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RITRON®
WIRELESS SOLUTIONS

RITRON DTXM-260-0BS6I

PROGRAMMABLE WIRELESS FM

MODEM TRANSCEIVER

VHF 220 - 222MHz

1 INTRODUCTION

1.1 GENERAL

The DTX Plus Series II Modem is a wireless modem designed to operate on the frequency bands at VHF, UHF, and 220 MHz. It supports over-the-air data rates of 4800 bps in a 5.0/6.25/7.5 kHz channel, 9600 bps in a 12.5/15 kHz channel, and 19.2 kbps in a 25/30 kHz channel. The modem supports three protocols, the legacy packet protocol of the DTXM-X54 series, a small-packet streaming protocol, and a no-overhead streaming protocol with no error detection/correction. Besides offering data communications, the DTX Plus modem includes voice transceiver audio input and outputs. The complete modem transceiver is housed in the standard DTX Plus case, resulting in a light, compact package.

1.2 MODEL IDENTIFICATION

The DTX Plus modem has a part number in the form of “DTXM-A60-BCDEF”

Where:

A is the major frequency band designator:

1=VHF (136-174 MHz)
2=217-245 MHz
3=340-400 MHz
4=UHF (400-520 MHz)

B is the sub-band designator:

G=340-360 and 400-420
A=420-440
B=430-450
0=136-174, 217-245, 360-380, and 450-470
M=380-400
C=470-490
T=490-512

C is the connector designator:

B=BNC connector
M= MCX connector
S=SMA connector

D designates the channel bandwidth:

S=6.25 kHz
N=12.5 kHz
W=25 kHz

E designates the maximum power level:

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

F designates the regulator option

I=Internal regulator (10-16 VDC operation with regulated RF power amplifier)
D=No regulator (7.5 VDC operation)
L=RF PA is unregulated, but the remainder of the modem is regulated (10-watt versions)

Example: A DTXM-460-OBN6I would be a UHF module for operation between 450 and 470 MHz with a BNC RF connector, narrow (12.5 kHz channel spacing) IF bandwidth, 6 watts maximum output power, and an internal regulator to allow operation from 10 to 15 volts.

1.3 FCC/IC REGULATIONS

1.3.1 LICENSING

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

1.3.2 PRODUCT CERTIFICATION

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

1.3.3 SAFETY STANDARDS-RF EXPOSURE

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

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

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

NOTE: THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

NOTICE: This radio is intended for use in general population/uncontrolled conditions, where users do not have full knowledge of their exposure and cannot exercise control over their exposure to meet FCC/IC limits.

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

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

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

Federal Communications Commission Regulations:

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

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

Compliance with RF Exposure Standards:

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

The DTXM two-way radio complies with the following RF energy exposure standards and guidelines, and when used as directed, the DTXM radio is designed to comply with ISED RSS-102 Exposure Limits. In addition, the DTXM radio is designed to comply with the following Standards and Guidelines:

• United States Federal Communications Commission, Code of Federal Regulations; 47 CFR JJ 1.1307, 1.1310, 2.1091 and 2.1093.

• American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 3-2003.

• Institute of Electrical and Electronic Engineers (IEEE) C95.3-2003 Edition.
Copyright Telecommunications Industry Association

To control exposure to yourself and others and ensure compliance with the general population/uncontrolled environment exposure limits always adhere to the following procedures:
Guidelines:
• User awareness instructions should accompany device when transferred to other users.

