RITRON, INC.

DTX-MRM Rev.B 06-97

RITRON MODELS DTX-150 & DTX-450
PROGRAMMABLE
FM TRANSCEIVER MODULES

MAINTENANCE & OPERATING MANUAL

FOR USE ONLY BY AUTHORIZED SERVICE/ MAINTENANCE PERSONNEL

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IMPORTANT MAINTENANCE/REPAIR INFORMATION

Surface Mount Repair: RITRON surface mount products require special equipment and servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty. If you are not completely familiar with surface mount component repair techniques, RITRON recommends that you defer maintenance to qualified service personnel.

Precautions For Handling CMOS Devices: The DTX transceiver module contains complementary metal-oxide semiconductor (CMOS) devices, which require special handling techniques. CMOS circuits are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, with no failure appearing until weeks or months later. For this reason, take special precautions any time you disassemble the module. Follow the precautions below, which are even more critical in low humidity environments.

1) Storage/transport - CMOS devices that will be stored or transported must be placed in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for other semiconductors.
2) Grounding - All CMOS devices must be placed on a grounded bench surface. The technician that will work on the radio/CMOS circuit must be grounded before handling the radio. Normally, the technician wears a conductive wrist strap in series with a 100 KΩ resistor to ground.
3) Clothing - Do not wear nylon clothing while handling CMOS circuits.
4) Power off - Remove power before connecting, removing or soldering a PC board that contains CMOS devices.
5) Power/voltage transients - Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, making sure that no voltage transients are present.
6) Soldering - Use a grounded soldering iron for soldering CMOS circuitry.
7) Lead-straightening tools - When straightening CMOS leads, provide ground straps for the tool used.

Properly Attach The RF Board Shield: THE RF BOARD SHIELD COVER SHOULD NOT BE REMOVED, UNLESS A COMPONENT MUST BE REPLACED. This shield lid must be properly attached for transmitter stability, heatsinking and microphonics. The lid edges should fit tightly and uniformly all around the frame. Set all twist tabs 45 to 60 degrees with respect to their walls. Tighten the final transistor heatsink nut to 5 lb.-inches of torque to ensure adequate heatsinking and avoid breaking the device.

DTX Reassembly - Supply Voltage On Connector Pin: Remove power from the unit and carefully align the pins between the boards before reassembling the radio.

DTX Transmitter Power Measurement: The DTX transceiver module is a modified version of the original RTX handheld. The RTX radio was designed to produce a minimum of 5 Watts of TX power at nominal supply voltage (+9.6 Volts DC), throughout the radio's operating frequency range. The transmitter was designed with close tolerances, to exceed the RF power output specification by as little as possible in order to maximize battery life.

1. MODELS DTX-150 & DTX-450 SPECIFICATIONS

1.1 GENERAL

	DTX-150	DTX-450
FCC IDENTIFIER:	VHF (AIERTX-150)	UHF (AIERTX-450)
FCC RULE PARTS:	22, 74, 90	22, 74, 90, 95
FREQUENCY CONTROL:	Synthesized, PLL	Synthesized, PLL
FREQUENCY STEPS:	5 or 12.5 KHz	12.5 KHz
NUMBER OF CHANNELS:	11 with independent TX/RX Frequencies and Codes	
TRANSMIT/RECEIVE SPACING:	15MHz	20 MHz
MODE OF OPERATION:	Simplex or Half Duplex	Simplex or Half Duplex
SUPPLY VOLTAGE:	+10 -15 VDC with internal Regulator +8-11 VDC with internal Regulator bypassed	
RF INPUT/OUTPUT:	BNC or SMA Female, 2.5mm Female, 50 Ω	
POWER AND DATA INTERFACE:	10 Pin IDC Box Header(Mates with AMP#746285-1)	
OPERATING TEMPERATURE:	-30 to +60 degrees Centigrade	
MAXIMUM DIMENSIONS:	4.5"L, 1.24" H, 2.5" D	
WEIGHT:	8.9 oz	

1.2 TRANSMITTER

OPERATING BANDWIDTH:	15MHz	20 MHz
FREQUENCY STABILITY:	5 PPM	5 PPM
RF POWER OUTPUT:	5 Watts, Programmable to 2 Watts	
MODULATION DISTORTION:	less than 4%	
DUTY CYCLE:	50%	
TRANSMITTER ATTACK TIME:	14ms maximum	
SPURIOUS AND HARMONICS:	-50 dBc maximum	
FM HUM AND NOISE:	-47 dB	-43 dB
MODULATION INPUT IMPEDANCE:	100K Ω @ both Pins 1 and 8	
MODULATION RESPONSE, @ PIN 1:	20-5000 HZ +/- 1.5 DB	
MODULATION RESPONSE, @ PIN 8:	Deviation Limited and 3 KHz Low Pass Filtered User Selectable: Flat, Pre-emphasized, or 300 HzHigh Pass Filtered	
TRANSMITTER CURRENT DRAIN:	1.5 A @ 9.5 VDC for 5 Watts 0.8 A @ 9.5 VDC for 2 Watts	

1.3 RECEIVER

OPERATING BANDWIDTH:	15MHz	20 MHz
FREQUENCY STABILITY:	5 PPM	5 PPM
SENSITIVIY,12 DB SINAD:	.25 µV	.3 µV
RF OUTPUT IMPEDANCE:	50 Ω	50 Ω
SELECTIVITY:	-70 dB @ 30 KHz, -65 dB @ 25 KHz	
SPURIOUS AND IMAGE REJECTION:	-50 dB	-50 dB
INTERMODULATION:	-65 dB	-65 dB
FM HUM AND NOISE:	-45 dB	-45 dB
CONDUCTED SPURIOUS @ ANTENNA:	-60 dBm	-40 dBm UHF

1.3 RECEIVER - CONTINUED

	DTX-150	DTX-450
RECEIVE CURRENT DRAIN:		
w/ Control Board	76 mA	86 mA
wo/ Control Board	65 mA	75 mA
RECEIVE ATTACK TIME:	12 ms	12 ms
CARRIER DETECT ATTACK TIME:	13 ms @ 1 µV	13 ms @ 1 µV
RSSI ATTACK TIME:	<12 ms @ 1µV	<12 ms @ 1µV
AUDIO DISTORTION:	less than 3%	less than 3%
AUDIO OUTPUT LEVEL:	0-8 Vp-p into 8Ω	
AUDIO RESPONSE:	Flat, De-emphasized, High Pass Filtered	

1.4 CODED SQUELCH

PROGRAMMABLE FORMATS:	CTCSS and DCS Encode and Decode Two Tone Sequencial Paging Decode

1.5 INPUT/OUTPUT CONNECTOR

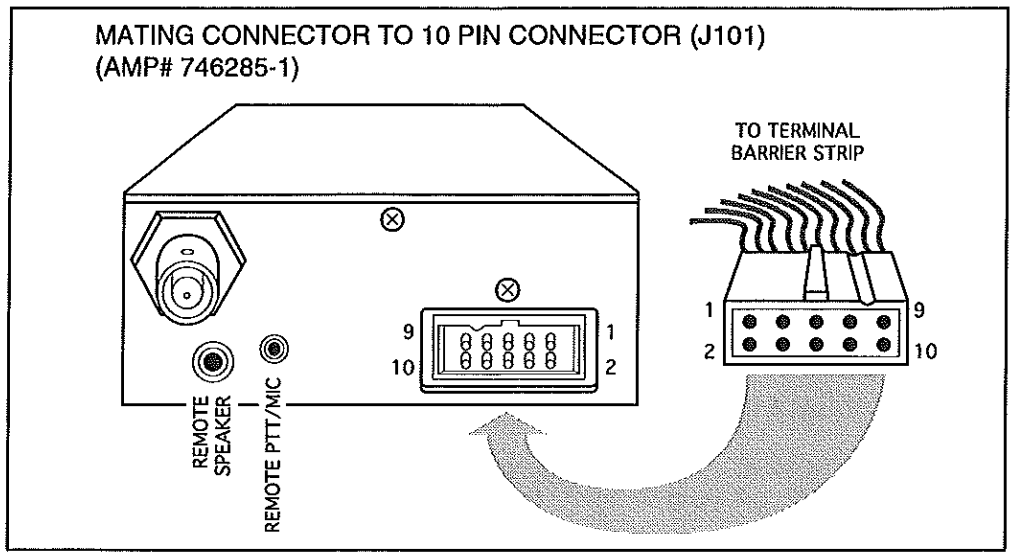
PIN	DESCRIPTION
1	TX Wideband Modulation Input
2	RX Wideband Demodulated Output
3	Channel Select Input
4	Tone Detect Output
5	Supply Voltage Input
6	TX Key Input (Polarity Selectable)
7	Carrier Detect Output (Polarity Selectable)
8	TX Modulation Input
9	Ground
10	RX Audio Output

LOCAL TEST "ORDER-WIRE" SPEAKER MICROPHONE CONNECTORS

3.5 MM	DESCRIPTION
TIP:	RX Speaker Audio, 1 Watt to 8 Ω
RING:	Programming Data To/From PC Programmer
SLEEVE:	Ground

2.5 MM	DESCRIPTION
TIP:	TX Key and TX Audio Combined
SLEEVE:	Ground

DTX MODULE INPUT/OUTPUT CONNECTIONS



PIN#	DESCRIPTION
1	TX WB IN - Input with flat frequency response for transmitted data. VHF: 2 Vp-p @ 1 KHz for 5 KHz deviation. UHF: 0.4 Vp-p @ 1 KHz for 5 KHz deviation
2	RX WB OUT - Non de-emphasized/amplified received audio. 1 Vp-p audio with 1 KHz tone @ +/- 3 KHz deviation
3	CHANNEL SELECT - 0 VDC for Chan 1, +5VDC for Chan B as listed in the PC Programmer. If no connection is made, reverts to Chan B. For use of all 11 channels, refer to "DTX Channel Selection" of the Programming selection.
4	TONE DETECT - If programmed for tone signaling, output will go low on detection of correct tone.
5	+V SUPPLY - Voltage input, +11 to +15VDC.
6	TX KEY - 0VDC will key transmitter. May be configured for activation on a logic high voltage. Refer to "Keying" in Transmitter section in the Theory of Operation.
7	CARRIER DETECT - Output will go low when receiving correct frequency. May be configured to go high when receiving correct frequency. Refer to "Carrier/Tone Detect" section in the Theory of Operation.
8	TX DATA IN - Low-Pass Filtered and pre-emphasized to 3000 Hz. Internal sensitivity adjustment provided. Factory set for 1.0 Vp-p @ 1 KHz for +/- 2500 Hz deviation.
9	GND - Chassis ground.
10	RX DATA OUT - De-emphasized and amplified 300 to 3000 Hz received audio. Adjustable from 0 to 8 Vp-p. Set for 1.3Vp-p with a 1KHz signal 3 KHz deviation. Under transmit conditions, side tone audio is present at this pin. Factory setting VHF:1.3 Vp-p side tone. UHF: 0.4 Vp-p. This output is suitable to drive a 8 ohm(minimum) speaker.

RF CONNECTOR - SMA/BNC

When the transmitter is keyed, the RF power output should be 5 Watts as measured using a 50 Ohm Wattmeter. If the channel is programmed for low power, the RF power should be 1 to 3 Watts. Unit is available with either BNC or SMA connector.

2.5 MM/3.5 MM JACKS (J601/J602)

The 3.5 MM jack is used for PC programming via the programming cable. The 2.5 MM jack may be used to charge an external battery. Both jacks are used if an optional remote speaker/microphone is plugged in (models RSM-2X or RSM-3X).

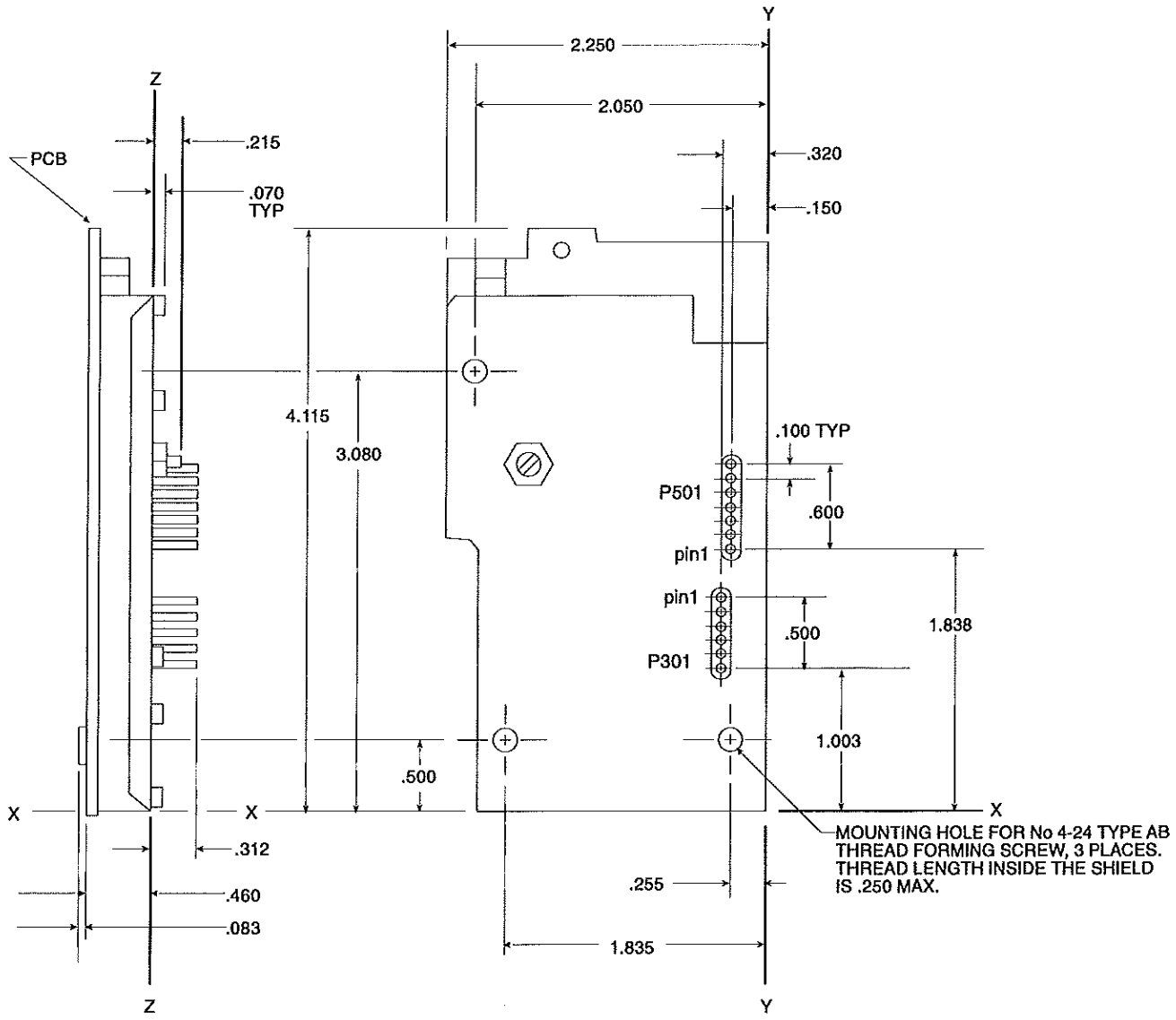
1.5.1 DTX RF BOARD INPUT/OUTPUT CONNECTIONS

NOTE: Use mating connectors Methode #1008-006-2101 and #1008-007-2101(RITRON #'s 21443061, 21443071) or equivalent for applications not requiring a DTX Control Board.

	PIN	DESCRIPTION
P301	1	TX ENABLE - This input should be +5VDC in transmit mode only.
	2	LATCH IN - A rising edge at this point loads valid data into sythesizer IC301.
	3	CLK IN - A rising edge at this input loads valid data into synthesizer IC301.
	4	DATA IN - Input for loading serial data into sythesizer IC301.
	5	TX MOD. - Input for transmitted data. VHF: 2 Vp-p @ 1 KHz for +/- 5 KHz deviation. UHF: 0.4 Vp-p @ 1 KHz for +/- 5 KHz deviation.
	6	LOCK DET. OUT - Output from synthesizer IC301 lock detect. Output high = locked, Output low = unlocked
P501	1	+VREG - Supply voltage input. +8 to +11VDC.
	2	STROBE - Input to receiver and synthesizer supply control. A logic high turns on the receiver and synthesizer circuitry.
	3	GND - Chassis ground.
	4	RSSI - DC voltage output from the noise detector circuitry of IC 501. The less voltage present, the stronger the signal.
	5	RX AUDIO - Demodulated receiver audio from IC501. Output level is 1.7 Vp-p 1KHz @ 3KHz deviation, dc coupled, and referenced to +1.5VDC.
	6	+VREG - Same input as Pin #1.
	7	HI - LO PWR CONTROL - For 5 Watts of RF output, this input must be logic high, and for 1-3 Watts of RF output, this input must be low.

1.5.2

DTX RF BOARD MOUNTING DIMENSIONS



1.6 DTX SYNTHESIZER PROGRAMMING

The following information describes the DTX synthesizer programming format. This information can be used for designing programming software for the DTX RF Board synthesizer, when the DTX Control Board is not used.

The Ritron radio uses a PLL (Phase Locked Loop) frequency synthesizer that compares the outputs of a Reference frequency Divider and the divided frequency of the Voltage Controlled Oscillator (VCO) and generates an error voltage that is applied to the VCO to adjust the VCO frequency such that the frequency input to the Phase Detector from the Reference Divider equals the divided frequency of the VCO.

Two programming words must be loaded into the synthesizer Integrated Circuit to properly transmit or receive a desired frequency.

First is the Reference Counter Control word and second is the Programming Divider Control word. The Reference Counter Control Word is constructed as follows for a VHF radio module:

$$\text{Reference Divisor} = \frac{\text{Reference Oscillator Frequency}}{\text{Synthesizer Step Frequency}}$$

$$\text{Reference Divisor} = \frac{16.000\ \text{MHz}}{0.005\ \text{MHz}} = 3200$$

The Reference Divisor must be properly formatted to become the Reference Divider Control Word. This requires appending a "1" on the LSB (Least Significant Bit) end of the Reference Divisor and preceding the MSB (Most Significant Bit) of the Reference Divisor with enough "0"'s to make the complete word 16 bits long.

Reference Word	= (Reference Divisor * 2) + 1	
	= (3200 * 2) + 1	
	= 6401	(Decimal)
	= $1901	(Hexadecimal)
	= %0001 1001 0000 0001	(Binary)

The data from each bit of the word is presented to the synthesizer IC Data line MSB first. After each bit is applied to the Data Input, the Clock line is set high and then low. After the last bit is clocked in, the Enable line is set high and then low.

The second word that must be sent to the synthesizer Control IC is the Divisor Control Word and it is computed using:

$$\text{Divisor} = \frac{\text{Desired Output Frequency}}{\text{Synthesizer Step Frequency}}$$

For example, assume a VHF radio with the Desired Transmit Frequency of 154.600 MHz.

Desired Output Frequency = Transmit Frequency

$$\text{Divisor} = \frac{\text{Desired Output Frequency}}{\text{Synthesizer Step Frequency}} = \frac{154.600}{0.005} = 30920$$

1.6 A "0" must be appended to the Divisor as a control bit to indicate that the information is destined for the Divisor Control Register. This is done by multiplying the divisor by 2. Additionally, leading "0"'s must be added to (or stripped from) the beginning of the word to total 20 bits in order to completely program the register.

Finally, the trickiest part about programming the Synthesizer Control IC is that the Divisor Control Word consists of two internal counters. One is controlled by the 6 least significant bits of the Divisor and the second by the remaining upper bits. However, the register for the 6 bit counter is 7 bits long! This means that an extra bit must be inserted between the 7th and 8th bits as counted from the LSB. So for example:

Divisor Control Word	= 30920 * 2 = 61840	
	= $F190	
	= %1111 0001 1001 0000	
	= %1111 0001 10001 0000	(insert bit)
	= %000 1111 0001 10001 0000	(add "0"'s)
	= %0001 1110 0011 0001 0000	(rejustify)
	= $1E310	(convert to hex)

For receive mode, the Desired Output Frequency is the First Local Oscillator Frequency which differs from the Desired Receive Frequency by the First Intermediate Frequency (First I.F.).

Desired Output Frequency = Desired Receive Frequency - 1st I.F.

For UHF operation the First I.F. is 21.4 MHz and for VHF operation the First I.F. is 10.7 MHz. In both cases the First Local Oscillator frequency is below the Desired Receive Frequency of 154.600 MHz.

Desired Output Frequency = 154.600 - 10.7
= 143.900

$$\text{Divisor} = \frac{\text{Desired Output Frequency}}{\text{Synthesizer Step Frequency}}$$

$$= \frac{143.900}{0.005} = 28780$$

Divisor Word	= Divisor * 2	
	= 28780 * 2 = 57560	
	= $E0D8	
	= %1110 0000 1101 1000	
	= %1110 0000 10101 1000	(insert bit)
	= %000 1110 0000 10101 1000	(add "0"'s)
	= %0001 1100 0001 0101 1000	(rejustify)
	= $1C158	(convert to hex)

For UHF radios with a 12.5 KHz Synthesizer Step Frequency:

$$\text{Reference Divisor} = \frac{\text{Reference Oscillator Frequency}}{\text{Synthesizer Step Frequency}}$$

$$\text{Reference Divisor} = \frac{16.0125\ \text{MHz}}{0.0125\ \text{MHz}} = 1281$$

1.6 Reference Word = (Reference Divisor * 2) + 1
= (1281 * 2) + 1
= 2563 (Decimal)
= $0A03 (Hexadecimal)
= %0000 1010 0000 0011 (Binary)

For UHF Transmit Frequency of 464.500 MHz:

$$\text{Divisor} = \frac{\text{Desired Output Frequency}}{\text{Synthesizer Step Frequency}} = \frac{464.500}{0.0125} = 37160$$

Divisor Control Word = 37160 * 2 = 74320
= $12250
= %0001 0010 0010 0000
= %0001 0010 0010 00101 0000 (insert bit)
= %001 0010 0010 00101 0000` (add "0"'s)
= %0010 0100 0100 0101 0000 (rejustify)
= $24450 (convert to hex)

For a UHF Receive Frequency of 464.500 MHz with a 21.4 MHz 1st I.F.:

Desired Output Frequency = Desired Receive Frequency - 1st I.F.
Desired Output Frequency = 464.500 - 21.4
= 443.100

$$\text{Divisor} = \frac{\textbf{Desired Output Frequency}}{\text{Synthesizer Step Frequency}}$$

$$= \frac{443.100}{0.0125} = 35448$$

Divisor Control Word = 35448 * 2 = 70896
= $114F0
= %0001 0001 0100 1111 0000
= %0001 0001 0100 10111 0000 (insert bit)
= %001 0001 0100 10111 0000 (trim "0"')
= %0010 0010 1001 0111 0000 (rejustify)
= $22970 (convert to hex)

Before loading data, the Power Strobe line should be held high for at least 10 milliseconds to allow the radio module to power up. Additionally, the proper transmit data should be loaded into the synthesizer immediately prior to setting the TX Enable line to +5 Volts.

All logic levels are 5 Volts true logic.

This is the most essential information required. Refer to the appropriate Ritron transceiver technical manual and the Fugitsu MB1504 Synthesizer Controller Integrated Circuit data sheet for additional information.

2. INTRODUCTION

2.1 GENERAL

The RITRON DTX is a programmable 2-way radio module that operates in a professional FM communications band (UHF or VHF available). Each channel can be programmed to contain a unique set of operating frequencies and options. Eleven channels are available.

The DTX module is made up of two PC boards - a transceiver and an audio/logic control board. These are enclosed in an aluminum case, with four connectors built into one end of the case: 1) a SMA/BNC 50 Ohm connector; 2) a 2.5 mm microphone/PTT jack; 3) a 3.5 mm programming / receive audio jack and; 4) a 10-pin Box connector.

Connections to the DTX module are available through the 10-pin connector. The power supply +12 VDC and Ground lines are wired to the module's 10-pin connector.

2.1.1 MODEL IDENTIFICATION

The model number appears on a label attached to the DTX enclosure. A "DTX-150" number means that the unit is designed to operate in the VHF FM band, on frequencies from 150 to 165 MHz. "DTX-450" identifies the module as UHF, for use on frequencies from 450 to 470 MHz.

MODEL	FREQUENCY (MHZ)	DESCRIPTION
DTX-150-EB	136-151	VHF High Band
DTX-150-0B	150-165	VHF High Band
DTX-150-FB	160-174	VHF High Band
DTX-450-GB	400-430	UHF Government Band
DTX-450-0B	450-470	UHF Private Radio Band
DTX-450-AB	470-490	UHF Private Radio T Band
DTX-450-BB	490-512	UHF Private Radio T Band

Models above have a BNC antenna connector. To order with a SMA antenna connector, change the last character of the model number from "B" to "S".

2.2 FCC REGULATIONS

2.2.1 LICENSING

The FCC requires the radio owner to obtain a station license for his radios 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.

2.2.2 SAFETY STANDARDS

The FCC (with its action in General Docket 79-144, March 13, 1985) has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment. RITRON follows these safety standards, and recommends that you observe them also:

- DO NOT operate radio equipment near electrical blasting caps or in an explosive atmosphere.
- DO NOT operate any radio transmitter unless all RF connectors are secure and any open connectors are properly terminated.
- DO NOT operate the transmitter of a fixed radio (base station, microwave, rural telephone RF equipment) or marine radio when someone is within two feet of the antenna.
- Repair of RITRON products should be performed only by RITRON authorized personnel.

3. ACCESSORIES

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

IMPORTANT: THE ITEMS LISTED BELOW FOR USE WITH THE RTX HANDHELD ARE TO BE USED WITH THE DTX MODULE.

DESCRIPTION	ITEM NO.
Programming Kit for DTX radios (via PC compatible computer)	RPT-PCPK

Includes: 1) 1 - Software installation instructions
2) 2 - Programming software diskettes, 3.5" and 5.25" (1 each)
3) 1 - PC/radio adapter cable (DB-25F connector to 6 pin modular connector)
4) 1 - PC cable adapter (6 pin modular connector to 3.5 mm plug)

Factory programming of channels, codes and features is also optional.

Remote Speaker/Microphone RSM-3X

4. OPERATION

4.1 WHAT THE RADIO TONES MEAN

IMPORTANT: The information below may be useful for testing purposes. An optional RSM-3X speaker/ microphone or external speaker connected to pin-10 of the 10-pin connector is required. Grounding pin-6 of the 10-pin connector will cause the unit to transmit..

The RSM-3X remote speaker/microphone has a two-plug connector. The larger plug is inserted into the 3.5 mm jack, the smaller plug into the 2.5 mm microphone/PTT jack.

RITRON programmable radios respond to certain instructions by sounding a tone or series of tones. These tones can tell you whether a radio is working as you expect.

4.1.1 POWER ON/SELF CHECK "OK"

When power is applied to the transmitter, the unit then runs a quick "self test." When the internal system checks confirm basic functions, the radio sounds a brief "confirmation tone" to indicate that the unit is in *OPERATING MODE* and ready for use.

4.1.2 ERROR TONES

However, if the self test detects a diagnostic error, an error tone sounds. One low-pitched tone means that the radio microcontroller is not working as it should. Alternating tones (the second is lower pitched) indicate that the radio frequency synthesizer is malfunctioning. If you get one of these messages, turn off the radio and try again. If you cannot correct a problem, consult an authorized RITRON service facility or RITRON.

Repeating error tones occur if you press the Push-To-Talk button while a "Receive Only" channel is selected. This is because a "Receive Only" channel does not contain a transmit frequency, which must be present for the radio to broadcast. The error tone repeats until you release the PTT.

One low tone sounds and the transmitter automatically shuts off if you hold the PTT button down continuously for a specified time (normally, 30 seconds). This transmitter time-out feature may be turned off or adjusted with the optional PC programming kit (model RPT-PCPK).

4.2 CHANNEL SELECTION (IN OPERATING MODE)

The voltage applied to pin-3 of the 10-pin connector determines which channel is selected. A logic "high", (+5VDC), will select Channel B, while a "low", 0VDC, will select Channel 1. Each of the other nine channels may be selected by placing an incremental voltage between 0 and +5 Volts on pin 3.

The radio produces a brief confirmation tone each time a new channel is selected.

If the channel selected has not been programmed, the radio automatically operates on the next previous channel that has been programmed. If all previous channels are blank, the radio then checks channel B (11). If B is also blank, A (10) is next, and so on, downward through the remaining channels.

4.3 OPERATING MODES

4.3.1 RECEIVE MODE

The DTX module can receive broadcasts while the transmitter is off. Whether or not the radio does receive an incoming signal depends upon the squelch settings.

Squelch is the function that mutes interference from other licensees and/or background noise.

There are two types of squelch used in the DTX module. First is carrier squelch. This allows the radio to detect all but weak broadcasts on the channel, and silences noise. Second is Quiet Call (coded) squelch. This allows the radio module to screen out "on-frequency" transmissions that do not carry the Quiet Call code programmed for the channel.

When a radio frequency is shared by several licensees in an area, coded squelch keeps other licensees' broadcasts from disturbing your radio network. When the radio is in monitor mode, coded squelch is turned off and all communications on the channel can be received by the DTX Module.

4.3.2 TRANSMIT MODE

Before transmitting, make sure the channel is not in use. Check pin-7 of the 10-pin connector, a logic "Low" indicates a carrier is present, and a logic "High" indicates no carrier present. Normally, you should not transmit until the channel is clear.

To transmit with the speaker/microphone, press and hold the PTT (Push-To-Talk) button. Pressing the PTT button activates the transmitter if the channel contains a transmit frequency. The transmitter will not come on for a "Receive Only" channel.

RITRON programmable radios feature a transmitter time-out function, which automatically terminates a continuous transmission that lasts for a specified time. (This time may be adjusted by authorized service personnel, using the RPT-PCPK programming kit.) The unit sounds a tone when the transmitter shuts off.

4.4 PROGRAMMABLE OPTIONS

DTX radios may be operated with options that are programmed on a per channel basis, including Quiet Call code signaling, scanning and special features.

4.4.1 QUIET CALL CODE SIGNALING

Code signaling allows you to screen out broadcasts from other systems on the channel. RITRON programmable radios come from the factory ready to operate with three communications industry standard signaling formats, including Quiet Call (QC), Digital Quiet Call (DQC) and Paging Quiet Call (PQC). Generally, "Quiet Call" refers to the entire family of RITRON signaling formats (QC, DQC and PQC), unless specified otherwise.

4.4.1.2 *QUIET CALL (QC)*

Quiet Call is RITRON's tradename for what the communications industry calls sub-audible tone, tone squelch or CTCSS (Continuous Tone Coded Squelch System). A radio system can use a unique Quiet Call code to avoid receiving transmissions from other licensees. Units with Quiet Call squelch turned on stay quiet unless they detect the appropriate code on a broadcast.

Channels programmed with Quiet Call automatically transmit a code with each broadcast. Note that other nearby licensees on your channel can hear your transmissions unless they have another code enabled.

4.4.1.3 *DIGITAL QUIET CALL (DQC)*

Digital Quiet Call is RITRON's tradename for digital coded squelch. DQC works the same as QC, except that a digital code is transmitted with the broadcast. Units programmed with the correct code "recognize" the call and allow the transmission to be received.

4.4.1.4 *PAGING QUIET CALL (PQC)*

4.4.1.4.1 General

Paging Quiet Call (PQC) is RITRON's tradename for its selective paging system. Each radio or group of radios may have a unique PQC code. Any channel that contains an operating frequency can be programmed with one of these codes. (A channel programmed with PQC may also contain a QC code.) With a PQC channel selected, the radio will not apply RX audio to the DTX Module until the programmed PQC code is received. (If an optional RSM-3X speaker/microphone is plugged into the DTX module for testing purposes, you will hear a ringing tone announce incoming calls.)

Each Paging Quiet Call code is broadcast as a unique pair of audible tones, with the first tone sent for two seconds, and the second tone for two seconds. PQC codes can be originated by a base station paging encoder, a telephone (via a RITRON RR-454 Repeater Plus/RP-200 system), or a RITRON programmable radio equipped with a Touch Tone encoder keypad.

4.4.1.4.2 The All-Call Code

Radios operated with PQC respond to an All-Call code, as well as to their individual codes. This allows one page to be heard by all "PQC units" on the channel.

TO SEND AN ALL-CALL PAGE:

1) *Select a channel programmed with Paging Quiet Call.*
2) *Remove power from the module*
3) *Ground the TX Key Line (pin-6 of 10-pin connector) while applying power to the module. Continue to ground the TX Key line for six seconds.*
4) *Remove the ground from the TX Key line.*
5) *Ground the TX Key Line to deliver your message.*

4.4.2 SCANNING (NORMAL/PRIORITY)

TO SCAN: Select the channel that contains a scan list.
TO STOP SCANNING: Change channels.

GENERAL

Scanning automatically lets you listen to broadcasts on different radio channels (frequencies). You may choose the channels to be scanned by creating a "scan list." This list of channel numbers is stored in a radio channel. **(A channel cannot hold both a scan list and an operating frequency.)**

HOW SCANNING WORKS

When a channel is selected that contains a scan list, the radio pauses, sounds a tone, and then repeatedly checks each channel of the scan list in turn. Channels are scanned in the order that they were programmed into the list. When a broadcast is received on a channel being scanned, scanning stops on that channel. Scanning resumes when the transmission ends.

If you connect an optional RSM-3X speaker/microphone for testing purposes, you can find out which channel received the last broadcast. Select the channels, one at a time until the radio emits a "beep." The channel just selected was the last active.

PRIORITY SCANNING

Priority scanning lets the radio monitor other channels without missing a call on the priority channel, which the radio periodically checks for activity even when scanning has stopped on another channel. Priority scanning works only if the scan list programmed is a Priority Scan List, not a Normal Scan List.

5. PROGRAMMING THE RADIO

5.1 PROGRAMMING THE DTX TRANSCEIVER MODULE

To program the DTX Module, the RITRON RPT-PCPK PC Programming Kit must be used.
NOTE: Software version 3.0R11 or later must be used.

DTX MODEL SELECTION:
When selecting a "Model" to program a DTX Transceiver, USE ONLY the listings of DTX Telemetry Modules.

Example: To program a DTX-150 using the RPT-PCPK PC Programmer, choose from the list of available Models;

DTX-150 VHF-FM Telemetry Module

All of the CHANNEL and PERSONALITY programming options are available to use for programming the DTX Module.

