RITRON, INC.

PRELIMINARY 07-12

RITRON MODELS DTX-X60 SERIES

PROGRAMMABLE

FM TRANSCEIVER MODULES

OPERATING MANUAL

PRELIMINARY!

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1 INTRODUCTION

1.1 GENERAL

The RITRON DTX Plus modules are programmable 2-way radios, which operate either in the VHF or UHF professional FM communications bands as well as a number of other bands in the 220 MHz and 350 MHz region. Each of eight channels can be programmed to contain a unique set of operating frequencies. The DTX Plus module is made up of two PC boards, an RF board and a control/loader board. These two boards are enclosed in a metal case with two connectors on one end; a 50 ohm BNC connector for connection to an antenna and a DB-15 sub-miniature connector for power and control input/output.

In addition, the RF board is available as a stand-alone unit for system integrators.

1.2 MODEL IDENTIFICATION

The part number system for the DTX Plus module is as follows:

The module has a part number in the form of "DTX-A54-BCDEF"

Where:

A is the major frequency band designator:

1=VHF (136-174 MHz bands)
2=220-245 MHz band
3=340-400 MHz bands
4=UHF (400-430 MHz and 450-470 MHz bands)

B is the sub-band designator:

G=136-162 for #1 above , 340-360 MHz for #3 above, and 400-430 MHz for #4 above.
A=420-440
B=430-450
O=148-174 for #1 above, 220-245 for #2 above, 360-380 for #3 above, and 450-470 for #4 above.
M=380-400 for #3 above.
C=470-490
T=490-512

Note that not all of the sub-bands listed above may be available, and that other sub-bands may become available.

C is the connector designator:

B=BNC connector
M=MCX connector

D designates the IF bandwidth:

W=wide (25/30 kHz channel bandwidth)
N=narrow (12.5/15 kHz channel bandwidth)
S=very narrow (5/ 6.25/ 7.5 kHz channel bandwidth)

E designates the maximum power level:

3=3 watts
6=6 watts
9=10 watts

F designates whether the control/loader board has a regulator and if so, at what current level:

D=no regulator; the unit must operate from external, regulated +7.5 VDC and is limited to either 3 or 6 watts max.
L=low current regulator; the power module is not regulated. Used for 10 watt version only.
I=high current regulator; the unit operates from 10-15 volts at either 3 or 6 watts max.

Example: A DTX-454-OBN6I would be a UHF module for operation between 450 and 470 MHz with a BNC RF connector, narrow (12.5 kHz channel bandwidth) IF bandwidth, 6 watts maximum output power, and an internal regulator to allow operation from 10 to 15 volts.

The part number system for a stand-alone RF board is the same as that for a module except that "F" designator (regulator option) does not exist and a "-DD" is appended at the end.

1.3 FCC REGULATIONS

1.3.1 LICENSING

For those frequency bands governed by FCC rules, the FCC requires that the radio owner obtain a station license for his radio before using the equipment to transmit, but does not require an operating license or permit. The station licensee is responsible for proper operation and maintenance of his radio equipment, and for ensuring that transmitter power, frequency and deviation are within the limits specified by the station license. This includes checking the transmitter frequency and deviation periodically using appropriate methods. Note also, that wideband operation (25/30 kHz channel bandwidth) may not be permitted.

1.3.2 PRODUCT CERTIFICATION

The DTX modules are certified by the FCC for operation in the United States and by Industry Canada for operation in Canada on certain frequency bands and sub-bands for transmission of either voice or data signals when aligned according to the alignment procedure for the proper bandwidth and when operated as a complete unit in the metal case. Operation of the RF board as a stand-alone unit or in combination with any other equipment, in any mode outside the alignment procedure, or with the clipper filter electronically disabled will require the filing of a new type acceptance application with the FCC by the user.

