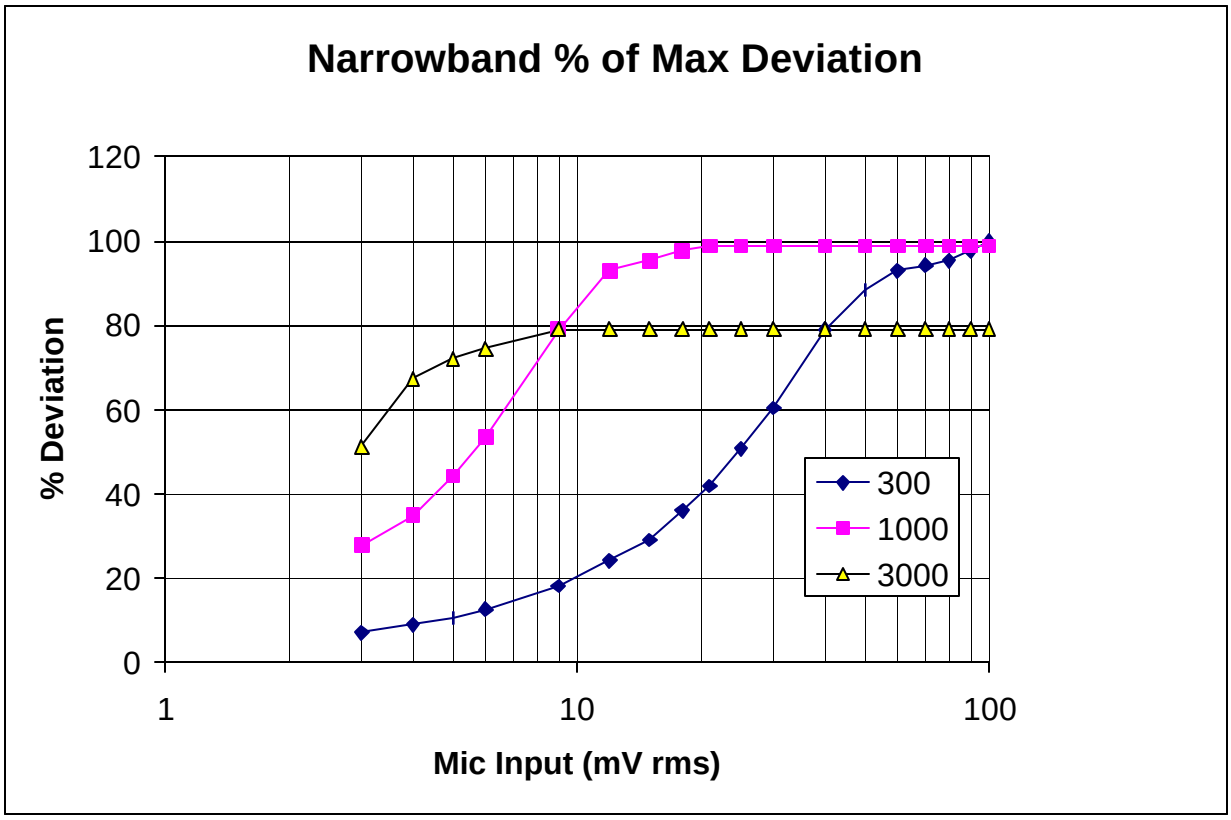
TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE: The output of the HP8920A audio generator was applied to the microphone input of the DTX-142. The output of the generator was adjusted from 3 mV to 100 mV rms at frequencies from 300 to 3000 Hz. The deviations were normalized to the maximum deviation, which occurred at 300 Hz. The first plot shows narrowband and the second wideband response.

RESULTS for NARROWBAND:



TYPE OF TEST: MODULATION LIMITING

FCC PART: 2.1047 (b)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

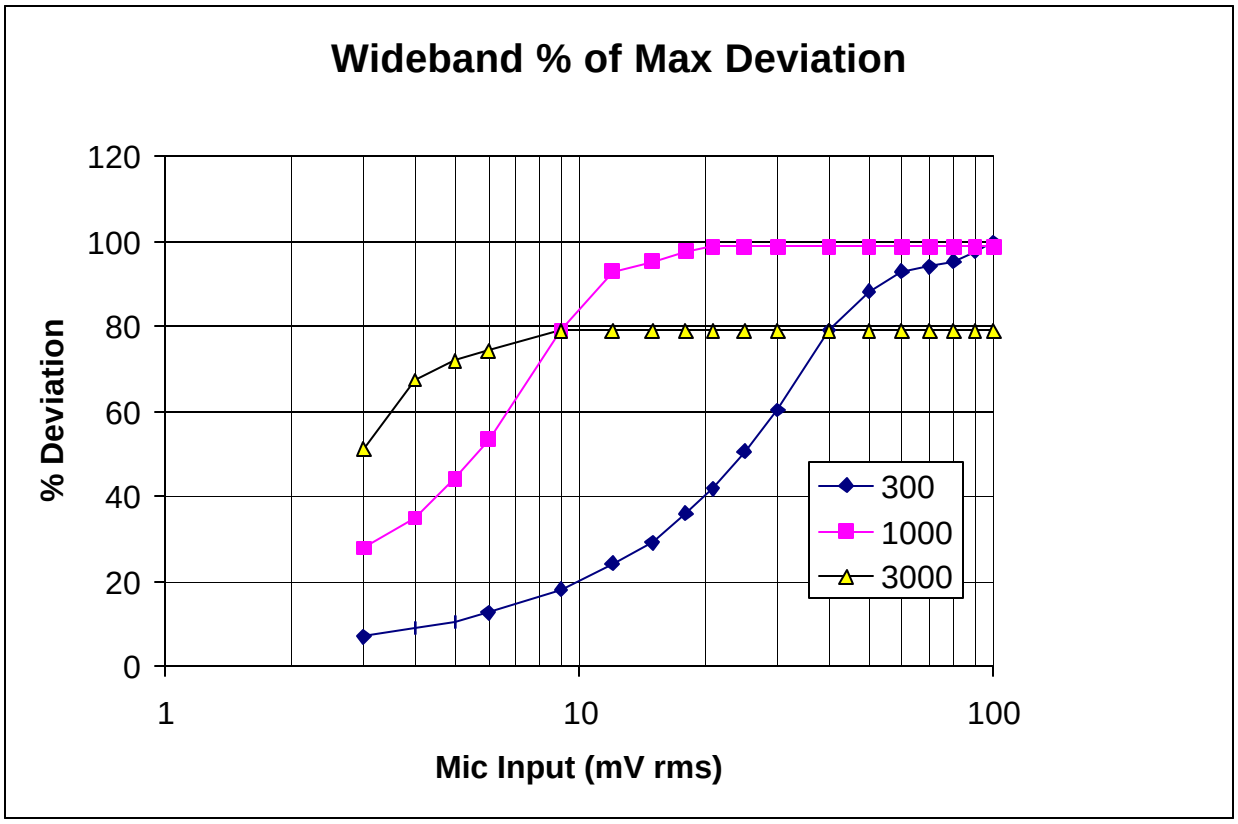
MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