After programming is completed, disconnect and then re-apply power to the DTX Module to place it back into operating mode.

DTX CHANNEL SELECTION:
As stated in the General Specifications, the DTX Transceiver has the capability of being programmed for 11 channels. However, if no external device is connected to the Channel Select Pin (pin-3 of the 10-pin connector), then Channel B becomes the default channel.

To use some or all of the 11 available channels, the following table lists a voltage range and a standard value resistor to achieve that voltage for a specific channel. Either the voltage or resistance can be applied to the Channel Select Pin (pin-3 of the 10-pin connector) to select a specific channel.

Channel	Min.(Volts)	Max.(Volts)	Rselect(Ohms)
1	0.000	0.176	0
2	0.195	0.723	1000
3	0.742	1.230	2200
4	1.250	1.738	4700
5	1.758	2.266	6800
6	2.285	2.734	10000
7	2.754	3.223	15000
8	3.242	3.730	22000
9	3.750	4.238	39000
A	4.258	4.727	82000
B	4.746	5.000	OPEN

5.2 CLONING

Cloning allows authorized service personnel to easily copy all channel data from one radio into another, saving time spent entering identical channel contents via the RPT-PCPK PC Programmer.

The radio's "personality," however, cannot be cloned. Personality data controls radio operation for all channels, and includes options such as the transmitter time-out time and battery saver enable. (A radio's personality may be copied to another radio using a PC compatible computer and optional programming kit model RPT-PCPK.)

TO COPY ALL CHANNEL DATA FROM ONE DTX RADIO TO ANOTHER, FOLLOW THE STEPS BELOW.

WARNING: Using an incorrectly wired substitute for the RITRON cloning cable will damage the radio(s)! DO NOT use a standard telephone cable as a part of the cloning cable.

NOTE: The DTX module will not sound any tones during cloning.

1) Remove power from both DTX modules.

2) Connect a cloning cable adapter to one end of the cloning cable, by mating the adapter's modular socket to the cable's modular plug. The adapter is a short cable (approx. 9") with a 6-pin modular socket at one end, and a 3.5 mm plug at the other.

3) Connect the remaining adapter to the other end of the cloning cable.

4) Plug one end of the cloning cable into one radio's audio jack, the other end into the second radio's audio jack.

5) The order in which the radios are turned on determines which is the master and which is the slave. Apply power to the unit that contains the channel data that you wish to copy (the master). Failure to power on the master first causes channel data to flow in the wrong direction.

6) Apply power to the slave.

7) After 60 seconds, remove power from the slave first. Then turn off power to the master. The slave is now programmed with the same channel contents as the master.

8) Disconnect the cloning cable.

5.3 PC COMPUTER PROGRAMMING KIT

RITRON's programming kit (model RPT-PCPK) allows programming of several of Ritron's synthesized products with a PC compatible computer.

RITRON's adapter cable connects the radio to a computer's serial communications port. Once the cable is hooked up, the user inserts the diskette provided into his computer's floppy disk drive and loads a software program. This program transfers data between radio and computer memory, and includes on-screen instructions and help. Radio data may be saved to the computer's hard disk to program other radios.

5.3.1

THE RPT-PCPK KIT INCLUDES:

1) RITRON Transceiver Programmer software, which is contained on one diskette (3.5" format).

2) Installation instructions (RITRON #01454947) and a registration form.

3) RITRON PC to radio adapter cable, which is terminated at one end with a DB-25F connector, at the other end with a modular plug. The DB-25 plugs into the computer's serial port, the modular plug into an adapter.

4) The adapter is for use with DTX radios. This adapter mates the modular plug to a 3.5 mm plug, for connection to the radio's 3.5 mm jack.

THE RPT-PCPK KIT REQUIRES:

5.3.2 A PC compatible computer with DOS 3.2 or later. The computer must have a RS-232 serial port available. A hard disk drive is recommended.

COMPUTER SOFTWARE COPYRIGHTS

5.4 The RITRON, INC. products described in this manual include copyrighted RITRON, INC. computer programs. Laws in the United States and other countries grant to RITRON, INC. certain exclusive rights in its copyrighted computer programs, including the exclusive right to distribute copies of the programs, make reproductions of the programs, and prepare derivative works based on the programs. Accordingly, any computer programs contained in RITRON, INC. products may not be copied or reproduced in any manner without the express written permission of RITRON. The purchase of RITRON, INC. products does not grant any license or rights under the copyrights or other intellectual property of RITRON, INC., except for the non-exclusive, royalty fee license to use that arises in the sale of a product, or as addressed in a written agreement between RITRON, INC. and the purchaser of RITRON, INC. products.

5.5 PROGRAMMABLE FEATURES TABLES

The tables below indicate whether each feature may be programmed with a PC computer. (RITRON programming kit model RPT-PCPK is required.)

NOTE: Some features, may not be applicable in DTX systems.

5.5.1 FEATURES PROGRAMMABLE PER CHANNEL

These features are programmed for individual channels.

FEATURE	RANGE	STANDARD SETTING
Transmit (TX) Frequency	-	-
Receive (RX) Frequency	-	-
Scan List	-	-
Carrier Only, No Tones or Codes	-	-
Quiet Call (CTCSS)	-	-
Quiet Call Encode Only	-	-
Digital Quiet Call (DCS)	-	-
Digital Quiet Call Inverted	-	-
Digital Quiet Call TX Invert	-	-
Digital Quiet Call RX Invert	-	-
Digital Quiet Call Encode Only	-	-
Quiet Call and Paging Quiet Call	-	-
Quiet Call Encode Only and Paging Quiet Call	-	-
Paging Quiet Call Only	-	-
Quiet Call With Separate Decode/Encode	-	-
Squelch Tightner Factor	0-7	0
Busy Channel Transmit Inhibit	Y-N	N
Channel Monitor Lock Out	Y-N	N
Scan Resume Delay	Y-N	Y
Paging Quiet Call Transpond	Y-N	N
When PTT Is Released	Normal, Reversal	Normal
Reduced Transmitter Power	Y-N	N
Transmit Time Out Timer	Y-N	Y
Special Mode Output	Y-N	N
PQC Squelch When Selected	Y-N	Y

5.5.2 FEATURES PROGRAMMABLE PER RADIO

These features are programmed for the radio using a PC computer and programming kit model RPT-PCPK. All channels are set together.

FEATURE	RANGE	STANDARD SETTING	PC	PTT
Transmit Time Out Time	0-255 s	RTX/DTX, RPM 180 s	√	-
Transmit Hang Time For Quiet Call	0-983 ms	183 ms	√	-
Transmit Hang Time For Digital Quiet Call	0-983 ms	183 ms	√	-
Quiet Call Tone Reversal Default	Y-N	Y	√	-
Special Quiet Call Encode Code	Any Code	FF	√	-
Paging Quiet Call Special 1st Tone (443)	300-1500 Hz	483.6 Hz	√	-
Paging Quiet Call Special 2nd Tone (443)	300-1500 Hz	788.6 Hz	√	-

5.5.2 FEATURES PROGRAMMABLE PER RADIO (CON'T.)

FEATURE	RANGE	STANDARD SETTING
Paging Quiet Call All-Call Enable	Y-N	Y
Scan Resume Delay Time	0-4 s	2 s
Priority Scan Look Time	0-4250 ms	1833 ms
Busy Channel Transmit Inhibit Over-Ride Time	0-127.5 s	4.5 s
Number Of Allowable Channels	1-16	DTX/RTX 11, RPM 16
Lock Detect Error Mute	Y-N	N
Monitor Button Operation	T-M	T
Synthesizer Steps	5.0 - 12.5	5.0(VHF) 12.5(UHF)
Battery Saver Enable	Y-N	N
Battery Saver Delay	0-255 s	10 s
Faster QC Decode on TX/RX	Y-N	Y
Scan Revert Set Per Channel	Y-N	N
QC Code 53 Freq. (Hz)	60-250	149.9
PQC Group Calls	Y-N	N
PQC Auto Reset	Y-N	Y
PQC Monitor Trip	Y-N	N
Disable Scan Start Delay	Y-N	N
Scan Channel Lockout	Y-N	Y
Last Active Channel Beep	Y-N	Y
Scan Priority Channel Beeps	Y-N	Y
Fast Channel Beep Out	Y-N	N
Disable Miscellaneous Beeps	Y-N	N
Disable Channel Select Beeps	Y-N	N
Disable PTT Debounce	Y-N	Y
Disable Open Squelch	Y-N	N
Low Battery Volts	6.0 - 10.0	7.97
Dead Battery Volts	6.0 - 10.0	7.15

5.5.3 DESCRIPTIONS OF FEATURES

Battery Saver - This is the time that the radio must remain idle before the battery saver begins cycling.

Busy Channel Transmit Inhibit - Busy Channel Transmit Inhibit keeps the radio from broadcasting if the channel is busy, and is often used in conjunction with Channel Monitoring Lock Out. If you transmit when the channel is busy with a signal not intended for your radio (not carrying your Quiet-Call code), this feature sounds a "busy" tone in the speaker and keeps the transmitter turned off.

Busy Channel Transmit Inhibit Over-Ride Time - If the Busy Channel TX Inhibit feature is programmed for your channel, and you want to reply to an incoming call that was broadcast via a repeater, you normally would not be able to transmit until the repeater hang time ended. (The hang time is the time that the repeater's transmitter stays on after the receiver ceases to detect an incoming call.) The over-ride option allows you to transmit a reply to a call, regardless of whether the channel is busy (with the repeater's hang time signal).

Carrier Only, No Tones or Codes - One radio frequency is used to transmit and receive. Quiet Call is not programmed for the channel.

Channel Monitor Lock Out - This function may be programmed to keep the radio user from listening to other licensees on a shared channel. The transmit/busy lamp indicates whether the channel is busy. Quiet-Call or Digital Quiet-Call must be used with this option.

Dead Battery Volts - Voltage of external battery when radio will automatically shut off. A long, low frequency tone will be emitted at this time.

5.5.3 DESCRIPTIONS OF FEATURES (CON'T.)

Digital Quiet Call (DQC) - This operates the same as Quiet Call (CTCSS), except that a digital code, instead of a sub-audible tone, is used for coded communications.

Digital Quiet Call Encode Only - The code programmed for the channel is transmitted with your calls. However, Digital Quiet Call is turned off during receive mode. All communications on the channel sound in the speaker.

Digital Quiet Call Inverted - The code programmed for the channel is inverted for receive and transmit modes. The Digital Quiet Call chart in this manual lists codes, normal and inverted.

Digital Quiet Call RX Invert - The code is inverted for receive mode only.

Digital Quiet Call TX Invert - The programmed code is inverted for transmit mode.

Disable Channel Select Beep - The "beep" when channel is selected may be muted.

Disable Miscellaneous Beeps - Various "beeps" will be muted.

Disable Open Squelch - The radio will remain in carrier squelch when the monitor button is depressed for 5 seconds.

Disable PTT Debounce - The debounce routine should be disabled for Telemetry applications to provide more rapid RX/TX transitions.

Disable Scan Start Delay - The 1 second time interval from when a scan channel is selected to when the scan "beep" is heard can be disabled.

Fast Channel Beep Out - The speed at which a channel is read out during PTT programming is doubled.

Faster QC Decode on TX/RX - Enables a faster TX/RX Quiet-Call unmute when using the radio with a repeater.

Last Active Channel Beep - The "beep" that acknowledges when a channel is selected signifying it was the last channel with activity, may be disabled.

Lock Detect Error Mute - The error tone when the radio's synthesizer has not locked on frequency may be disabled.

Low Battery Volts - Voltage at which radio emits a shorts beep every 20 seconds when battery voltage is low.

Monitor Button Operation - The monitor button may be programmed for either Momentary mode, or Toggle mode. Toggle mode switches between Paging, Tone, Carrier and Open Squelch.

Number Of Channels - This value must be set at 11 for DTX and RTX radios, regardless of the number of channels programmed.

Paging Quiet Call All-Call Enable - The radio's All-Call decode feature may be enabled or disabled.

Paging Quiet Call Only - If the channel is programmed with PQC, the unit can receive pages, and transmit the All-Call page.

Paging Quiet Call Special 1st Tone (443) - Any 300 - 1500 Hz frequency pair that has 2 second, 2 second signaling timing may be substituted for Paging Quiet Call code 443. This is the first tone of that pair.

5.5.3 DESCRIPTIONS OF FEATURES (CON'T.)

Paging Quiet Call Special 2nd Tone (443) - This is the second tone of the frequency pair used to replace PCQ code 443.

Paging Quiet Call Transpond - If you receive a page and do not answer within three seconds, this feature automatically keys your radio's transmitter and sends an "acknowledgement" tone to the party.

Power Strobe - Enabling this option allows the radio to go into battery saver mode when the radio remains idle. (This is for DTX and RTX radios only.)

Priority Scan Look Time - During priority scanning, the radio's microcontroller regularly checks the priority channel for activity. The look time is the time between these checks. A lower value means that the priority channel is checked more frequently.

PQC Auto Reset - Paging mode is automatically set 12 seconds after responding to page.

PQC Group Calls - Allow all units of the same group to hear a single page.

PQC Monitor Trip - Any QC tone will be disabled and the radio will revert to carrier squelch after a page.

PQC Squelch When Selected - When Paging Channel is selected, the radio will also hear tone coded traffic on the channel.

QC Code 53 Freq (Hz) - Any QC tone frequency may be programmed.

Quiet Call (CTCSS) - Programming a Quiet Call code allows you to screen out transmissions that do not carry your code. Your code is broadcast when the radio transmits.

Quiet Call Encode Only - The Quiet Call code programmed for the channel is transmitted with your broadcasts. However, Quiet Call is turned off during receive mode, allowing all traffic on the channel to be heard.

Quiet Call and Paging Quiet Call (PQC) - If PQC is programmed on a channel with Quiet Call, the radio can receive pages while that channel is selected.

Quiet Call Encode Only and Paging Quiet Call - This option works exactly the same as the one listed above, except that Quiet Call is deactivated during receive mode.

When PTT Is Released (PTT Release Options For Quiet Call Encode) - This option enables the radio to match various methods for eliminating the squelch tail (noise burst) at the end of a transmission. You may program the radio to do the following when the PTT button is released: 1) reverse the phase of the encode tone and leave the transmitter on for the turn-off time or, 2) turn off the tone and leave the transmitter on for the turn-off time.

Quiet Call Tone Reversal Default - This sets Quiet Call tone phase reversal as the default method of squelch tail elimination for the radio.

Quiet Call With Separate Decode/Encode - One Quiet Call (QC) code is activated during receive mode, a second QC code during transmit mode.

Receive Frequency - The radio frequency that receives broadcasts from other units.

5.5.3 DESCRIPTIONS OF FEATURES (CON'T.)

Reduced Transmitter Power - This feature allows for reduced transmitter power on individual channels, which might be required by the radio owner's FCC license. Reduced transmit power also conserves the battery charge.

Scan Channel Lockout - When scanning, a nuisance channel, other than the 1st channel in the scan list, may be deleted by pressing the monitor button.

Scan List - A list of channels that the radio automatically monitors when the channel that contains the list is selected.

Scan Priority Channel Beep - When a priority channel is received while scanning, a short beep will be heard.

Scan Resume Delay Time - After the radio has stopped on a busy channel and the broadcast ends, this is the time the radio waits to resume scanning. This delay allows the user to hear the rest of a paused conversation on the channel, or to reply before scanning resumes. The standard delay time is two seconds.

Scan Resume Delay - This is normally enabled, in which case the radio waits the Scan Resume Delay Time before scanning continues. However, this feature may be disabled if required.

Scan Revert Set Per Channel - Different types of scanning may be programmed on a per channel basis.

Special Mode Output - This output, which terminates inside of the DTX radio, can be used to switch electrical equipment, etc.

Special Quiet Call Encode Code - A channel can reference this code as its Quiet Call (sub-audible) encode frequency. This enables channels with Paging Quiet Call (two-tone sequential) decode to have separate Quiet Call encode/decode frequencies.

Squelch Tightner Factor - Carrier squelch is set for maximum sensitivity at the factory, but may be adjusted (by authorized service personnel) to mute weak signals. This feature reduces distant "co-channel" or other interference for channels that are not programmed with Quiet-Call.

Synthesizer Steps - On a per radio basis, the synthesizer steps may be set for 5 or 12.5 KHz.

Transmit Frequency - The radio frequency that is broadcast while the transmitter is activated.

Transmit Hang Time For Digital Quiet Call - This is the time that the Digital Quiet Call turn-off code is transmitted after the PTT is released.

Transmit Hang Time For Quiet Call - This is the time that either no Quiet Call tone or the phase reversed Quiet Call tone is transmitted after the PTT is released.

Transmit Time Out Time - This is the time that you can press the PTT continuously before the Transmit Time Out Timer shuts off the transmitter. (The timer must be turned on.)

Transmit Time Out Timer - This feature automatically shuts off the transmitter (ending your call) if you hold down the PTT button continuously for a specified time. This time can be set to as much as 255 seconds, or the feature turned off. The radio speaker sounds a tone when the transmitter shuts off.

MODEL DTX-150/450 MAINTENANCE/REPAIR

6. DTX-150 THEORY OF OPERATION

IMPORTANT: AN OPTIONAL RSM-3X SPEAKER/MICROPHONE IS REQUIRED TO KEY THE DTX MODULE USING A PTT (PUSH-TO-TALK).

6.1 INTRODUCTION

This explanation begins with the power supply circuitry. Next comes the transceiver. Because the microcontroller controls transceiver functions (via logic circuitry), the transceiver explanation incorporates controller input. The audio circuitry, which conditions both receive and transmit signals, is discussed for both receive and transmit modes. The final section lists pin descriptions for the microcontroller.

The transceiver includes a frequency synthesizer, track tuned receiver, transmitter, high/low power control and antenna switching/low-pass filter circuitry. All are located on one printed circuit board, called the RF board. A second PC board, the audio/logic board, contains audio conditioning and logic circuitry, and the microcontroller. The radio's two PC boards are connected with two header/plug connectors (P301, P501).

6.2 POWER SUPPLY AND VOLTAGE DISTRIBUTION

The DTX Module is powered by an external source through Pins 5(+Vsupply) and 9(gnd) of the 10-Pin Box Connector. The voltage(+Vsupply) is then fed to F601 and a reverse voltage diode CR603. This voltage supplies IC102 and Q609. The output of IC102 is a regulated +5VDC that is applied to circuitry throughout the DTX Control Board, Q609 and associated circuitry (Q606, Q607 and Q608) comprise an adjustable voltage regulator to supply circuitry in the DTX Control Board, and the DTX RF Board. R616 is factory set for 9.5VDC at the collector of Q609.

Voltage regulator IC302 applies +5 VS via Q315 to the prescaler/synthesizer controller (IC301), VCO, reference oscillator, frequency temperature compensation circuit, bandswitch circuit (via Q305) and receiver (via Q310). C355 and C354 provide filtering for IC302.

Voltage switch Q313/Q403 supplies voltage to the transmitter buffer and driver device. Regulator IC102 applies +5V REG to the following: microcontroller IC101; channel selector switch (R105 and R110); Q202, which, under the control of IC101 (PWR STROBE), switches +5V SW to the audio processing circuitry; Q601 and Q604, which apply a logic low to IC101 pin 49 to enable the transmitter when TX Key is grounded.

6.2.1 POWER STROBE

If power conservation is a concern, the DTX Module includes a power strobe feature, which reduces average current drain by periodically removing voltage from part of the radio. The strobe duty cycle is approximately 20 %. (The receiver is on for 150 ms, off for 800 ms). Microcontroller IC101 generates a 0 to +5 Volt square wave (PWR STROBE) at pin 34. This output routinely switches on and off Q203, which in turn toggles Q202. Q202 applies +5V SW to the MF6 low-pass filters, and to bilateral switches IC201 A-D, and to triple SPDT switch IC205. Buffer amplifier IC202A provides approximately +2 Volts (+Vag) for audio conditioning circuitry.

When the 0 Volt portion of the square wave is applied to the base of Q203, the transistor shuts off, placing the radio in standby mode (to extend battery life). The +5 Volt signal level forward biases Q203, which causes current to flow through R233 and R234 to ground. Approximately +2 Volts at the base of Q202 activates that device, which then applies +5V SW to the circuitry mentioned above. The radio is then in receive mode.

The power strobe also controls Q314, which pulls the base of Q315 low to apply +V SW to voltage regulator IC302. As mentioned above, that IC supplies voltage to the phase-locked loop (PLL) and the receiver. And, the strobe switches Q102, which allows serial data to flow between microcontroller IC101 and prescaler divider/synthesizer controller IC301.

6.2.2 LOW VOLTAGE RESET

A low voltage reset circuit (Q101 and R103) protects against internal EE memory loss due to battery voltages below about +5.3 Volts, by shutting off the microcontroller. A DC level below +5 Volts at the regulator (IC102) output can cause the CPU to randomly execute instructions that might include an "erase sequence." Q101 turns off when this voltage drops below +5 Volts. Q101 then pulls IC101 pin 18 low to reset the microcontroller.

The DTX Module will alert the user if the supply voltage drops below a set value, by sounding a beep every 20 seconds. This value, called the "low voltage set," is programmed at the factory for "battery-end-of-life," but can be re-programmed for another value using the PC Programming Kit. If the battery voltage drops below +7 VDC, the radio emits a low frequency tone when turned on. Below about +5 Volts, the radio will not operate. R107 applies +V SW (minus the voltage drop across the voltage divider formed by R107 and R108) to a microcontroller A/D converter at pin 11. This voltage must be between 0 and +5 VDC, as referenced to the voltages at pins 7 and 8 (which are 0 and +5 VDC, respectively). The A/D output is compared with the pre-programmed "low voltage set" to determine whether the supply voltage is low.

6.3 PHASE-LOCKED LOOP

The DTX-150 radio is built around a common phase-locked loop (PLL) that consists of a voltage controlled oscillator (VCO) and a frequency synthesizer. The PLL generates both the receiver first injection and transmitter carrier signals.

6.3.1 VCO/BUFFER AMPLIFIER

Q307, L303, varactor CR307 and associated components form the VCO (Voltage Controlled Oscillator), a resonant circuit that oscillates at approximately 150 MHz. Varying the voltage at the cathode of CR307 changes the varactor's capacitance, which in turn alters the VCO output frequency; for example, when the voltage at CR307 is increased (normally, the charge in C322-324 provides this voltage), CR307's capacitance decreases, which increases the VCO output frequency. +5 VDC is tied to the collector of Q307. C332 and C333 serve as a feedback network. C338 couples the oscillator signal to buffer amplifier Q308. C335 and C341 function as RF bypass capacitors. The amplified signal at Q308's collector is coupled by C340 and applied both to synthesizer controller IC301 pin 8 (via R342 and C342) and to buffer amplifier Q309. The buffered VCO signal at Q309's collector then feeds through C345 and R346 as local oscillator injection into the source of Q502, the receiver 1st mixer. The output of Q309 feeds Q311 (through R347/C346), the transmitter buffer amplifier.

6.3.2 PRESCALER DIVIDER/SYNTHESIZER CONTROLLER

IC301 contains both a prescaler and synthesizer controller. The prescaler squares and divides the VCO output tied to pin 8 by either 64 or 65, determined by a synthesizer controller logic signal. A logic high instructs the prescaler to divide the VCO frequency by 64, a low by 65. The exact number of times the prescaler is instructed to change divisors is determined by the channel frequency. +5 VDC is supplied to IC301 at pin 4.

IC301 contains a digital phase detector that works as follows - when an operating channel is changed or the receive/transmit mode switched, either of which selects a new synthesizer operating frequency, microcontroller IC102 (pin 52) clocks new data into IC301's internal buffer (pin 10) in synchronization with clock pulses applied to IC301 pin 9. (Signals from the microcontroller are usually too fast to observe with an oscilloscope.) Until all data is loaded into the buffer, the synthesizer continues to function at the previous operating frequency.

Once all new data is loaded into the buffer, a single pulse from IC101 appears at IC301 pin 11 that instructs the synthesizer controller to latch and execute the new data. IC301 utilizes internal circuitry to determine whether the present VCO output frequency is correct by comparing the phase and frequency of the VCO signal (at pin 8) and the 16 MHz reference oscillator. IC301 produces a pulse output signal proportional to the phase difference between the two input signals. If the VCO output frequency is too high, pin 16 pulses high. If the frequency is too low, pin 15 pulses low.

The charge pump (Q303, Q304 and associated components) and loop filter (C322-325, R323-325 and L302) transform the synthesizer controller output into a DC voltage for application to the VCO. The synthesizer system is "locked" when the phase and frequency of both the reference and the divided VCO signal are the same.

6.3.3 REFERENCE OSCILLATOR

The 16 MHz reference oscillator connected between IC301 pins 1 and 2 is built around crystal Y301, C308, varactor CR301 and tuning capacitor C310. A temperature compensation circuit (R305-307, CR302 and variable thermistor R308) provides the synthesizer controller with a constant 16 MHz reference frequency (+/ - 5 PPM).

6.3.4 OSCILLATOR MODULATION

When the unit is in transmit, gate IC205B passes TX modulation to the reference oscillator via C312, and to the VCO via R310. R310 routes modulation through C317 and R326 to the cathode of varactor CR305. Because CR305 is coupled to the VCO through C328, modulation causes the VCO frequency to vary. C312 applies modulation to the reference crystal to provide for the addition of any Quiet Call or Digital Quiet Call signals. If modulation was not applied to the reference, QC and DQC encode tones would be distorted as the synthesizer attempted to track them.

6.3.5 HIGH VOLTAGE SOURCE

Q301, CR303 and associated components supply approximately +15 Volts to run the charge pump. When the radio is switched on, Q315 provides collector voltage for Q301, a voltage multiplier. The 16 MHz signal at the gate of Q301 is amplified by Q301, then rectified by CR303. The rectified voltage is applied to Zener diode CR304 to supply the charge pump.

6.3.6 CHARGE PUMP/LOOP FILTER

The charge pump, Q303, Q304 and surrounding components, processes the phase detector (IC301) pulses to yield a signal that the loop filter can smooth into a DC voltage. R314 applies the pulses to Q303. Q303 turns on, applying a voltage "burst" to the loop filter (C322-325, R323-325 and L302) and charging C322-325 one pulse at at time toward +14 Volts. The loop filter provides the DC level at CR307 that governs the VCO frequency.

R320 routes the signal from IC301 pin 16 to Q304. Q304 turns on and discharges C322-325 one pulse at a time, the resulting DC voltage applied to CR307.

6.3.7 BANDSWITCH

Because the DTX-150 utilizes a single oscillator for both transmit and receive modes, the oscillator's frequency range must shift approximately 10.7 MHz when the unit is switched between transmit and receive. While the radio is in receive mode, a bandswitch circuit (Q306, R329, R331, C330 and CR306) places C327 in parallel with the VCO tank circuit, increasing the tank's capacitance and so shifting the VCO tuning range about 10.7 MHz.

With the DTX-150 in receive, the TX enable line at the base of Q305 is low, which turns on that device. When +5 VS is applied to the base of Q306, Q306 switches on and current flows through CR306 to ground. CR306 acts like a short circuit, incorporating C327 into the oscillator circuit. When the DTX-150 is "keyed," Q305 shuts off, removing the +5 VS. Q306 turns off, switching off CR306. C327 is removed from the oscillator circuit, increasing the VCO output frequency approximately 10.7 MHz.

6.3.8 SOURCE-FOLLOWER BUFFER

The source lead of FET Q302 applies a DC voltage, which "tracks" the varactors in the receiver RF amplifier circuit to the VCO. Q302 isolates the VCO from the receiver amplifier.

6.4 RECEIVER

6.4.1 RX +5V SUPPLY

When the DTX Module's TX Key line is ungrounded, the transmitter shuts off and the TX enable line switches low. Q310 is biased on, and applies RX +5V to the receiver.

6.4.2 RF AMPLIFIER

A received signal from the antenna first passes through an elliptical low-pass filter (C420-423, L411-413) to remove spurious harmonics above about 200 MHz. L410 and C501 then apply the RF signal to a 2-pole track-tuned tank circuit whose center frequency depends upon the VCO tuning voltage applied (via Q302) to varactors CR501-504. C511 applies the output to the emitter of Q501, a low-noise, high-frequency RF amplifier. R503 and R504 set the base bias for Q501. L503 applies collector voltage to the stage. C512 supplies an RF bypass for L503; R505 restricts the current through Q501. C513 couples the amplified RF signal into a second 2-pole track-tuned tank circuit, whose bandpass shape further sharpens front-end response. C523 applies the output signal to the gate of common-source JFET Q502, the 1st mixer.

6.4.3 1ST MIXER

The RF input signal drives the gate of mixer Q502, while the VCO signal at Q309's collector drives the source. A resonant tank circuit (T502) emphasizes the 10.7 MHz difference frequency component of the mixer output, which C527 couples to a 10.7 MHz four-pole crystal filter (YF501, C528 and YF502). R509 applies the filter output to the base of Q503, a grounded-emitter buffer amplifier that provides stable gain. C532 then applies the signal to IC501 pin 16.

6.4.4 FM RECEIVER SUBSYSTEM

A multi-function integrated circuit, IC501 and associated components, forms the FM-receiver subsystem. This subsystem performs the functions of: 1) 2nd local oscillator (10.245 MHz), 2) 2nd mixer, 3) 2nd IF amplifier, 4) FM detector and 5) noise amplifier.

IC501 pins 1 and 2, 10.245 MHz crystal Y501, and feedback capacitors C534 and C535 comprise the 2nd local oscillator - which provides low-side injection (10.245 MHz). The 10.7 MHz signal at IC501 pin 16 and the 2nd local oscillator output are mixed, with the resulting 455 KHz mixer output appearing at IC501 pin 3. A 455 KHz, 4-pole ceramic filter, YF503, connects the balanced-mixer output to the input of the limiting IF amplifier at IC501 pin 5. IC501 pin 6 is the decoupled input to the IF amplifier, IC501 pin 7 the limited IF output signal. An internal quadrature detector, whose center frequency is determined by T501, detects the FM IF signal. One input of the quadrature detector connects internally to the IF signal at IC501 pin 7, while the other detector input is the phase-shifted signal from quadrature coil T501 at IC501 pin 8. Demodulated audio appears at pin 9, where a low-pass filter (R517 and C540) removes spurious quadrature output. Audio then simultaneously enters both the voice/tone conditioning circuit (via P501 pin 5) and a noise filter/amplifier (R519-522, C541-542 and the amplifier internal to IC501 at pins 10 and 11) whose bandpass is centered at 8 KHz. Thermistor R526 provides temperature compensation.

6.4.5 CARRIER SQUELCH

The noise amplifier output at IC501 pin 11 is rectified and filtered to produce a DC voltage called the RSSI (Received Signal Strength Indication) that is inversely proportional to receive signal strength. CR506 and

Q504 form a voltage-doubling detector. C544 integrates the detected signal, while R524 and C545 filter it. R525, CR505A and CR505B form a threshold bias circuit that keeps Q504 slightly biased on, maintaining a constant noise output independent of ambient temperature. The RSSI is applied to IC101 pin 9 (via P501 pin 4) for carrier detect. The microcontroller enables carrier detect by comparing the RSSI with a "squelch set" voltage (adjusted with potentiometer R114) at pin 12.

6.5 VOICE/TONE CONDITIONING IN RECEIVE MODE

6.5.1 GENERAL

DTX-150 Receive Audio conditioning filter circuits are shared with the transmitter. The same high-pass filter/amplifier (IC202B associated components) and-low-pass filter/amplifier (IC203A-C) used for "receive" voice band conditioning are used for "transmit." Similarly, the low-pass filter (IC204C) used for sub-audible tone decode filtering is also used for sub-audible tone encode. Altering circuit configuration with bilateral gates IC201A-D and analog switches IC205 (A-C) permits using the same audio filtering system for both receive and transmit modes.

After R517 and C540 remove 455 KHz elements at the demodulated audio output (IC501 pin 9), C202 couples the signal to bilateral gates IC201A and IC201D. The received signal follows two separate paths: one for voice band (which includes PQC tones) audio conditioning, the other for sub-audible (QC and DQC) tone detection.

6.5.2 VOICE BAND

When the transmitter shuts off, IC101 pin 35 (TX ENABLE) applies a low to the base of Q201, which shuts off. +5 SW at R229 toggles gate IC201A, allowing received audio to reach high-pass filter/amplifier circuit, IC202B and associated components. The amplified signal, with frequencies below about 250 Hz (sub-audible tones) attenuated, exits IC202B pin 1 and travels to an amplifier (IC203A and associated components) via C212 and R218. Analog switch IC205-C is open, and so removed from the circuit. The audio signal exits IC203A pin-2 and enters a low-pass filter to attenuate frequencies above 3 KHZ. The low-pass filter output is applied to bilateral gate IC201C and the input of amplifier IC203B. The audio passes through gate IC201C when squelch is enabled and a high at IC101 pin 45 toggles the gate. R222 and C216 provide de-emphasis, and with potentiometer R601, direct the signal to audio amplifier IC601 and associated circuitry. In receive mode, TX ENABLE is low, opening analog switch IC205B. The output at IC203B is applied to the input of amplifier IC206A. The squared output of IC206A pin-7 is applied to IC101 pin-22 for PQC(Paging Quiet Call) decode.

6.5.3 SUB-AUDIBLE

Audio also passes through IC201D, which is turned on unless the radio transmitter is keyed, and enters pin 8 of IC204C, a 6-pole low-pass filter that attenuates frequencies above approximately 250 Hz. In receive mode, the output at pin-3 passes through analog switch IC205A into IC204B, a limiter that squares the signal. The signal then drives the QC (Quiet Call) input at IC101 pin-47 to decode the correct sub-audible (QC) tone.

6.6 AUDIO AMPLIFIER

R601, the volume level control, attenuates voice band audio passed through "squelch gate" IC201C to audio amplifier IC601. C601 provides high-pass filtering. C605 couples the output at pin 5 to the RX Data Out pin(pin-10 of 10-pin connector) and J602. With a load impedance of 8 Ω, the maximum output at pin 5 is about 1 Watt.

When the radio is in receive mode, the microcontroller places a high on pin 27, which forward biases Q603. Q603 then pulls the base of Q602 low, which turns on that transistor. Supply voltage (+V Supply) for the audio amplifier (at the emitter of Q602) is connected to pin 6. (When the radio is switched into transmit mode, IC101 pin 27 goes low.)