1.3.3 SAFETY STANDARDS-RF EXPOSURE

RF ENERGY EXPOSURE AWARENESS AND CONTROL INFORMATION, AND OPERATIONAL INSTRUCTIONS FOR FCC OCCUPATIONAL USE REQUIREMENTS:

BEFORE USING THIS 2-WAY RADIO, READ THIS IMPORTANT RF ENERGY AWARENESS AND CONTROL INFORMATION AND OPERATIONAL INSTRUCTIONS TO ENSURE COMPLIANCE WITH THE FCC'S AND IC'S RF EXPOSURE GUIDELINES.

NOTICE: This radio is intended for use in occupational/controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC/IC limits. This radio device is NOT authorized for general population, consumer, or any other use.

This 2-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, electric power, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health and industry work with organizations to develop standards for exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection. All 2-way radios marketed in North America are designed, manufactured and tested to ensure they meet government established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of 2-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it. Please refer to the following websites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html
http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

Federal Communications Commission Regulations:

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for mobile 2-way radios before they can be marketed in the U.S. When 2-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a label directing users to specific user awareness information.

The DTX 2-way radio has an RF exposure product label. Also, this DTX manual includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

Compliance with RF Exposure Standards:

The DTX two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty factors of up to 50% talk and 50% listen and is authorized by the FCC for occupational use. In terms of measuring RF energy for compliance with the FCC exposure guidelines, your radio antenna radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode. The DTX two-way radio complies with the following RF energy exposure standards and guidelines:

• United States Federal Communications Commission, Code of Federal Regulations; 47 CFR §§ 2 sub-part J.

• American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992.

• Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition.

To control exposure to yourself and others and ensure compliance with the occupational/controlled environment exposure limits always adhere to the following procedures:

Guidelines:

• User awareness instructions should accompany device when transferred to other users.

• Do not use this device if the operational requirements described herein are not met.

Instructions:

• Transmit no more than the rated duty factor of 50% of the time. To transmit (talk or send data), assert the PTT input pin. To receive calls, un-assert the PTT input. Transmitting 50% of the time, or less, is important because this radio generates measurable RF energy exposure only when transmitting (in terms of measuring for standards compliance).

• Transmit only when people are at least the recommended minimum lateral distance away, as shown in Table 1, from a properly installed according to installation instructions, externally-mounted antenna.

NOTE - Table 1 lists the recommended minimum lateral distance for bystanders in an uncontrolled environment from transmitting types of antennas (i.e., monopoles over a ground plane, or dipoles) at several different ranges of rated radio power for mobile radios installed on a vehicle.

Table 1. Rated Power and Recommended Lateral Distance for quarter-wave ground plane antenna:

Rated Power of DTX 2-way Radio	Recommended Minimum Lateral Distance from Transmitting Antenna
Less than 10 watts	6.4 inches (16.2 cm)
10 watts	7.2 inches (18.2 cm)

Antennas

• Install antennas taking into account the recommended minimum lateral distances in Table 1. These antenna installation guidelines are limited to antennas with appropriate ground planes. The antenna installation should additionally be in accordance with:

a.) The requirements of the antenna manufacturer/supplier.
b.) Instructions in this manual including minimum antenna cable lengths.
c.) Antennas other than those shown in Table 1 must be tested with the DTX module for RF exposure compliance in the environment in which it is to be used per the FCC's OET Bulletin 65, Edition 97-01 or Industry Canada RSS-102.

• Use only a VHF quarterwave antenna or equivalent antenna or other antennas as specified in Table 1. Unauthorized antennas, modifications, or attachments could damage the radio and may violate FCC regulations.

Approved Accessories

• This radio has been tested and meets the FCC RF exposure guidelines when used with the Ritron accessories supplied or designated for this product. Use of other accessories may not ensure compliance with the FCC's RF exposure guidelines, and may violate FCC regulations.

• For a list of Ritron approved accessories see this user manual, or visit the following website which lists approved accessories: www.ritron,com

Contact Information:

For additional information on exposure requirements or other information, contact Ritron at (317) 846-1201 or at www.ritron.com.