RESULTS for WIDEBAND:



TYPE OF TEST: EMISSIONS DESIGNATOR

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

CALCULATIONS:

For voice:

The necessary bandwidth as determined by Carson's rule for a wideband channel is:

Maximum modulation frequency (M) in kHz	= 3
Maximum deviation (D) in kHz	= 4.3
Constant K	= 1
Necessary bandwidth for **wideband** in kHz	= (2xM) + (2xDxK) = 14.6

Wideband emissions designator applied for is 14K6F3E.

The necessary bandwidth for the narrowband channel is:

Maximum modulation frequency (M) in kHz	= 3
Maximum deviation (D) in kHz	= 2.2
Constant K	= 1
Necessary bandwidth for **narrowband** in kHz	= (2xM) + (2xDxK) = 10.4

Narrowband emissions designator applied for is 10K4F3E.

For data:

The necessary bandwidth for the narrowband channel is:

Maximum modulation frequency (M) in kHz	= 2.4
Maximum deviation (D) in kHz	= 2.2
Constant K	= 1
Necessary bandwidth for **narrowband** in kHz	= (2xM) + (2xDxK) = 9.2

Narrowband emissions designator applied for is 9K2F1D.

TYPE OF TEST: OCCUPIED BANDWIDTH

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE:

1. The DTX-142 was programmed for transmitter operation on 159.100 MHz, was set for 12.5 kHz bandwidth operation, and the deviation was adjusted for +/- 2.2 kHz at 1000 Hz on channel (1). Channel (2) is programmed for 25 kHz wide band operation and yields +/- 4.3 kHz deviation at 1000 Hz.

2. The RF output of the DTX-142 was measured with a HP8920A communications test set wattmeter at 5.0 watts. Power was supplied to the DTX-142 via a BK1730 power supply set at +13.8 VDC.

3. The antenna was connected to the HP8560E spectrum analyzer via a 20 dB power attenuator.

4. The output of the HP8920A audio function generator was applied to the microphone input of the DTX-142. The frequency of the audio signal generator was set to 2500 Hz and the output adjusted to a level 16 dB greater than that necessary to produce 50% of the rated system deviation at the frequency of maximum response.

5. The spectrum analyzer was centered on 159.100 and the sidebands were read. The appropriate narrow or wide band emission mask was also superimposed.

TYPE OF TEST: 12.5 kHz VOICE OCCUPIED BANDWIDTH

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

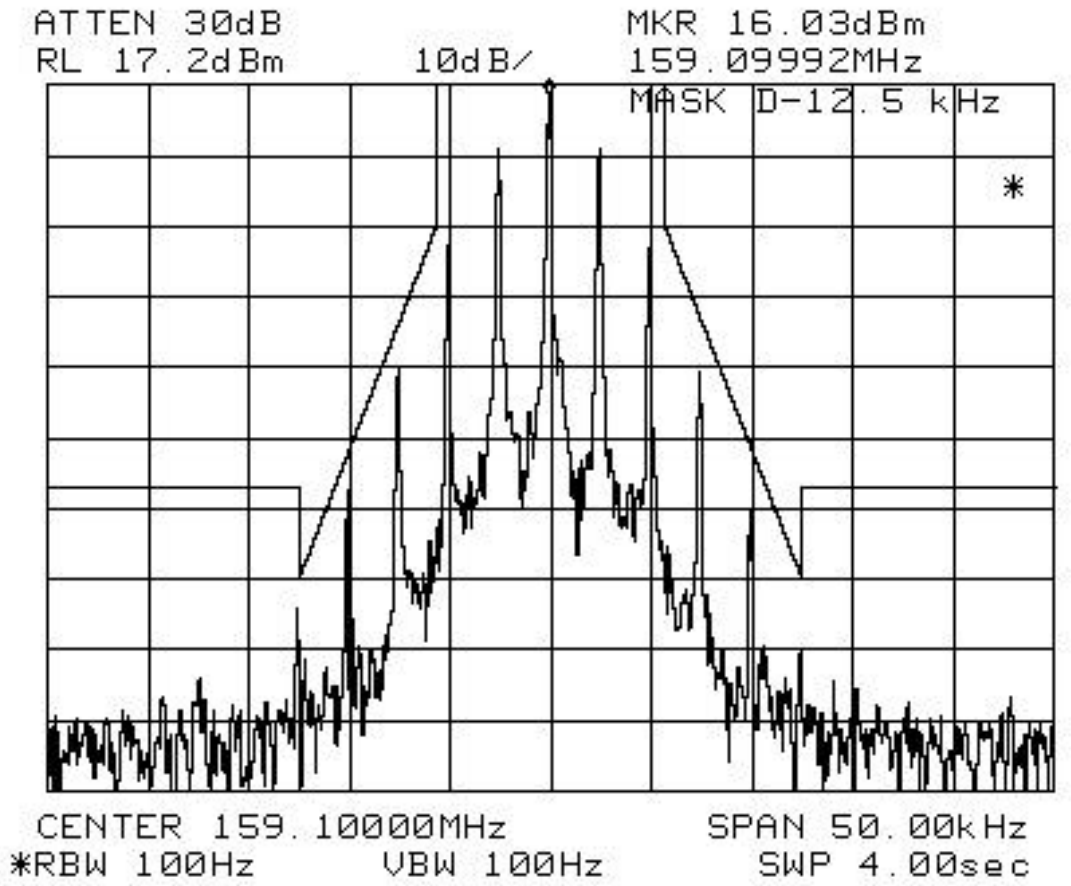
MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