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

Instructions:

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

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

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

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

Rated Power of DTXM-260-0BS6I Radio	Recommended Minimum Lateral Distance from Transmitting Antenna
6 watts	11 inches (28 cm)

Antennas

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

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

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

Approved Accessories

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

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

Contact Information:

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

INFORMATIONS DE SENSIBILISATION ET DE CONTRÔLE À L'EXPOSITION AUX ÉNERGIES RF, ET INSTRUCTIONS OPÉRATIONNELLES POUR LES EXIGENCES D'UTILISATION PROFESSIONNELLE DE LA FCC:

AVANT D'UTILISER CETTE RADIO À 2 VOIES, LISEZ CES INFORMATIONS IMPORTANTES SUR LA SENSIBILISATION ET LE CONTRÔLE À L'ÉNERGIE RF ET LES INSTRUCTIONS OPÉRATIONNELLES POUR VOUS ASSURER LA CONFORMITÉ AVEC LES DIRECTIVES D'EXPOSITION AUX RF DE LA FCC ET DES IC.

CET APPAREIL EST CONFORME À LA PARTIE 15 DES RÈGLES FCC. LE FONCTIONNEMENT EST SOUMIS AUX DEUX CONDITIONS SUIVANTES: (1) CET APPAREIL NE PEUT PAS CAUSER DES INTERFÉRENCES DANGEREUSES, ET (2) CET APPAREIL DOIT ACCEPTER TOUTE INTERFÉRENCE REÇUE, Y COMPRIS LES INTERFÉRENCES POUVANT CAUSER UN FONCTIONNEMENT INDÉSIRABLE.

REMARQUE: LE BÉNÉFICIAIRE N'EST PAS RESPONSABLE DES CHANGEMENTS OU MODIFICATIONS NON EXPRESSÉMENT APPROUVÉS PAR LA PARTIE RESPONSABLE DE LA CONFORMITÉ. DE TELLES MODIFICATIONS POURRAIENT ANNULER L'AUTORITÉ DE L'UTILISATEUR DE FAIRE FONCTIONNER L'ÉQUIPEMENT.

AVIS: Cette radio est destinée à être utilisée dans la population générale / dans des conditions non contrôlées, où les utilisateurs n'ont pas une connaissance complète de leur exposition et ne peuvent pas contrôler leur exposition pour respecter les limites FCC / IC.

Cette radio bidirectionnelle utilise l'énergie électromagnétique dans le spectre des radiofréquences (RF) pour fournir des communications entre deux ou plusieurs utilisateurs à distance. Il utilise l'énergie des radiofréquences (RF) ou des ondes radio pour envoyer et recevoir des appels. L'énergie RF est une forme d'énergie électromagnétique. D'autres formes comprennent, mais sans s'y limiter, l'énergie électrique, la lumière du soleil et les rayons X. L'énergie RF, cependant, ne doit pas être confondue avec ces autres formes d'énergie électromagnétique qui, lorsqu'elles sont mal utilisées, peuvent causer des dommages biologiques. Des niveaux très élevés de rayons X, par exemple, peuvent endommager les tissus et le matériel génétique.

Des experts en science, ingénierie, médecine, santé et industrie travaillent avec des organisations pour développer des normes d'exposition à l'énergie RF. Ces normes fournissent des niveaux recommandés d'exposition aux RF pour les travailleurs et le grand public. Ces niveaux d'exposition RF recommandés incluent des marges de protection substantielles. Toutes les radios bidirectionnelles commercialisées en Amérique du Nord sont conçues, fabriquées et testées pour garantir qu'elles respectent les niveaux d'exposition aux RF établis par le gouvernement. En outre, les fabricants recommandent également des instructions d'utilisation spécifiques aux utilisateurs de radios bidirectionnelles. Ces instructions sont importantes car elles informent les utilisateurs sur l'exposition à l'énergie RF et fournissent des procédures simples sur la façon de la contrôler. Veuillez consulter les sites Web suivants pour plus d'informations sur ce qu'est l'exposition à l'énergie RF et comment contrôler votre exposition pour assurer la conformité avec les limites d'exposition RF établies.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html

http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

Règlements de la Federal Communications Commission:

Les règles de la FCC exigent que les fabricants se conforment aux limites d'exposition à l'énergie RF de la FCC pour les radios mobiles bidirectionnelles avant de pouvoir être commercialisées aux États-Unis. et capables de contrôler leur exposition pour répondre aux exigences professionnelles. La sensibilisation à l'exposition peut être facilitée par l'utilisation d'une étiquette orientant les utilisateurs vers des informations spécifiques de sensibilisation des utilisateurs.