2 SPECIFICATIONS

2.1 GENERAL

FCC Identifier	
DTX-160-0	AIERIT33-1600 (Pending)
DTX-260-0	AIERIT33-2600 (Pending)
DTX-460-G	AIERIT33-460G (Pending)
DTX-460-0 (3-watt version)	AIERIT33-46003
DTX-460-0 (6-watt version)	AIERIT33-4600
DTX-460-0 (9-watt version)	AIERIT33-46009 (Pending)
FCC Rule Parts	90 (Part 80 and Part 90 for DTX-260)
Industry Canada Rule Parts	RSS-119
Frequency Ranges	
DTX-160-0	136-174 MHz
DTX-260-0	220-245 MHz
DTX-360-G	340-360 MHz*
DTX-360-0	360-380 MHz*
DTX-360-M	380-400 MHz
DTX-460-G	400-430 MHz
DTX-460-A	420-440 MHz *
DTX-460-B	430-450 MHz *
DTX-460-0	450-470 MHz
DTX-460-C	470-490 MHz *
DTX-460-T	490-512 MHz *

* Not Available Yet

Number of Channels	8
Transmit/Receive Spacing	Up to the span of the sub-band
Mode of Operation	Simplex or Half Duplex
Frequency Control	PLL Synthesizer
Channel Increment (Synthesizer step size)	
DTX-160/260	2.5 kHz/3.125 kHz
DTX-360/460	6.25 kHz
Emissions Bandwidth	
Very narrow mode	4.0-4.8 kHz depending upon modulation
Narrow Mode	11 kHz
Wide Mode	16 kHz
Frequency Stability	
-30 °C to +50 °C	+/-1.0 ppm
-40 °C to +60 °C	+/-1.5 ppm
Supply Voltage	
3 and 6 watt versions	

w/o internal regulator	7.5 VDC
w internal regulator	11 to 16 VDC
10 watt version (DTX-460-0 only)	11.5 to 15 VDC
RF Input/Output Connector	BNC standard
Power/Data Interface	15 pin subminiature D type
Operating Temperature	-30 to +60 °C
Maximum Dimensions (L x W x H)	3.6" x 2.3" x 1.0" including connectors
Weight	6 oz.

2.2 TRANSMITTER

Operating Bandwidth	Up to the span of the sub-band
RF Output Power (internally adjustable)	
3 watt version (DTX-460-0 only)	1 to 3 watts
6 watt version	1 to 6 watts (2.5 watts min. recommended)
10 watt version (DTX-460-0 only)	2 to 10 watts
Duty Cycle	5 to 100 % depending upon voltage and power level (see chart elsewhere in manual)
RF Load Impedance	50 ohms
Modulation Distortion (per TIA/EIA 603)	5 % max.
Modulation Frequency Response (+1/-3 dB, ref 1 kHz)	
Narrowband versions:	
w pre-emphasis	400 Hz to 2500 Hz
w/o pre-emphasis	50 Hz to 2700 Hz
Very narrowband versions:	
w/o pre-emphasis	50 Hz to 1200 Hz
Transmitter Attack Time:	10 ms max
Spurious and Harmonics	-25 dBm max.
FM Hum and Noise	
Very narrow channel (5/6.25/7.5 kHz) operation	40 dB min.
Narrow channel (12.5/15 kHz) operation	45 dB min.
Group Delay Variation (Within Frequency Response)	5 us max.
Current Drain	Depends upon supply voltage and regulator options (see chart elsewhere in manual).
AUX IN adjustment range (60% rated dev.)	
w pre-emphasis (@ 1 kHz)	200 to 1000 mV rms
w/o pre-emphasis (flat)	40 to 300 mV rms