RESULTS: Narrowband voice channel with 2500 Hz tone.



TYPE OF TEST: 25 kHz VOICE OCCUPIED BANDWIDTH

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

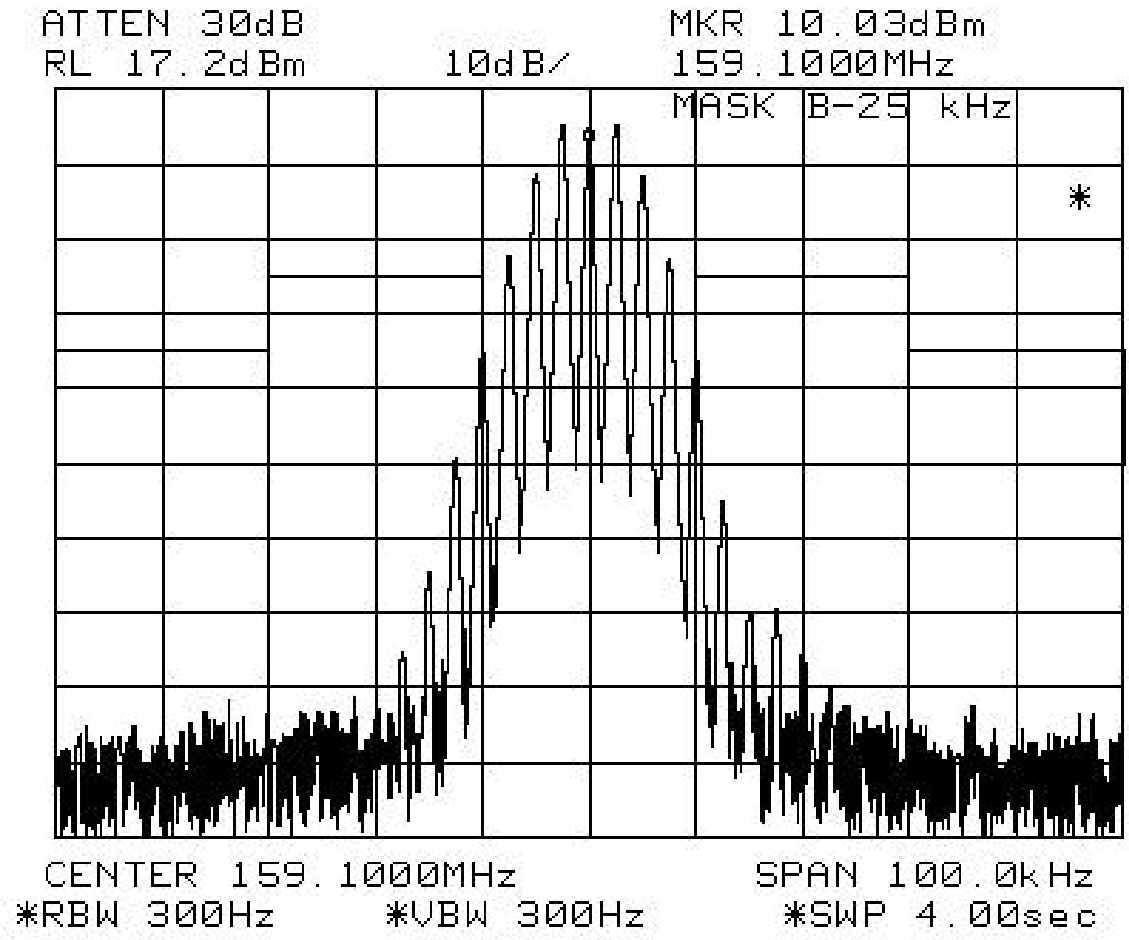
MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

RESULTS: Wideband voice with 2500 Hz tone.