6.6.1 CARRIER/TONE DETECT

CARRIER DETECT

When the DTX is receiving the correct frequency, IC101 pin-37 goes high. A logic high on the base of Q206 will cause Q206 to turn on pulling the collector of Q206 low. This low output is fed through R223 to CD OUT(pin-7 of J101). For a logic high present at CD OUT when the correct frequency is detected, remove R223 and add R228. Now, when the collector of Q206 goes low in the presence of carrier, the base of Q205 is low and turns off Q205. The collector of Q205 is pulled high and that logic high is fed through R228 to CD OUT.

TONE DETECT

If the DTX has been programmed for tone signaling, and the correct tone is sent with the correct carrier, then IC101 pin-36 goes high. The logic high is fed to the base of Q207 and turns Q207 on. The collector of Q207 is pulled low. The logic low is fed through R243 and connected to TD(pin-4 of J101).

6.7 ANTENNA SWITCHING/LOW-PASS FILTER

An elliptical low-pass filter comprised of C420-423 and L411-413 removes harmonics from the transmitter output before applying the RF signal to the antenna port. Received signals pass through the low-pass filter before entering the receiver RF input circuitry.

Two high speed PIN diodes (CR401, CR402) and associated components form the antenna switching circuit, which isolates the transmitter output from the antenna when the DTX-150 is in "receive" mode; no voltage is applied to PIN diodes CR401 and CR402 - they do NOT conduct. This reverse biases CR401 to prevent the transmitter amplifier from affecting receiver tuning and removes CR402 from the receiver input. Incoming signals from the antenna pass through the low-pass filter, then L410 and C501 to the receiver RF amplifier.

When the unit is switched into "transmit," Q313 applies +V TX to R404. Current flows through R404, L409, CR401, L410 and then CR402 to ground, forward biasing the diodes. CR401 passes transmitter RF power to the antenna port. CR402 shunts the receiver RF input to ground. Now L410 provides sufficient impedance to isolate transmitter power from the receiver RF amplifier, Q501.

6.8 TRANSMITTER

6.8.1 KEYING

The DTX-150 is keyed by applying a ground to the TX KEY (pin-6 of the 10-pin connector) input pulling the base of Q204 to ground. Q204 turns on, and switches +5Vreg to the to the base of Q604. Q604 turns on and pulls IC101 pin-49 low. The output of pin-35 of IC101 (Tx Enable) goes high to enable the transmitter circuitry.

The DTX-150 may also be keyed by applying a logic high to the TX KEY input. To do this, remove R257 and add R255. A high on the base of Q208 will cause Q208 to turn on, pulling the collector of Q208 low. A low at the base of Q204, turns Q204 on, Q204 then applies +Vreg to the base of Q604. Q604 turns on and pulls IC101 pin-49 low to cause IC101 pin-35 to go high and enable the transmitter circuitry.

The DTX-150 can also be "keyed" via the 2.5mm Chg/Mic Test Jack using the RSM-3X Speaker/Mic. When the PTT of the RSM-3X is depressed, a low via the internal electret microphone is applied to the base of Q601. Q601 turns on and switches +5Vreg to the base of Q604. Q604 turns on, pulls IC101 pin-49 low, which pulls the TX Enable output (pin-35 of IC101) high.

6.8.2 +V TX SUPPLY

The high at pin 35 (TX ENABLE) activates Q312 and Q313, which form a voltage regulator that supplies power amplifier transistor Q401 and the antenna switching circuit. (The TX ENABLE line controls other circuitry, too, as related in other paragraphs.) The high at pin 35 is routed to Q312, forward biasing the base-emitter junction and causing current to flow from the +V SW line to ground through R353, Q312 and R351. The resulting voltage at Q312's collector switches on Q313, which in turn applies +V TX to Q401 via R403, Q403, Z402 and L402. When the user ungrounds the TX KEY LINE, IC101 pin-35 switches low, which turns off Q312, and so releases the transmitter.

6.8.3 POWER AMPLIFIER

Q311 and associated components further amplify the VCO signal at Q309's collector before feeding it via C348 to the 5 Watt, wide-band RF power amplifier. C401 matches the signal to the base of Q401. The output at Q401's collector is then coupled into the base of Q402, a 5 Watt power amplifier. The resulting 5 Watt signal is matched to 50 Ω for application to the switching circuit.

6.8.4 POWER CONTROL CIRCUIT

"Reduced power channels" may be programmed using the RPT-RPT-PCPK PC Programmer. All low power channels have the same power output, approximately 1-3 Watts.
The power control circuit works as follows: when a channel programmed for low power is selected and the transmitter is keyed, IC101 pin 24 (HI/LO PWR CONTROL) applies a logic low to Q404's base. Q404 and Q403 do not turn on and are "removed" from the circuit. R405 limits the current supplied to Q401, which in turn reduces the drive to RF final transistor Q402. As a result, transmitter power output decreases.

When a channel programmed for high power (the default setting) is selected and the transmitter is activated, IC101 pin 24 applies a high to Q404's base. Q404 turns on and pulls Q403's base low. Q403 is biased on and switches +V TX to Q401's collector. Q401 drives Q402.

6.9 VOICE/TONE CONDITIONING IN TRANSMIT MODE

6.9.1 GENERAL

DTX Transmit Audio conditioning filter circuits are shared with the receiver. Low-pass filter/amplifier (IC203A-C) used for "receive" voice band conditioning are used for "transmit." Similarly, the low-pass filter (IC204C) is used for sub-audible tone decode filtering is also used for sub-audible tone encode. Altering circuit configuration with bilateral gates IC201A-D and analog switch IC205 (A-C) permits using the same audio filtering system for both receive and transmit modes.

When the user presses the PTT button, IC101 pin 35 goes high, turning on the transmitter via Q313 and closing analog switch IC205B. (IC205B gates TX modulation.) The TX ENABLE line also controls Q201, which keeps RX AUDIO out of the audio conditioning circuitry during transmit by opening switches IC201A and IC201D. IC101 pin 27 applies a low to the base of Q603 which must be off to remove voltage from the audio amplifier (via Q602). With the collector of Q602 low, Q605 turns on to pass microphone audio to the high-pass filter/amplifier (IC202B).

When Pin-6 of J101 is grounded, the collector of Q204 goes high and is connected to the base of Q603. Q603 turns on, switching +Vsupply through Q602 to turn on audio amplifier IC601. Any audio signal present at the output of summing amplifier IC203B passes through analog switchIC205B and is fed to the inverting input of IC601. The amplified signal at the output of IC601 is fed to pin-10 of J101 as transmitted "side-tone".

6.9.2 VOICE BAND

Transmit audio can be applied at (3) different inputs. The first is the 2.5mm Chg/Mic Test Jack. When the PTT is depressed, microphone audio passes through J601, Audio Switch Q605, R235 and C228 to the input of high-pass filter/amplifier IC202B and associated circuitry. The output of IC202B is then pre-emphasized by C212 and R240 and then fed to the input of the summing/limiting amplifier IC203A.

A second input is on Pin-8 of J101. The audio signal is attenuated by R226 and then fed into amplifier IC206B. The output of IC206B can then be directed either to the input of high-pass filter.amplifier IC202B, or to C233 and R246 for pre-emphasis and then to the input of summing/limiting amplifier IC203. The module is shipped with the audio fed to C233 and R246.

The third input is on pin-1 of J101. This input connects directly to summing amplifier IC203B. When the DTX-150 is "keyed", the output of IC203B passes through analog switch IC205B, and is fed to the oscillator modulation input.

6.9.3 SUB-AUDIBLE

Remember that the microcontroller opens bilateral switch IC201D (via the TX ENABLE line) when the unit is in transmit, disconnecting received audio from the low-pass filter. IC101 generates sub-audible/digital encode tones (at pin 33) for application to pin 13 of summing node buffer amplifier IC204A. The output at pin 4 then enters 250 Hz low-pass filter IC204C. The microcontroller sets the low-pass filter's corner frequency to approximately 250 Hz (IC101 pin 43 "floats" in tri-state mode), or to about 150 Hz (pin 43 pulls to ground) by switching C206 into the circuit. The 150 Hz corner frequency operates when a QC tone below 125 Hz or a DQC tone is encoded. During transmit, analog switch IC205A connects the output of IC204C (pin-3) to the tone deviation control, R206. C221 and R227 couple the tone signal to the input of summing amplifier IC203B.

6.10 MICROCONTROLLER (IC101) PIN DESCRIPTIONS

PIN	DESCRIPTION
1	SPEAKER "BEEP" OUTPUT (I/O). Alerting tones exit this pin for application to the audio amplifier.
3	CHANNEL SELECT (A/D). The DTX uses a 0-5VDC voltage applied to this pin and read by the microcontroller A/D to determine the operating channel.
4	PROGRAMMING CODE KEY (A/D).
5	SYNTHESIZER LOCK DETECT (A/D). The frequency synthesizer is considered locked if pin 4 is greater than +3.3 VDC (as derived from the synthesizer's lock detect output at IC301 pin 7), and unlocked if less than that value. The microcontoller program checks the lock detect line 180 ms after the synthesizer is programmed, and if the synthesizer is out of lock, sends an error tone. If the synthesizer remains out of lock, the tones continue; if the synthesizer locks, the tones cease and normal operation resumes.
7	GND (A/D).
8	+5 VDC REFERENCE (A/D).
9	RSSI - RECEIVED SIGNAL STRENGTH INDICATION (A/D). The RSSI, a DC voltage derived from rectified demodulated noise, is applied to the microcontroller at pin 9 for carrier detect. The RSSI level should increase with increasing noise on the channel.

PIN	DESCRIPTION
10	+V Supply (A/D), +5 VDC.
12	SQUELCH SET (A/D). The microcontroller divides the voltage input here by two and compares it to the voltage applied to the RSSI input. When the RSSI voltage is less than this value, carrier detect is enabled. After detecting a carrier, the the RSSI input must rise to this value plus a threshold voltage to disable carrier detect.
13-14	GND
15	6 K EE PROM PROGRAMMING VOLTAGE +5 VDC (I). Used only in "special software units."
16	REFERENCE OSCILLATOR INPUT (I). Connected to the reference oscillator crystal network.
17	REFERENCE OSCILLATOR OUTPUT (O). Connected to the reference oscillator crystal network.
18	RESET\ (IN). When pin 18 is pulled low, microcontroller operations stop. A low-voltage reset circuit pulls pin 18 low when +V SW is less than about +5.3 Volts. This ensures that the microcontroller does not erase internal EE memory due to improper program execution with an "out of spec" supply voltage.
19	IRQ\(IN). This line is pulled low when the PTT is pressed. This is used to immediately wake the unit from battery saver mode when the user tries to transmit.
22	PQC DECODE (I). This input receives Paging Quiet Call signals for decoding (via IC206A).
24	HIGH/LOW POWER OUT (O). This output selects transmitter power.
25	SPECIAL MODE OUTPUT (O). This output may be programmed to either a high or a low state on a per channel basis for controlling accessories.
28	TX/BUSY INDICATOR (I/O). When the radio switches into transmit mode, pin 35 goes high and pin 28 is driven low to light the TX/BUSY LED. In receive mode, pin 28 pulses at a one second rate to indicate that the channel is busy.
33	QC ENCODE (I/O). Pin 33 applies either Quiet Call or Digital Quiet Call tones to low-pass filter IC204C (via IC204A). The QC encode line is tri-stated when the unit is not encoding one of these formats.
34	Power Strobe (O).
35	TRANSMIT ENABLE (I/O). Pin 35 pulls high to disable the receiver, toggle bilateral transmission gates, switch the VCO operating range and, activate the transmitter.
36	TONE DETECT (O). Pin-36 pulls high when the correct tone signal is present.
37	CARRIER DETECT (O). Pin-37 pulls high when the correct carrier frequency is present.
38	GND
41	SUPPLY RETURN (I), GND.

PIN	DESCRIPTION
42	SYNTHESIZER SHIFT REGISTER LATCH (O). Following an operating frequency change (which includes a receive/transmit mode transition), pin 42 sends a single positive pulse to the synthesizer IC, latching the new serial data into IC301.
43	LP FILTER SLEW CONTROL (I/O). The filter slew control decreases the low-pass corner frequency to improve decode and encode waveform purity. Pin 43 appears tri-stated while the radio decodes or encodes Quiet Call tones above 141.3 Hz, and as an "active low" for QC tones below 141.3 Hz and Digital Quiet Call.
45	RX AUDIO ENABLE (I/O). A low at pin 45 opens switch IC201C, preventing receive signals from reaching the audio amplifier. For example: if the microcontroller must generate a "beep," it first pulls pin 45 low to open switch IC201C and mute received audio ("beeping" tones follow another route to the audio amplifier). When the monitor button is pressed for four seconds, the microcontroller pulls pin 45 high to close IC201C and pass audio.
46	PQC ENCODE (I/O). Pin 46 is tri-stated unless the microcontroller is generating the Paging Quiet Call All-Call tone (483.5 Hz). Turning on the unit while holding the PTT button sends the All-Call page.
47	QC/DQC DECODE INPUT (I/O). The limited sub-audible data is applied here for both QC and DQC decode.
48	MONITOR (I/O). A low on the monitor line, defeats the tone squelch requirement that only a programmed tone can unsquelch audio. A momentary closure toggles between monitor and tone squelch modes. Grounding the Monitor Line for more than about four seconds defeats carrier squelch and directs receiver noise to the audio amplifier.
49	PTT SWITCH (I/O). Switching pin 49 low instructs the software to pull the transmit enable line high.
50	SERIAL DATA IN (I). Pin 50 links the microcontroller to communications from an external data terminal, or to a PC compatible computer running a communications program. Pin 50 serves as the DATA IN line for cloning and for programming with the PC Programming Kit.
51	SERIAL DATA CLOCK (O). The line at pin 51 toggles in the center of each bit period sent via the serial data out line, and clocks data to the synthesizer shift register.
52	SERIAL DATA OUT (O). Pin 52 supplies serial data out for: 1) Synthesizer IC301 (125 Kbits/sec, binary, w/clock) 2) External Communications (1200 bits/sec, ASCII, asynchronous) 3) Cloning operations

7. DTX-150 ALIGNMENT PROCEDURE

THE ALIGNMENT PROCEDURE REQUIRES ADJUSTING VARIABLE COMPONENTS. REFER TO THE PARTS PLACEMENT DIAGRAMS.

7.1 RECOMMENDED EQUIPMENT

1) 0 to 15 VDC, 2 Ampere current-limited power supply
2) FM service monitor (to 200 MHz)
3) Oscilloscope (to 20 MHz)
4) FM deviation meter
5) RF Wattmeter, 10 Watts full scale
6) PC computer and RITRON PC programmer kit (model RPT-PCPK)
7) Frequency counter (to 200 MHz)
8) VTVM or DMM
9) SINAD measuring device
10) RITRON model RTX-SRVBD adapter
11) RITRON model AAD-BX cable
12) RSM-3X

7.2 RADIO PREPARATION

1) Program the channels below as shown, using the PC programmer. For an explanation, refer to the programming section of this manual.

   Channel 1 - 157.320 MHz and 071 DQC code
   Channel B - 157.320 MHz and 123 Hz CTCSS Tone (QC code 18)

2) Remove the (2) Philips head screws from the DTX module lid. Remove the lid.

3) Remove the three (3) Torx head screws that hold the DTX RF board to the control board. These screws are accessible through the bottom of the chassis.

4) Carefully pull the board on top (RF board) apart from the bottom board (control board).

5) Using the RTX-SRVBD adapter, connect the RF board to the control board (J301 to P301 and J501 to P501). Refer to the parts placement diagrams.

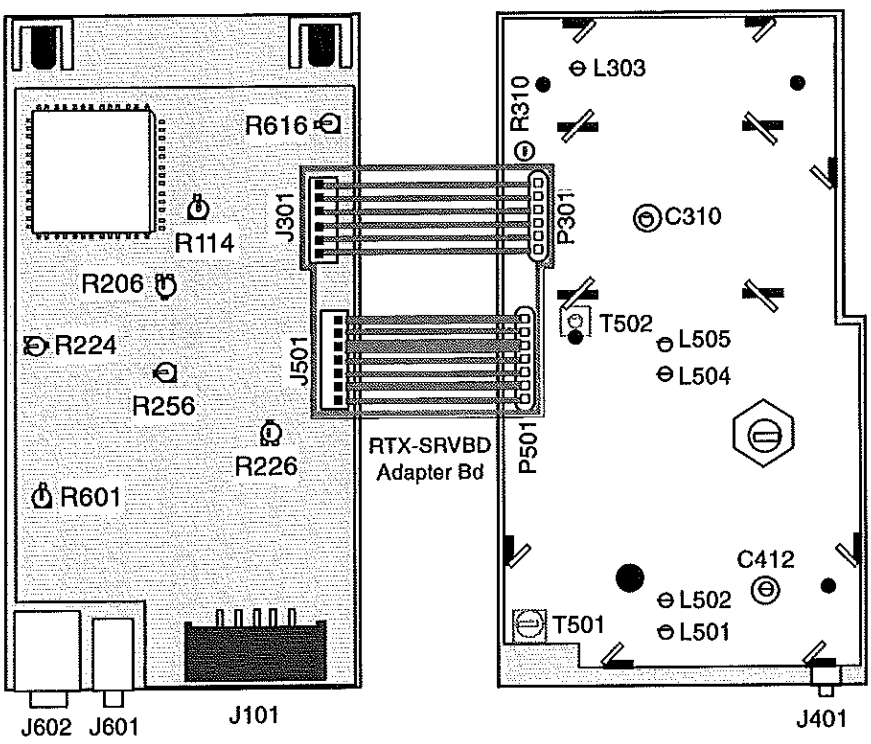
6) Set the power supply to +12.5 VDC and connect to pin-5 (+12.5 VDC) and pin-9 (GND) of J101. (Don't switch on the supply yet.)

7) Connect the FM service monitor to the 2.5 mm RF test jack at the top of the RF board.

8) Turn on the power supply to place the radio in operating mode.

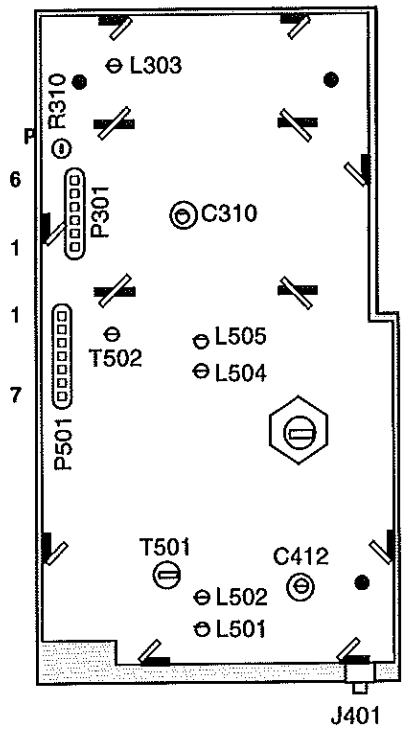
CAUTION: RITRON surface mount products require special servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty.

DTX MODULE - CONNECTORS and ADJUSTMENT LOCATION



DTX Control Board Topside

DTX-150 (VHF)
RF Board Topside



DTX-450 (UHF)
RF Board Topside

DTX Control Board

J101 = 10-pin Connector
J301 = 6-pin Connector
J501 = 7-pin Connector
J601 = Change Jack (2.5 mm)
J602 = Programming Jack (2.5 mm)
R114 = Squelch Adjust
R206 = QC Deviation Adjust
R224 = Voice Deviation Adjust
R226 = Tx Data In Sensitivity Adjust
R256 = Vag Adjust
R601 = Rx Audio Adjust
R616 = Internal 9.5 VDC Adjust

DTX RF Boards

C310 = Reference Frequency
C412 = Power Output Adjust
J401 = RF Test Jack (2.5 mm)
L303 = Synthesizer Control Voltage Adjust
L501, L502, L504 and L505 =
RX RF Amplifier/Filter
P301 = 6-pin Connector
P501 = 7-pin Connector
R310 = Modulation Balance Control Adjust
T501 = Quadrature Detector Adjust
T502 = IF Band-Pass Filter Adjust

PROGRAMMING KIT

Programming Kit Model RPT-PCPK 3.0R7 (or higher) includes a:
1) programming disk (3.5" format) and
2) PC/Radio interface cable with adapters.

7.2.1 INTERNAL SUPPLY VOLTAGE

1) Switch power supply on.

2) Connect VTVM or DMM to the collector of Q609.

3) Adjust R616 for 9.5 VDC +/-0.25 VDC.

7.3 SYNTHESIZER

The synthesizer control voltage should not need re-adjustment, unless a key component in the synthesizer has been replaced. Do not perform steps 1 through 5 unless such a component has been replaced. Key components do not include the synthesizer reference crystal or the synthesizer IC. (Synthesizer alignment errors cause poor operation at temperature extremes.)

1) Unground pin-3 of J101.

2) Connect a VTVM, DMM or oscilloscope to test point 35 (which is accessible from the bottom of the PCB. (Refer to the DTX-150 RF board bottomside parts placement diagram.)

3) The voltage at this point should be +6.5 VDC (+/-0.5 VDC).

   IF NOT:

   Proceed with steps 4 and 5.

4) Locate L303, the VCO coil. (Refer to the DTX-150 RF board topside parts placement diagram.)

5) Note the position of L303's core (visible through a hole in the RF shield). Adjust L303 until the voltage at test point 35 is +6.5 VDC. A small adjustment (a quarter turn) should produce a large change in voltage.

   IF THE VOLTAGE DOES NOT ADJUST:

   Rotate the core of L303 back to its original position before troubleshooting.

7.4 REFERENCE FREQUENCY

1) Make sure that the radio has been powered on and is at room temperature.

2) Unground pin-3 of J101.

3) Set the service monitor receiver to 146.620 MHz (receiver L.O. frequency = receive frequency - 10.7 MHz). The monitor should be able to receive the L.O. signal with a short antenna.

4) Locate C310, which adjusts the frequency. (Refer to the DTX-150 RF board topside parts placement diagram.) Adjust C310 through a hole in the RF shield to center the frequency.

7.5 MODULATION BALANCE CONTROL

Normally, the balance control should not require re-alignment. The purpose of the balance adjustment is to prevent sub-audible (Quiet Call) and digital coded (Digital Quiet Call) encode signals from being distorted.

1) Ground pin-3 of J101.

2) Set the service monitor to receive 157.320 MHz.

3) Connect the demodulated output of the monitor to the oscilloscope.

4) Locate balance control R310, which is accessible through a hole in the RF shield. (Refer to the DTX-150 RF board topside parts placement diagram.)

5) Activate the transmitter (ground PIN-6 OF J101) and adjust R310 (DTX-150 RF board) for the "best" square wave waveform as observed on the oscilloscope. The transmitter may also be activated by connecting the RSM-3X and pressing the PTT switch.

6) Locate QC deviation control R206. (See the DTX control board topside parts placement diagram.)

7) Unground pin-3 of J101.

8) Activate the transmitter (ground pin-6 of J101) and adjust R206 for +/-600 Hz deviation as seen on the deviation meter.

7.6 TRANSMITTER

1) Connect a Wattmeter to the RF test jack, J401.

2) Unground pin-3 of J101.

3) Locate C412, which is accessible through a hole in the RF shield.

4) Activate the transmitter (ground pin-6 of J101).

5) Adjust C412 for power output of 5 Watts.

6) Unground pin-6 of J101. Plug RSM-3X into the 2.5mm and 3.5mm jacks (J601 and J602.)

7) Set the service monitor to receive 157.320 MHz.

8) With the PTT depressed, speak loudly into the electret microphone and adjust voice deviation control R224 (located on the control board) for +/-5.0 KHz maximum deviation as read on the deviation meter. Release the PTT.

If applicable:

9) Connect desired transmit audio signal to pin-8 of J101.

10) Ground pin-6 of J101 to transmit.

11) Adjust R226 for desired signal deviation as measured on the service monitor.

7.7

RECEIVER

IMPORTANT: THE RECEIVER CANNOT BE ALIGNED UNTIL THE SYNTHESIZER CONTROL VOLTAGE IS CORRECT.

THE DTX IF FILTER AND QUADRATURE ALIGNMENT IS EXTREMELY DELICATE AND CRITICAL. ADJUSTMENT SHOULD NOT BE NECESSARY UNLESS A COMPONENT HAS BEEN CHANGED.

7.7.1

CTCSS BIAS CONTROL

1) Set the service monitor RF signal generator for 157.320 MHz.

2) Set the generator to FM modulate the signal with a 123 Hz tone at +/-600 Hz deviation.

3) Connect the oscilloscope to IC204B pin-2.

4) Adjust R256 for a symmetrical 123 Hz squarewave.

7.7.2

RF BAND-PASS TRACKING

1) Connect a SINAD meter to pins 10 and 9 of J101. Refer to the DTX input/output Connections diagram.

2) Unground pin-3 of J101.

3) Adjust L501, L502, L504 and L505 to position the aluminum core of each slightly above the shield cover.

4) Set the service monitor RF signal generator to 157.320 MHz

5) Set the generator to FM modulate the signal with 1 KHz @ +/-3 KHz deviation along with a signal of 123 Hz @ +/- 600 Hz deviation. Set the generator output to 1000 μV.

6) Adjust squelch control R114 fully counter-clockwise to "open" squelch.

7) At this point, a 1 KHz tone should be seen at pin-10 of J101.

8) Decrease the generator output and adjust L501 and L502, then L504 and L505 for best SINAD.

7.7.3

IF FILTER

9) Set the generator output to 500 μV.

10) FM modulate the generator with a 15 Hz signal @ +/-15 KHz.

11) Connect the 15 Hz signal directly to the HORIZONTAL input of the oscilloscope, and set the horizontal sweep to EXTERNAL.

12) Connect the VERTICAL input of the oscilloscope to test point 43, which is located on the bottom side of the RF board. Refer to the DTX-150 RF board bottomside diagram.

13) Locate T502 using the DTX-150 RF board topside parts placement diagram. Adjust T502 for a 10.7 MHz bandpass waveform.

NOTE: For some versions of the DTX-150 RF board, the shield will have to be removed before you can access T502.

7.7.4 QUADRATURE DETECTOR

14) Set the generator for a FM modulated 1 KHz signal @ +/-7.5 KHz deviation along with a signal of 123 Hz @ +/-600 Hz deviation. Set the output to 2000 µV.

15) Connect the oscilloscope to pins 10 and 9 of J101 (control board).

16) Find T501 on the DTX-150 RF board topside diagram. Adjust T501 for maximum amplitude of the 1 KHz sine wave.

NOTE: For some versions of the DTX-150 RF board, the shield will have to be removed before you can access T501.

7.7.5 CARRIER SQUELCH

17) Decrease the deviation of the modulated 1 KHz signal to +/-3 KHz.

18) Adjust R601 for desired amplitude at pin-10 of J101.

19) Decrease the signal generator output and adjust L501 and L502, then L504 and L505 for best 12 dB SINAD. The 12 dB SINAD should be less than 0.25 µV.

20) Set the generator output for a 12 dB SINAD reading.

21) Adjust squelch control R114 (control board) clockwise until no signal is seen at pin-10 of J101.

22) Slowly rotate R114 counter-clockwise until a signal is seen.

23) Decrease the generator output by 5 dB. The radio should squelch. If not, repeat steps 20 and 21.

8. DTX-450 THEORY OF OPERATION

IMPORTANT: AN OPTIONAL RSM-3X SPEAKER/MICROPHONE IS REQUIRED TO KEY THE DTX MODULE USING A PTT (PUSH-TO-TALK).

8.1 INTRODUCTION

These sections start with a description of the power supply circuitry. Next comes the transceiver. Because the microcontroller controls transceiver functions (via logic circuitry), the transceiver explanation incorporates controller input. The audio circuitry, which conditions both receive and transmit signals, is discussed for both receive and transmit modes. The final section lists pin descriptions for the microcontroller.

The transceiver includes a frequency synthesizer, track tuned receiver, transmitter, high/low power control and antenna switching/low-pass filter circuitry. All are located on one printed circuit board, called the RF board. A second PC board, the audio/logic board, contains audio conditioning and logic circuitry, and the microcontroller. The radio's two PC boards are connected with two header/plug connectors (P301, P501).

8.2 POWER SUPPLY AND VOLTAGE DISTRIBUTION

The DTX Modeule is powered by an external source through Pins 5(+Vsupply) and 9(Gnd) of the 10-pin Box Connector. The voltage(+Vsupply is then fed to F601 and a reverse voltage diode CR603 This voltage supplies IC102 and Q609. The output of IC102 is a regulated +5VDC that is applied to circuitry throughout the DTX Control Board. Q609 and associated circuitry(Q606, Q607, and Q608) comprise an adjustable voltage regulator to supply circuitry in the DTX Control Board and the DTX RF Board. R616 is factory set for 9.5 VDC at the collector of Q609.

Voltage regulator IC302 applies +5 VS (via Q315) to the prescaler/synthesizer controller (IC301), VCO, reference oscillator, frequency temperature compensation circuit, bandswitch circuit (via Q305) and receiver (via Q310). C355 and C354 provide filtering for IC302.

Voltage switch Q313/Q403 supplies voltage to the transmitter buffer and driver device. Regulator IC102 applies +5V REG to the following: microcontroller IC101; channel selector switch (R105 and R110); Q202, which, under the control of IC101 (PWR STROBE), switches +5V SW to the audio processing circuitry; Q601 and Q604, which apply a logic low to IC101 pin 49 to enable the transmitter when the TX KEY is grounded.

8.2.1 POWER STROBE

If power conservation is a concern, the DTX Modeule includes a power strobe feature, which reduces average current drain by periodically removing voltage from part of the radio. The strobe duty cycle is approximately 20%. (The receiver is on for 150 ms, off for 800 ms). Microcontroller IC101 generates a 0 to +5 Volt square wave (PWR STROBE) at pin 34. This output routinely switches on and off Q203, which in turn toggles Q202. Q202 applies +5V SW to the MF6 low-pass filters, and to bilateral switches IC201A-D, and to triple SPDT Switch IC205. Buffer amplifier IC202A provides approximately +2 Volts (+Vag) for audio conditioning circuitry.

When the 0 Volt portion of the square wave is applied to the base of Q203, the transistor shuts off, placing the handheld in standby mode (to extend battery life). The +5 Volt signal level forward biases Q203, which causes current to flow through R233 and R234 to ground. Approximately +2 Volts at the base of Q202 activates that device, which then applies +5V SW to the circuitry mentioned above. The radio is then in receive mode.

The power strobe also controls Q314, which pulls the base of Q315 low to apply +V SW to voltage regulator IC302. As mentioned above, that IC supplies voltage to the phase-locked loop (PLL) and the receiver. And, the strobe switches Q102, which allows serial data to flow between microcontroller IC101 and prescaler divider/synthesizer controller IC301.

8.2.2 LOW VOLTAGE RESET

A low voltage reset circuit (Q101 and R103) protects against internal EE memory loss due to battery voltages below about +5.3 Volts, by shutting off the microcontroller. A DC level below +5 Volts at the regulator (IC102) output can cause the CPU to randomly execute instructions that might include an "erase sequence." Q101 turns off when this voltage drops below +5 Volts. Q101 then pulls IC101 pin 18 low to reset the microcontroller.

The DTX Module will alert the user if the supply voltage drops below a set value, by sounding a beep every 20 seconds. This value, called the "low voltage set," is programmed at the factory for "battery-end-of-life," but can be re-programmed for another value using the PC Programming Kit. If the battery voltage drops below +7 VDC, the radio emits a low frequency tone when turned on. Below about +5 Volts, the radio will not operate. R107 applies +V SW (minus the voltage drop across the voltage divider formed by R107 and R108) to a microcontroller A/D converter at pin 11. This voltage must be between 0 and +5 VDC, as referenced to the voltages at pins 7 and 8 (which are 0 and +5 VDC, respectively). The A/D output is compared with the pre-programmed "low voltage set" to determine whether the supply voltage is low.

8.3 PHASE-LOCKED LOOP

The DTX-450 radio is built around a common phase-locked loop (PLL) that consists of a voltage controlled oscillator (VCO) and a frequency synthesizer. The PLL generates both the receiver first injection and transmitter carrier signals.

8.3.1 VCO/BUFFER AMPLIFIER

Q307, L303, varactor CR307 and associated components form the VCO (Voltage Controlled Oscillator), a resonant circuit that oscillates at approximately 450 MHz. Varying the voltage at the cathode of CR307 changes the varactor's capacitance, which in turn alters the VCO output frequency; for example, when the voltage at CR307 is increased (normally, the charge in C322-324 provides this voltage), CR307's capacitance decreases, which increases the VCO output frequency. +5 VDC is tied to the collector of Q307. C332 and C333 serve as a feedback network. C338 couples the oscillator signal to buffer amplifier Q308. C335 and C341 function as RF bypass capacitors. The amplified signal at Q308's collector is coupled by C340 and applied both to synthesizer controller IC301 pin 8 (via R342 and C342) and to buffer amplifier Q309. The buffered VCO signal at Q309's collector then feeds through C345 and R346 as local oscillator injection into the source of Q502, the receiver 1st mixer. The output of Q309 feeds Q311 (through R347 and C346), the transmitter buffer amplifier.

8.3.2 PRESCALER DIVIDER/SYNTHESIZER CONTROLLER

IC301 contains both a prescaler and synthesizer controller. The prescaler squares and divides the VCO output tied to pin 8 by either 64 or 65, determined by a synthesizer controller logic signal. A logic high instructs the prescaler to divide the VCO frequency by 64, a low by 65. The exact number of times the prescaler is instructed to change divisors is determined by the channel frequency. +5 VDC is supplied to IC301 at pin 4.

IC301 contains a digital phase detector that works as follows - when an operating channel is changed or the receive/transmit mode switched, either of which selects a new synthesizer operating frequency, microcontroller IC102 (pin 52) clocks new data into IC301's internal buffer (pin 10) in synchronization with clock pulses applied to IC301 pin 9. (Signals from the microcontroller are usually too fast to observe with an oscilloscope.) Until all data is loaded into the buffer, the synthesizer continues to function at the previous operating frequency.

Once all new data is loaded into the buffer, a single pulse from IC101 appears at IC301 pin 11 that instructs the synthesizer controller to latch and execute the new data. IC301 utilizes internal circuitry to determine whether the present VCO output frequency is correct by comparing the phase and frequency of the VCO signal (at pin 8) and the 16.0125 MHz reference oscillator. IC301 produces a pulse output signal proportional to the phase difference between the two input signals. If the VCO output frequency is too high, pin 16 pulses high.