2.3 RECEIVER

Operating Bandwidth	Up to span of the sub-band
Sensitivity (12 dB SINAD @ 1 kHz w de-emphasis)	0.25 uV (-119.0 dBm)
RF Input Impedance	50 ohms nominal
Adjacent Channel Selectivity	
+/-6.25 kHz w very narrow IF	45 dB min.
+/- 12.5 kHz w narrow IF	60 dB min.
Spurious and Image Rejection	
IF/2	60 dB min.
Image & other	70 dB min.
Intermodulation Rejection	68 dB min.
FM Hum and Noise	
Very narrow channel (5/6.25/7.5 kHz) operation	40 dB min.
Narrow channel (12.5/15 kHz) operation	45 dB min.
Conducted Spurious	-57 dBm max.
Receive Attack Time (transmit to receive)	10 ms max.
Carrier Detect Attack Time	5 ms max.
Audio Distortion	5 % max.
Audio Response (+1/-3 dB, ref 1 kHz)	
Narrowband versions:	
w de-emphasis	400 Hz to 2500 Hz
w/o de-emphasis	100 Hz to 3500 Hz
Very narrowband versions:	
w/o de-emphasis	100 Hz to 1500 Hz
Receive Current Drain	Depends upon supply voltage options (see chart elsewhere in manual).
AUX OUT Adjustment Range (60 % rated dev.)	
w de-emphasis (@ 1 kHz)	50 to 500 mV rms open circuit
w/o de-emphasis (@1 kHz)	250 to 1800 mV rms open circuit

3 DTX INPUT/OUTPUT CONNECTOR

Connector Pinout

Pin Number	Name	Description	Comments
1	CS0	Channel Select low bit	
2	CS1	Channel Select mid bit	
3	CS2	Channel Select high bit	
4	MIC IN	Microphone Input	Input for microphone type signals to be transmitted. Signals at this input are pre-emphasized, limited, and filtered. This input is disabled in very narrowband mode.
5	CSN	High/Low Power or Channel 1/2	
6	RAW SUPPLY	Power Supply Input	Positive Supply voltage input.
7	AUX IN	Auxiliary Input	Wideband input for data.
8	AUX OUT	Auxiliary Output	Wideband output for data.
9	PGN IN/OUT	Programming I/O	External programmer connects here.
10.	CTS	Clear to Send	Asserted when transmitter can accept modulation.
11.	RX MON	Monitor	Breaks squelch in receive.
12.	AUDIO OUT	Audio PA Output	Output of audio PA.
13.	DCD	Carrier Detect	Carrier detect output.
14.	PTT/RTS	Push to Talk	Activates transmitter.
15.	GND	Ground	Negative supply point and

reference for all inputs.

Pinout Description

Pin Number	Description
1	CS0-Least significant bit of the channel select lines. Active high 5 volt TTL/CMOS level. Internal 10 kΩ pull-up to +5 volts.
2	CS1-Mid bit of the channel select lines. Active high 5 volt TTL/CMOS level. Internal 10 kΩ pull-up to +5 volts.
3	CS2-Most significant bit of the channel select lines. Active high 5 volt TTL/CMOS level. Internal 10 kΩ pull-up to +5 volts.

Channel	CS2	CS1	CS0
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

0 = Logic low
1 = Logic high

Note: Due to the internal pull-up resistors, the unit defaults to channel 8 if the channel pins are left open (unconnected). **Channel 8 would be the nominal channel when the Ritron programmer is connected.**

4	MIC IN-Microphone input. This input accepts microphone-type input signals for transmit. This input is a higher gain version of the AUX IN input. This input is not available in very narrow channel mode.
5	CSN-Depending upon how it is programmed, this input selects between channels 1 and 2 or between high and low RF output power. This input is TTL/CMOS level type input with a logic low required for channel 1/low power and a logic high required for channel 2/high power. Internal 10 kΩ pull-up to +5 volts.
6	RAW SUPPLY- The positive supply voltage for the unit is supplied through this pin. The actual supply voltage required depends upon model type. Ensure that the correct supply voltage per the given model is used.
7	AUX IN-This is the main audio input for modulation. The gain through this input to the modulator is programmable, as is the use of pre-emphasis, but not independently of the MIC IN. This signal passes through the clipper and clipper filter.
8	AUX OUT-This is the broadband output of the receiver. The gain from the receiver to the output is programmable, as is the use of de-emphasis. The choice of AC or DC coupling from the RF board discriminator is also programmable. The coupling at the output of this pin is AC coupled, however. It can be converted to DC coupling with internal hardware modifications. **Note: The output impedance is approximately 600**

ohms. Therefore, it is not recommended that this output drive loads with less than 1000 ohms unless the resultant voltage drop is accounted for.