TYPE OF TEST: 12.5 kHz RANDOM DATA OCCUPIED BANDWIDTH

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

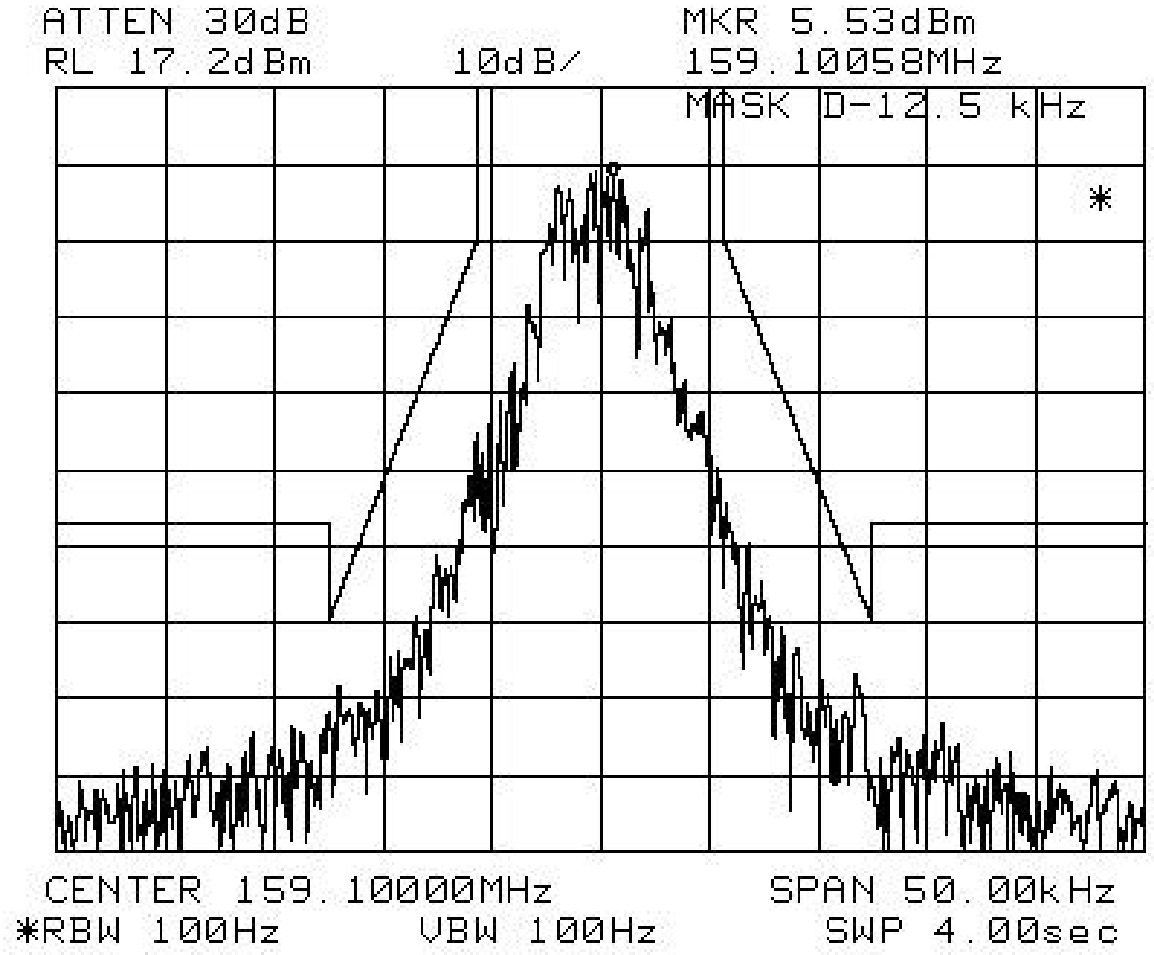
TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE: An 11 bit pseudo-random (PN) code generator producing 4-level data stream at 9600bps was connected to the AUX_IN port of the DTX-142. The auxiliary input gain adjust pot (R375) was adjusted to yield a peak deviation of 2.2 kHz. The following plot shows the occupied bandwidth well within the narrowband FCC limits.

RESULTS:



TYPE OF TEST: 12.5 kHz UNIFORM DATA OCCUPIED BANDWIDTH

FCC PART: 2.1049 (c)(1) per 90.210 (b)(d)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

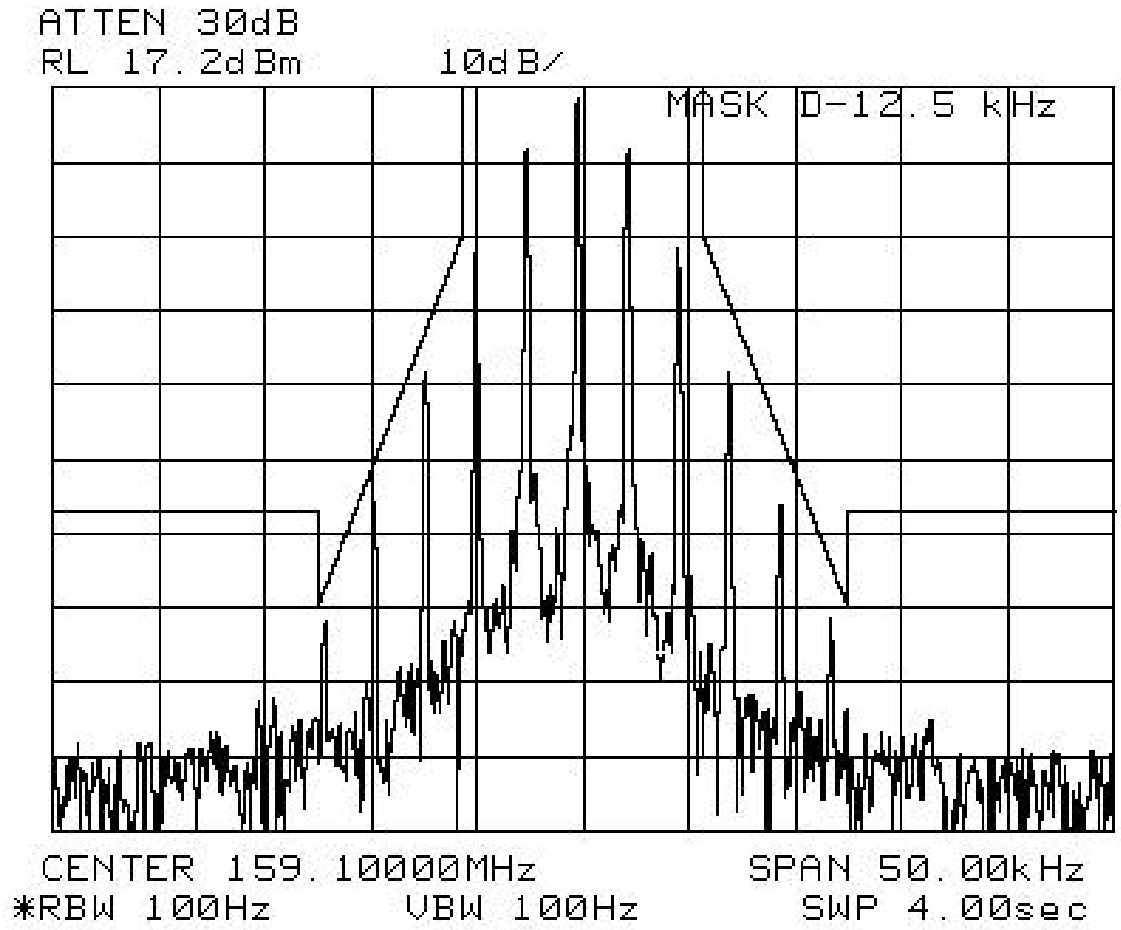
TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE: A 2400 Hz square wave generator was connected to the AUX_IN port of the DTX-142. This represents an alternating 1,0,1,0 data pattern. The auxiliary input gain adjust pot (R375) was adjusted to yield a peak deviation of 2.2 kHz. The following plot shows the occupied bandwidth within the narrowband FCC limits.