If the frequency is too low, pin 15 pulses low.
The charge pump (Q303, Q304 and associated components) and loop filter (C322-325, R323-324 and L302) transform the synthesizer controller output into a DC voltage for application to the VCO. The synthesizer system is "locked" when the phase and frequency of both the reference and the divided VCO signal are the same.

8.3.3 REFERENCE OSCILLATOR

The 16.0125 MHz reference oscillator connected between IC301 pins 1 and 2 is built around crystal Y301, C308, varactor CR301 and tuning capacitor C310. A temperature compensation circuit (R305-307, CR302 and variable thermistor R308) provides the synthesizer controller with a constant 16.0125 MHz reference frequency (+/- 5 PPM).

8.3.4 OSCILLATOR MODULATION

When the unit is in transmit, gate IC205B passes TX modulation to the reference oscillator via C312, and to the VCO via R310. R310 routes modulation through C317 and R326 to the cathode of varactor CR305. Because CR305 is coupled to the VCO through C328, modulation causes the VCO frequency to vary. C312 applies modulation to the reference crystal to provide for the addition of any Quiet Call or Digital Quiet Call signals. If modulation was not applied to the reference, QC and DQC encode tones would be distorted as the synthesizer attempted to track them.

8.3.5 HIGH VOLTAGE SOURCE

Q301, CR303 and associated components supply approximately +15 Volts to run the charge pump. When the radio is switched on, Q315 provides collector voltage for Q301, a voltage multiplier. The 16.0125 MHz signal at the gate of Q301 is amplified by Q301, then rectified by CR303. The rectified voltage is applied to zener diode CR304 to supply the charge pump.

8.3.6 CHARGE PUMP/LOOP FILTER

The charge pump, Q303, Q304 and surrounding components, processes the phase detector (IC301) pulses to yield a signal that the loop filter can smooth into a DC voltage. R314 applies the pulses to Q303. Q303 turns on, applying a voltage "burst" to the loop filter (C322-325, R323-324 and L302) and charging C322-325 one pulse at at time toward +14 Volts. The loop filter provides the DC level at CR307 that governs the VCO frequency.

R320 routes the signal from IC301 pin 16 to Q304. Q304 turns on and discharges C322-325 one pulse at a time, the resulting DC voltage applied to CR307.

8.3.7 BANDSWITCH

Because the DTX-450 utilizes a single oscillator for both transmit and receive modes, the oscillator's frequency range must shift approximately 21.4 MHz when the unit is switched between transmit and receive. While the radio is in receive mode, a bandswitch circuit (Q306, R329, R331, C330 and CR306) places C327 in parallel with the VCO tank circuit, increasing the tank's capacitance and so shifting the VCO tuning range about 21.4 MHz.

With the DTX-450 in receive, the TX enable line at the base of Q305 is low, which turns on that device. When +5 VS is applied to the base of Q306, Q306 switches on and current flows through CR306 to ground. CR306 acts like a short circuit, incorporating C327 into the oscillator circuit. When the DTX-450 is "keyed," Q305 shuts off, removing the +5 VS. Q306 turns off, switching off CR306. C327 is removed from the oscillator circuit, increasing the VCO output frequency approximately 21.4 MHz.

8.3.8 SOURCE-FOLLOWER BUFFER

The source lead of FET Q302 applies a DC voltage, which "tracks" the varactors in the receiver RF amplifier circuit to the VCO. Q302 isolates the VCO from the receiver amplifier.

8.4 RECEIVER

8.4.1 RX +5V SUPPLY

When the DTX Module's TX KEY line is ungrounded, the transmitter shuts off and the TX enable line switches low. Q310 is biased on, and applies RX +5V to the receiver.

8.4.2 RF AMPLIFIER

A received signal from the antenna first passes through a low-pass filter (C420-423, L411-413). L410 and C501 then apply the RF signal to a 2-pole track-tuned tank circuit whose center frequency depends upon the VCO tuning voltage applied (via Q302) to varactors CR501-504. C511 applies the output to the base of Q501, a low-noise, high-frequency RF amplifier. R503 and R504 set the base bias for Q501, while CR507A and CR507B limit the input signal to 0.7 Volts (to protect the transistor). L503 applies collector voltage to the stage. C512 supplies an RF bypass for L503; R505 restricts the current through Q501. C513 couples the amplified RF signal into a second 2-pole track-tuned tank circuit, whose bandpass shape further sharpens front-end response. C523 applies the output signal to the gate of common-source JFET Q502, the 1st mixer.

8.4.3 1ST MIXER

The RF input signal drives the gate of mixer Q502, while the VCO signal at Q309's collector drives the source. A resonant tank circuit (T502) emphasizes the 21.4 MHz difference frequency component of the mixer output, which C527 couples to a 21.4 MHz four-pole crystal filter (YF501, C528 and YF502). R509 applies the filter output to the base of Q503, a grounded-emitter buffer amplifier that provides stable gain. C532 then applies the signal to IC501 pin 16.

8.4.4 FM RECEIVER SUBSYSTEM

A multi-function integrated circuit, IC501 and associated components, forms the FM-receiver subsystem. This subsystem performs the functions of: 1) 2nd local oscillator (20.945 MHz), 2) 2nd mixer, 3) 2nd IF amplifier, 4) FM detector and 5) noise amplifier.

IC501 pins 1 and 2, 20.945 MHz crystal Y501, and feedback capacitors C534 and C535 comprise the 2nd local oscillator - which provides low-side injection (20.945 MHz). The 21.4 MHz signal at IC501 pin 16 and the 2nd local oscillator output are mixed, with the resulting 455 KHz mixer output appearing at IC501 pin 3. A 455 KHz, 4-pole ceramic filter, YF503, connects the balanced-mixer output to the input of the limiting IF amplifier at IC501 pin 5. IC501 pin 6 is the decoupled input to the IF amplifier, IC501 pin 7 the limited IF output signal. An internal quadrature detector, whose center frequency is determined by T501, detects the FM IF signal. One input of the quadrature detector connects internally to the IF signal at IC501 pin 7, while the other detector input is the phase-shifted signal from quadrature coil T501 at IC501 pin 8. Demodulated audio appears at pin 9, where a low-pass filter (R517 and C540) removes spurious quadrature output. Audio then simultaneously enters both the voice/tone conditioning circuit (via P501 pin 5) and a noise filter/amplifier (R519-522, C541-542 and the amplifier internal to IC501 at pins 10 and 11) whose bandpass is centered at 8 KHz. R526 provides temperature compensation.

8.4.5 CARRIER SQUELCH

The noise amplifier output at IC501 pin 11 is rectified and filtered to produce a DC voltage called the RSSI

(Received Signal Strength Indication) that is inversely proportional to receive signal strength. CR506 and Q504 form a voltage-doubling detector. C544 integrates the detected signal, while R524 and C545 filter it. R525, CR505A and CR505B form a threshold bias circuit that keeps Q504 slightly biased on, maintaining a constant noise output independent of ambient temperature. The RSSI is applied to IC101 pin 9 (via P501 pin 4) for carrier detect. The microcontroller enables carrier detect by comparing the RSSI with a "squelch set" voltage (adjusted with potentiometer R114) at pin 12.

8.5 VOICE/TONE CONDITIONING IN RECEIVE MODE

8.5.1 GENERAL

DTX Receive audio conditioning filter circuits are shared with the transmitter. The same high-pass filter/ amplifier (IC202B associated components) and low-pass filter/amplifier (IC203A-C) used for "receive"voice band conditioning are used for the "transmit" as well. Similarly, the low-pass filter (IC204C) used for sub-audible tone decode filtering is also used for sub-audible tone encode. Altering circuit configuration with bilateral gates IC201(A-D) and analog switches IC205(A-C)permits using the same audio filtering system for both receive and transmit modes.

After R517 and C540 remove 455 KHz elements at the demodulated audio output (IC501 pin 9), C202 couples the signal to bilateral gates IC201A and IC201D. The received signal follows two separate paths: one for voice band (which includes PQC tones) audio conditioning, the other for sub-audible (QC and DQC) tone detection.

8.5.2 VOICE BAND

When the transmitter shuts off, IC101 pin 35 (TX ENABLE) applies a low to the base of Q201, which shuts off. +5 SW at R229 toggles gate IC201A, allowing received audio to reach high-pass filter/amplifier circuit, IC202B and associated components. The amplified signal, with frequencies below about 250 Hz (sub-audible tones) attenuated, exits IC202B pin 1 and travels to an amplifier (IC203A and associated components) via C212 and R218. Analog switch IC205C is open, and so removed from the circuit. The audio signal exits IC203A pin-2 and enters a low-pass filter to attenuate frequencies above 3 KHz. The low-pass filter output is applied to bilateral gate IC201C and the input of amplifier IC203B. The audio passes through gate IC201C when squelch is enabled and a high at IC101 pin 45 toggles the gate. R222 and C216 provide de-emphasis, and with potentiometer R601, direct the signal to audio amplifier IC601 and associated circuitry. In receive mode, TX ENABLE is low, opening analog switch IC205B. The output at IC203B is applied to the input of amplifier IC206A. The squared output of IC206A pin-7 is applied to IC101 pin-22 for PQC(Paging Quiet Call) decode.

8.5.3 SUB-AUDIBLE

Audio also passes through IC201D, which is turned on unless the radio transmitter is keyed, and enters pin 8 of IC204C, a 6-pole low-pass filter that attenuates frequencies above approximately 250 Hz. In receive mode, the output at pin 3 passes through anaolog switch IC205A into IC204B, a limiter that squares the signal. The signal then drives the QC (Quiet Call) input at IC101 pin-47 to decode the correct sub-audible (QC) tone.

8.6 AUDIO AMPLIFIER

R601, the volume level control, attenuates voice band audio passed through "squelch gate" IC201C to audio amplifier IC601. C601 provides high-pass filtering. C605 couples the output at pin 5 to the RX Data Out Pin(pin-10 of the 10-pin connector) and J602. With a load impedance of 8 Ω, the maximum output at pin 5 is about 1 Watt.

When the radio is in receive mode, the microcontroller places a high on pin 27, which forward biases Q603. Q603 then pulls the base of Q602 low, which turns on that transistor. Supply voltage (+Vsupply) for the audio

amplifier (at the emitter of Q602) is connected to pin 6. (When the radio is switched into transmit mode, IC101 pin 27 goes low.)

CARRIER/TONE DETECT

CARRIER DETECT

When the DTX is receiving the correct frequency, IC101 pin-37 goes high. A logic high on the base of Q206 will cause Q206 to turn on pulling the collector of Q206 low. This low output is fed through R223 to CD OUT(pin-7 of J101). For a logic high present at CD OUT when the correct frequency is detected, remove R223 and add R228. Now, when the collector of Q206 goes low in the presence of carrier, the base of Q205 is low and turns off Q205. The collector of Q205 is pulled high and that logic high is fed through R228 to CD OUT.

TONE DETECT

If the DTX has been programmed for tone signaling, and the correct tone is sent with the correct carrier, the IC101 pin-36 goes high. The logic high is fed to the base of Q207 and turns Q207 on. The collector of Q207 is pulled low. The logic low is fed through R243 and connected to TD(pin-4 of J101).

8.7 ANTENNA SWITCHING/LOW-PASS FILTER

A low-pass filter comprised of C420-423 and L411-413 removes harmonics from the transmitter output before applying the RF signal to the antenna port. Received signals pass through the low-pass filter before entering the receiver RF input circuitry.

Two high speed PIN diodes (CR401, CR402) and associated components form the antenna switching circuit, which isolates the transmitter output from the antenna when the DTX-450 is in "receive" mode; no voltage is applied to PIN diodes CR401 and CR402 - they do NOT conduct. This reverse biases CR401 to prevent the transmitter amplifier from affecting receiver tuning and removes CR402 from the receiver input. Incoming signals from the antenna pass through the low-pass filter, then L410 and C501 to the receiver RF amplifier.

When the unit is switched into "transmit," Q313 applies +V TX to R404. Current flows through R404, L409, CR401, L410 and then CR402 to ground, forward biasing the diodes. CR401 passes transmitter RF power to the antenna port. CR402 shunts the receiver RF input to ground. Now L410 provides sufficient impedance to isolate transmitter power from the receiver RF amplifier, Q501.

8.8 TRANSMITTER

8.8.1 KEYING

The DTX-450 is keyed by applying a ground to the TX KEY (pin-6 of the 10-pin connector) input pulling the base of Q204 to ground. Q204 turns on, and switches +5Vreg to the base of Q604. Q604 turns on and pulls IC101 pin-49 low. The output of pin-35 of IC101 (TX Enable) goes high to enable the transmitter circuitry.

The DTX-450 may also be keyed by applying a logic high to the TX KEY input. To do this, remove R257 and add R255. A high on the base of Q208 will cause Q208 to turn on, pulling the collector of Q208 low. A low at the base of Q204, turns Q204 on, Q204 then applies +5Vreg to the base of Q604. Q604 turns on and pulls IC101 pin-49 low to cause IC101 pin-35 to go high and enable the transmitter circuitry.

The DTX-450 can also be "keyed" via the 2.5mm Chg/Mic Test Jack using the RSM-3X Speaker/Mic. When the PTT of the RSM-3X is depressed, a low via the internal electret microphone is applied to the base of Q601.

Q601 turns on and switches +5Vreg to the base of Q604. Q604 turns on, pulls IC101 pin-49 low, which pulls the TX Enable output (pin-35 of IC101) high.

+V TX SUPPLY

The high at pin 35 (TX ENABLE) activates Q312 and Q313, which form a voltage regulator that supplies power amplifier transistor Q401 and the antenna switching circuit. (The TX ENABLE line controls other circuitry, too, as related in other paragraphs.) The high at pin 35 is routed to Q312, forward biasing the base-emitter junction and causing current to flow from the +V SW line to ground through R353, Q312 and R351. The resulting voltage at Q312's collector switches on Q313, which in turn applies +V TX to Q401 via R403, Q403, Z402 and L402. When the user releases the PTT, the microcontroller switches pin 35 low, which turns off Q312, and so releases the transmitter.

POWER AMPLIFIER

Q311 and associated components further amplify the VCO signal at Q309's collector before feeding it via C348 to the 5 Watt, wide-band RF power amplifier. C401 matches the signal to the base of Q401. The output at Q401's collector is then coupled into the base of Q402, a 5 Watt power amplifier. The resulting 5 Watt signal is matched to 50 Ω for application to the switching circuit.

POWER CONTROL CIRCUIT

"Reduced power channels" may be programmed as described in the programming special features section of this manual. All low power channels have the same power output, approximately 1 - 3 Watts.
The power control circuit works as follows: when a channel programmed for low power is selected and the transmitter is keyed, IC101 pin 24 (HI/LO PWR CONTROL) applies a logic low to Q404's base. Q404 and Q403 do not turn on and are "removed" from the circuit. R405 limits the current supplied to Q401, which in turn reduces the drive to RF final transistor Q402. As a result, transmitter power output decreases.

When a channel programmed for high power (the default setting) is selected and the transmitter is activated, IC101 pin 24 applies a high to Q404's base. Q404 turns on and pulls Q403's base low. Q403 is biased on and switches +V TX to Q401's collector. Q401 drives Q402.

8.9 VOICE/TONE CONDITIONING IN TRANSMIT MODE

8.9.1 GENERAL

DTX Transmit Audio conditioning filter circuits are shared with the receiver. Low-pass filter/amplifier (IC203A-C) used for "receive" voice band conditioning are used for "transmit." Similarly, the low-pass filter (IC204C) is used for sub-audible tone decode filtering is also used for sub-audible tone encode. Altering circuit configuration with bilateral gates IC201A-D and analog switch IC205 (A-C) permits using the same audio filtering system for both receive and transmit modes.

When the user presses the PTT button, IC101 pin 35 goes high, turning on the transmitter via Q313 and closing analog switch IC205B. (IC205B gates TX modulation.) The TX ENABLE line also controls Q201, which keeps RX AUDIO out of the audio conditioning circuitry during transmit by opening switches IC201A and IC201D. IC101 pin 27 applies a low to the base of Q603 which must be off to remove voltage from the audio amplifier (via Q602). With the collector of Q602 low, Q605 turns on to pass microphone audio to the high-pass filter/amplifier (IC202B).

When Pin-6 of J101 is grounded, the collector of Q204 goes high and is connected to the base of Q603. Q603

turns on, switching +Vsupply through Q602 to turn on audio amplifier IC601. Any audio signal present at the output of summing amplifier IC203B passes through analog switchIC205B and is fed to the inverting input of IC601. The amplified signal at the output of IC601 is fed to pin-10 of J101 as transmitted "side-tone".

8.9.2 VOICE BAND

Transmit audio can be applied at (3) different inputs. The first is the 2.5mm Chg/Mic Test Jack. When the PTT is depressed, microphone audio passes through J601, Audio Switch Q605, R235 and C228 to the input of high-pass filter/amplifier IC202B and associated circuitry. The output of IC202B is then pre-emphasized by C212 and R240 and then fed to the input of the summing/limiting amplifier IC203A.

A second input is on Pin-8 of J101. The audio signal is attenuated by R226 and then fed into amplifier IC206B. The output of IC206B can then be directed either to the input of high-pass filter.amplifier IC202B, or to C233 and R246 for pre-emphasis and then to the input of summing/limiting amplifier IC203. The module is shipped with the audio fed to C233 and R246.

The third input is on pin-1 of J101. This input connects directly to summing amplifier IC203B. When the DTX-450 is "keyed", the output of IC203B passes through analog switch IC205B, and is fed to the oscillator modulation input.

8.9.3 SUB-AUDIBLE

Remember that the microcontroller opens bilateral switch IC201D (via the TX ENABLE line) when the unit is in transmit, disconnecting received audio from the low-pass filter. IC101 generates sub-audible/digital encode tones (at pin 33) for application to pin 13 of summing node buffer amplifier IC204A. The output at pin 4 then enters 250 Hz low-pass filter IC204C. The microcontroller sets the low-pass filter's corner frequency to approximately 250 Hz (IC101 pin 43 "floats" in tri-state mode), or to about 150 Hz (pin 43 pulls to ground) by switching C206 into the circuit. The 150 Hz corner frequency operates when a QC tone below 125 Hz or a DQC tone is encoded. During transmit, analog switch IC205A connects the output of IC204C (pin-3) to the tone deviation control, R206. C221 and R227 couple the tone signal to the input of summing amplifier IC203B.

8.10 MICROCONTROLLER (IC101) PIN DESCRIPTIONS

PIN	DESCRIPTION
1	SPEAKER "BEEP" OUTPUT (I/O). Alerting tones exit this pin for application to the audio amplifier.
3	CHANNEL SELECT (A/D). The DTX uses a 0-5 VDC voltage applied to this pin and read by the microcontroller A/D to determine the operating channel.
4	PROGRAMMING CODE KEY (A/D).
5	SYNTHESIZER LOCK DETECT (A/D). The frequency synthesizer is considered locked if pin 4 is greater than +3.3 VDC (as derived from the synthesizer's lock detect output at IC301 pin 7), and unlocked if less than that value. The microcontoller program checks the lock detect line 180 ms after the synthesizer is programmed, and if the synthesizer is out of lock, sends an error tone. If the synthesizer remains out of lock, the tones continue; if the synthesizer locks, the tones cease and normal operation resumes.

PIN	DESCRIPTION
7	GND (A/D).
8	+5 VDC REFERENCE (A/D).
9	RSSI - RECEIVED SIGNAL STRENGTH INDICATION (A/D). The RSSI, a DC voltage derived from rectified demodulated noise, is applied to the microcontroller at pin 9 for carrier detect. The RSSI level should increase with increasing noise on the channel.
10	+V Supply (A/D), +5 VDC.
12	SQUELCH SET (A/D). The microcontroller divides the voltage input here by two and compares it to the voltage applied to the RSSI input. When the RSSI voltage is less than this value, carrier detect is enabled. After detecting a carrier, the the RSSI input must rise to this value plus a threshold voltage to disable carrier detect.
13-14	GND
15	6 K EE PROM PROGRAMMING VOLTAGE +5 VDC (I). Used only in "special software units."
16	REFERENCE OSCILLATOR INPUT (I). Connected to the reference oscillator crystal network.
17	REFERENCE OSCILLATOR OUTPUT (O). Connected to the reference oscillator crystal network.
18	RESET\ (IN). When pin 18 is pulled low, microcontroller operations stop. A low-voltage reset circuit pulls pin 18 low when +V SW is less than about +5.3 Volts. This ensures that the microcontroller does not erase internal EE memory due to improper program execution with an "out of spec" supply voltage.
19	IRQ\(IN). This line is pulled low when the PTT is pressed. This is used to immediately wake the unit from battery saver mode when the user tries to transmit.
22	PQC DECODE (I). This input receives Paging Quiet Call signals for decoding (via IC206A).
24	HIGH/LOW POWER OUT (O). This output selects transmitter power.
25	SPECIAL MODE OUTPUT (O). This output may be programmed to either a high or a low state on a per channel basis for controlling accessories.
28	TX/BUSY INDICATOR (I/O). When the radio switches into transmit mode, pin 35 goes high and pin 28 is driven low to light the TX/BUSY LED. In receive mode, pin 28 pulses at a one second rate to indicate that the channel is busy.
33	QC ENCODE (I/O). Pin 33 applies either Quiet Call or Digital Quiet Call tones to low-pass filter IC204C (via IC204A). The QC encode line is tri-stated when the unit is not encoding one of these formats.
34	Power Strobe (O).

PIN	DESCRIPTION
35	TRANSMIT ENABLE (I/O). Pin 35 pulls high to disable the receiver, toggle bilateral transmission gates, switch the VCO operating range and, activate the transmitter.
36	TONE DETECT (O). Pin-36 pulls high when the correct tone signal is present.
37	CARRIER DETECT (O). Pin-37 pulls high when the correct carrier frequency is present.
38	GND
41	SUPPLY RETURN (I), GND.
42	SYNTHESIZER SHIFT REGISTER LATCH (O). Following an operating frequency change (which includes a receive/transmit mode transition), pin 42 sends a single positive pulse to the synthesizer IC, latching the new serial data into IC301.
43	LP FILTER SLEW CONTROL (I/O). The filter slew control decreases the low-pass corner frequency to improve decode and encode waveform purity. Pin 43 appears tri-stated while the radio decodes or encodes Quiet Call tones above 141.3 Hz, and as an "active low" for QC tones below 141.3 Hz and Digital Quiet Call.
45	RX AUDIO ENABLE (I/O). A low at pin 45 opens switch IC201C, preventing receive signals from reaching the audio amplifier. For example: if the microcontroller must generate a "beep," it first pulls pin 45 low to open switch IC201C and mute received audio ("beeping" tones follow another route to the audio amplifier). When the monitor button is pressed for four seconds, the microcontroller pulls pin 45 high to close IC201C and pass audio.
46	PQC ENCODE (I/O). Pin 46 is tri-stated unless the microcontroller is generating the Paging Quiet Call All-Call tone (483.5 Hz). Turning on the unit while holding the PTT button sends the All-Call page.
47	QC/DQC DECODE INPUT (I/O). The limited sub-audible data is applied here for both QC and DQC decode.
48	MONITOR (I/O). A low on the monitor line defeats the tone squelch requirement that only a programmed tone can unsquelch audio. A momentary closure toggles between monitor and tone squelch modes. Grounding the Monitor Line for more than about four seconds defeats carrier squelch and directs receiver noise to the audio amplifier.
49	PTT SWITCH (I/O). Switching pin 49 low instructs the software to pull the transmit enable line high.
50	SERIAL DATA IN (I). Pin 50 links the microcontroller to communications from an external data terminal, or to a PC compatible computer running a communications program. Pin 50 serves as the DATA IN line for cloning and for programming with the PC Programming Kit.
51	SERIAL DATA CLOCK (O). The line at pin 51 toggles in the center of each bit period sent via the serial data out line, and clocks data to the synthesizer shift register.
52	SERIAL DATA OUT (O). Pin 52 supplies serial data out for: 1) Synthesizer IC301 (125 Kbits/sec, binary, w/clock) 2) External Communications (1200 bits/sec, ASCII, asynchronous) 3) Cloning operations

9. DTX-450 ALIGNMENT PROCEDURE

THE ALIGNMENT PROCEDURE REQUIRES ADJUSTING VARIABLE COMPONENTS. REFER TO THE PARTS PLACEMENT DIAGRAMS.

9.1 RECOMMENDED EQUIPMENT

1) 0 to 15 VDC, 2 Ampere current-limited power supply
2) FM service monitor (to 500 MHz)
3) Oscilloscope (to 20 MHz)
4) FM deviation meter
5) RF Wattmeter, 10 Watts full scale
6) PC computer and RITRON PC programmer kit (model RPT-PCPK)
7) Frequency counter (to 500 MHz)
8) VTVM or DMM
9) SINAD measuring device
10) RITRON model RTX-SRVBD adapter
11) RITRON model AAD-BX cable
12) RSM-3X

9.2 RADIO PREPARATION

1) Program the channels below as shown, using the PC programmer. For an explanation, refer to the programming section of this manual.

   Channel 1 - 460.225 MHz and 071 DQC code
   Channel B - 460.225 MHz and 123 Hz CTCSS Tone (QC code 18)

2) Remove the (2) Philips head screws from the DTX module lid. Remove the lid.

3) Remove the three (3) Torx head screws that hold the DTX RF board to the control board. These screws are accessible through the bottom of the chassis.

4) Carefully pull the board on top (RF board) apart from the bottom board (control board).

5) Using the RTX-SRVBD adapter, connect the RF board to the control board (J301 to P301 and J501 to P501). Refer to the parts placement diagrams.

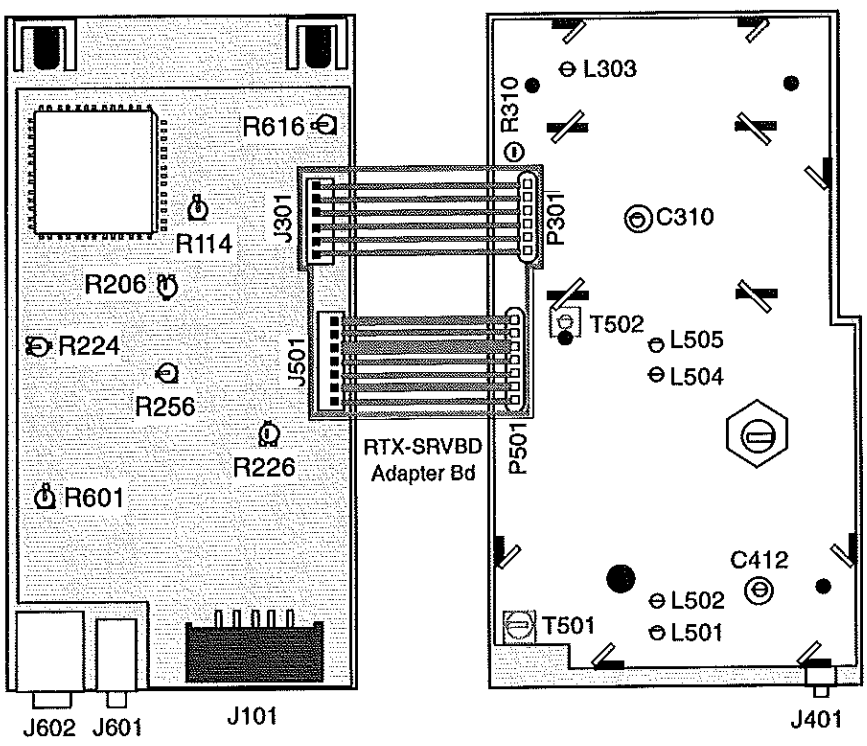
6) Set the power supply to +12.5 VDC and connect to pin-5 (+12.5 VDC) and pin-9 (GND) of J101. (Don't switch on the supply yet.)

7) Connect the FM service monitor to the 2.5 mm RF test jack at the top of the RF board.

8) Turn on the power supply to place the radio in operating mode.

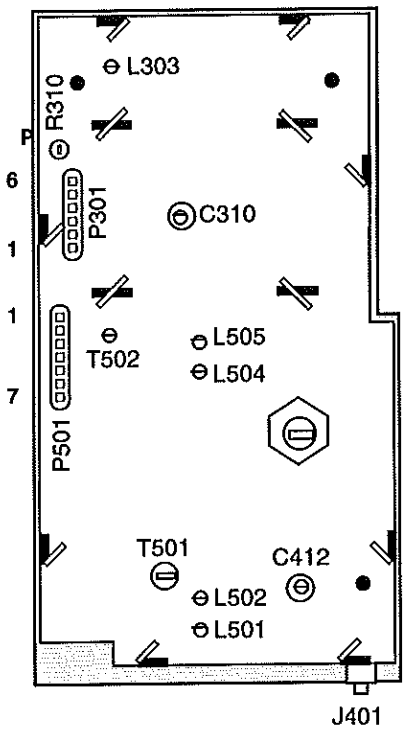
CAUTION: RITRON surface mount products require special servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty.

DTX MODULE - CONNECTORS and ADJUSTMENT LOCATION



DTX Control Board Topside

DTX-150 (VHF)
RF Board Topside



DTX-450 (UHF)
RF Board Topside

DTX Control Board

J101 = 10-pin Connector
J301 = 6-pin Connector
J501 = 7-pin Connector
J601 = Change Jack (2.5 mm)
J602 = Programming Jack (2.5 mm)
R114 = Squelch Adjust
R206 = QC Deviation Adjust
R224 = Voice Deviation Adjust
R226 = Tx Data In Sensitivity Adjust
R256 = Vag Adjust
R601 = Rx Audio Adjust
R616 = Internal 9.5 VDC Adjust

DTX RF Boards

C310 = Reference Frequency
C412 = Power Output Adjust
J401 = RF Test Jack (2.5 mm)
L303 = Synthesizer Control Voltage Adjust
L501, L502, L504 and L505 =
RX RF Amplifier/Filter
P301 = 6-pin Connector
P501 = 7-pin Connector
R310 = Modulation Balance Control Adjust
T501 = Quadrature Detector Adjust
T502 = IF Band-Pass Filter Adjust

PROGRAMMING KIT

Programming Kit Model RPT-PCPK 3.0R7 (or higher) includes a:
1) programming disk (3.5" format) and
2) PC/Radio interface cable with adapters.

INTERNAL SUPPLY VOLTAGE

1) Switch power supply on.

2) Connect VTVM or DMM to the collector of Q609.

3) Adjust R616 for 9.5 VDC +/-0.25 VDC.

9.3 SYNTHESIZER

The synthesizer control voltage should not need re-adjustment, unless a key component in the synthesizer has been replaced. Do not perform steps 1 through 5 unless such a component has been replaced. Key components do not include the synthesizer reference crystal or the synthesizer IC. (Synthesizer alignment errors cause poor operation at temperature extremes.)

1) Unground pin-3 of J101.

2) Connect a VTVM, DMM or oscilloscope to test point 35 (which is accessible from the bottom of the PCB. (Refer to the DTX-450 RF board bottomside parts placement diagram.)

3) The voltage at this point should be +6.5 VDC (+/-0.5 VDC).

   IF NOT:

   Proceed with steps 4 and 5.

4) Locate L303, the VCO coil. (Refer to the DTX-450 RF board topside parts placement diagram.)

5) Note the position of L303's core (visible through a hole in the RF shield). Adjust L303 until the voltage at test point 35 is +6.5 VDC. A small adjustment (a quarter turn) should produce a large change in voltage.

   IF THE VOLTAGE DOES NOT ADJUST:

   Rotate the core of L303 back to its original position before troubleshooting.

9.4 REFERENCE FREQUENCY

1) Make sure that the radio has been powered on and is at room temperature.

2) Unground pin-3 of J101.

3) Set the service monitor receiver to 438.825 MHz (receiver L.O. frequency = receive frequency - 21.4 MHz). The monitor should be able to receive the L.O. signal with a short antenna.

4) Locate C310, which adjusts the frequency. (Refer to the DTX-450 RF board topside parts placement diagram.) Adjust C310 through a hole in the RF shield to center the frequency.

9.5 MODULATION BALANCE CONTROL

Normally, the balance control should not require re-alignment. The purpose of the balance adjustment is to prevent sub-audible (Quiet Call) and digital coded (Digital Quiet Call) encode signals from being distorted.

1) Ground pin-3 of J101.

2) Set the service monitor to receive 460.225 MHz.

3) Connect the demodulated output of the monitor to the oscilloscope.

4) Locate balance control R310, which is accessible through a hole in the RF shield. (Refer to the DTX-450 RF board topside parts placement diagram.)
5) Activate the transmitter and adjust R310 (DTX-450 RF board) for the "best" square wave waveform as observed on the oscilloscope.

NOTE: The transmitter can be activated by grounding Pin-6 of J101 or by connecting an optional RSM-3X remote speaker/microphone and pressing the PTT.

6) Locate QC deviation control R206. (See the DTX control board topside parts placement diagram.)

7) Unground pin-3 of J101.

8) Activate the transmitter (ground pin-6 of J101) and adjust R206 for +/-600 Hz deviation as seen on the deviation meter.

9.6 TRANSMITTER

1) Connect a Wattmeter to the RF test jack, J401.

2) Unground pin-3 of J101.

3) Locate C412, which is accessible through a hole in the RF shield.

4) Activate the transmitter (ground pin-6 of J101).

5) Adjust C412 for power output of 5 Watts.

6) Unground pin-6 of J101. Plug RSM-3X into the 2.5mm and 3.5mm jacks (J601 and J602.)

7) Set the service monitor to receive 460.225 MHz.

8) With the PTT depressed, speak loudly into the electret microphone and adjust voice deviation control R224 (located on the control board) for +/-5.0 KHz maximum deviation as read on the deviation meter. Release the PTT.

If applicable:
9) Connect desired transmit audio signal to pin-8 of J101.

10) Ground pin-6 of J101 to transmit.

11) Adjust R226 for desired signal deviation as measured on the service monitor.

9.7 RECEIVER

IMPORTANT: THE RECEIVER CANNOT BE ALIGNED UNTIL THE SYNTHESIZER CONTROL VOLTAGE IS CORRECT.

THE DTX IF FILTER AND QUADRATURE ALIGNMENT IS EXTREMELY DELICATE AND CRITICAL. ADJUSTMENT SHOULD NOT BE NECESSARY UNLESS A COMPONENT HAS BEEN CHANGED.