9 PGN IN/OUT-Connect via RITRON DTXP-PCPK PC Programming Kit to computer for programming the unit.

10 CTS-Clear-To-Send output from the unit which indicates that the unit is transmitting a carrier at the correct frequency and power level and is ready to accept an input signal to be transmitted. This output would normally become asserted in response to a PTT RTS (see pin 14 description below) activation. The polarity of this output can be programmed. The output is active low 5 volt logic with an internal 10 k ohm pull-up to 5 volts. It can source up to 10 mA when low.

11 RX MON-This input breaks the squelch (unmutes) on the receiver i.e. allows for monitoring the channel even when a signal not strong enough to break squelch is present. Input levels are TTL/CMOS; polarity may be programmed. Internal 10 kΩ pull-up to +5 volts.

12 AUDIO OUT-This is the output of the audio power amplifier. This output can drive up to 100 milliwatts into an 8 ohm load. The output level can be controlled by programming. De-emphasis can be applied to this output, but not independently of the AUX OUT output.

13 DCD-Carrier detect output. This output becomes asserted when a signal strong enough to exceed the programmed squelch threshold is present. This output is not affected by the RX MON input. The polarity can be programmed. The output is active low 5 volt logic with an internal 10 kΩ pull-up to +5 volts. It can source up to 10 mA when low.

14 PTT/RTS-Push to Talk/Request to Send. This input commands the unit to transmit. Input levels are TTL/CMOS; polarity may be programmed. Internal 10 kΩ pull-up to +5 volts.

15 GND-System ground. All signals and voltages are referenced to this input. The negative side of the power supply should connect here.

4 ACCESSORIES

Note: Programming kits are for use by authorized service/maintenance personnel only.

The Programming Kit for DTX-154/454 radios (via compatible computer) is model DTXP-PCKT. It includes:

1) Programming software diskettes, 3.5" (qty 2).

2) 1 25 pin PC to 6 pin modular adapter cable with built-in interface circuitry.

3) 1 modular adapter to DB-15 connector cable with power cable.

Factory programming of channels and features is also optional. Contact the factory for details.

5 OPERATION

5.1 CHANNEL SELECTION

The DTX module supports eight channels. The desired channel is chosen via pins 1, 2, and 3 of the 15 pin connector as shown:

Channel	Pin 3 (CS2)	Pin 2 (CS1)	Pin 1(CS0)
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

0 = Logic low (0 to 0.3 VDC)
1 = Logic high (3.5 to 5.0 VDC or left unconnected)

A logic low is a voltage level below 1 volt while a logic high is a voltage level above 3.5 volts. These three pins have an internal 10 kΩ pull-up resistor to + 5 volts. Therefore, any pin left unconnected will assume a logic high state. Do NOT apply voltages outside the range of 0 to +5 volts to these pins. Note: When the Ritron programming cable is connected, these pins are not connected and thus, assume a logic high state. Therefore, the radio will be on channel 8 when the Ritron programming cable is connected.

A change in the channel selection in receive will cause the receiver to operate on the new channel. In transmit, however, the channel selection is only checked upon a push-to-talk activation. Changes in channel during transmit will not change the transmit operating channel of the unit until the unit is cycled from transmit to receive and back to transmit.

5.2 POWER SUPPLY VOLTAGE

Pin 6 is the positive supply input to the unit. The type of module determines the actual voltage that should be applied to this pin. One should be absolutely sure of the proper voltage and current requirements before applying power.