La radio bidirectionnelle DTXM est conçue et testée pour se conformer à un certain nombre de normes et directives nationales et internationales (énumérées ci-dessous) concernant l'exposition humaine à l'énergie électromagnétique de radiofréquence. Cette radio est conforme aux limites d'exposition IEEE et ICNIRP pour un environnement d'exposition professionnelle / contrôlée aux RF à des facteurs de service allant jusqu'à 50% de conversation et 50% d'écoute et est autorisée par la FCC pour une utilisation professionnelle. En termes de mesure de l'énergie RF pour se conformer aux directives d'exposition de la FCC, votre antenne radio émet de l'énergie RF mesurable uniquement lorsqu'elle émet (pendant la conversation), pas lorsqu'elle reçoit (écoute) ou en mode veille.

La radio bidirectionnelle DTXM est conforme aux normes et directives d'exposition à l'énergie RF suivantes, et lorsqu'elle est utilisée selon les instructions, la radio DTXM est conçue pour se conformer aux limites d'exposition RSS-102 d'ISDE. De plus, la radio DTXM est conçue pour se conformer aux normes et directives suivantes:

• Commission fédérale des communications des États-Unis, Code of Federal Regulations; 47 CFR JJ 1.1307, 1.1310, 2.1091 et 2.1093.

• Institut national américain des normes (ANSI) / Institut des ingénieurs électriques et électroniques (IEEE) C95. 3-2003.

• Édition C95.3-2003 de l'Institut des ingénieurs électriciens et électroniciens (IEEE).
Copyright Association de l'industrie des télécommunications

Pour contrôler l'exposition à vous-même et aux autres et garantir le respect des limites d'exposition de la population générale / de l'environnement non contrôlé, respectez toujours les procédures suivantes:

Des lignes directrices:
• Les instructions de sensibilisation de l'utilisateur doivent accompagner l'appareil lors du transfert à d'autres utilisateurs.

• N'utilisez pas cet appareil si les exigences opérationnelles décrites ici ne sont pas satisfaites.

Instructions:

• Ne transmettez pas plus que le facteur de service nominal de 50% du temps. Pour transmettre (parler ou envoyer des données), confirmez la broche d'entrée PTT. Pour recevoir des appels, désactivez l'entrée PTT. La transmission à 50% du temps, ou moins, est importante car cette radio génère une exposition à l'énergie RF mesurable uniquement lors de la transmission (en termes de mesure de la conformité aux normes).

• Ne transmettez que lorsque les personnes se trouvent au moins à la distance latérale minimale recommandée, comme indiqué dans le tableau 1, d'une antenne montée à l'extérieur correctement installée conformément aux instructions d'installation.

NOTE - Le Tableau 1 énumère la distance latérale minimale recommandée pour les spectateurs dans un environnement non contrôlé par rapport aux types d'antennes de transmission (c'est-à-dire monopôles

sur un plan de masse ou dipôles) à plusieurs plages de puissance radio nominale pour les radios mobiles installées sur un véhicule.

Tableau 1. Puissance nominale et distance latérale recommandée pour l'antenne quart d'onde, gain unitaire, plan de masse:

Puissance nominale de DTXM-260-0BS6I	latérale minimale recommandée Distance radio bidirectionnelle de l'antenne émettrice
6 watts	11 pouces (28 cm)

Antennes

• Installez les antennes en tenant compte des distances latérales minimales recommandées ci-dessus. Ces directives d'installation d'antenne sont limitées aux antennes avec des plans de masse appropriés. L'installation de l'antenne doit en outre être conforme à:

a.) Les exigences du fabricant / fournisseur d'antenne.
b.) Les instructions de ce manuel, y compris les longueurs minimales de câble d'antenne.
c.) Les antennes autres que celles indiquées dans le tableau 1 doivent être testées avec le module DTX pour vérifier la conformité d'exposition RF dans l'environnement dans lequel il doit être utilisé, conformément au bulletin OET 65 de la FCC, édition 97-01 ou à l'industrie Canada RSS-102.