RESULTS:



TYPE OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

FCC PART: 2.1051

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE:

The DTX-142 was programmed for transmitter operation 159.100 MHz. Power was supplied to the DTX-142 by a BK Precision Model 1730 Power Supply. The supply voltage was set to 13.8 VDC.
The transmitter was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation as specified in FCC Part 2.1049 (c)(1). The DTX-142 antenna terminal was connected to the input of a 20 dB power attenuator. After the attenuator and before a Hewlett-Packard Model 8559A Spectrum Analyzer a 272 MHz high pass filter was inserted. The measured insertion loss of the external attenuator and high pass filter are listed below. The spectrum was searched from 8 MHz to the 10th harmonic of the operating frequency. All unreported emissions are more than 20 dB below the FCC limit.

RESULTS:

Carrier Frequency: 159.100 **MHz**
Power Output: 5.0 **Watts**

Multiple of Carrier	Emission Frequency (MHz)	Analyzer Reading (dBm)	Attenuator & filter Loss(dB)	Spurious Level (dBm)	FCC Limit (dBm)	dB below FCC Limit
2	318.2000	-55.0	20.6	-35.4	-20	15.40
3	477.3000	-58.0	20.5	-37.5	-20	17.50

TYPE OF TEST: FIELD STRENGTH OF SPURIOUS RADIATION

FCC PART: 2.1053

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE:

Field strength of spurious radiation of the DTX-142 was taken on the RITRON three-meter test range using the substitution method. The following procedure was used.

1. The DTX-142 was programmed to transmit at 5.0 watts on 159.100 MHz powered by a Ritron RPS-1A power supply.

2. The DTX-142 was then terminated at the antenna port with 50 ohm power load.

3. All field strength measurements were made with the Hewlett-Packard Model 8560E Spectrum Analyzer connected to the Electro-Metrics LPA-25 log periodic receive antenna.

4. A tuned Electro-Metrics dipole was substituted at the radio side of the range driven by a known power level from the HP8657B to produce a known ERP at each harmonic. The receiving antenna was oriented both vertically and horizontally and reference measurements were taken at each harmonic. Cable loss from generator to the dipole was taken into account.

5. For each emission, the height and polarization of the field strength measuring antenna and orientation of the DTX-142 were varied to find maximum field strength.

6. The spectrum was searched up to the 10th harmonic of the transmit frequency. All non-harmonics were less than 20 dB below the FCC limits specified in Part 90.210(d)(3).

EQUATIONS:

Emission ERP (dBm) = Pgen (dBm) – Cable Loss (dB) – Ps (dBm) + Pr (dBm)

Where:

Pgen is the reference generator level.
Cable Loss is the loss of the cable from the signal generator to the reference antenna.
Ps is the level at the receiving antenna when the reference level is being transmitted.
Pr is the level at the receiving antenna when the radio is substituted for the reference antenna.

TYPE OF TEST: FIELD STRENGTH OF SPURIOUS RADIATION

FCC PART: 2.1053

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

RESULTS:

Test Frequency:	159.1	MHz
Test Power:	5.0	watts

DTX-142 – horizontal

	freq(GHz)	Pgen (dBm)	cable loss (dB)	Ps (dBm)	Pr (dBm)	Emission ERP (dBm)	FCC Limit (dBm)	margin(dB)
2	0.3182	0	0.1	-27.0	-72.3	-45.4	-20	25.4
3	0.4773	0	0.2	-28.8	-67.7	-39.1	-20	19.1
4	0.6364	0	0.3	-33.2	-70.3	-37.4	-20	17.4
5	0.7955	0	0.9	-37.3	-71.0	-34.6	-20	14.6
6	0.9546	0	1.0	-39.8	-65.5	-26.7	-20	6.7
7	1.1137	0	1.0	-46.2	-76.0	-30.8	-20	10.8
8	1.2728	0	1.2	-50.0	-78.7	-29.9	-20	9.9
9	1.4319	0	1.3	-52.2	-87.3	-36.4	-20	16.4
10	1.591	0	1.5	-51.8	-77.7	-27.4	-20	7.4