9.7.1 CTCSS BIAS CONTROL

1) Set the service monitor RF signal generator for 460.225 MHz.

2) Set the generator to FM modulate the signal with a 123 Hz tone at +/-600 Hz deviation.

3) Connect the oscilloscope to IC204B pin-2.

4) Adjust R256 for a symmetrical 123 Hz squarewave.

9.7.2 RF BAND-PASS TRACKING

1) Connect a SINAD meter to pins 10 and 9 of J101. Refer to the DTX input/output Connections diagram.

2) Unground pin-3 of J101.

3) Adjust L501, L502, L504 and L505 to position the aluminum core of each slightly above the shield cover.

4) Set the service monitor RF signal generator to 460.225 MHz

5) Set the generator to FM modulate the signal with 1 KHz @ +/-3 KHz deviation along with a signal of 123 Hz @ +/- 600 Hz deviation. Set the generator output to 1000 μV.

6) Adjust squelch control R114 fully counter-clockwise to "open" squelch.

7) At this point, a 1 KHz tone should be seen at pin-10 of J101.

8) Decrease the generator output and adjust L501 and L502, then L504 and L505 for best SINAD.

9.7.3 IF FILTER

9) Set the generator output to 500 μV.

10) FM modulate the generator with a 15 Hz signal @ +/-15 KHz.

11) Connect the 15 Hz signal directly to the HORIZONTAL input of the oscilloscope, and set the horizontal sweep to EXTERNAL.

12) Connect the VERTICAL input of the oscilloscope to test point 43, which is located on the bottom side of the RF board. Refer to the DTX-450 RF board bottomside diagram. (Test point 43 is next to P501.)

13) Locate T502 using the DTX-450 RF board topside parts placement diagram. Adjust T502 for a 21.4 MHz bandpass waveform.

9.7.4 QUADRATURE DETECTOR

14) Set the generator for a FM modulated 1 KHz signal @ +/-7.5 KHz deviation and a 123 Hz signal @ +/- 600 Hz deviation. Set the output to 2000 μV.

15) Connect the oscilloscope to pins 1 and 2 of P601 (control board).

16) Find T501 on the DRTX-450 RF board topside diagram. Adjust T501, through a hole in the RF shield, for maximum amplitude of the 1 KHz sine wave.

9.7.5 CARRIER SQUELCH

17) Decrease the deviation of the modulated 1 KHz signal to +/-3 KHz.

18) Adjust R601 for desired amplitude at pin-10 of J101.

19) Decrease the signal generator output and adjust L501 and L502, then L504 and L505 for best 12 dB SINAD. The 12 dB SINAD should be less than 0.30 μV.

20) Set the generator output for a 12 dB SINAD reading.

21) Adjust squelch control R114 (control board) clockwise until no signal is seen at pin-10 of J101.

22) Slowly rotate R114 counter-clockwise until a signal is seen.

23) Decrease the generator output by 5 dB. The radio should squelch. If not, repeat steps 20 and 21.

10. DTX CONTROL BOARD VOLTAGES

MEASUREMENT CONDITIONS:

INTERNAL SUPPLY @ +9.5 VDC, UNIT IN OPERATING MODE.
READINGS TAKEN WITH CHANNEL B PROGRAMMED AND SELECTED, UNIT "KEYED" BY GROUNDING TX KEY LINE.
IMPORTANT: Because the DTX radio is constructed with grounding "sub-planes," use a system ground in the same proximity as the circuit being measured. All readings indicated as GND are true system ground.

KEY: ALL MEASUREMENTS ARE IN VOLTS DC, UNLESS AS INDICATED BELOW.

GND = GROUND
NC = NOT CONNECTED

DEVICE	PIN	DTX CONTROL BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q101	E	5.6	5.6	5.6	Low Voltage Detector
	B	4.9	4.9	4.9	
	C	5.6	5.6	5.6	
Q102	D	0.0	0.0	0.0	Data Switch
	G	0.6	0.6	0.6	
	S	0.0	0.0	0.0	
Q201	E	GND	GND	GND	TX/RX Audio Control
	B	0.0	5.0	0.0	
	C	4.8	0.0	4.8	
Q202	E	4.9	4.9	4.9	RX Strobe Voltage Control
	B	4.2	4.2	4.2	
	C	4.8	4.8	4.8	
Q203	E	4.1	4.1	4.1	RX Strobe Voltage Control
	B	4.8	4.8	4.8	
	C	4.2	4.2	4.2	
Q204	E	5.0	5.0	5.0	PTT Switch
	B	5.0	6.3	6.3	
	C	0.0	0.0	0.0	
Q205	E	GND	GND	GND	Carrier Detect High
	B	0.0	0.6	8.1	
	C	12.4	12.1	0.0	
Q206	E	GND	GND	GND	Carrier Detect Low
	B	5.0	0.0	0.0	
	C	0.0	0.6	8.1	

DEVICE	PIN	DTX CONTROL BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q207	E	GND	GND	GND	Tone Detect Low
	B	5.0	0.0	0.0	
	C	0.0	12.1	12.4	
Q208	E	GND	GND	GND	TX Key High
	B	0.0	0.0	0.0	
	C	5.0	0.0	7.6	
Q601	E	4.9	4.9	4.9	PTT Switch
	B	4.9	4.3	4.9	
	C	0.0	4.9	0.0	
Q602	E	12.4	12.4	12.4	Audio Amplifier Switch
	B	11.6	12.4	12.4	
	C	12.3	1.6	1.6	
Q603	E	4.2	3.8	0	Audio Amplifier Switch
	B	4.8	4.5	0	
	C	11.6	11.6	12.4	
Q604	E	GND	GND	GND	PTT Switch
	B	0	4.5	0	
	C	11.6	11.6	12.4	
Q605	D	5	2.5	5	TX Audio Gate
	G	11.2	2	4.3	
	S	0	2.5	5	
Q606	E	12.4	12.1	12.4	Internal Regulator
	B	12.4	11.6	12.4	
	C	11.7	10.8	11.7	
Q607	E	11.7	10.8	11.7	Internal Regulator
	B	11.1	10.2	11.1	
	C	0	1.7	0	
Q608	E	4.5	4.5	4.5	Internal Regulator
	B	5	5	5	
	C	11.1	10.2	11.1	
Q609	E	11.7	10.8	11.7	Internal Regulator
	B	12.4	11.6	12.4	
	C	9.5	9.4	9.5	
IC101	1	0	0	0	Microcontroller
	2	—	NC	—	
	3	5	5	5	
	4	0	0	0	
	5	4.4	4.4	4.4	
	6	—	NC	—	
	7	GND	GND	GND	
	8	4.9	4.9	4.9	
	9	0.9	0	1.3	
	10	4.9	4.9	4.9	
	11	3.8	3.8	3.8	
	12	2.3	2.3	2.3	
	13	GND	GND	GND	

DEVICE	PIN	DTX CONTROL BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC101	14	GND	GND	GND	Microcontroller
	15	4.9	4.9	4.9	
	16	2.5	2.5	2.5	
	17	2.7	2.7	2.7	
	18	5	5	5	
	19	4.9	0	4.9	
	20	—	NC	—	
	21	—	NC	—	
	22	2	2	2	
	23	—	NC	—	
	24	0	4.9	0	
	25	—	NC	—	
	26	4.9	4.9	4.9	
	27	4.9	0	0	
	28	—	NC	—	
	29	—	NC	—	
	30	—	NC	—	
	31	—	NC	—	
	32	0	0	0	
	33	1.8	2.3	1.8	
	34	4.9	4.9	4.9	
	35	0	4	0	
	36	0	0	0	
	37	0	0	0	
	38	0	0	0	
	39	0	0	0	
	40	—	NC	—	
	41	0	0	0	
	42	0	0	0	
	43	0	0	0	
	44	—	NC	—	
	45	4.9	0	0	
	46	0	0	0	
	47	2	2	2	
	48	4.9	4.9	4.9	
	49	4.9	0	4.9	
	50	0	0	0	
	51	0	0	0	
	52	0	0	0	
IC102	1	4.9	4.9	4.9	+5 Volt Regulator
	2	GND	GND	GND	
	3	12.4	12.4	12.4	

DEVICE	PIN	DTX CONTROL BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC201	1	2	2	2	Audio Switches
	2	2	1.8	2	
	3	2	1.8	2	
	4	2	2	2	
	5	4.9	0	4.9	
	6	4.9	0	0	
	7	GND	GND	GND	
	8	1.8	1.8	1.8	
	9	1.8	0	0	
	10	0	2	0	
	11	2	2	2	
	12	0	5	0	
	13	4.9	0	4.9	
	14	4.9	4.8	4.9	
IC202A	1	2	2	2	High-Pass Filter
IC202B	2	2	2	2	+Vag Supply
	3	2	2	2	
	4	GND	GND	GND	
	5	2	2	2	
	6	2	2	2	
	7	2	2	2	
	8	4.8	4.8	4.8	
IC203A	1	2	2	2	Limiting Amp (pins 1-2, 14)
IC203B	2	2	2	2	Summing Amp (pins 4, 5-13)
IC203C	3	1.9	1.9	1.9	Low-Pass Filter(pins 3, 6-12)
	4	2	2	2	
	5	2	2	2	
	6	5	5	5	
	7	2	2	2	
	8	2	2	2	
	9	2.6	2.6	2.6	
	10	GND	GND	GND	
	11	2.6	2.6	2.6	
	12	GND	GND	GND	
	13	2	2	2	
	14	2	2	2	

DEVICE	PIN	DTX CONTROL BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC204A	1	2	2	2	Summing Node Buffer
	2	2	2	2	Amplifier (pins 4-5, 13)
IC204B	3	2.0	2.0	2.0	Limiter (pins 1, 2, 14)
IC204C	4	2.0	2.0	2.0	Low-Pass Filter (pins 3, 6-12)
	5	2.0	2.0	2.0	
	6	5.0	5.0	5.0	
	7	2.0	2.0	2.0	
	8	2.0	2.0	2.0	
	9	2.6	2.6	2.6	
	10	GND	GND	GND	
	11	2.6	2.6	2.6	
	12	GND	GND	GND	
	13	2.0	2.0	2.0	
	14	2.0	2.0	2.0	
IC601	1	1.3	1.3	1.0	Audio Amplifier
	2	0.0	0.0	0.0	
	3	0.0	0.0	0.0	
	4	GND	GND	GND	
	5	6.0	6.0	0.5	
	6	12.4	12.4	1.8	
	7	—	NC	—	
	8	1.3	1.2	1.0	
IC205 A,B,C	1	2.0	2.0	2.0	Audio Switches
	2	2.0	2.0	2.0	
	3	2.0	2.0	2.0	
	4	2.0	2.0	2.0	
	5	2.0	2.0	2.0	
	6	GND	GND	GND	
	7	GND	GND	GND	
	8	GND	GND	GND	
	9	0.0	5.0	0.0	
	10	0.0	5.0	0.0	
	11	0.0	5.0	0.0	
	12	—	NC	—	
	13	1.9	2.0	1.9	
	14	2.0	2.0	2.0	
	15	2.0	2.0	2.0	
	16	5.0	5.0	5.0	

11. DTX-150 RF BOARD VOLTAGES

MEASUREMENT CONDITIONS:

INTERNAL SUPPLY @ +9.5 VDC, UNIT IN OPERATING MODE
READINGS TAKEN WITH CHANNEL B PROGRAMMED AND SELECTED

IMPORTANT: Because the DTX radio is constructed with grounding "sub-planes," use a system ground in the same proximity as the circuit being measured. All readings indicated as GND are true system ground.

KEY: ALL MEASUREMENTS ARE IN VOLTS DC, UNLESS AS INDICATED BELOW.

GND = GROUND
NC = NOT CONNECTED

DEVICE	PIN	DTX-150 RF BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q301	D	9.4	9.4	9.4	Voltage Multiplier
	G	0	0	0	
	S	GND	GND	GND	
Q302	D	14.4	14.4	14.4	Buffer For Front End Tracking
	G	5.9	5.1	5.9	
	S	6.6	6	6.6	
Q303	E	14.4	14.4	14.4	Charge Source For VCO
	B	14.4	14.4	14.4	
	C	6	5.2	6.0	
Q304	E	0	0	0	Charge Drain For VCO
	B	0	0	0	
	C	6	5.2	6	
Q305	E	5	5	5	Bandswitch Voltage Source
	B	4.3	4.6	4.3	
	C	4.9	0	4.9	
Q306	E	GND	GND	GND	VCO Scaling Switch
	B	4.9	0	4.9	
	C	0	4.9	1	
Q307	E	1.5	1.5	1.5	VCO Oscillator
	B	2	2	2	
	C	4.4	4.4	4.4	
Q308	E	GND	GND	GND	VCO Buffer/Amplifier
	B	0.7	0.7	0.7	
	C	4.4	4.4	4.4	

DEVICE	PIN	DTX-150 RF BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q309	E	GND	GND	GND	VCO Output Buffer
	B	0.7	0.7	0.7	
	C	3.8	3.8	3.8	
Q310	E	5	5	5	RX Voltage Switch
	B	4.3	4.5	4.3	
	C	4.8	0.8	4.8	
Q311	E	GND	GND	GND	1st TX Amplifier
	B	0	0.7	0	
	C	0	7.7	0	
Q312	E	0	3.5	0	TX Voltage Switch Driver
	B	0	4	0	
	C	9.5	8.5	9.5	
Q313	E	9.5	9.5	9.5	TX Voltage Switch
	B	9.5	8.5	9.5	
	C	0	9.5	0	
Q314	E	4.2	4.2	4.2	RX Voltage Switch Driver
	B	4.8	4.8	4.8	
	C	8.8	8.5	8.8	
Q315	E	9.6	9.6	9.6	RX Voltage Switch
	B	8.8	8.7	8.8	
	C	9.3	9.4	9.3	
Q401	E	GND	GND	GND	TX RF Driver Amplifier
	B	0	0.6	0	
	C	0	9.5	0	
Q402	E	GND	GND	GND	TX Final Amplifier
	B	0	0	0	
	C	9.5	9.5	9.5	
Q403	E	0	9.6	0	TX Low Power Switch
	B	0	8.8	0	
	C	0	9.5	0	
Q404	E	0	4.2	0	TX Low Power Switch
	B	0	4.7	0	
	C	0	8.8	0	
Q501	E	GND	GND	GND	RX RF Amplifier
	B	0.8	0	0.8	
	C	2.9	0	2.8	
Q502	D	4.8	0.6	4.8	RX Mixer
	G	0	0	0	
	S	0.5	0	0.5	
Q503	E	GND	GND	GND	IF Amplifier
	B	0.7	0	0.7	
	C	1.2	0.6	1.2	
Q504	E	0.5	0	0.5	Squelch Noise Detector
	B	1	0	1	
	C	4.8	0.6	4.8	

DEVICE	PIN	DTX-150 RF BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC301	1	1.9	1.9	1.9	UHF Synthesizer
	2	1.8	1.8	1.8	
	3	—	NC	—	
	4	4.4	4.4	4.4	
	5	—	NC	—	
	6	GND	GND	GND	
	7	4.4	4.4	4.4	
	8	3.1	3.1	3.1	
	9	0	0	0	
	10	4.8	0	4.8	
	11	0	0	0	
	12	—	NC	—	
	13	—	NC	—	
	14	—	NC	—	
	15	14.2	14.2	14.2	
	16	0	0	4	
IC302	1	5	5	5	+5 Volt Regulator
	2	GND	GND	GND	
	3	9.5	9.5	9.5	
IC501	1	4.7	0.6	4.7	IF Subsystem
	2	4.2	0.3	4.2	
	3	4.5	0.6	4.5	
	4	4.8	0.6	4.8	
	5	4.4	0.6	4.4	
	6	4.4	0.6	4.4	
	7	4.4	0.6	4.4	
	8	4.8	0.6	4.8	
	9	1.8	0	1.8	
	10	0.7	0	0.7	
	11	2	0	2	
	12	—	NC	—	
	13	—	NC	—	
	14	—	NC	—	
	15	GND	GND	GND	
	16	1.7	0	1.7	

12. DTX-450 RF BOARD VOLTAGES

MEASUREMENT CONDITIONS:

INTERNAL SUPPLY @ +9.5 VDC, UNIT IN OPERATING MODE
READINGS TAKEN WITH CHANNEL B PROGRAMMED AND SELECTED

IMPORTANT: Because the DTX radio is constructed with grounding "sub-planes," use a system ground in the same proximity as the circuit being measured. All readings indicated as GND are true system ground.

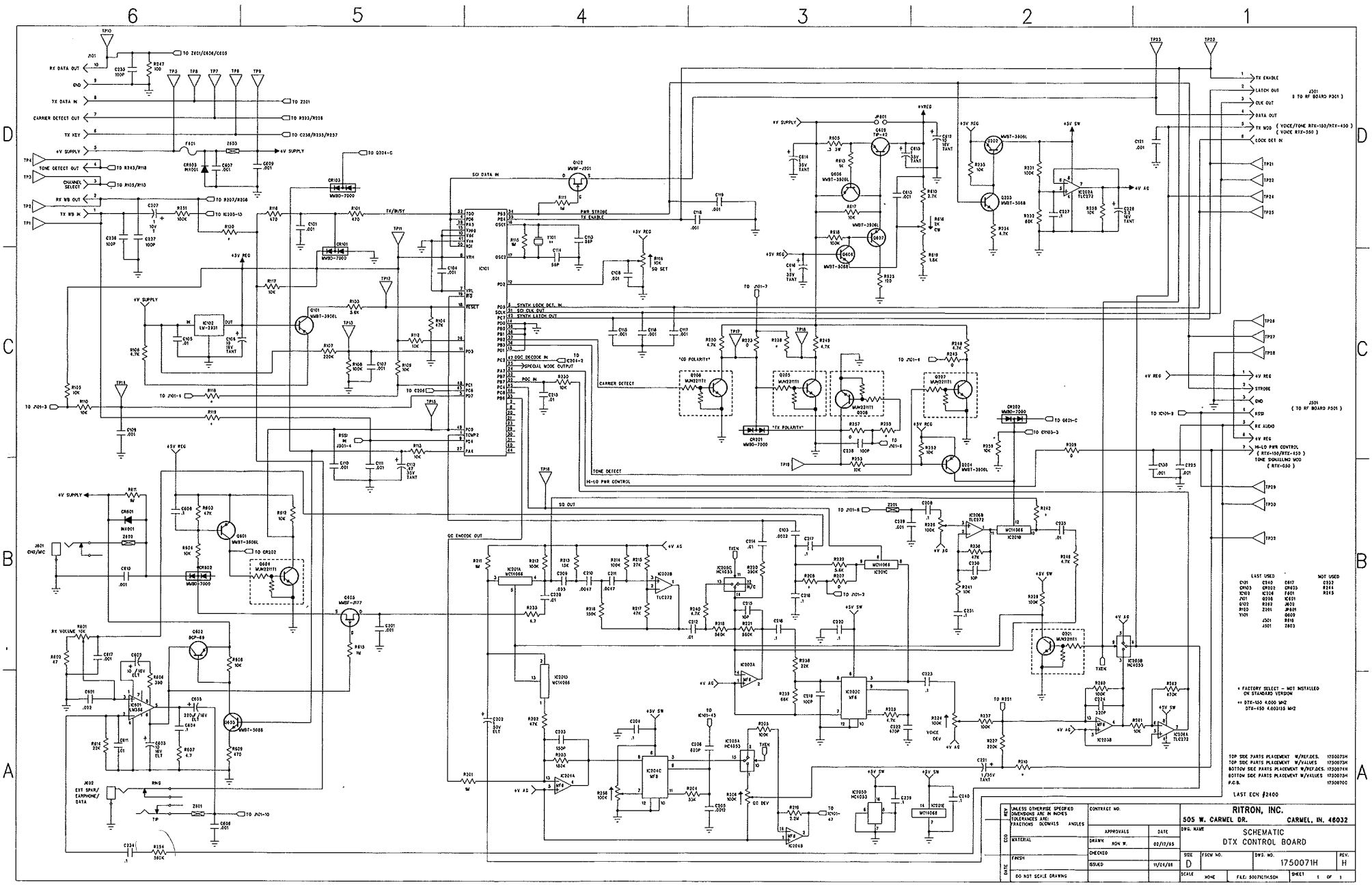
KEY: ALL MEASUREMENTS ARE IN VOLTS DC, UNLESS AS INDICATED BELOW.

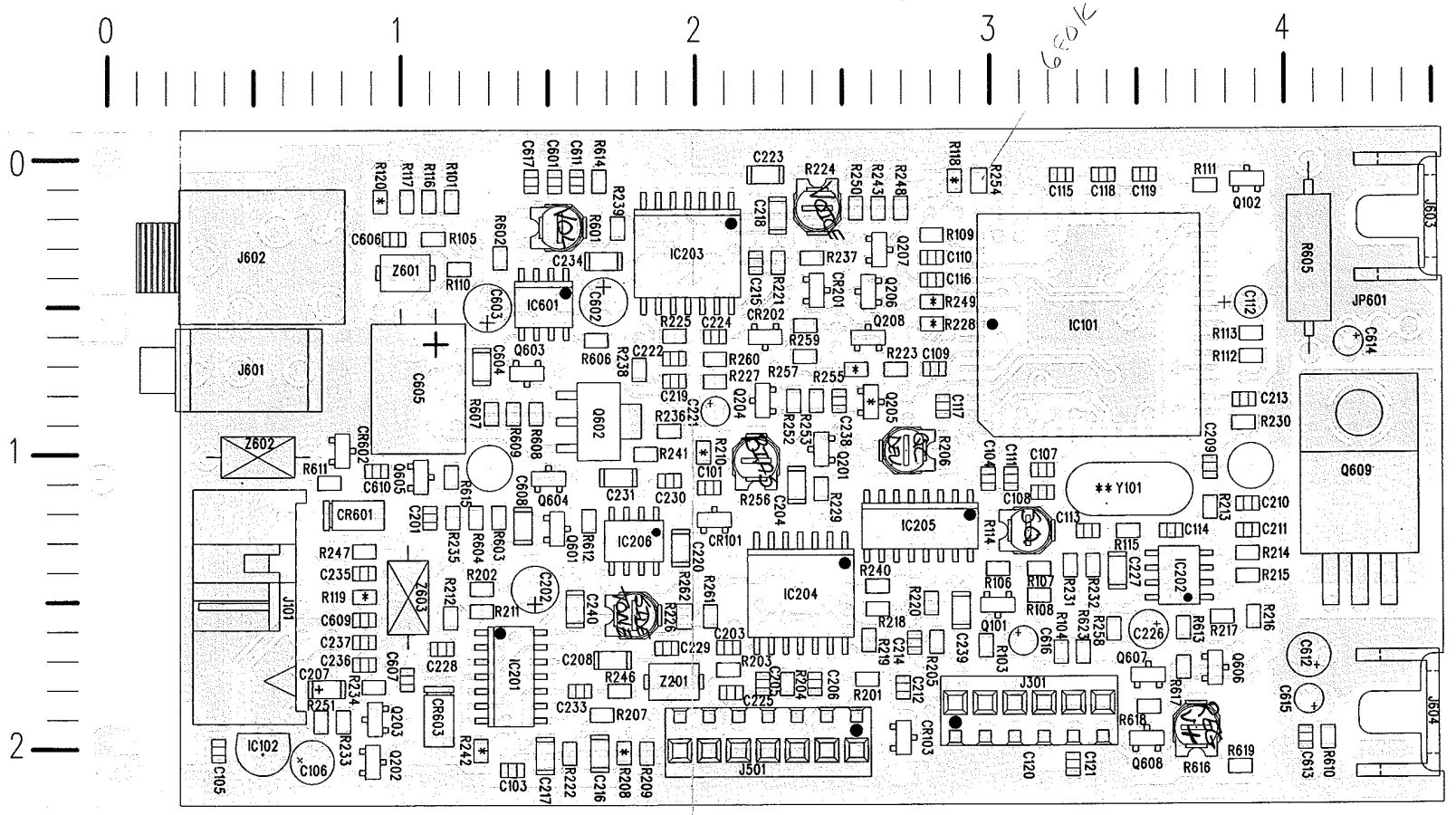
GND = GROUND
NC = NOT CONNECTED

DEVICE	PIN	DTX-450 RF BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q301	D	9.4	9.4	9.4	Voltage Multiplier
	G	0	0	0	
	S	GND	GND	GND	
Q302	D	14.4	14.4	14.4	Buffer For Front End Tracking
	G	5.9	5.1	5.9	
	S	6.6	6	6.6	
Q303	E	14.4	14.4	14.4	Charge Source For VCO
	B	14.4	14.4	14.4	
	C	6	5.2	6.0	
Q304	E	0	0	0	Charge Drain For VCO
	B	0	0	0	
	C	6	5.2	6	
Q305	E	5	5	5	Bandswitch Voltage Source
	B	4.3	4.6	4.3	
	C	4.9	0	4.9	
Q306	E	GND	GND	GND	VCO Scaling Switch
	B	4.9	0	4.9	
	C	0	4.9	1	
Q307	E	1.5	1.5	1.5	VCO Oscillator
	B	2	2	2	
	C	4.4	4.4	4.4	
Q308	E	GND	GND	GND	VCO Buffer/Amplifier
	B	0.7	0.7	0.7	
	C	4.4	4.4	4.4	

DEVICE	PIN	DTX-450 RF BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q309	E	GND	GND	GND	VCO Output Buffer
	B	0.7	0.7	0.7	
	C	3.8	3.8	3.8	
Q310	E	5	5	5	RX Voltage Switch
	B	4.3	4.5	4.3	
	C	4.8	0.8	4.8	
Q311	E	GND	GND	GND	1st TX Amplifier
	B	0	0.7	0	
	C	0	7.7	0	
Q312	E	0	3.5	0	TX Voltage Switch Driver
	B	0	4	0	
	C	9.5	8.5	9.5	
Q313	E	9.5	9.5	9.5	TX Voltage Switch
	B	9.5	8.5	9.5	
	C	0	9.6	0	
Q314	E	4.2	4.2	4.2	RX Voltage Switch Driver
	B	4.8	4.8	4.8	
	C	8.8	8.5	8.8	
Q315	E	9.5	9.5	9.5	RX Voltage Switch
	B	8.8	8.7	8.8	
	C	9.3	9.4	9.3	
Q401	E	GND	GND	GND	TX RF Driver Amplifier
	B	0	0.6	0	
	C	0	9.5	0	
Q402	E	GND	GND	GND	TX Final Amplifier
	B	0	0	0	
	C	9.5	9.5	9.5	
Q403	E	0	9.6	0	TX Low Power Switch
	B	0	8.8	0	
	C	0	9.5	0	
Q404	E	0	4.2	0	TX Low Power Switch
	B	0	4.7	0	
	C	0	8.8	0	
Q501	E	GND	GND	GND	RX RF Amplifier
	B	0.8	0	0.8	
	C	2.9	0	2.8	
Q502	D	4.8	0.6	4.8	RX Mixer
	G	0	0	0	
	S	0.5	0	0.5	
Q503	E	GND	GND	GND	IF Amplifier
	B	0.7	0	0.7	
	C	1.2	0.6	1.2	
Q504	E	0.5	0	0.5	Squelch Noise Detector
	B	1	0	1	
	C	4.8	0.6	4.8	

DEVICE	PIN	DTX-450 RF BOARD VOLTAGES			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC301	1	1.9	1.9	1.9	UHF Synthesizer
	2	1.8	1.8	1.8	
	3	—	NC	—	
	4	4.4	4.4	4.4	
	5	—	NC	—	
	6	GND	GND	GND	
	7	4.4	4.4	4.4	
	8	3.1	3.1	3.1	
	9	0	0	0	
	10	4.8	0	4.8	
	11	0	0	0	
	12	—	NC	—	
	13	—	NC	—	
	14	—	NC	—	
	15	14.2	14.2	14.2	
	16	0	0	4	
IC302	1	5	5	5	+5 Volt Regulator
	2	GND	GND	GND	
	3	9.5	9.5	9.5	
IC501	1	4.7	0.6	4.7	IF Subsystem
	2	4.2	0.3	4.2	
	3	4.5	0.6	4.5	
	4	4.8	0.6	4.8	
	5	4.4	0.6	4.4	
	6	4.4	0.6	4.4	
	7	4.4	0.6	4.4	
	8	4.8	0.6	4.8	
	9	1.8	0	1.8	
	10	0.7	0	0.7	
	11	2	0	2	
	12	—	NC	—	
	13	—	NC	—	
	14	—	NC	—	
	15	GND	GND	GND	
	16	1.7	0	1.7	


6
5
4
3
2
1
D
C
B
A
RX DATA OUT
TX DATA IN
CARRIER DETECT OUT
TX KEY
+5V SUPPLY
TONE DETECT OUT
CHANNEL SELECT
RX WB OUT
TX WB IN
GND
SCI DATA IN
PWR STROBE
TX ENABLE
TX/RX/ST
SQ OUT
SYNTH LOCK DET. IN
SCI CLK OUT
SYNTH LATCH OUT
DOC DECODE IN
SPECIAL MODE OUTPUT
POC IN
CARRIER DETECT
TONE DETECT
HI-LO PWR CONTROL
QC ENCODE OUT
"CO POLARITY"
"TX POLARITY"
RSSI
TX ENABLE
LATCH OUT
CLK OUT
DATA OUT
TX MOD (VOICE/TONE RTX-150/RTX-450) (VOICE RTX-550)
LOCK DET IN
RX AUDIO
HI-LO PWR CONTROL (RTX-150/RTX-450) TONE SIGNALLING MOD (RTX-550)
LAST USED
C101 C940 C817 C832
CR103 CR102 CR403 R244
IC103 IC206 F601 R245
J101 R208 IC601
Q102 R383 J600
R120 Z201 JP601
Y301 Q609
J301 R816
J501 Z803
NOT USED
* FACTORY SELECT – NOT INSTALLED ON STANDARD VERSION
** DTX-150 4.000 MHZ
DTX-450 4.600135 MHZ
TOP SIDE PARTS PLACEMENT W/REF.DES. 1750073H
TOP SIDE PARTS PLACEMENT W/VALUES 1750074H
BOTTOM SIDE PARTS PLACEMENT W/REF.DES. 1750075H
BOTTOM SIDE PARTS PLACEMENT W/VALUES 1750076H
P.C.B. 1750070C
LAST ECN #2400
RITRON, INC.
505 W. CARMEL DR. CARMEL, IN. 46032
SCHEMATIC
DTX CONTROL BOARD
DWG. NO. 1750071H
REV. H
SIZE D
SCALE NONE
FILE: 5007107H.SCH
SHEET 1 OF 1
CONTRACT NO.
APPROVALS
DRAWN RON W.
DATE 02/17/95
CHECKED
ISSUED 11/01/88
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES
MATERIAL
FINISH
DO NOT SCALE DRAWING



* FACTORY SELECT – NOT INSTALLED ON STANDARD VERSION

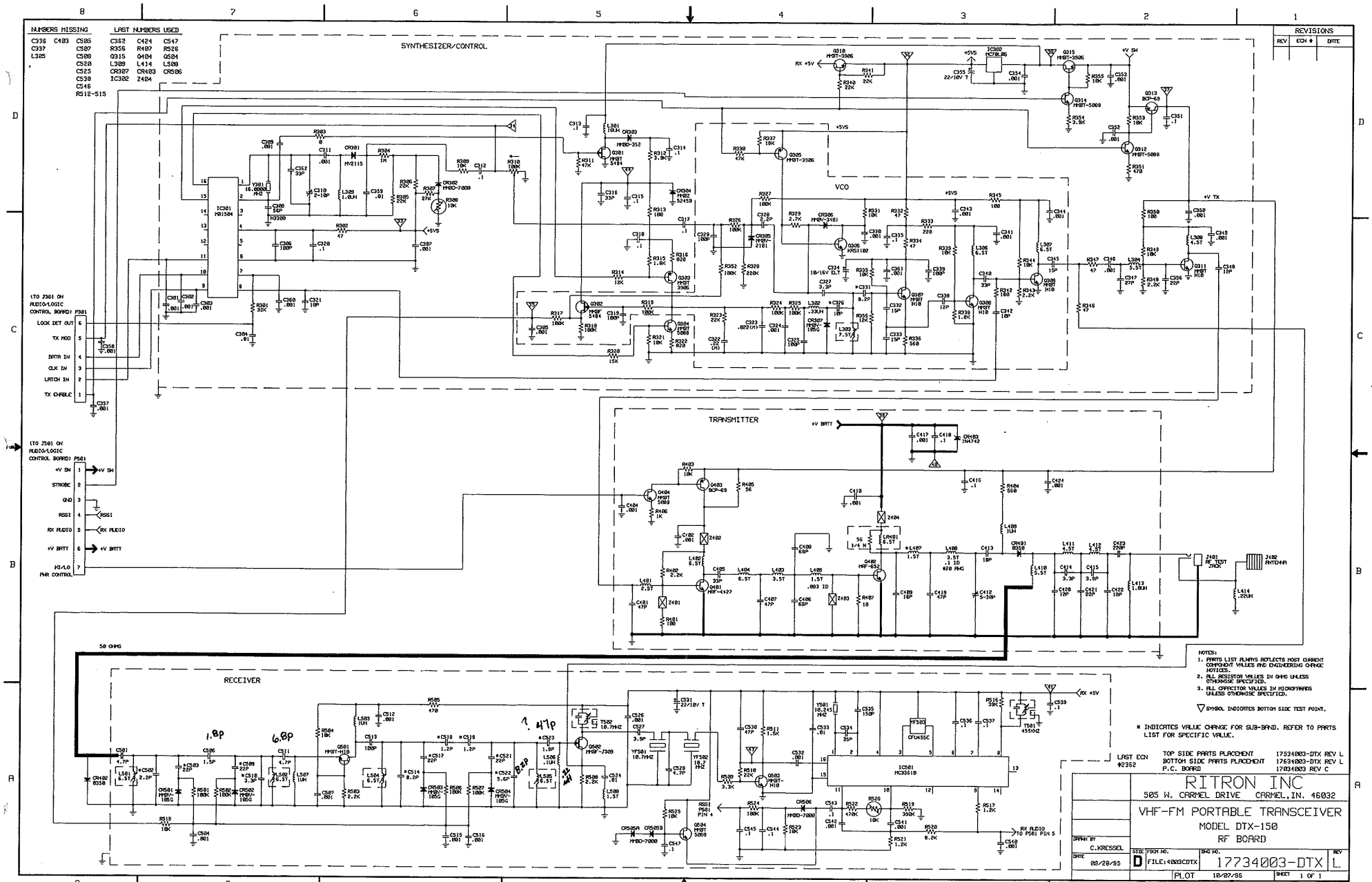
** DTX-150 – 4.000 MHZ
DTX-450 – 4.003125 MHZ

DTX-CONTROL
1750072H
TOP SIDE PARTS PLACEMENT W/REF. DES.