The DTX-160, DTX-260, DTX-360 units and the 3 and 6-watt DTX-460 units use 7.5 volt RF power modules. Two supply voltage options are available for these units depending upon whether the control/loader board has a regulator installed. If a regulator is not installed, the voltage should be 7.5 volts +/-10 %. This voltage should be "clean" and preferably regulated since the RF power module is powered directly from this source. Variations in voltage will cause variations in transmitted output power. Conversely, if the control/loader board has a regulator installed, the supply voltage can be at any voltage between 11 and 16 volts. The RF power module in the 10 watt DTX-460 unit requires at least 12 volts to achieve 10 watts, although voltages as high as 15 may be used. Since the module is powered directly from this voltage, the supply should be "clean" and, preferably, regulated. The output power will vary with supply voltage. Switching power supplies can be used, but in models without the internal regulator, care must be taken that the output waveform is low noise. Also, the module antenna should never be placed near an unshielded switching power supply.

5.3 CURRENT DRAIN VS SUPPLY VOLTAGE

The current drain of the module is a function of the supply voltage, the RF output in transmit and the regulator option. The internal 7.5-volt regulator is a switching type such that the current drain actually decreases with an increase in supply voltage. Typical current drain values are shown in the table below:

Receive Mode

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	130 mA
11.0 V	Yes	100 mA
12.5 V	Yes	90 mA
16.0 V	Yes	75 mA

Transmit Mode – 1 watt output power

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	1.2 A
11.0 V	Yes	0.9 A
12.5 V	Yes	0.7 A
16.0 V	Yes	0.5 A

Warning: Although the output power can be set as low as 1 watt, and the module is certified as low as 1 watt, operation below 2.5 watts output power is not recommended. At low power levels, the output power can vary by 50% or more with variations in ambient temperature.

Transmit Mode – 3 watt output power

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	1.8 A
11.0 V	Yes	1.4 A
12.5 V	Yes	1.2 A
16.0 V	Yes	0.9 A

Note: The 3-watt version of the DTX-460 operates more efficiently than the 6-watt version with power reduced to 3 watts. Therefore, the current drain values for the 3-watt version of the DTX-460 will be about 80% of the values shown above.

Transmit Mode – 6 watt output power

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	2.5 A
11.0 V	Yes	2.1 A
12.5 V	Yes	2.0 A
16.0 V	Yes	1.5 A

Transmit Mode – 10 watt output power (10-watt version of DTX-460 only)

Supply Voltage	Internal Regulator	Current Drain

13.5 V	RF PA is unregulated	2.5 A

5.4 DUTY CYCLE/KEY-DOWN LIMITATIONS

The major heat generating component within the modules is the RF power amplifier which has a maximum temperature limit that should not be exceeded. In addition, the temperature within the module itself must be kept below the maximum temperature of the reference oscillator to ensure that regulatory frequency stability limits are observed. As a result, depending upon the RF output power, the supply voltage, and the ambient temperature, limits upon the average transmit duty cycle and the maximum continuous transmitter on time exist. These limits are summarized below for operation in still air:

	Ambient Temperature (°C)	Duty Cycle (%)	Key-Down Time (s)
3 watts RF output	25	30	45
	50	5	10
6 watts RF output	25	20	30
	50	3	5
10 watts RF output	25	20	15
	50	3	5

Blowing air across the unit and/or adding a heat sink to the rear of the unit where the PA module is located can significantly improve the duty cycle/key-down times. Ritron offers an option where the case screws at the rear of the module are longer allowing heat sinks to be attached. Contact Ritron for additional information on this option and special instructions on attaching heat sinks without compromising the mechanical integrity of the RF PA module.

5.5 OPERATING MODES

5.5.1 RECEIVE

Carrier Detect and Squelch Operation

The DTX is a transceiver; i.e. it can receive and transmit, although not at the same time. A carrier detect system exists within the unit to detect the presence of a carrier which controls the logic state of the DCD (data carrier detect) output. The RF levels at which this output changes state are programmable. In addition, the unit may be programmed such that the audio outputs, AUDIO OUT and AUX OUT, are muted (squelched) in conjunction with DCD operation. In units where squelch operation has been enabled, the RX MON input can be used to override a squelched condition. The DCD output is not affected by the RX MON operation.