Utilisez uniquement une antenne quart d'onde VHF ou une antenne équivalente ou d'autres antennes comme décrit ci-dessus. Les antennes, modifications ou accessoires non autorisés peuvent endommager la radio et enfreindre les réglementations FCC.

Accessoires approuvés

• Cette radio a été testée et répond aux directives d'exposition RF de la FCC lorsqu'elle est utilisée avec les accessoires Ritron fournis ou désignés pour ce produit. L'utilisation d'autres accessoires peut ne pas garantir la conformité avec les directives d'exposition RF de la FCC et peut enfreindre les réglementations FCC.

• Pour une liste des accessoires approuvés par Ritron, consultez ce manuel de l'utilisateur ou visitez le site Web suivant qui répertorie les accessoires approuvés: www.ritron, com

Informations de contact:

Pour plus d'informations sur les exigences d'exposition ou d'autres informations, contactez Ritron au (317) 846-1201 ou sur www.ritron.com.

2 SPECIFICATIONS

2.1 GENERAL

Model:	DTXM-260-0BS6I
FCC Rule Parts	90
IC Rule Parts	RSS-119
Data rate (bps)	
5 kHz channel	4800 bps
Modulation	
Data	4FSK
Over-the-Air Protocols	Ritron Proprietary
Number of Channels	2
Operating Bandwidth	
220-222 MHz	2 MHz
Synthesizer Step Size	
220-222 MHz	2.5/3.125 kHz
Emissions Bandwidth	
Data	
5 kHz channels	4.0 kHz
Frequency Stability	
-30°C to +60°C	+/- 1.0 ppm
-30°C to +75°C	+/- 1.5 ppm
Supply Voltage	
D-version	7.5+/-0.5 VDC
I, L-versions	11-16 VDC
RF Connector	BNC (optional MCX and SMB)
Power/Data Connector	15-pin subminiature D-type
Dimensions (LxWxH)	3.6”x 2.3” x1.0”
Weight	6 oz
Indicators	Transmit LED, Receive LED

2.2 TRANSMITTER

RF Output Power	
VHF 220-222 MHz	1-6 watts
RF Load Impedance	50 ohms resistive, VSWR 1.5:1 or less
PTT attack time	10 ms max.
Spurious and Harmonics	-25 dBm max.
FM Hum and Noise	
5 kHz channel	35 dB min.
Current Drain	
1 watt	1.1 A max.
2 watts	1.6 A max.
6 watts	2.2 A max.

2.3 RECEIVER

Sensitivity.	
Data (10^{-3} BER)	0.30 uV max.
Adjacent Channel Selectivity	
5 kHz channel	50 dB min.
Spurious and Image Rejection	70 dB min.
IMD Rejection	67 dB min.
FM Hum and Noise	
5 kHz channel	35 dB min.
Conducted Emissions	-57 dBm max.
Squelch Attack Time	15 ms max.
Receive Current Drain	120 mA max.

3 DTXM I/O CONNECTOR AND INDICATORS

3.1 15-PIN I/O CONNECTOR

Connector Pinout

Pin	Name	Description	Comments
1	AUDIO_IN	Input	Input for Audio to be transmitted in Voice mode
2	AUDIO_OUT	Output	Line level receiver audio output
3	SPEAKER	Output	Receiver audio output to drive a speaker
4	A/B	Input	Channel 1/2 or High/Low power
5	NC		Not Used
6	Supply	Input	DC Power + input connects here to power unit
7	NC	Output	Receiver Alignment-Do NOT CONNECT
8	RD	Output	RS-232 data output from modem
9	TD	Input	RS-232 data input to the modem
10	CTS	Output	RS-232 clear to send output from modem
11	DSR	Output	RS-232 data set ready output from modem
12	TEST	Input	Used for PTT in voice mode
13	CD	Output	Carrier detect
14	RTS	Input	RS-232 request to send input to modem
15	GND		System ground, - power supply input connects here