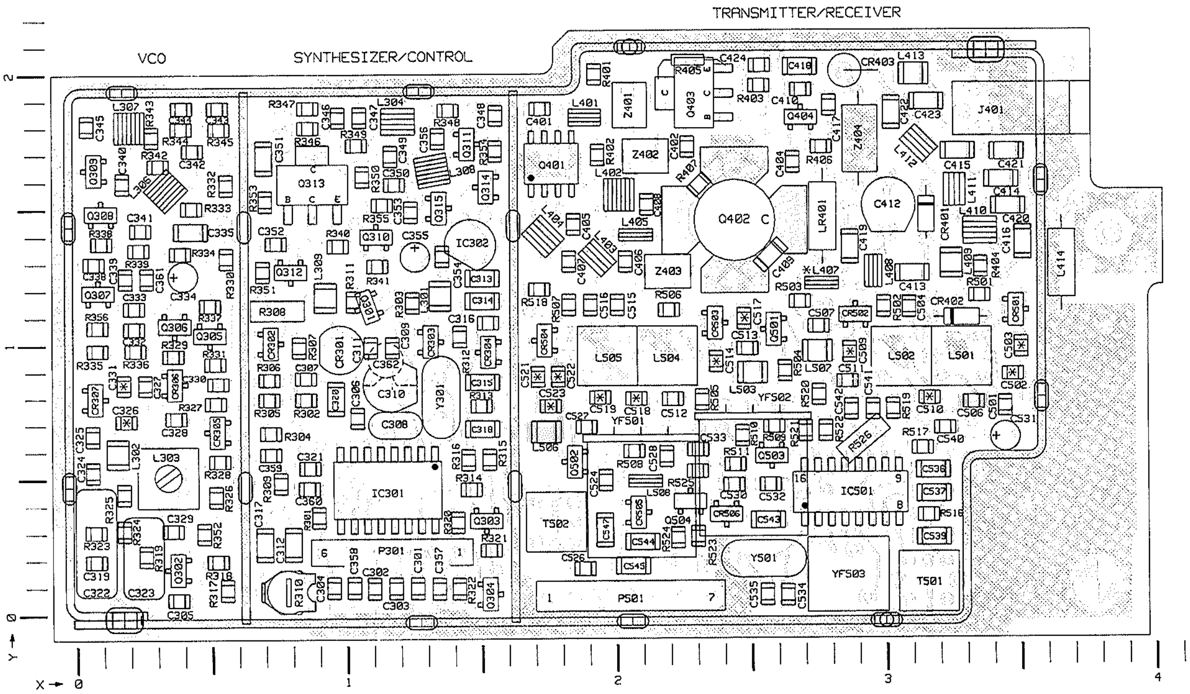
RITRON, INC. CARMEL,IN. 46032

LAST ECN #2400 11/05/96

SCHEMATIC	1750071H
TOP SIDE PARTS PLACEMENT W/VALUES	1750073H
BOT SIDE PARTS PLACEMENT W/REF. DES.	1750074H
BOT SIDE PARTS PLACEMENT W/VALUES	1750075H
P.C.B.	1750070C


NUMBERS MISSING
C338 C403 C585 C362 C424 C547
C337 C587 R356 R407 R526
L325 C588 Q315 Q404 Q584
C526 L388 L414 L508
C525 CR387 CR403 CR506
C538 IC382 Z404
C546
R512-515
LAST NUMBERS USED
REVISIONS
REV ECN # DATE
SYNTHESIZER/CONTROL
VCO
TRANSMITTER
RECEIVER
(TO J381 ON AUDIO/LOGIC CONTROL BOARD) P381
LOCK DET OUT 6
TX MOD 5
DATA IN 4
CLK IN 3
LATCH IN 2
TX ENABLE 1
(TO J581 ON AUDIO/LOGIC CONTROL BOARD) P581
+V SW 1
STROBE 2
GND 3
RSSI 4
RX AUDIO 5
+V BATT 6
HI-LO PWR CONTROL 7
50 OHMS
NOTES:
1. PARTS LIST ALWAYS REFLECTS MOST CURRENT COMPONENT VALUES AND ENGINEERING CHANGE NOTICES.
2. ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
SYMBOL INDICATES BOTTOM SIDE TEST POINT.
* INDICATES VALUE CHANGE FOR SUB-BAND. REFER TO PARTS LIST FOR SPECIFIC VALUE.
LAST ECN 02352
TOP SIDE PARTS PLACEMENT 17534003-DTX REV L
BOTTOM SIDE PARTS PLACEMENT 17634003-DTX REV L
P.C. BOARD 17034003 REV C
RITRON INC
505 W. CARMEL DRIVE CARMEL, IN. 46032
VHF-FM PORTABLE TRANSCEIVER
MODEL DTX-150
RF BOARD
DRAWN BY C.KRESSEL
DATE 03/28/95
SIZE D
FSCM NO.
DWG NO. 17734003-DTX
REV L
FILE:14003CDTX
PLOT 10/07/96
SHEET 1 OF 1

>ECN 2174-REV J: C513 TO 100P, C320 TO 2.2P
>ECN 2192-REV K: C413 FROM 100P(1206) TO 10P(1206)
>ECN 2301-RELEASE DTX-150
>CHANGE R314 FROM 22K TO 12K
>CHANGE R316 FROM 1K TO 820 OHM
>CHANGE R320 FROM 27K TO 15K
>CHANGE R322 FROM 1K TO 820 OHM
>CHANGE R323 FROM 22K TO 10K
>REMOVE C546
>ECN 2362-REV L: C514 FROM 6.8P TO 8.2P AND C522 FROM 4.7P TO 5.6P



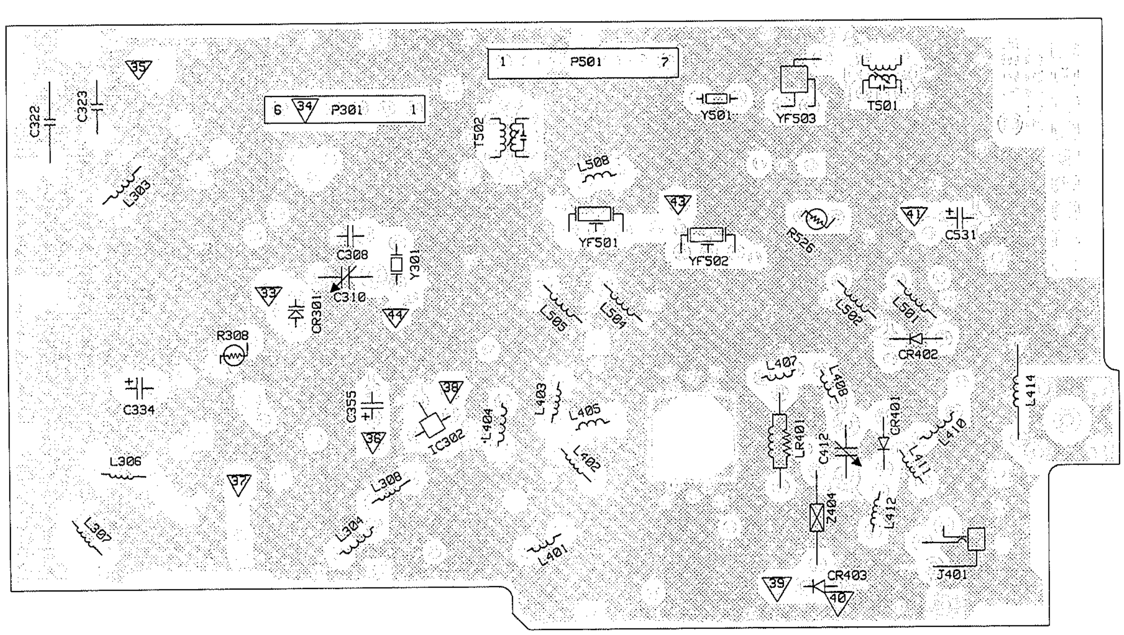
DTX-150 RF BOARD TOPSIDE PARTS PLACEMENT
17534003-DTX REV L
RITRON, INC CARMEL, IN.
PARTS WITH REFERENCE DESIGNATORS
LAST ECN #2362
DATE: 10/04/96

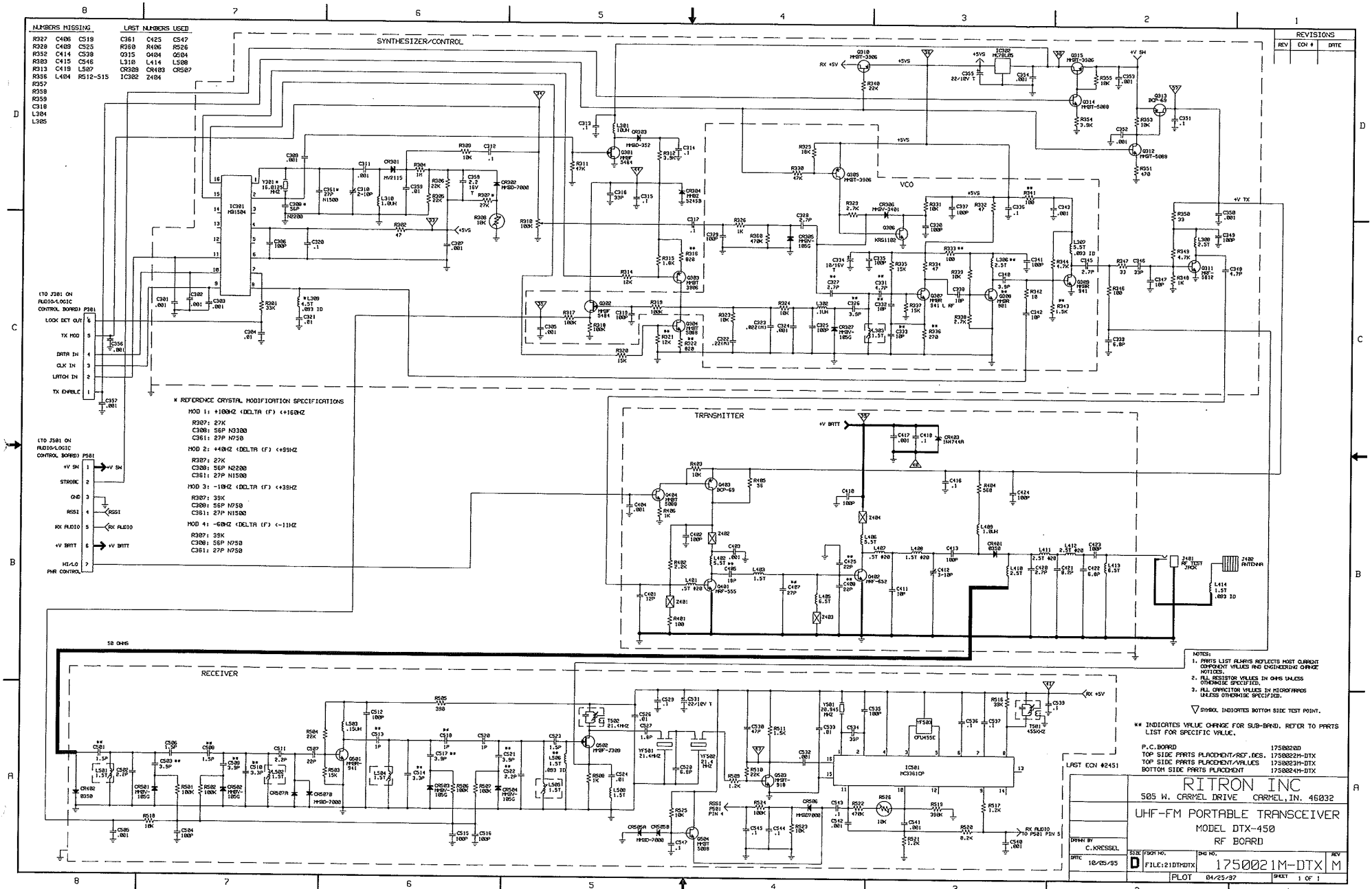
* INDICATES VALUE CHANGE FOR SUB-BAND. REFER TO PARTS LIST FOR SPECIFIC VALUE.

SCHEMATIC	17734003-DTX REV L
TOP SIDE PARTS PLACEMENT/W VALUES	17534003-DTX REV L
BOTTOM SIDE PARTS PLACEMENT	17634003-DTX REV L
P.C. BOARD	17034003 REV C

DTX-150 RF BOARD BOTTOM SIDE PARTS PLACEMENT
17634003-DTX REV L
RITRON, INC CARMEL, IN.
LAST ECN #2362
DATE: 10/04/96

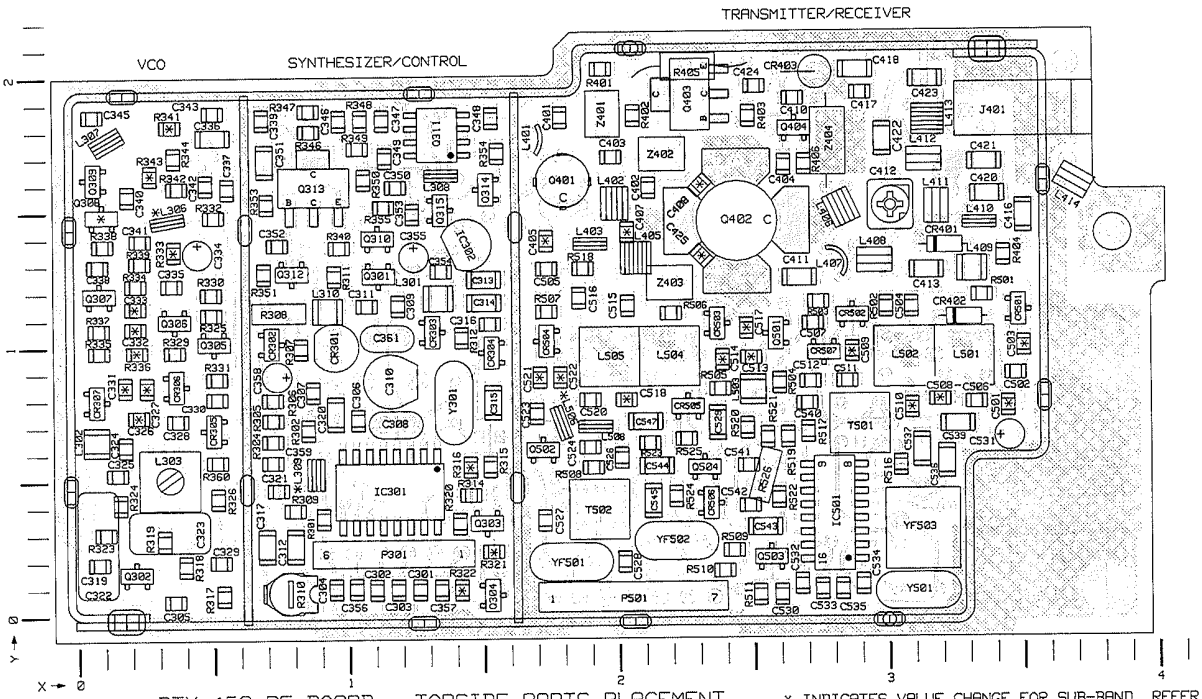
P.C. BOARD	17034003 REV C
TOP SIDE PARTS PLACEMENT/W VALUES	17534003-DTX REV L
TOP SIDE PARTS PLACEMENT/W REF.DES.	17534003-DTX REV L
SCHEMATIC	17734003-DTX REV L




NUMBERS MISSING
R327 C406 C519
R328 C408 C525
R352 C414 C538
R383 C415 C546
R313 C419 L507
R356 L404 RS12-515
R357
R358
R359
C318
L304
L305
LAST NUMBERS USED
C361 C425 C547
R368 R406 R526
Q315 Q404 Q504
L318 L414 L508
CR309 CR403 CR507
IC302 Z404
SYNTHESIZER/CONTROL
VCO
TRANSMITTER
RECEIVER
REVISIONS
REV
ECN #
DATE
* REFERENCE CRYSTAL MODIFICATION SPECIFICATIONS
MOD 1: +100HZ (DELTA (F) <+160HZ
R307: 27K
C308: 56P N3300
C361: 27P N750
MOD 2: +40HZ (DELTA (F) <+99HZ
R307: 27K
C308: 56P N2200
C361: 27P N1500
MOD 3: -10HZ (DELTA (F) <+39HZ
R307: 39K
C308: 56P N750
C361: 27P N1500
MOD 4: -60HZ (DELTA (F) <-11HZ
R307: 39K
C308: 56P N750
C361: 27P N750
(TO J301 ON AUDIO/LOGIC CONTROL BOARD) P301
LOCK DET OUT
TX MOD
DATA IN
CLK IN
LATCH IN
TX ENABLE
(TO J301 ON AUDIO/LOGIC CONTROL BOARD) P301
+V SW
STROBE
GND
RSSI
RX AUDIO
+V BATT
HI/LO PWR CONTROL
50 OHMS
NOTES:
1. PARTS LIST ALWAYS REFLECTS MOST CURRENT COMPONENT VALUES AND ENGINEERING CHANGE NOTICES.
2. ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
▽ SYMBOL INDICATES BOTTOM SIDE TEST POINT.
** INDICATES VALUE CHANGE FOR SUB-BAND, REFER TO PARTS LIST FOR SPECIFIC VALUE.
P.C.BOARD 1750020D
TOP SIDE PARTS PLACEMENT/REF.DES. 1750022M-DTX
TOP SIDE PARTS PLACEMENT/VALUES 1750023M-DTX
BOTTOM SIDE PARTS PLACEMENT 1750024M-DTX
LAST ECN #2451
RITRON INC
505 W. CARMEL DRIVE CARMEL, IN. 46032
UHF-FM PORTABLE TRANSCEIVER
MODEL DTX-450
RF BOARD
DRAWN BY C.KRESSEL
DATE 10/25/95
SIZE D
FSCM NO.
DWG NO. 1750021M-DTX
REV M
FILE:21DTMDTX
PLOT 04/25/97
SHEET 1 OF 1

ECN 2163: REVISED TO PRODUCTION
ADD C358-2.2 TANT
ECN 2171: R388 FROM 90Ω TO 1KΩ
ECN 2208: R348 FROM 20K TO 22K
ECN 2281: REVISED DTX-450
CHANGE R314 FROM 22K TO 12K
CHANGE R316 FROM 1K TO 820 OHM
CHANGE R319 FROM 47Ω TO 15Ω
CHANGE R321 FROM 10K TO 12K
CHANGE R322 FROM 1K TO 820 OHM
REMOVE C340
ECN 2368/REV. J: C361 FROM 33P TO 27P
NOTE W758 AND W1588 CHANGE
ECN 2420/REV. K: R482 FROM 1.2K TO 2.2K
ECN 2430/REV. L: ADD R268 (470K)

ECN 2451/REV. M: CHANGE C412 FROM 1.5-10P THRU HOLE TO 3-10P SURFACE MOUNT



DTX-450 RF BOARD TOPSIDE PARTS PLACEMENT

* INDICATES VALUE CHANGE FOR SUB-BAND. REFER TO PARTS LIST FOR SPECIFIC VALUE.

1750022M-DTX

RITRON, INC CARMEL, IN.

PARTS WITH REFERENCE DESIGNATORS

LAST ECN #2451

DATE:04/28/97

SCHEMATIC	1750021M-DTX
TOP SIDE PARTS PLACEMENT/VALUES	1750023M-DTX
BOTTOM SIDE PARTS PLACEMENT	1750024M-DTX
P.C. BOARD	1750020D

DTX-450-G RF BOARD BOTTOM SIDE PARTS PLACEMENT

1750024P-DTX-G

400 TO 430 MHZ

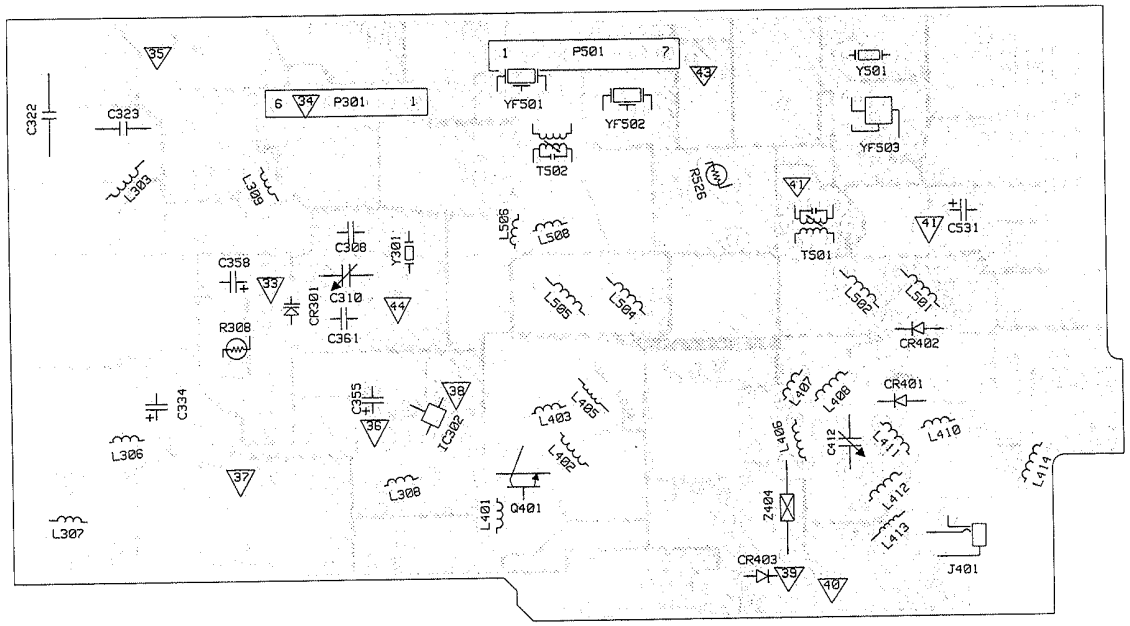
RITRON, INC CARMEL, IN.

PARTS WITH REFERENCE DESIGNATORS

LAST ECN #2451

DATE:04/28/97

SCHEMATIC	1750021P-DTX-G
TOP SIDE PARTS PLACEMENT/RFE.DES.	1750022P-DTX-G
TOP SIDE PARTS PLACEMENT/VALUES	1750023P-DTX-G
P.C. BOARD	1750020D



19. DTX-CONTROL BOARD SCHEMATIC REFERENCE PARTS LIST

NOTE: This parts list reflects values current with ECN 2400. If a component value in the schematic differs from the value in the parts list, the parts list is to be considered more current.

Ref.	Ritron #	Description	Coordinates	
CAPACITORS				
C 101	15111102	.001MF X7R 0805 50V CHIP CAP	1.113	2.047 T
C 103	15111222	.0022uF X7R 0805 50V CHIP CAP	2.071	1.378 T
C 104	15111102	.001MF X7R 0805 50V CHIP CAP	1.086	2.992 T
C 105	15111103	.01MF X7R 0805 50V CHIP	2.003	0.381 T
C 106	01502013	10uf TANT CAP 16V(C) .1~ r 20%	2.042	0.699 T
C 107	15111102	.001MF X7R 0805 50V CHIP CAP	1.056	3.176 T
C 108	15111102	.001MF X7R 0805 50V CHIP CAP	1.132	3.176 T
C 109	15111102	.001MF X7R 0805 50V CHIP CAP	0.713	2.811 T
C 110	15111102	.001MF X7R 0805 50V CHIP CAP	0.335	2.803 T
C 111	15111102	.001MF X7R 0805 50V CHIP CAP	1.086	3.069 T
C 112	01502005	.47uf TANT CAP 35v(v) .1~ 20%	0.491	3.884 T
C 113	15110560	56PF NPO 0805 50V CHIP CAP	1.263	3.330 T
C 114	15110560	56PF NPO 0805 50V CHIP CAP	1.263	3.612 T
C 115	15111102	.001MF X7R 0805 50V CHIP CAP	0.056	3.245 T
C 116	15111102	.001MF X7R 0805 50V CHIP CAP	0.411	2.803 T
C 117	15111102	.001MF X7R 0805 50V CHIP CAP	0.840	2.840 T
C 118	15111102	.001MF X7R 0805 50V CHIP CAP	0.056	3.386 T
C 119	15111102	.001MF X7R 0805 50V CHIP CAP	0.056	3.525 T
C 121	15111102	.001MF X7R 0805 50V CHIP CAP	2.055	3.277 T
C 130	15111102	.001MF X7R 0805 50V CHIP CAP		
C 201	15111102	.001MF X7R 0805 50V CHIP CAP	1.214	1.100 T
C 202	01503203	1 uf ELT CAP 50V .05LS X .16W X .3L	1.506	1.455 T
C 203	15110151	150PF NPO 0805 50V CHIP	1.655	2.111 T
C 204	15121104	.1MF X7R 1206 50V CHIP CAP	1.105	2.344 T
C 205	15111122	.0012MF X7R 0805 50V CHIP	1.779	2.226 T
C 206	15110821	820PF NPO 0805 50V CHIP CAP	1.779	2.404 T
C 207	152A6105	1MF 10V ~3.2X1.6~ CHIP TANTALUM		
C 208	15121104	.1MF X7R 1206 50V CHIP CAP	1.697	1.718 T
C 209	15111333	.033MFD X7R 0805 50V CHIP CAP	1.049	3.744 T
C 210	15111472	.0047MF X7R 0805 50V CHIP	1.173	3.871 T
C 211	15111472	.0047MF X7R 0805 50V CHIP	1.263	3.870 T
C 212	15111103	.01MF X7R 0805 50V CHIP	1.792	2.702 T
C 213	15111103	.01MF X7R 0805 50V CHIP	0.820	3.860 T
C 214	15111103	.01MF X7R 0805 50V CHIP	1.640	2.741 T
C 215	15110100	10PF NPO 0805 50V CHIP CAP	0.350	2.205 T
C 216	15121104	.1MF X7R 1206 50V CHIP CAP	2.014	1.674 T
C 217	15121104	.1MF X7R 1206 50V CHIP CAP	2.022	1.489 T
C 218	15121104	.1MF X7R 1206 50V CHIP CAP	0.191	2.282 T
C 219	15110101	100PF NPO 0805 50V CHIP CAP	0.752	1.927 T
C 220	15121104	.1MF X7R 1206 50V CHIP CAP	1.317	1.947 T
C 221	01502007	1uf TANT CAP 35v(v) .1~ 20%	0.854	2.068 T
C 222	15110471	470PF NPO 0805 50V CHIP	0.675	1.928 T
C 223	15121104	.1MF X7R 1206 50V CHIP CAP	0.053	2.239 T
C 224	15110221	220pf NPO 0805 50V CHIP CAP	0.601	2.066 T
C 225	15111102	.001MF X7R 0805 50V CHIP CAP	1.808	2.120 T
C 226	01502009	2.2uf TANT CAP 16V(V) .1~ r 20%	1.598	3.534 T
C 227	15121104	.1MF X7R 1206 50V CHIP CAP	1.398	3.429 T
C 228	15111103	.01MF X7R 0805 50V CHIP	1.658	1.140 T
C 229	15111102	.001MF X7R 0805 50V CHIP CAP	1.657	1.901 T
C 230	15110100	10PF NPO 0805 50V CHIP CAP	1.089	1.911 T
C 231	15121104	.1MF X7R 1206 50V CHIP CAP	1.078	1.738 T
C 233	15111103	.01MF X7R 0805 50V CHIP	1.802	1.607 T
C 234	15121104	.1MF X7R 1206 50V CHIP CAP	0.345	1.689 T
C 235	15110101	100PF NPO 0805 50V CHIP CAP	1.401	0.875 T
C 236	15110101	100PF NPO 0805 50V CHIP CAP	1.711	0.875 T
C 237	15110101	100PF NPO 0805 50V CHIP CAP	1.635	0.875 T
C 238	15110101	100PF NPO 0805 50V CHIP CAP	0.820	2.488 T
C 239	15121104	.1MF X7R 1206 50V CHIP CAP	1.531	2.900 T
C 240	15121104	.1MF X7R 1206 50V CHIP CAP	1.523	1.590 T
C 601	15111223	.022mf X7R 0805 CHIP CAP 50V	0.075	1.523 T
C 602	01503201	10uf ELT CAP 16V .05~ .16~x.3~ r	0.482	1.689 T
C 603	01503201	10uf ELT CAP 16V .05~ .16~x.3~ r	0.502	1.295 T
C 604	15121104	.1MF X7R 1206 50V CHIP CAP	0.701	1.275 T
C 605	01503011	220uf ELT CAP 16V .12~ .32~x.48~ r	0.506	1.120 T
C 606	15111102	.001MF X7R 0805 50V CHIP CAP	0.269	0.977 T
C 607	15111102	.001MF X7R 0805 50V CHIP CAP	1.763	1.021 T
C 608	15121104	.1MF X7R 1206 50V CHIP CAP	1.241	1.415 T
C 609	15111102	.001MF X7R 0805 50V CHIP CAP	1.559	0.876 T
C 610	15111102	.001MF X7R 0805 50V CHIP CAP	1.055	0.917 T
C 611	15111103	.01MF X7R 0805 50V CHIP	0.073	1.598 T
C 612	01502013	10uf TANT CAP 16V(C) .1~ r 20%	1.688	4.077 T
C 613	15111102	.001MF X7R 0805 50V CHIP CAP	1.967	4.065 T
C 614	01502007	1uf TANT CAP 35v(v) .1~ 20%	0.625	4.215 T
C 615	01502007	1uf TANT CAP 35v(v) .1~ 20%	1.836	4.077 T
C 616	01502007	1uf TANT CAP 35v(v) .1~ 20%	1.634	3.110 T
C 617	15111102	.001MF X7R 0805 50V CHIP CAP	0.073	1.444 T
DIODES				
CR101	48A1005C	MMBD7000 DUAL DIODE SOT-23	1.222	2.064 T
CR103	48A1005C	MMBD7000 DUAL DIODE SOT-23	1.963	2.703 T
CR201	48A1005C	MMBD7000 DUAL DIODE SOT-23	0.445	2.414 T
CR202	48A1005C	MMBD7000 DUAL DIODE SOT-23	0.603	2.237 T
CR601	48A60001	1N4001 DIODE, 50V DL-41 MELF	1.204	0.840 T
CR602	48A1005C	MMBD7000 DUAL DIODE SOT-23	0.986	0.802 T
CR603	48A60001	1N4001 DIODE, 50V DL-41 MELF	1.887	1.129 T
FUSE				
F 601	06000040	WIRE; #40AWG TINNED BUS (INCHES)		
INTEGRATED CIRCUITS				
IC101	314B0006	MICROCONTROLLER, 06 CODE	0.563	3.334 T
IC102	03131019	LM2931; 5VDC REGULATOR	2.015	0.532 T
IC201	31124066	MC14066 QUAD ANALOG SWITCH SO-14	1.752	1.373 T
IC202	31010005	TLC272 DUAL PKG OP AMP SO-8	1.415	3.638 T
IC203	31020001	MF6CWM-50 6 POLE FILT. SOLIC	0.319	1.974 T
IC204	31020001	MF6CWM-50 6 POLE FILT. SOLIC	1.472	2.356 T
IC205	31134053	HC4053 ANALOG TRIPLE SPDT SWITCH	1.245	2.756 T
IC206	31010005	TLC272 DUAL PKG OP AMP SO-8	1.293	1.790 T
IC601	31010004	LM386MX-1 AUDIO AMP SO-8	0.490	1.486 T
CONNECTORS, HEADERS				
J 101	02100351	HEADER, IDC BOX, 10 CONDUCTOR, RIGHT ANG		
J 301	21443061	6 POS PC VERT GOLD		
J 501	21443071	CONNECTOR, 7 POS PC VERT GOLD		
J 601	02100001	2.5MM PC-MT JACK; ANT-CHGR	0.712	0.295 T
J 602	02100053	3.5MM STEREO JACK; PANEL MOUNT		
TRANSISTORS				
Q 101	4801002A	MMBT3906 "SOT23"	1.513	3.023 T
Q 102	48410001	NFET LOW-VGS SOT23	0.072	3.872 T
Q 201	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.984	2.428 T
Q 202	4801002A	MMBT3906 "SOT23"	2.042	0.904 T
Q 203	4801001Q	MMBT-5088 "SOT-23"	1.897	0.912 T
Q 204	4801002A	MMBT3906 "SOT23"	0.818	2.228 T
Q 205	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.824	2.596 T
Q 206	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.450	2.588 T
Q 207	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.308	2.626 T
Q 208	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.606	2.587 T
Q 601	4801002A	MMBT3906 "SOT23"	1.251	1.530 T
Q 602	48180001	BCP-69 PNP RF PWR, SOT-223	0.888	1.672 T
Q 603	4801001Q	MMBT-5088 "SOT-23"	0.725	1.429 T
Q 604	48010R02	MUN2211T1 W/BIAS RES. SOT-23	1.081	1.501 T
Q 605	4841006Y	MMBF-J177 P-CHAN FET	1.075	1.069 T
Q 606	4801002A	MMBT3906 "SOT23"	1.729	3.759 T
Q 607	4801002A	MMBT3906 "SOT23"	1.752	3.532 T
Q 608	4801001Q	MMBT-5088 "SOT-23"	1.968	3.526 T
Q 609	04800019	TIP-42; 40V 6A PNP POWER TRANS	1.129	4.251 T