Receiver Audio Outputs

Two receiver audio outputs are present on the DTX module. The AUX OUT is a general purpose output which can have pre-emphasis enabled or bypassed. Its gain can be controlled and its output is designed to drive 1000 ohm or higher loads. The coupling from the discriminator on the RF board may be set to AC or DC by the programmer. DC coupling allows for internal bandwidth to extend to DC, but if a high gain value is chosen for the AUX OUT, clipping may occur on the waveform due to discriminator voltage offsets. AC coupling removes this issue. The output stage is AC coupled, but can be modified for DC coupling. This requires replacing a coupling capacitor with a zero-ohm resistor. Contact Ritron for details on this modification. The AUDIO OUT is always de-emphasized, but its gain can be programmed. This output can drive 8-ohm speaker-type loads.

5.5.2 TRANSMIT

PTT Operation

The transmitter is activated by placing the PTT/RTS (Push-To-Talk/Request-To-Send) input in its asserted state. This state is programmable. If the unit is to operate in simplex (transmitter and receiver on the same frequency), one should check for activity on the channel before transmitting. This can be done by checking the state of the DCD output. In addition, the unit can be programmed so that transmit operation is inhibited if the DCD threshold has been exceeded (busy channel lockout option).

CTS Output

The CTS (Clear To Send) output goes to its active state when the unit has powered up the transmitter, it is locked on the correct transmit frequency, and it is ready to accept modulation. This output may be used to signal a modem to start transmitting data. If this output is not used, to avoid losing data, a delay of at least 12 ms is required between PTT/RTS activation and the application of data.

Transmitter Audio Inputs

Two mutually exclusive audio inputs are available on the DTX module. The AUX IN is a general-purpose input with an input impedance greater than 50 k-ohms and is capacitive coupled with a lower roll-off frequency of about 25 Hz. The MIC IN input is a higher gain input designed for connection to a standard electret or dynamic microphone. The choice of the input source is made via the programmer. The selected signal can be set for a pre-emphasized or flat audio response and the gain can also be set. At maximum gain, the AUX IN signal input can achieve 60% rated modulation with about 25 mv rms input signal while the MIC IN signal can achieve the same modulation with 4 mv rms in the low gain position and 0.5 mv in the high gain position.

High/Low Power

If RNet compatibility mode is not programmed into the unit, high and low power levels can be programmed into the unit on a channel by channel basis. High power is selected by placing the CSN input at a logic high state. Placing the CSN input at a logic low state chooses low power. The CSN input has an internal pull-up resistor; it will assume the high state and the module will be set for high power when left unconnected.

Specialized Modem Operation

Modems designed to achieve the highest data rates possible in a radio channel may require a direct DC connection to the modulation path and the removal of the limiter-filter. In order to receive FCC Certification, the DTX module must either be tested and approved with a specific modem connected to the transmitter, or a modulation limiter and limiter-filter must always be present in the transmit modulator audio path with the modulation inputs AC coupled. To allow for the most flexibility for the end user, the unit was certified as a stand-alone unit. It is possible, with hardware modifications and special programming software (not supplied with the unit), to DC couple the AUX IN input and/or defeat the limiter-filter. The modulation limiter would still be in place, but the deviation of the DTX module could be set such that the modulation limit within the DTX module is never reached. The deviation would be set by the modem level and the AUX IN gain setting. The end user/system integrator would then bear the responsibility of obtaining certification or operating in a frequency band where certification is not required. Contact RITRON for details. **Note: Most modems will connect directly to the DTX without requiring any special modifications or programming.**

Antenna Placement

The DTX module is enclosed in a metal housing for RF shielding. However, RF emitting sources located very close (less than 12 inches) to the unit can at times affect its operation. It is not recommended that an antenna be connected directly to the module's BNC connector unless the RF output power is set for less than 2 watts or the module is placed within another RF-tight enclosure.

5.6 RNET COMPATIBILITY MODE

The DTX module can be programmed to mimic some of the behavior of the RNet 450 radio. In the RNet compatibility mode, the CSN input is used as a channel selector line. A logic low selects channel 1 while a logic high selects channel 2. The channel select lines, CS0, CS1, and CS2 have no effect. Also, the DCD output is held in its true state during transmit. It would normally be false in transmit.