DTX-142 - vertical

	freq(GHz)	Pgen (dBm)	cable loss (dB)	Ps (dBm)	Pr (dBm)	Emission ERP(dBm)	FCC limit(dBm)	margin(dB)
2	0.3182	0	0.1	-29.2	-74.2	-45.1	-20	25.1
3	0.4773	0	0.2	-30.7	-61.5	-31.0	-20	11.0
4	0.6364	0	0.3	-35.3	-63.5	-28.5	-20	8.5
5	0.7955	0	0.9	-38.3	-71.0	-33.6	-20	13.6
6	0.9546	0	1.0	-39.8	-65.2	-26.4	-20	6.4
7	1.1137	0	1.0	-47.8	-80.0	-33.2	-20	13.2
8	1.2728	0	1.2	-50.8	-85.7	-36.1	-20	16.1
9	1.4319	0	1.3	-49.5	-90.2	-42.0	-20	22.0
10	1.591	0	1.5	-51.5	-75.8	-25.8	-20	5.8

TYPE OF TEST: FREQUENCY STABILITY VS. TEMPERATURE

FCC PART: 2.1055 (a)(1)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE:

1. The DTX-142 was programmed for operation at 5.0 watts on 159.100 MHz.

2. Power was supplied to the DTX-142 by a BK Precision Model 1730 power supply set to the nominal operating voltage of +13.8 VDC. The DTX-142 antenna terminal was connected to the input of an HP8920A RF communications test set used to measure frequency of the carrier.

3. Temperature was measured with a Triplet thermocouple.

4. The temperature was raised to +60°C and allowed to stabilize for 30 minutes. The transmitter was activated and the frequency recorded. The temperature was lowered in 10°C increments down to -30°C, allowing 20 minutes to stabilize at each temperature. In addition, the frequency was measured at 25°C, the temperature at which the unit is to be set to the correct frequency per the Users manual.

TYPE OF TEST: FREQUENCY STABILITY VS. TEMPERATURE

FCC PART: 2.1055 (a)(1)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

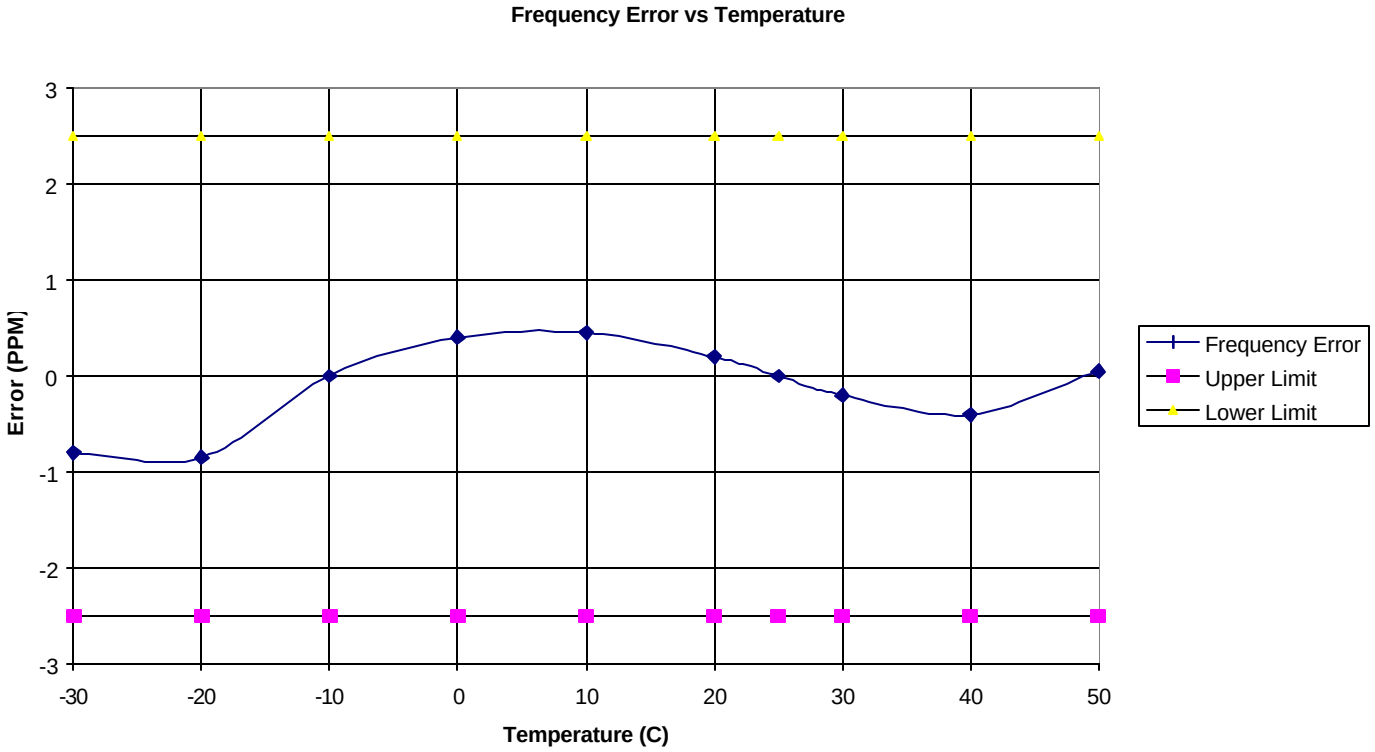
MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

RESULTS:



TYPE OF TEST:	FREQUENCY STABILITY VS. VOLTAGE
FCC PART:	2.1055 (d)(2)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	DTX-142
TYPE OF UNIT:	VHF-FM Two Way Radio Transceiver Module
FCC ID:	AIERIT17-142
DATE:	May 30, 2003

PROCEDURE:

1. The DTX-142 was programmed to operate at 159.100 MHz at 5.0 watts at 13.8 VDC.

2. Power was supplied to the DTX-142 by a BK Precision Model 1730 power supply, and supply voltage was measured with a Protek 506 DVM.