Ref.	Ritron#	Description	Coordinates	
RESISTORS				
R 101	47100471	470 OHM 0805 CHIP RES.	0.142	1.173 T
R 103	47100562	5.6K OHM 0805 CHIP RES.	1.651	2.983 T
R 104	47100473	47K OHM 0805 CHIP RES.	1.673	3.238 T
R 105	47100103	10K OHM 0805 CHIP RES	0.269	1.112 T
R 106	47100472	4.7K OHM 0805 CHIP RES.	1.390	3.025 T
R 107	47100224	220K OHM 0805 CHIP RES.	1.390	3.164 T
R 108	47100104	100K OHM 0805 CHIP RES	1.480	3.164 T
R 109	47100103	10K OHM 0805 CHIP RES	0.259	2.803 T
R 110	47100103	10K OHM 0805 CHIP RES	0.371	1.199 T
R 111	47100105	1M OHM 0805 CHIP RES	0.093	3.731 T
R 112	47100103	10K OHM 0805 CHIP RES	0.673	3.884 T
R 113	47100103	10K OHM 0805 CHIP RES	0.596	3.884 T
R 114	47270103	VARIABLE RESISTOR 10K SEALED	1.261	3.114 T
R 115	47100105	1M OHM 0805 CHIP RES	1.263	3.466 T
R 116	47100471	470 OHM 0805 CHIP RES.	0.142	1.097 T
R 117	47100103	10K OHM 0805 CHIP RES	0.142	1.021 T
R 118	47100000	ZERO OHM 0805 CHIP RES.	0.075	2.881 T
R 119	47100000	ZERO OHM 0805 CHIP RES.	1.481	0.877 T
R 120	47100000	ZERO OHM 0805 CHIP RES.	0.143	0.930 T
R 201	47100105	1M OHM 0805 CHIP RES	1.764	2.581 T
R 202	47100473	47K OHM 0805 CHIP RES.	1.455	1.275 T
R 203	47100184	180K OHM 0805 CHIP RES.	1.731	2.110 T
R 204	47100333	33K OHM 0805 CHIP RES.	1.779	2.311 T
R 205	47100104	100K OHM 0805 CHIP RES	1.638	2.817 T
R 206	47270104	VARIABLE RESISTOR 100K SEALED	0.989	2.728 T
R 207	47100000	ZERO OHM 0805 CHIP RES.	1.884	1.681 T
R 208	47100000	ZERO OHM 0805 CHIP RES.	2.012	1.756 T
R 209	47100000	ZERO OHM 0805 CHIP RES.	2.015	1.832 T
R 210	47100000	ZERO OHM 0805 CHIP RES.	0.994	2.027 T
R 211	47100105	1M OHM 0805 CHIP RES	1.531	1.275 T
R 212	47100104	100K OHM 0805 CHIP RES	1.553	1.169 T
R 213	47100153	15K OHM 0805 CHIP RES	1.184	3.744 T
R 214	47100104	100K OHM 0805 CHIP RES	1.340	3.870 T
R 215	47100273	27K OHM 0805 CHIP RES.	1.417	3.870 T
R 216	47100154	150K OHM 0805 CHIP RES.	1.556	3.889 T
R 217	47100473	47K OHM 0805 CHIP RES.	1.555	3.783 T
R 218	47100564	560K OHM 0805 CHIP RES	1.525	2.618 T
R 219	47100225	2.2M 0805 CHIP RESISTOR	1.631	2.587 T
R 220	47100394	390K OHM 0805 CHIP RES.	1.507	2.799 T
R 221	47100564	560K OHM 0805 CHIP RES	0.350	2.282 T
R 222	47100562	5.6K OHM 0805 CHIP RES.	2.014	1.571 T
R 223	47100000	ZERO OHM 0805 CHIP RES.	0.714	2.681 T
R 224	47270104	VARIABLE RESISTOR 100K SEALED	0.153	2.417 T
R 225	47100472	4.7K OHM 0805 CHIP RES.	0.599	1.928 T
R 226	47270104	VARIABLE RESISTOR 100K SEALED	1.545	1.778 T
R 227	47100224	220K OHM 0805 CHIP RES.	0.754	2.067 T
R 228	47100000	ZERO OHM 0805 CHIP RES.	0.560	2.803 T
R 229	47100104	100K OHM 0805 CHIP RES	1.118	2.427 T
R 230	47100103	10K OHM 0805 CHIP RES	0.898	3.857 T
R 231	47100104	100K OHM 0805 CHIP RES	1.379	3.270 T
R 232	47100683	68K OHM 0805 CHIP RES.	1.379	3.347 T
R 233	47100103	10K OHM 0805 CHIP RES	1.906	0.805 T
R 234	47100472	4.7K OHM 0805 CHIP RES.	1.788	0.907 T
R 235	471004A7	4.7 OHM 0805 CHIP RES.	1.214	1.177 T
R 236	47100473	47K OHM 0805 CHIP RES.	0.921	1.910 T
R 237	47100104	100K OHM 0805 CHIP RES	0.336	2.398 T
R 238	47100223	22K OHM 0805 CHIP RES.	0.713	1.809 T
R 239	47100683	68K OHM 0805 CHIP RES.	0.233	1.737 T
R 240	47100472	4.7K OHM 0805 CHIP RES.	1.448	2.617 T
R 241	47100103	10K OHM 0805 CHIP RES	0.999	1.831 T
R 242	47100000	ZERO OHM 0805 CHIP RES.	2.005	1.271 T
R 243	47100000	ZERO OHM 0805 CHIP RES.	0.168	2.622 T
R 246	47100472	4.7K OHM 0805 CHIP RES.	1.802	1.741 T
R 247	47100101	100 OHM 0805 CHIP RES.	1.327	0.876 T
R 248	47100472	4.7K OHM 0805 CHIP RES.	0.167	2.698 T
R 249	47100472	4.7K OHM 0805 CHIP RES.	0.485	2.803 T
R 250	47100472	4.7K OHM 0805 CHIP RES.	0.167	2.546 T
R 251	47100104	100K OHM 0805 CHIP RES	1.906	0.729 T
R 252	47100103	10K OHM 0805 CHIP RES	0.820	2.335 T
R 253	47100103	10K OHM 0805 CHIP RES	0.820	2.412 T
R 254	47100564	560K OHM 0805 CHIP RES.		
R 255	47100000	ZERO OHM 0805 CHIP RES.	0.714	2.547 T
R 256	47270104	VARIABLE RESISTOR 100K SEALED	1.035	2.206 T
R 257	47100000	ZERO OHM 0805 CHIP RES.	0.669	2.374 T
R 258	47100103	10K OHM 0805 CHIP RES	1.595	3.417 T
R 259	47100103	10K OHM 0805 CHIP RES	0.565	2.375 T
R 260	47100104	100K OHM 0805 CHIP RES	0.678	2.067 T
R 261	47100103	10K OHM 0805 CHIP RES	1.549	2.050 T
R 262	47100474	470K OHM 0805 CHIP RES	1.549	1.960 T
R 601	47270103	VARIABLE RESISTOR 10K SEALED	0.230	1.527 T
R 602	47100470	47 OHM 0805 CHIP RES.	0.333	1.338 T
R 603	47100473	47K OHM 0805 CHIP RES.	1.213	1.333 T
R 604	47100103	10K OHM 0805 CHIP RES	1.213	1.255 T
R 605	04720022	0.3 OHM 1W CUR.LIMIT.RES	0.342	4.083 T
R 606	47100391	390 OHM 0805 CHIP RES	0.613	1.664 T
R 607	471004A7	4.7 OHM 0805 CHIP RES.	0.861	1.308 T
R 608	47100103	10K OHM 0805 CHIP RES	0.862	1.459 T
R 609	47100471	470 OHM 0805 CHIP RES.	0.862	1.383 T
R 610	47100272	2.7K OHM 0805 CHIP RES.	1.966	4.141 T
R 611	47100105	1M OHM 0805 CHIP RES	1.095	0.758 T
R 612	47100103	10K OHM 0805 CHIP RES	1.225	1.638 T
R 613	47100102	1K OHM 0805 CHIP RES	1.592	3.652 T
R 614	47100223	22K OHM 0805 CHIP RES.	0.074	1.674 T
R 615	47100105	1M OHM 0805 CHIP RES	1.076	1.172 T
R 616	47270202	RESISTOR, VAR. SMT, SEALED, 2K OHM	1.946	3.694 T
R 617	47100103	10K OHM 0805 CHIP RES	1.726	3.652 T
R 618	47100104	100K OHM 0805 CHIP RES	1.860	3.534 T
R 619	47100182	1.8K OHM 0805 CHIP RES.	2.064	3.841 T
R 623	47100121	120 OHM 0805 CHIP RES	1.673	3.313 T
FERRITE BEADS				
Z 201	18360001	BEAD; FERRITE SURFACE MOUNT	1.771	1.925 T
Z 601	18360001	BEAD; FERRITE SURFACE MOUNT	0.383	1.016 T
Z 602	1801029L	FAIR-RITE BEAD ON AXIAL LEADS		
Z 603	1801029L	FAIR-RITE BEAD ON AXIAL LEADS		

HARDWARE		
HD101	02100358	CONNECTOR, INSERT BOX MILITARY POLARIZED
HD102	25101100	MOUNTING BRACKET "X" SERIES
HD103	25101100	MOUNTING BRACKET "X" SERIES
HD104	25702800	SHIELD, LEFT CONTROL BOARD DRTX
HD105	25702500	SHIELD, RIGHT, CONTROL BOARD, DRTX
HD301	02800114	CRYSTAL SUPPORT
HD302	02801003	4-40; 1/4~ PHILLIPS FLAT
HD303	02802003	4-40 X 1/4~ X 3/32~ HEX NUT/ZINC PLT.
CRYSTALS		
Y 101	02300058	CRYSTAL; 4.00MHZ 10PPM HC-44 (DTX-150)
	02300066	CRYSTAL; 4.003125MHZ 10PPM HC-44 (DTX-450)

20. DTX-150 RF BOARD SCHEMATIC REFERENCE PARTS LIST

NOTE: This parts list reflects values current with ECN 2406. If a component value in the schematic differs from the value in the parts list, the parts list is to be considered more current.

1. Only surface mount components have XY coordinates listed.
2. (E) = 136 - 151 MHz
   (F) = 160- 174 MHz

Ref.	Ritron#	Description	Coordinates	
CAPACITORS				
C 301	15111102	.001MF X7R 0805 50V CHIP CAP	1.260	0.096 T
C 302	15111102	.001MF X7R 0805 50V CHIP CAP	1.100	0.096 T
C 303	15111102	.001MF X7R 0805 50V CHIP CAP	1.180	0.096 T
C 304	15111103	.01MF X7R 0805 50V CHIP	0.950	0.099 T
C 305	15111102	.001MF X7R 0805 50V CHIP CAP	0.375	0.055 T
C 306	15110101	100PF NPO 0805 50V CHIP CAP	1.040	0.726 T
C 307	15111102	.001MF X7R 0805 50V CHIP CAP	0.849	0.875 T
C 308	01511803	56pf N3300 CERDIS CAP 50V .16 X.1 r		
C 309	15111102	.001MF X7R 0805 50V CHIP CAP	1.170	0.990 T
C 310	01550021	2-10pf VARCER CAP 250V .2 X .24 r		
C 311	15111102	.001MF X7R 0805 50V CHIP CAP	1.090	0.990 T
C 312	15121104	.1MF X7R 1206 50V CHIP CAP	0.800	0.259 T
C 313	15121104	.1MF X7R 1206 50V CHIP CAP	1.504	1.245 T
C 314	15121104	.1MF X7R 1206 50V CHIP CAP	1.504	1.160 T
C 315	15121104	.1MF X7R 1206 50V CHIP CAP	1.504	0.860 T
C 316	15110330	33PF NPO 0805 50V CHIP	1.526	1.080 T
C 317	15121104	.1MF X7R 1206 50V CHIP CAP	0.695	0.259 T
C 318	15121104	.1MF X7R 1206 50V CHIP CAP	1.504	0.685 T
C 319	15110101	100PF NPO 0805 50V CHIP CAP	0.071	0.195 T
C 320	15121104	.1MF X7R 1206 50V CHIP CAP	0.960	0.799 T
C 321	15110100	10PF NPO 0805 50V CHIP CAP	0.864	0.540 T
C 322	01501071	.22uf MLPOLY CAP 50V .2 r 5 %		
C 323	01501070	.022uf MLPOLY CAP 50V .2 r 5%		
C 324	15111102	.001MF X7R 0805 50V CHIP CAP	0.060	0.525 T
C 325	15110101	100PF NPO 0805 50V CHIP CAP	0.060	0.660 T
C 326	15110100	10PF NPO 0805 50V CHIP CAP	0.185	0.715 T
	15110150	15PF NPO 0805 50V CHIP CAP (E)		
C 327	151103A3	3.3pf NPO 0805 CHIP CAP	0.255	0.850 T
C 328	151102A2	2.2PF NPO 0805 50V CHIP	0.369	0.725 T
C 329	15110101	100PF NPO 0805 50V CHIP CAP	0.355	0.310 T
C 330	15111102	.001MF X7R 0805 50V CHIP CAP	0.524	0.855 T
C 331	151108A2	8.2PF NPO 0805 50V CHIP	0.175	0.851 T
	151104A7	4.7PF NPO 0805 50V CHIP CAP (F)		
C 332	15110150	15PF 0805 NPO 50V CHIP CAP	0.214	1.060 T
C 333	15110150	15PF 0805 NPO 50V CHIP CAP	0.214	1.135 T
C 334	01502013	10uf TANT CAP 16V(C) .1~ r 20%	0.395	1.255 T
C 335	15121104	.1MF X7R 1206 50V CHIP CAP	0.424	1.420 T
C 338	15110120	12PF NPO 0805 50V CHIP CAP	0.065	1.300 T
C 339	15110101	100PF NPO 0805 50V CHIP CAP	0.181	1.246 T
C 340	15110330	33PF NPO 0805 50V CHIP	0.171	1.596 T
C 341	15111102	.001MF X7R 0805 50V CHIP CAP	0.238	1.424 T
C 342	15110100	10PF NPO 0805 50V CHIP CAP	0.431	1.715 T
C 343	15111102	.001MF X7R 0805 50V CHIP CAP	0.524	1.875 T
C 344	15111102	.001MF X7R 0805 50V CHIP CAP	0.391	1.875 T
C 345	15110150	15PF 0805 NPO 50V CHIP CAP	0.040	1.809 T
C 346	15111102	.001MF X7R 0805 50V CHIP CAP	0.970	1.839 T
C 347	15110270	27pf NPO 0805 50V CHIP CAP	1.050	1.839 T
C 348	15110120	12PF NPO 0805 50V CHIP CAP	1.555	1.845 T
C 349	15111102	.001MF X7R 0805 50V CHIP CAP	1.165	1.694 T
C 350	15111102	.001MF X7R 0805 50V CHIP CAP	1.179	1.590 T
C 351	15121104	.1MF X7R 1206 50V CHIP CAP	0.695	1.689 T
C 352	15111102	.001MF X7R 0805 50V CHIP CAP	0.740	1.375 T
C 353	15111102	.001MF X7R 0805 50V CHIP CAP	1.240	1.489 T
C 354	15111102	.001MF X7R 0805 50V CHIP CAP	1.355	1.326 T
C 355	01502015	22uf TANT CAP 10V(A) .1~ r 20%	1.255	1.325 T
C 356	15110220	22PF NPO 0805 50V CHIP CAP	1.340	1.759 T
C 357	15111102	.001MF X7R 0805 50V CHIP CAP	1.340	0.094 T
C 358	15111102	.001MF X7R 0805 50V CHIP CAP	1.025	0.099 T
C 359	15111103	.01MF X7R 0805 50V CHIP	0.719	0.590 T
C 360	15111102	.001MF X7R 0805 50V CHIP CAP	0.861	0.465 T
C 361	15111102	.001MF X7R 0805 50V CHIP CAP	0.261	1.246 T
C 362	01510021	33pf NP0 CERDIS CAP 50V .200x.1 r		
C 401	15110470	47PF NPO 0805 50V CHIP	1.720	1.870 T
C 402	15111102	.001MF X7R 0805 50V CHIP CAP	2.265	1.726 T
C 404	15111102	.001MF X7R 0805 50V CHIP CAP	2.655	1.669 T
C 405	15110330	33PF NPO 0805 50V CHIP	1.843	1.442 T
C 406	15110680	68PF NPO 0805 50V CHIP CAP	2.035	1.304 T
C 407	15110470	47PF NPO 0805 50V CHIP	1.825	1.305 T
C 408	15110680	68PF NPO 0805 50V CHIP CAP	2.115	1.514 T
C 409	15120180	18PF NPO 1206 50V CHIP CAP		
C 410	15111102	.001MF X7R 0805 50V CHIP CAP	2.686	1.940 T
C 412	01550006	5-30pf VARCER CAP 250V .2 x .24 r		
C 413	15120180	18PF NPO 1206 50V CHIP CAP	3.097	1.259 T
C 414	151203A3	3.3PF NPO 1206 50V CHIP CAP	3.428	1.604 T
C 415	151203A9	3.9PF NPO 1206 50V CHIP CAP	3.267	1.709 T
C 416	15121104	.1MF X7R 1206 50V CHIP CAP	3.506	1.373 T
C 417	15111102	.001MF X7R 0805 50V CHIP CAP	2.790	1.881 T
C 418	15121104	.1MF X7R 1206 50V CHIP CAP	2.684	2.025 T
C 419	15120470	47 PF NPO 1206 50V CHIP CAP	2.866	1.357 T
C 420	15120120	12PF NPO 1206 50V CHIP CAP	3.453	1.506 T
C 421	15120220	22PF NPO 1206 50V CHIP CAP	3.448	1.706 T
C 422	15120120	12PF NPO 1206 50V CHIP CAP	3.021	1.853 T
C 423	15120221	220PF NPO 1206 50V CHIP CAP	3.152	1.894 T
C 424	15111102	.001MF X7R 0805 50V CHIP CAP	2.534	2.030 T
C 501	151104A7	4.7PF 0805 50V CHIP CAP.	3.440	0.765 T
C 502	151102A2	2.2PF NPO 0805 50V CHIP	3.469	0.885 T
	151104A7	4.7PF NPO 0805 50V CHIP (E)		
	151101A0	1.0PF NPO 0805 50V CHIP (F)		
C 503	15110220	22PF NPO 0805 50V CHIP CAP	3.500	0.987 T
	15110470	47PF NPO 0805 50V CHIP CAP (E)		
C 504	15111102	.001MF X7R 0805 50V CHIP CAP	3.085	1.134 T
C 506	151101A5	1.5PF NPO 0805 50V CHIP	3.324	0.780 T
C 507	15111102	.001MF X7R 0805 50V CHIP CAP	2.750	1.065 T
C 509	15110220	22PF NPO 0805 50V CHIP CAP	2.865	0.969 T
	15110470	47PF NPO 0805 50V CHIP CAP (E)		
C 510	151103A3	3.3pf NPO 0805 50V CHIP CAP	3.160	0.795 T
	151103A9	3.9PF NPO 0805 50V CHIP CAP (E)		
	151101A5	1.5PF NPO 0805 50V CHIP CAP (F)		
C 511	151104A7	4.7PF NPO 0805 50V CHIP CAP	2.856	0.860 T
C 512	15111102	.001MF X7R 0805 50V CHIP CAP	2.209	0.794 T
C 513	15110101	100PF NPO 0805 50V CHIP CAP	2.486	0.983 T
C 514	151108A2	8.2PF NPO 0805 50V CHIP CAP		
	151104A7	4.7PF NPO 0805 50V CHIP CAP (F)		
C 515	15111102	.001MF X7R 0805 50V CHIP CAP	2.005	1.144 T
C 516	15111102	.001MF X7R 0805 50V CHIP CAP	1.905	1.144 T
C 517	15110220	22PF NPO 0805 50V CHIP CAP	2.474	1.092 T
	15110470	47PF NPO 0805 50V CHIP CAP (E)		
C 518	151101A2	1.2PF NPO 0805 50V CHIP CAP	2.074	0.795 T
	151101A5	1.5PF NPO 0805 50V CHIP CAP (E)		
	151101A0	1.0PF NPO 0805 50V CHIP CAP (F)		
C 519	151101A2	1.2PF NPO 0805 50V CHIP CAP	1.940	0.800 T
	151101A0	1.0PF NPO 0805 50V CHIP CAP (F)		
C 521	15110220	22PF NPO 0805 50V CHIP CAP	1.710	0.879 T
	15110470	47PF NPO 0805 50V CHIP CAP (E)		

Ref.	Ritron #	Description	Coordinates	
C 522	151105A6	5.6PF NPO 0805 50V CHIP CAP		
	151103A9	3.9PF NPO 0805 50V CHIP CAP (F)		
C 523	151101A8	1.8PF NPO 0805 50V CHIP CAP	1.757	0.769 T
	151103A3	3.3PF NPO 0805 50V CHIP CAP (E)		
	151101A5	1.5PF NPO 0805 50V CHIP CAP (F)		
C 524	15111103	.01MF X7R 0805 50V CHIP	1.959	0.493 T
C 526	15111102	.001MF X7R 0805 50V CHIP CAP	1.881	0.165 T
C 527	151103A9	3.9PF NPO 0805 50V CHIP	1.889	0.690 T
C 528	151104A7	4.7PF 0805 50V CHIP CAP.	2.185	0.580 T
C 530	15110470	47PF NPO 0805 50V CHIP	2.434	0.475 T
C 531	01502015	22uf TANT CAP 10V(A) .1~ r 20%	3.440	0.650 T
C 532	15111102	.001MF X7R 0805 50V CHIP CAP	2.569	0.475 T
C 533	15111103	.01MF X7R 0805 50V CHIP	2.301	0.605 T
C 534	15110390	39PF NPO 0805 50V CHIP CAP	2.631	0.067 T
C 535	15110151	150PF NPO 0805 50V CHIP	2.555	0.069 T
C 536	15121104	.1MF X7R 1206 50V CHIP CAP	3.172	0.528 T
C 537	15121104	.1MF X7R 1206 50V CHIP CAP	3.174	0.440 T
C 539	15121104	.1MF X7R 1206 50V CHIP CAP	3.174	0.280 T
C 540	15111102	.001MF X7R 0805 50V CHIP CAP	3.217	0.684 T
C 541	15111102	.001MF X7R 0805 50V CHIP CAP	2.950	0.754 T
C 542	15111102	.001MF X7R 0805 50V CHIP CAP	2.870	0.754 T
C 543	15121104	.1MF X7R 1206 50V CHIP CAP	2.559	0.345 T
C 544	15121104	.1MF X7R 1206 50V CHIP CAP	2.094	0.265 T
C 545	15121104	.1MF X7R 1206 50V CHIP CAP	2.059	0.175 T
C 547	15121104	.1MF X7R 1206 50V CHIP CAP	1.955	0.309 T
DIODES				
CR301	04810015	MV-2115 VARI CAP		
CR302	48A1005C	MMBD7000 DUAL DIODE SOT-23	0.720	1.007 T
CR303	48E1005G	MMBD-352LT1 SCHOTTKY DIODE SOT23	1.312	1.012 T
CR304	48B1008W	MMBZ 5245 ZENER DIODE, SOT23	1.526	0.973 T
CR305	48C1004G	MMBV-2101L DIODE VVC SOT-23	0.521	0.676 T
CR306	48A1004D	MMBV3401TI UHF DIODE SOT-23	0.364	0.854 T
CR307	48C1004E	MMBV-105G DIODE VVC, SOT-23	0.070	0.800 T
CR401	04810032	DIODE; PIN ; UHF 10W DO-34PKG		
CR402	04810032	DIODE; PIN ; UHF 10W DO-34PKG		
CR403	04820017	MZP4744A ZENER DIODE 15V 1W 5% BULK		
CR501	48C1004E	MMBV-105G DIODE VVC, SOT-23	3.480	1.120 T-
CR502	48C1004E	MMBV-105G DIODE VVC, SOT-23	2.886	1.105 T-
CR503	48C1004E	MMBV-105G DIODE VVC, SOT-23	2.366	1.076 T-
CR504	48C1004E	MMBV-105G DIODE VVC, SOT-23	1.735	1.015 T
CR505	48A1005C	MMBD7000 DUAL DIODE SOT-23	2.079	0.374 T
CR506	48A1005C	MMBD7000 DUAL DIODE SOT-23	2.404	0.366 T
HARDWARE				
	25702600	SHIELD R.F. RTX WELDED		
HD209	25102700	SHIELD,R.F.,PARTITION,RTX		
HD210	25102700	SHIELD,R.F.,PARTITION,RTX		
HD211	25702000	SHIELD, VCO CUP, RTX		
HD212	26200600	HEATSINK, R.F POWER, RTX SERIES		
HD213	25102900	SHIELD,R.F.,COVER,RTX-450		
HD214	25300300	INSULATOR; COVER RTX		
HD215	02802005	8-32 X 11/32" X 1/8" HEX NUT		
	28271008	NYLON SPACER, .187 O.D., .115 I.D.		
INTEGRATED CIRCUITS				
IC301	31330001	MB1504 UHF SYNTHESIZER	1.150	0.460 T-
IC302	03131012	MC78L05CP 5V REGULATOR	1.480	1.403 T
IC501	31030001	MC3361BD SO-16 IF SUBSYSTEMS	2.864	0.445 T
CONNECTORS				
J 401	02100339	2.5 mm JACK P.C. MOUNT, MICRO		
P 301	21343061	HEADER 6 POS.,NON-POLAR VERT., GOLD		
P 501	21343071	HEADER,7 POS.,NON-POLAR VERT GOLD		

Ref.	Ritron #	Description	Coordinates	
INDUCTORS				
L 301	18110103	CHIP INDUCTOR 10uhy	1.345	1.184 T
L 302	18110331	CHIP INDUCTOR .33uhy	0.150	0.599 T
L 303	01851907	7.5T 5MM ACVSW SHLD COIL HITEMP PLSTISOL		
L 304	01870955	5.5T AIRFCW COIL .1 a L		
L 306	01870956	6.5T AIRFCW COIL .12 a L		
L 307	01870956	6.5T AIRFCW COIL .12 a L		
L 308	01870804	COIL,4.5T,0.150" ID,#26AWG,LHH CW		
L 309	18110102	CHIP INDUCTOR 1.0uhy	0.920	1.179 T
L 401	01870952	2.5T AIRFCW COIL .05 a L		
L 402	01870806	COIL,6.5T,0.150"ID,#26AWG,LHH,CW		
L 403	01870953	3.5T AIRFCW COIL .07 a L		
L 404	01870956	6.5T AIRFCW COIL .12 a L		
L 405	01870951	1.5T AIRFCW COIL .03 a L		
L 407	01803001	1.5T .093ID FREEFORM LHH #20AWG		
	01870952	2.5T AIRFCW COIL .05 a L (E)		
L 408	01870953	3.5T AIRFCW COIL .07 a L		
L 409	18110102	CHIP INDUCTOR 1.0uhy	3.240	1.299 T
L 410	01870955	5.5T AIRFCW COIL .1 a L		
L 411	01870955	5.5T AIRFCW COIL .1 a L		
L 412	01870955	5.5T AIRFCW COIL .1 a L		
L 413	18110102	CHIP INDUCTOR 1.0uhy	3.109	2.000 T
L 414	1800205L	.22 uh MOL FCW COIL .250 A		
L 501	01850206	6.5T SW COIL W/5MM SHIELD		
L 502	01850206	6.5T SW COIL W/5MM SHIELD		
L 503	18110102	CHIP INDUCTOR 1.0uhy	2.509	0.895 T
L 504	01850206	6.5T SW COIL W/5MM SHIELD		
L 505	01850206	6.5T SW COIL W/5MM SHIELD		
L 506	18110101	CHIP INDUCTOR 0.1uhy	1.744	0.675 T
L 507	18110102	CHIP INDUCTOR 1.0uhy	2.749	0.975 T
L 508	01870951	1.5T AIRFCW COIL .03 a L		
LR401	01800160	6.5T #26AWG/56 OHM 1/4W 5% CC, COIL/RES.		
TRANSISTORS				
Q 301	4841006B	MMBF5484 NFET GP SOT23	1.132	1.153 T
Q 302	4841006B	MMBF5484 NFET GP SOT23	0.372	0.167 T
Q 303	4801002A	MMBT3906 "SOT23"	1.515	0.345 T
Q 304	4801001Q	MMBT-5088 "SOT-23"	1.529	0.074 T
Q 305	4801002A	MMBT3906 "SOT23"	0.494	1.036 T
Q 306	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.364	1.071 T
Q 307	4821003E	MMBT-H10 VHF, SOT-23	0.081	1.194 T-
Q 308	4821003E	MMBT-H10 VHF, SOT-23	0.092	1.486 T-
Q 309	4821003E	MMBT-H10 VHF, SOT-23	0.066	1.646 T
Q 310	4801002A	MMBT3906 "SOT23"	1.111	1.399 T-
Q 311	4821003E	MMBT-H10 VHF, SOT-23	1.449	1.739 T
Q 312	4801001Q	MMBT-5088 "SOT-23"	0.794	1.270 T
Q 313	48180001	BCP-69 PNP RF PWR, SOT-223	0.876	1.592 T-
Q 314	4801001Q	MMBT-5088 "SOT-23"	1.519	1.580 T
Q 315	4801002A	MMBT3906 "SOT23"	1.344	1.504 T
Q 401	48220002	MRF-4427 NPN RF, SO-8	1.763	1.665 T
Q 402	04801021	MRF652 UHF RF POWER AMP		
Q 403	48180001	BCP-69 PNP RF PWR, SOT-223	2.293	1.926 T
Q 404	4801001Q	MMBT-5088 "SOT-23"	2.686	1.835 T-
Q 501	4821003E	MMBT-H10 VHF, SOT-23	2.583	1.052 T
Q 502	4841006U	MMBFJ309L, N-CHAN, RF, SOT23	1.845	0.561 T
Q 503	4821003E	MMBT-H10 VHF, SOT-23	2.574	0.581 T
Q 504	4801001Q	MMBT-5088 "SOT-23"	2.271	0.414 T-

Ref.	Ritron#	Description	Coordinates	
RESISTORS				
R 301	47100333	33K OHM 0805 CHIP RES.	0.895	0.359 T
R 302	47100470	47 OHM 0805 CHIP RES.	0.850	0.795 T
R 303	47100000	ZERO OHM 0805 CHIP RES.	1.245	1.154 T
R 304	47100105	1M OHM 0805 CHIP RES	0.719	0.670 T
R 305	47100223	22K OHM 0805 CHIP RES.	0.714	0.795 T
R 306	47100223	22K OHM 0805 CHIP RES.	0.714	0.870 T
R 307	47100273	27K OHM 0805 CHIP RES.	0.825	0.991 T
R 308	04750100	THERMISTOR; 10K OHM		
R 309	47100103	10K OHM 0805 CHIP RES	0.755	0.485 T
R 310	47270104	VARIABLE RESISTOR 100K SEALED	0.780	0.085 T
R 311	47100473	47K OHM 0805 CHIP RES.	1.025	1.159 T
R 312	47100392	3.9K OHM 0805 CHIP RES.	1.420	1.030 T
R 313	47100101	100 OHM 0805 CHIP RES.	1.500	0.770 T
R 314	47100123	12K OHM 0805 CHIP RES.	1.461	0.460 T
R 315	47100182	1.8K OHM 0805 CHIP RES.	1.529	0.570 T
R 316	47100821	820 OHM 0805 CHIP RES.	1.450	0.569 T
R 317	47100104	100K OHM 0805 CHIP RES	0.555	0.091 T
R 318	47100104	100K OHM 0805 CHIP RES	0.521	0.195 T
R 319	47100104	100K OHM 0805 CHIP RES	0.255	0.216 T
R 320	47100153	15K OHM 0805 CHIP RES	1.410	0.339 T
R 321	47100103	10K OHM 0805 CHIP RES	1.534	0.235 T
R 322	47100821	820 OHM 0805 CHIP RES.	1.415	0.094 T
R 323	47100103	10K OHM 0805 CHIP RES	0.070	0.305 T
R 324	47100104	100K OHM 0805 CHIP RES	0.175	0.310 T
R 325	47100104	100K OHM 0805 CHIP RES	0.175	0.445 T
R 326	47100104	100K OHM 0805 CHIP RES	0.515	0.435 T
R 327	47100104	100K OHM 0805 CHIP RES	0.515	0.781 T
R 328	47100224	220K OHM 0805 CHIP RES.	0.530	0.565 T
R 329	47100272	2.7K OHM 0805 CHIP RES.	0.359	0.960 T
R 330	47100473	47K OHM 0805 CHIP RES.	0.555	1.319 T
R 331	47100103	10K OHM 0805 CHIP RES	0.514	0.930 T
R 332	47100470	47 OHM 0805 CHIP RES.	0.555	1.589 T
R 333	47100221	220 ohm 0805 CHIP RES	0.427	1.504 T
R 334	47100470	47 OHM 0805 CHIP RES.	0.385	1.338 T
R 335	47100103	10K OHM 0805 CHIP RES	0.079	0.980 T
R 336	47100561	560 OHM 0805 CHIP RES.	0.219	0.980 T
R 337	47100183	18K OHM 0805 CHIP RES.	0.495	1.145 T
R 338	47100182	1.8K OHM 0805 CHIP RES.	0.094	1.376 T
R 339	47100103	10K OHM 0805 CHIP RES	0.231	1.351 T
R 340	47100223	22K OHM 0805 CHIP RES.	0.969	1.365 T
R 341	47100223	22K OHM 0805 CHIP RES.	1.115	1.290 T
R 342	47100181	180 OHM 0805 CHIP RES	0.304	1.660 T
R 343	47100222	2.2K OHM 0805 CHIP RES	0.280	1.766 T
R 344	47100103	10K OHM 0805 CHIP RES	0.389	1.797 T
R 345	47100101	100 OHM 0805 CHIP RES.	0.529	1.795 T
R 346	47100470	47 OHM 0805 CHIP RES.	0.859	1.800 T
R 347	47100470	47 OHM 0805 CHIP RES.	0.859	1.875 T
R 348	47100222	2.2K OHM 0805 CHIP RES	1.379	1.865 T
R 349	47100103	10K OHM 0805 CHIP RES	1.039	1.735 T
R 350	47100101	100 OHM 0805 CHIP RES.	1.060	1.619 T
R 351	47100471	470 OHM 0805 CHIP RES.	0.690	1.270 T
R 352	47100104	100K OHM 0805 CHIP RES	0.470	0.300 T
R 353	47100103	10K OHM 0805 CHIP RES	0.700	1.529 T
R 354	47100392	3.9K OHM 0805 CHIP RES.	1.553	1.712 T
R 355	47100103	10K OHM 0805 CHIP RES	1.134	1.515 T
R 356	47100123	12K OHM 0805 CHIP RES.	0.079	1.065 T
R 401	47100101	100 OHM 0805 CHIP RES.	1.922	1.998 T
R 402	47100222	2.2K OHM 0805 CHIP RES	1.933	1.697 T
R 403	47100103	10K OHM 0805 CHIP RES	2.531	1.955 T
R 404	47100561	560 OHM 0805 CHIP RES.	3.350	1.281 T
R 405	4700118L	56 OHM 1/4W 5% CF		
R 406	47100102	1K OHM 0805 CHIP RES	2.761	1.725 T
R 407	47100100	10 ohm 0805 CHIP RES		
R 501	47100104	100K OHM 0805 CHIP RES	3.346	1.176 T
R 502	47100104	100K OHM 0805 CHIP RES	2.991	1.135 T
R 503	47100222	2.2K OHM 0805 CHIP RES	2.681	1.155 T
R 504	47100103	10K OHM 0805 CHIP RES	2.625	0.899 T
R 505	47100471	470 OHM 0805 CHIP RES.	2.317	0.791 T
R 506	47100104	100K OHM 0805 CHIP RES	2.196	1.125 T
R 507	47100104	100K OHM 0805 CHIP RES	1.825	1.145 T
R 508	47100222	2.2K OHM 0805 CHIP RES	2.065	0.600 T
R 509	47100332	3.3K OHM 0805 CHIP RES.	2.584	0.690 T
R 510	47100223	22K OHM 0805 CHIP RES.	2.466	0.656 T
R 511	47100152	1.5K OHM 0805 CHIP RES.	2.439	0.550 T
R 516	47100393	39K OHM 0805 CHIP RES.	3.154	0.362 T
R 517	47100122	1.2K OHM 0805 CHIP RES.	3.134	0.610 T
R 518	47100103	10K OHM 0805 CHIP RES	1.716	1.202 T
R 519	47100394	390K OHM 0805 CHIP RES.	3.025	0.755 T
R 520	47100822	8.2K OHM 0805 CHIP RES.	2.750	0.809 T
R 521	47100122	1.2K OHM 0805 CHIP RES.	2.700	0.674 T
R 522	47100474	470K OHM 0805 CHIP RES.	2.775	0.674 T
R 523	47100103	10K OHM 0805 CHIP RES	2.300	0.285 T
R 524	47100104	100K OHM 0805 CHIP RES	2.225	0.280 T
R 525	47100103	10K OHM 0805 CHIP RES	2.299	0.525 T
R 526	04750100	THERMISTOR; 10K OHM		
TRANSFORMERS				
T 501	05600018	455KHZ IF TRANSFORMER (5MM)		
T 502	05600035	I.F.TRANSFORMER 10.7MHZ 5MM		
CRYSTALS, FILTERS				
Y 301	02300097	CRYSTAL UM-1 16.000MHz Graded		
Y 501	02300043	CRYSTAL; 10.245MHZ; HC-44/UM-1		
YF501	02301001	10.7MHZ 2 POLE MONO FILT		
YF502	02301001	10.7MHZ 2 POLE MONO FILT		
YF503	02301008	FILTER CERAMIC CFU-455E2		
FERRITE BEADS				
Z 401	18360001	BEAD; FERRITE SURFACE MOUNT	2.053	1.882 T
Z 402	18360001	BEAD; FERRITE SURFACE MOUNT	2.112	1.692 T
Z 403	18360001	BEAD; FERRITE SURFACE MOUNT	2.192	1.267 T
Z 404	1801029L	FAIR-RITE BEAD ON AXIAL LEADS		

21. DTX-450 RF BOARD SCHEMATIC REFERENCE PARTS LIST

NOTE: This parts list reflects values current with ECN 2451. If a component value in the schematic differs from the value in the parts list, the parts list is to be considered more current.