3. The DTX-142 antenna terminal was connected to the input of an HP8920A communications test set, used to measure frequency of the carrier.

4. Frequency measurements were made at +25°C with the supply voltage varied from 85% to 115% of the nominal 13.8 VDC as well as at voltages down to 8 VDC since the unit is specified to that voltage.

5. The following plot shows the frequency error and +/- 2.5 PPM limits.

TYPE OF TEST: FREQUENCY STABILITY VS. VOLTAGE

FCC PART: 2.1055 (d)(2)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

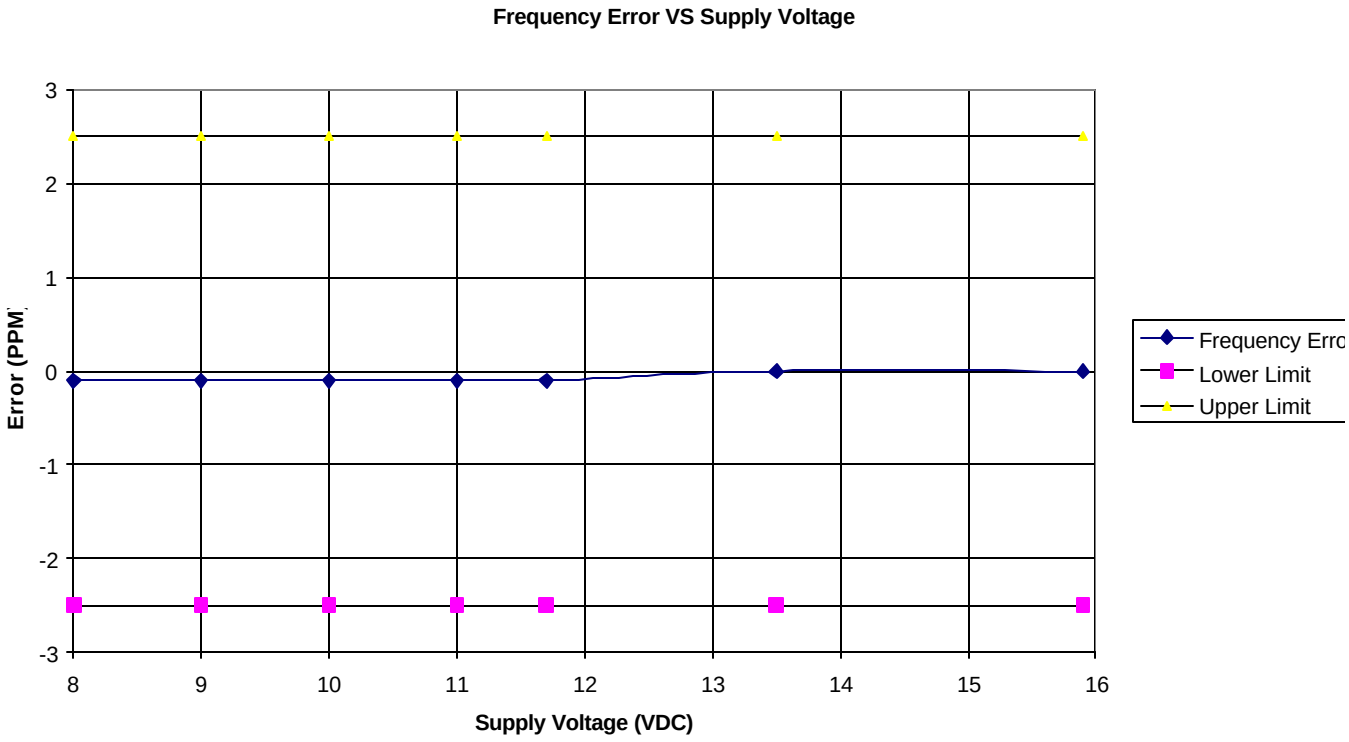
MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

FCC ID: AIERIT17-142

DATE: May 30, 2003

RESULTS:



TYPE OF TEST: TRANSIENT FREQUENCY BEHAVIOR

FCC PART: 90.214

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: DTX-142

TYPE OF UNIT: VHF-FM Two Way Radio Transceiver Module

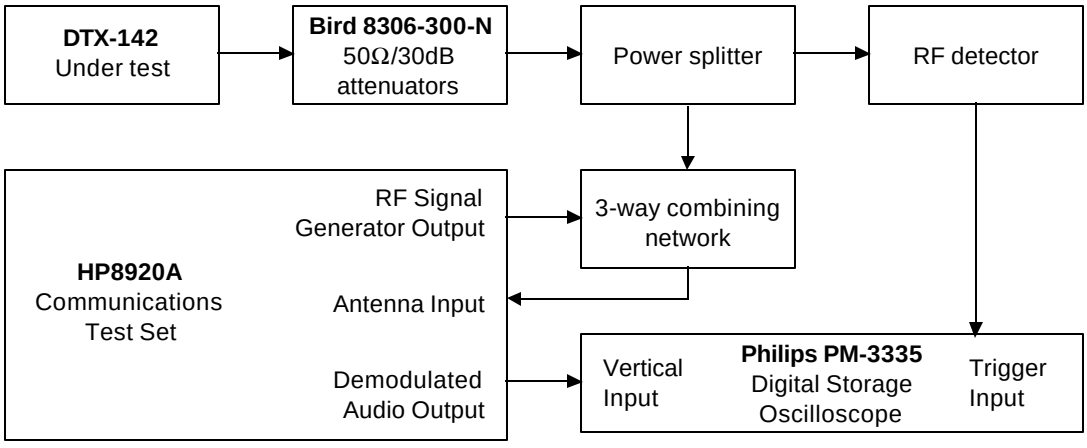
FCC ID: AIERIT17-142

DATE: May 30, 2003

PROCEDURE:

The DTX-142 was aligned for transmitter operation on 159.100 MHz at 5.0 watts.