1. Only surface mount components have XY coordinates listed.
2. (G) = 400 - 430MHz

Ref.	Ritron #	Description	Coordinates	
CAPACITORS				
C 301	15111102	.001MF X7R 0805 50V CHIP CAP	1.260	0.096 T
C 302	15111102	.001MF X7R 0805 50V CHIP CAP	1.100	0.096 T
C 303	15111102	.001MF X7R 0805 50V CHIP CAP	1.180	0.096 T
C 304	15111103	.01MF X7R 0805 50V CHIP	0.950	0.099 T
C 305	15111102	.001MF X7R 0805 50V CHIP CAP	0.355	0.055 T
C 306	15110101	100PF NPO 0805 50V CHIP CAP	1.035	0.726 T
C 307	15111102	.001MF X7R 0805 50V CHIP CAP	0.869	0.830 T
C 308	01510924	56pf N2200 CER DIS CAP .1 LEAD SPAC	0.524	0.565 T
C 309	15111102	.001MF X7R 0805 50V CHIP CAP	1.185	1.150 T
C 310	01550021	2-10pf VARCER CAP 250V .2 X .24 r	0.524	0.565 T
C 311	15111102	.001MF X7R 0805 50V CHIP CAP	1.070	1.150 T
C 312	15121104	.1MF X7R 1206 50V CHIP CAP	0.800	0.259 T
C 313	15121104	.1MF X7R 1206 50V CHIP CAP	1.504	1.245 T
C 314	15121104	.1MF X7R 1206 50V CHIP CAP	1.504	1.160 T
C 315	15121104	.1MF X7R 1206 50V CHIP CAP	1.535	0.789 T
C 316	15110330	33PF NPO 0805 50V CHIP	1.526	1.080 T
C 317	15121104	.1MF X7R 1206 50V CHIP CAP	0.695	0.259 T
C 319	15110101	100PF NPO 0805 50V CHIP CAP	0.076	0.195 T
C 320	15121104	.1MF X7R 1206 50V CHIP CAP	0.952	0.749 T
C 321	15111103	.01MF X7R 0805 50V CHIP	0.739	0.465 T
C 322	01501071	.22uf MLPOLY CAP 50V .2 r 5 %	0.524	0.565 T
C 323	01501070	.022uf MLPOLY CAP 50V .2 r 5%	0.524	0.565 T
C 324	15111102	.001MF X7R 0805 50V CHIP CAP	0.175	0.630 T
C 325	15110101	100PF NPO 0805 50V CHIP CAP	0.145	0.525 T
C 326	151103A9	3.9PF NPO 0805 50V CHIP	0.225	0.740 T
	151106A8	6.8PF NPO 0805 50V CHIP (G)		
C 327	151102A7	2.7PF NPO 0805 50V CHIP	0.255	0.850 T
	151103A9	3.9PF NPO 0805 50V CHIP (G)		
C 328	151102A7	2.7PF NPO 0805 50V CHIP	0.369	0.725 T
C 329	15110101	100PF NPO 0805 50V CHIP CAP	0.525	0.200 T
C 330	15110101	100PF NPO 0805 50V CHIP CAP	0.514	0.805 T
C 331	151104A7	4.7PF NPO 0805 50V CHIP CAP	0.175	0.851 T
	151106A8	6.8PF NPO 0805 50V CHIP CAP (G)		
C 332	15110100	10PF NPO 0805 50V CHIP CAP	0.214	1.070 T
	15110120	12PF NPO 0805 50V CHIP CAP (G)		
C 333	15110100	10PF NPO 0805 50V CHIP CAP	0.214	1.145 T
	15110120	12PF NPO 0805 50V CHIP CAP (G)		
C 334	01502013	10uf TANT CAP 16V(C) .1~ r 20%	0.445	1.345 T
C 335	15110101	100PF NPO 0805 50V CHIP CAP	0.349	1.228 T
C 336	15121104	.1MF X7R 1206 50V CHIP CAP	0.504	1.780 T
C 337	15110101	100PF NPO 0805 50V CHIP CAP	0.555	1.586 T
C 338	15110100	10PF NPO 0805 50V CHIP CAP	0.075	1.300 T
C 339	151106A8	6.8PF NPO 0805 50V CHIP	0.685	1.844 T
C 340	151103A9	3.9PF NPO 0805 50V CHIP	0.186	1.561 T
C 341	15110101	100PF NPO 0805 50V CHIP CAP	0.233	1.394 T
C 342	15110100	10PF NPO 0805 50V CHIP CAP	0.475	1.601 T
C 343	15111102	.001MF X7R 0805 50V CHIP CAP	0.504	1.870 T
C 345	151102A7	2.7PF NPO 0805 50V CHIP	0.059	1.860 T
C 346	15110330	33PF NPO 0805 50V CHIP	0.970	1.839 T
C 347	15110180	18PF NPO 0805 50V CHIP CAP	1.130	1.839 T
C 348	151104A7	4.7PF 0805 50V CHIP CAP.	1.535	1.845 T
C 349	15110101	100PF NPO 0805 50V CHIP CAP	1.140	1.699 T
C 350	15111102	.001MF X7R 0805 50V CHIP CAP	1.179	1.590 T
C 351	15121104	.1MF X7R 1206 50V CHIP CAP	0.695	1.689 T
C 352	15111102	.001MF X7R 0805 50V CHIP CAP	0.740	1.375 T
C 353	15111102	.001MF X7R 0805 50V CHIP CAP	1.240	1.489 T
C 354	15111102	.001MF X7R 0805 50V CHIP CAP	1.346	1.275 T
C 355	01502015	22uf TANT CAP 10V(A) .1~ r 20%	1.245	1.330 T
C 356	15111102	.001MF X7R 0805 50V CHIP CAP	1.025	0.099 T
C 357	15111102	.001MF X7R 0805 50V CHIP CAP	1.340	0.094 T
C 358	01502009	2.2uf TANT CAP 16V(V) .1~ r 20%		
C 359	15111103	.01MF X7R 0805 50V CHIP	0.719	0.569 T
C 361	01510806	CAP 27PF CERDISC N1500 5%50V .098LS	0.524	0.565 T
C 401	15110180	18PF NPO 0805 50V CHIP CAP		
C 402	15110101	100PF NPO 0805 50V CHIP CAP	2.115	1.581 T
C 403	15111102	.001MF X7R 0805 50V CHIP CAP	1.977	1.697 T
C 404	15111102	.001MF X7R 0805 50V CHIP CAP	2.615	1.664 T
C 405	15110180	18PF NPO 0805 50V CHIP	1.735	1.385 T
	15110220	22PF NPO 0805 50V CHIP CAP (G)		
C 407	15110270	27pf NPO 0805 50V CHIP CAP	2.035	1.415 T
	15110330	33PF NPO 0805 50V CHIP CAP (G)		
C 408	15110220	22PF NPO 0805 50V CHIP CAP		
	15110390	39PF NPO0805 50V CHIP CAP (G)		
C 410	15110101	100PF NPO 0805 50V CHIP CAP	2.651	1.910 T
C 411	15120120	12 PF NPO 1206 50V CHIP CAP	2.672	1.244 T
C 412	15400001	3-10PF CERAMIC TRIMMER CAP	0.524	0.565 T
C 413	15120101	100PF NPO 1206 50V CHIP CAP	3.142	1.269 T
C 416	15121104	.1MF X7R 1206 50V CHIP CAP	3.500	1.469 T
C 417	15111102	.001MF X7R 0805 50V CHIP CAP	2.901	1.930 T
C 418	15121104	.1MF X7R 1206 50V CHIP CAP	2.884	2.015 T
C 420	151202A7	2.7PF NPO 1206 50V CHIP CAP	3.368	1.551 T
C 421	151208A2	8.2PF NPO 1206 50V CHIP CAP	3.358	1.671 T
C 422	151206A8	6.8 PF NPO 1206 50V CHIP CAP	2.981	1.758 T
C 423	15120101	100PF NPO 1206 50V CHIP CAP	3.142	1.979 T
C 424	15110101	100PF NPO 0805 50V CHIP CAP	2.509	1.955 T
C 425	15110220	22PF NPO 0805 50V CHIP CAP		
	15110390	39PF NPO 0805 50V CHIP CAP (G)		
C 501	151101A5	1.5PF NPO 0805 50V CHIP	3.440	0.765 T
	151102A2	2.2PF NPO 0805 50V CHIP CAP (G)		
C 502	151102A2	2.2PF NPO 0805 50V CHIP	3.469	0.885 T
C 503	151103A9	3.9PF NPO 0805 50V CHIP	3.500	0.987 T
	151106A8	6.8PF NPO 0805 50V CHIP CAP (G)		
C 504	15110101	100PF NPO 0805 50V CHIP CAP	3.085	1.134 T
C 505	15111102	.001MF X7R 0805 50V CHIP CAP	1.736	1.282 T
C 506	151101A5	1.5PF NPO 0805 50V CHIP	3.324	0.780 T
C 507	15110220	22PF NPO 0805 50V CHIP CAP	2.720	1.075 T
C 508	151101A5	1.5PF NPO 0805 50V CHIP	3.189	0.790 T
	151101A8	1.8PF NPO 0805 50V CHIP CAP (G)		
C 509	151103A9	3.9PF NPO 0805 50V CHIP	2.865	0.969 T
	151106A8	6.8PF NPO 0805 50V CHIP CAP (G)		
C 510	151103A3	3.3pf NPO 0805 CHIP CAP	3.085	0.760 T
	151103A9	3.9PF NPO 0805 50V CHIP CAP (G)		
C 511	151102A2	2.2PF NPO 0805 50V CHIP	2.846	0.860 T
C 512	15110101	100PF NPO 0805 50V CHIP CAP	2.709	0.859 T
C 513	151101A0	1.0PF NPO 0805 50V CHIP	2.491	0.948 T
	151101A2	1.2PF NPO 0805 50V CHIP CAP (G)		
C 514	151103A3	3.3pf NPO 0805 CHIP CAP	2.385	0.940 T
	151103A9	3.9PF NPO 0805 CHIP CAP (G)		
C 515	15110101	100PF NPO 0805 50V CHIP CAP	2.035	1.144 T
C 516	15110101	100PF NPO 0805 50V CHIP CAP	1.855	1.174 T
C 517	151103A9	3.9PF NPO 0805 50V CHIP	2.474	1.057 T
	151106A8	6.8PF NPO 0805 50V CHIP (G)		
C 518	151101A0	1.0PF NPO 0805 50V CHIP	2.029	0.795 T
	151101A2	1.2PF NPO 0805 50V CHIP (G)		
C 520	151101A0	1.0PF NPO 0805 50V CHIP	1.895	0.795 T
C 521	151103A9	3.9PF NPO 0805 50V CHIP	1.710	0.879 T
	151106A8	6.8PF NPO 0805 50V CHIP (G)		

Ref.	Ritron #	Description	Coordinates	
C 522	151102A2	2.2PF NPO 0805 50V CHIP	1.785	0.879 T
	151103A3	3.3PF NPO 0805 50V CHIP (G)		
C 523	151101A5	1.5PF NPO 0805 50V CHIP	1.697	0.746 T
C 524	15111103	.01MF X7R 0805 50V CHIP	1.893	0.621 T
C 526	15111103	.01MF X7R 0805 50V CHIP	2.010	0.581 T
C 527	151101A8	1.8PF NPO 0805 50V CHIP		
C 528	151106A8	6.8PF NPO 0805 50V CHIP	2.020	0.195 T
C 529	15121104	.1MF X7R 1206 50V CHIP CAP	2.365	0.709 T
C 530	15110470	47PF NPO 0805 50V CHIP	2.600	0.069 T
C 531	01502015	22uf TANT CAP 10V(A) .1~ r 20%	3.445	0.655 T
C 532	15111102	.001MF X7R 0805 50V CHIP CAP	2.675	0.109 T
C 533	15111103	.01MF X7R 0805 50V CHIP	2.750	0.089 T
C 534	15110390	39PF NPO 0805 50V CHIP CAP	2.901	0.107 T
C 535	15110101	100PF NPO 0805 50V CHIP CAP	2.825	0.089 T
C 536	15121104	.1MF X7R 1206 50V CHIP CAP	3.212	0.562 T
C 537	15121104	.1MF X7R 1206 50V CHIP CAP	3.120	0.604 T
C 539	15121104	.1MF X7R 1206 50V CHIP CAP	3.254	0.700 T
C 540	15111102	.001MF X7R 0805 50V CHIP CAP	2.697	0.779 T
C 541	15111102	.001MF X7R 0805 50V CHIP CAP	2.479	0.550 T
C 542	15111102	.001MF X7R 0805 50V CHIP CAP	2.484	0.400 T
C 543	15121104	.1MF X7R 1206 50V CHIP CAP	2.539	0.320 T
C 544	15121104	.1MF X7R 1206 50V CHIP CAP	2.139	0.550 T
C 545	15121104	.1MF X7R 1206 50V CHIP CAP	2.125	0.419 T
C 547	15121104	.1MF X7R 1206 50V CHIP CAP	2.099	0.715 T
DIODES				
CR301	04810015	MV-2115 VARI CAP	0.524	0.565 T
CR302	48A1005C	MMBD7000 DUAL DIODE SOT-23	0.717	1.012 T
CR303	48E1005G	MMBD-352LT1 SCHOTTKY DIODE SOT23	1.312	1.052 T
CR304	48B1008W	MMBZ 5245 ZENER DIODE, SOT23	1.531	0.973 T
CR305	48C1004E	MMBV-105G DIODE VVC, SOT-23	0.501	0.691 T
CR306	48A1004D	MMBV3401TI UHF DIODE SOT-23	0.364	0.854 T
CR307	48C1004E	MMBV-105G DIODE VVC, SOT-23	0.070	0.800 T
CR401	04810032	DIODE; PIN ; UHF 10W DO-34PKG	0.524	0.565 T
CR402	04810032	DIODE; PIN ; UHF 10W DO-34PKG		
CR403	04820017	MZP4744A ZENER 15V 1W 5% BULK	0.524	0.565 T
CR501	48C1004E	MMBV-105G DIODE VVC, SOT-23	3.480	1.120 T
CR502	48C1004E	MMBV-105G DIODE VVC, SOT-23	2.866	1.105 T-
CR503	48C1004E	MMBV-105G DIODE VVC, SOT-23	2.366	1.076 T
CR504	48C1004E	MMBV-105G DIODE VVC, SOT-23	1.735	1.015 T
CR505	48A1005C	MMBD7000 DUAL DIODE SOT-23	2.256	0.769 T-
CR506	48A1005C	MMBD7000 DUAL DIODE SOT-23	2.339	0.409 T
CR507	48A1005C	MMBD7000 DUAL DIODE SOT-23	2.760	0.965 T
HARDWARE				
HD203	25602500	CRYSTAL SUPPORT, UM-1 PACKAGE		
HD204	25602500	CRYSTAL SUPPORT, UM-1 PACKAGE		
HD205	25602500	CRYSTAL SUPPORT, UM-1 PACKAGE		
HD206	25602500	CRYSTAL SUPPORT, UM-1 PACKAGE		
	25702600	SHIELD R.F. RTX WELDED		
HD209	25103700	SHIELD R.F. PARTITION RTX REV.A		
HD210	25103700	SHIELD R.F. PARTITION RTX REV.A		
HD211	25701300	GROUND STRAP	REV B	
HD212	25702000	SHIELD, VCO CUP, RTX		
HD213	26200600	HEATSINK, R.F POWER, RTX SERIES		
HD214	25300300	INSULATOR; COVER RTX		
HD215	25102900	SHIELD,R.F.,COVER RTX-450		
HD216	02802005	8-32 X 11/32~ X 1/8~ HEX NUT		
	28271008	NYLON SPACER, .187 O.D., .115 I.D.		
INTEGRATED CIRCUITS				
IC301	31330001	MB1504 UHF SYNTHESIZER	1.150	0.460 T
IC302	03131012	MC78L05CP 5V REGULATOR	1.475	1.392 T-
IC501	31030001	MC3361BD SO-16 IF SUBSYSTEMS	2.795	0.369 T

Ref.	Ritron #	Description	Coordinates	
CONNECTORS				
J 401	02100339	2.5 mm JACK P.C. MOUNT, MICRO	0.524	0.565 T
P 301	21343061	HEADER 6 POS.,NON-POLAR VERT., GOLD		
P 501	21343071	HEADER,7 POS.,NON-POLAR VERT GOLD		
INDUCTORS				
L 301	18110103	CHIP INDUCTOR 10uhy	1.335	1.177 T
L 302	18110101	CHIP INDUCTOR 0.1uhy	0.068	0.650 T
L 303	01851901	1.5T 5MM ACVSW SHLD COIL HITEMP PLSTISOL		
L 306	01870952	2.5T AIRFCW COIL .05 a L	0.524	0.565 T
	01870953	3.5T AIRFCW COIL .07 a L (G)		
L 307	01870955	5.5T AIRFCW COIL .1 a L		
L 308	01870952	2.5T AIRFCW COIL .05 a L		
L 309	01870954	4.5T AIRFCW COIL .09 a L	0.524	0.565 T
L 310	18110102	CHIP INDUCTOR 1.0uhy	0.925	1.132 T
L 401	01800165	COIL 1T .2ID, #20AWG	0.524	0.565 T
L 402	01870955	5.5T AIRFCW COIL .1 a L	0.524	0.565 T
L 403	01870951	1.5T AIRFCW COIL .03 a L		
L 405	01870956	6.5T AIRFCW COIL .12 a L	0.524	0.565 T
L 406	01870955	5.5T AIRFCW COIL .1 a L		
L 407	01800165	COIL 1T .2ID, #20AWG		
L 408	01802055	1.5T AIRFSW COIL .1 aL .15 #20	0.524	0.565 T
L 409	18110102	CHIP INDUCTOR 1.0uhy	3.310	1.272 T
L 410	01870952	2.5T AIRFCW COIL .05 a L		
L 411	01802056	2.5T AIRFSW COIL .1 aL .17 #20	0.524	0.565 T
L 412	01802056	2.5T AIRFSW COIL .1 aL .17 #20		
L 413	01870956	6.5T AIRFCW COIL .12 a L		
L 414	01870951	1.5T AIRFCW COIL .03 a L		
L 501	01851201	1.5T 5MM ACVSW SHIELD COIL HI-TEMP	0.524	0.565 T
L 502	01851201	1.5T 5MM ACVSW SHIELD COIL HI-TEMP		
L 503	18110151	CHIP INDUCTOR .15uhy	2.498	0.830 T
L 504	01851201	1.5T 5MM ACVSW SHIELD COIL HI-TEMP		
L 505	01851201	1.5T 5MM ACVSW SHIELD COIL HI-TEMP		
L 506	01870951	1.5T AIRFCW COIL .03 a L		
	01870801	1.5T AIRFCW COIL .150 ID (G)		
L 508	01870951	1.5T AIRFCW COIL .03 a L		
TRANSISTORS				
Q 301	4841006B	MMBF5484 NFET GP SOT23	1.114	1.260 T
Q 302	4841006B	MMBF5484 NFET GP SOT23	0.212	0.158 T-
Q 303	4801002A	MMBT3906 "SOT23"	1.510	0.340 T
Q 304	4801001Q	MMBT-5088 "SOT-23"	1.529	0.074 T
Q 305	4801002A	MMBT3906 "SOT23"	0.504	1.011 T
Q 306	48010R02	MUN2211T1 W/BIAS RES. SOT-23	0.359	1.096 T
Q 307	4821007Y	MMBR941LT1 LO POWER RF, SOT-23	0.081	1.194 T-
Q 308	4821007A	MMBT901TI NPN 1GHZ SOT-23	0.092	1.486 T-
	4821007Y	MMBR941LT1 LO POWER RF, SOT-23 (G)		
Q 309	4821007Y	MMBR941LT1 LO POWER RF, SOT-23	0.061	1.626 T
Q 310	4801002A	MMBT3906 "SOT23"	1.111	1.399 T-
Q 311	48220001	MRF-5812 NPN LOW POWER RF, SO-8	1.335	1.785 T
Q 312	4801001Q	MMBT-5088 "SOT-23"	0.794	1.270 T
Q 313	48180001	BCP-69 PNP RF PWR, SOT-223	0.876	1.592 T
Q 314	4801001Q	MMBT-5088 "SOT-23"	1.514	1.580 T
Q 315	4801002A	MMBT3906 "SOT23"	1.344	1.504 T
Q 401	04801030	MRF-555 NPN RF BIPOLAR (MAC-X PKG)	0.524	0.565 T
Q 402	04801021	MRF652 UHF RF POWER AMP		
Q 403	48180001	BCP-69 PNP RF PWR, SOT-223	2.273	1.926 T
Q 404	4801001Q	MMBT-5088 "SOT-23"	2.656	1.800 T-
Q 501	4821007Y	MMBR941LT1 LO POWER RF, SOT-23	2.583	1.037 T
Q 502	4841006U	MMBFJ309L, N-CHAN, RF, SOT23		
Q 503	4821003B	MMBT918LT1 VHF SOT23 (3B)	2.561	0.209 T-
Q 504	4801001Q	MMBT-5088 "SOT-23"	2.316	0.544 T-

Ref.	Ritron #	Description	Coordinates	
RESISTORS				
R 235	47100103	10K OHM 0805 CHIP RES	0.524	0.565 T
R 301	47100333	33K OHM 0805 CHIP RES.	0.905	0.359 T
R 302	47100470	47 OHM 0805 CHIP RES.	0.850	0.690 T
R 303	47100681	680 OHM 0805 CHIP RES.	0.524	0.565 T
R 304	47100105	1M OHM 0805 CHIP RES	0.719	0.648 T
R 305	47100223	22K OHM 0805 CHIP RES.	0.721	0.726 T
R 306	47100223	22K OHM 0805 CHIP RES.	0.720	0.801 T
R 307	47100273	27K OHM 0805 CHIP RES.	0.825	0.991 T
R 308	04750100	THERMISTOR; 10K OHM	0.524	0.565 T
R 309	47100103	10K OHM 0805 CHIP RES	0.800	0.390 T
R 310	47270104	VARIABLE RESISTOR 100K SEALED	0.780	0.085 T
R 311	47100473	47K OHM 0805 CHIP RES.	0.950	1.260 T
R 312	47100392	3.9K OHM 0805 CHIP RES.	1.420	1.030 T
R 314	47100123	12K OHM 0805 CHIP RES.		
R 315	47100182	1.8K OHM 0805 CHIP RES.	1.524	0.550 T
R 316	47100821	820 OHM 0805 CHIP RES.		
	47100102	1K OHM 0805 CHIP RES. (G)		
R 317	47100104	100K OHM 0805 CHIP RES	0.535	0.076 T
R 318	47100104	100K OHM 0805 CHIP RES	0.395	0.186 T
R 319	47100104	100K OHM 0805 CHIP RES	0.317	0.281 T
R 320	47100153	15K OHM 0805 CHIP RES		
R 321	47100123	12K OHM 0805 CHIP RES.		
	47100103	10K OHM 0805 CHIP RES. (G)		
R 322	47100821	820 OHM 0805 CHIP RES.		
	47100102	1K OHM 0805 CHIP RES. (G)		
R 323	47100103	10K OHM 0805 CHIP RES	0.100	0.305 T
R 324	47100103	10K OHM 0805 CHIP RES	0.155	0.415 T
R 325	47100183	18K OHM 0805 CHIP RES.	0.494	1.120 T
R 326	47100102	1K OHM 0805 CHIP RES	0.515	0.435 T
R 329	47100272	2.7K OHM 0805 CHIP RES.	0.359	0.980 T
R 330	47100473	47K OHM 0805 CHIP RES.	0.494	1.195 T
R 331	47100103	10K OHM 0805 CHIP RES	0.514	0.880 T
R 332	47100470	47 OHM 0805 CHIP RES.	0.504	1.480 T
R 333	47100101	100 OHM 0805 CHIP RES.	0.357	1.354 T
	47100221	220 OHM 0805 CHIP RES. (G)		
R 334	47100470	47 OHM 0805 CHIP RES.	0.215	1.228 T
R 335	47100153	15K OHM 0805 CHIP RES	0.079	0.980 T
R 336	47100271	270 OHM 0805 CHIP RES.	0.219	0.980 T
	47100471	470 OHM 0805 CHIP RES. (G)		
R 337	47100153	15K OHM 0805 CHIP RES	0.079	1.065 T
R 338	47100272	2.7K OHM 0805 CHIP RES.	0.094	1.376 T
R 339	47100103	10K OHM 0805 CHIP RES	0.231	1.311 T
R 340	47100223	22K OHM 0805 CHIP RES.	0.969	1.365 T
R 341	47100101	100 OHM 0805 CHIP RES.	0.346	1.820 T
	47100181	180 OHM 0805 CHIP RES. (G)		
R 342	47100100	10 ohm 0805 CHIP RES		
R 343	47100152	1.5K OHM 0805 CHIP RES.	0.270	1.639 T
	47100102	1K OHM 0805 CHIP RES. (G)		
R 344	47100472	4.7K OHM 0805 CHIP RES.	0.358	1.704 T
R 346	47100101	100 OHM 0805 CHIP RES.	0.859	1.800 T
R 347	47100330	33 OHM 0805 CHIP RES.	0.859	1.875 T
R 348	47100102	1K OHM 0805 CHIP RES	1.050	1.839 T
R 349	47100472	4.7K OHM 0805 CHIP RES.	1.039	1.735 T
R 350	47100330	33 OHM 0805 CHIP RES.	1.060	1.619 T
R 351	47100471	470 OHM 0805 CHIP RES.	0.690	1.270 T
R 353	47100103	10K OHM 0805 CHIP RES	0.700	1.529 T
R 354	47100392	3.9K OHM 0805 CHIP RES.	1.555	1.714 T
R 355	47100103	10K OHM 0805 CHIP RES	1.134	1.515 T
R 360	47100474	470K OHM 0805 CHIP RES.		
R 401	47100101	100 OHM 0805 CHIP RES.	1.942	2.022 T
R 402	47100222	2.2K OHM 0805 CHIP RES.	2.060	1.850 T
R 403	47100103	10K OHM 0805 CHIP RES	2.485	1.846 T
R 404	47100561	560 OHM 0805 CHIP RES.	3.425	1.321 T
R 405	04700118	56 OHM 1/4W 5% CF		

Ref.	Ritron #	Description	Coordinates	
R 406	47100102	1K OHM 0805 CHIP RES	2.690	1.666 T
R 501	47100104	100K OHM 0805 CHIP RES	3.346	1.176 T
R 502	47100104	100K OHM 0805 CHIP RES	2.991	1.135 T
R 503	47100153	15K OHM 0805 CHIP RES	2.741	1.155 T
R 504	47100223	22K OHM 0805 CHIP RES.	2.595	0.854 T
R 505	47100391	390 OHM 0805 CHIP RES 1/10W	2.376	0.833 T
R 506	47100104	100K OHM 0805 CHIP RES	2.196	1.115 T
R 507	47100104	100K OHM 0805 CHIP RES	1.735	1.125 T
R 508	47100102	1K OHM 0805 CHIP RES	1.905	0.545 T
R 509	47100122	1.2K OHM 0805 CHIP RES.	2.424	0.235 T
R 510	47100223	22K OHM 0805 CHIP RES.	2.389	0.160 T
R 511	47100152	1.5K OHM 0805 CHIP RES.	2.520	0.069 T
R 516	47100393	39K OHM 0805 CHIP RES.	3.042	0.547 T
R 517	47100122	1.2K OHM 0805 CHIP RES.	2.700	0.674 T
R 518	47100103	10K OHM 0805 CHIP RES	1.871	1.282 T
R 519	47100394	390K OHM 0805 CHIP RES.	2.625	0.655 T
R 520	47100822	8.2K OHM 0805 CHIP RES.	2.475	0.689 T
R 521	47100122	1.2K OHM 0805 CHIP RES.	2.550	0.654 T
R 522	47100474	470K OHM 0805 CHIP RES.	2.590	0.429 T
R 523	47100103	10K OHM 0805 CHIP RES	2.115	0.635 T
R 524	47100104	100K OHM 0805 CHIP RES	2.210	0.435 T
R 525	47100103	10K OHM 0805 CHIP RES	2.249	0.650 T
R 526	04750100	THERMISTOR; 10K OHM		
TRANSFORMERS				
T 501	05600018	455KHZ IF TRANSFORMER (5MM)	0.524	0.565 T
T 502	05600034	I.F TRANSFORMER; 21.4MHZ 5MM	0.524	0.565 T
CRYSTALS, FILTERS				
Y 301	02300096	CRYSTAL,UM-1,16.0125MHZ - GRADED		
Y 501	02300408	CRYSTAL 20.945MHZ HC-44/U 10PPM	0.524	0.565 T
YF501	02301401	21.4MHZ FILTER +/- 7.5KHZ HC-44	0.524	0.565 T
YF502	02301401	21.4MHZ FILTER +/- 7.5KHZ HC-44		
YF503	02301008	FILTER CERAMIC CFU-455E2	0.524	0.565 T
FERRITE BEADS				
Z 401	18360001	BEAD; FERRITE SURFACE MOUNT	1.948	1.857 T
Z 402	18360001	BEAD; FERRITE SURFACE MOUNT	2.167	1.707 T
Z 403	18360001	BEAD; FERRITE SURFACE MOUNT	2.192	1.227 T
Z 404	1801029L	FAIR-RITE BEAD ON AXIAL LEADS	0.524	0.565 T

22. DTX MECHANICAL PARTS LIST

Ref.	Ritron #	Description
HD304	02802026	NUT; KNURLED; M4PO.5/2.5MM JACK
HD305	02802027	NUT; KNURLED; M6PO.5/3.5MM JACK
HD306	13273000	ENCLOSURE, TOP, DTX
HD307	13394000	ENCLOSURE, BOTTOM, DTX, BNC
HD308	14200033	LABEL, FCC/SERIAL, DTX-150
	14200034	LABEL, FCC/SERIAL, DTX-450
HD309	21522201	CONNECTOR, BULKHEAD, REAR MNT BNC
HD310	28159102	SCREW,#4 AB,PH,T10 TORX,STNLS STL,3/8 LG
HD311	28159102	SCREW,#4 AB,PH,T10 TORX,STNLS STL,3/8 LG
HD312	01400672	MADE IN USA LABEL (REVISED)
HD313	02801005	4-40; 1/4~ PHILLIPS PAN
HD314	28119101	#4 AB,TORX PH STEEL ZINC, 5/8"
HD315	28119101	#4 AB,TORX PH STEEL ZINC, 5/8"
HD316	28119101	#4 AB,TORX PH STEEL ZINC, 5/8"
HD317	28151601	SCREW, 6-32 X 1/8 PPHMS
HD318	28151601	SCREW, 6-32 X 1/8 PPHMS

RITRON makes a full line of radio communications products: high power portables, mobiles, base stations, range-extending repeaters and telephone interconnects.

Call your dealer or RITRON for more information.

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RITRON TWO-WAY RADIOS ARE DESIGNED AND MANUFACTURED IN THE U.S.A.

MODEL DTX-MRM Rev. B 06-97