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



2. The HP8920A receiver was set to measure FM deviation with the audio bandwidth set at ≤ 20 Hz to ≥15 kHz and the RF frequency set to 159.100 MHz.

3. The HP8920A RF signal generator was set to 159.100 MHz with a 1 kHz tone at ±12.5 kHz deviation. The output level of the signal generator was set such that its level at the Antenna Input of the HP8920A Test Set was 30 dB below that of the level of the DTX-142 when it was keyed.

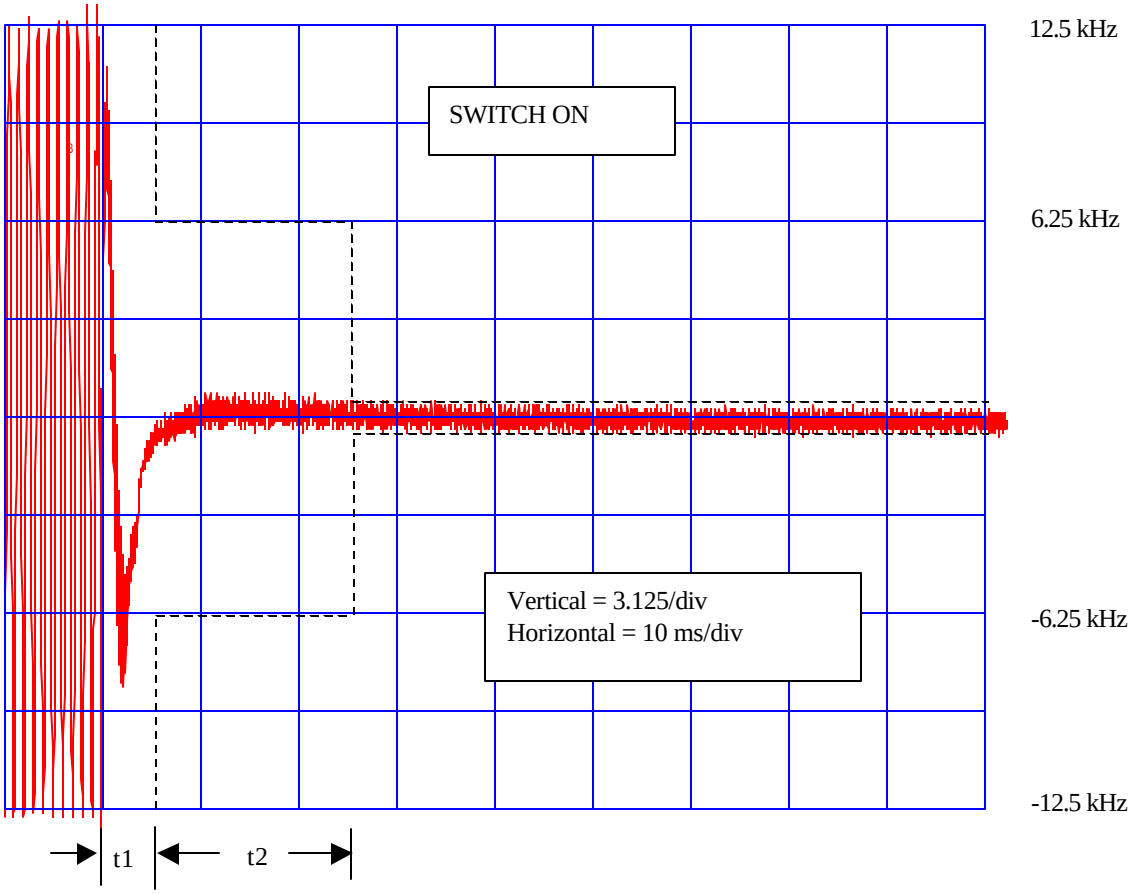
4. The Trigger Level of the Philips PM-3335 was set such that it triggered on when RF power from the DTX-142 was either detected or lost. For the transmitter turn-on waveforms, the delay was set such that the trigger point was 1 division from the left of the screen. Conversely, for turn-off waveforms, the delay was set for 1 division from the right side of the screen.

5. The trigger was set for positive, the unit keyed and the resulting waveform stored. The trigger was then set for negative, the unit keyed and the resulting waveform stored.

6. The FCC limits per Part 90.214 were added to the plot in the same manner illustrated in EIA-603-B Part 3.2.19.2

TYPE OF TEST:	TRANSIENT FREQUENCY BEHAVIOR
FCC PART:	90.214
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	DTX-142
TYPE OF UNIT:	VHF-FM Two Way Radio Transceiver Module
FCC ID:	AIERIT17-142
DATE:	May 30, 2003

SWITCH ON CONDITION t_{on}, t_1, and t_2



TYPE OF TEST:	TRANSIENT FREQUENCY BEHAVIOR
FCC PART:	90.214
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	DTX-142
TYPE OF UNIT:	VHF-FM Two Way Radio Transceiver Module
FCC ID:	AIERIT17-142
DATE:	May 30, 2003

SWITCH OFF