Pinout Description

Pin 1 - AUDIO_IN

This is the input for signals to be transmitted when the unit to be operated in the voice/analog mode. The actual transmission is initiated by asserting the TEST pin (pin 12). The polarity and modulation sensitivity for signals at this pin can be set via the programmer. The input resistance at this pin is greater than 10 kΩ and is AC coupled. Note that this pin is only active on the 12.5 kHz channel bandwidth models, NOT on the 6.25 kHz channel bandwidth models.

Pin 2 - AUDIO_OUT

Amplified, buffered, and filtered receiver audio is present at this output. The audio level can be adjusted via the programmer as well as the choice of a flat vs de-emphasized frequency response. The presence of audio at this pin is controlled by the squelch (carrier detect) settings, also adjustable via the programmer.

Pin 3 - SPEAKER

This output is similar to the AUDIO_OUT signal above except that it is always de-emphasized and is able to drive an 8-ohm speaker load. The level is adjustable via the programmer with the same setting as that which sets the AUDIO_OUT level.

Pin 4 - A/B

Depending on how it is programmed via the programmer, this pin can either be a channel A/channel B selection pin or a high/low transmit power selection pin. This pin has an internal pullup resistor to +5 volts and assumes a high (channel A or high power) state when left unconnected.

Pin 5 - Not Used

Pin 6 – SUPPLY

This is the positive power supply input for the modem.

Pin 7 - Receiver Alginment

This pin is the output pin of the modem IC's input operational amplifier. It is used during alignment to set the receiver gain and DC offset for proper modem IC receiver decoding. This pin **must be left unconnected** by the user!

Pin 8 - RD (Receive Data)

RS-232 data to be received from the modem is available at this pin. The data are at normal RS-232 levels and are **transmitted from the modem to be received by the host computer** or other device connected to the modem.

Pin 9 - TD (Transmit Data)

RS-232 data to be transmitted to the modem should be presented to this pin. The data should be at normal RS-232 levels and are **transmitted from the host computer or other device to the modem**.

Pin 10 - CTS (Clear to Send)

This RS-232 output pin is asserted by the modem as a response to an assertion of the RTS pin when it is ready and able to receive data from the host computer or device.

Pin 11 - DSR (Data Set Ready)

This RS-232 output pin is asserted by the modem when it is powered-up. It indicates that the modem is actually connected, although not necessarily ready to receive data. The polarity (active low/active high) is programmable via the programmer.

Pin 12 - TEST (Voice mode PTT)

This pin in used to key the transmitter. When asserted (taken low), this pin activates the voice/analog transmit audio path and keys the transmitter, or transmits data test patterns.

Pin 13 - CD (Carrier Detect)

This pin is asserted by the modem when the receiver has detected a carrier. The RF level for CD assertion is set via the programmer. Note that the modem demodulation circuitry does not actually use this signal to determine that a valid data packet has been received. The polarity (active low/active high) is programmable via the programmer

Pin 14 - RTS (Request to Send)

This RS-232 input pin is asserted by the host computer or device to indicate that it has data to be transmitted by the modem. If the modem is able to accept the data, the CTS pin will be asserted in response.

Pin 15 - GND (Ground)

The system ground common point and negative connection for the power supply input.

3.2 INDICATORS

The DTXM Modem has two indicators on the side of the unit, one green RX LED and one red TX LED. They function as follows:

GREEN RX LED-This LED can be programmed to be illuminated under a variety of conditions. The choices are: Never (Off), whenever power is applied (Power On), when receiving, whether or not an actual signal is on the frequency (RX Synthesizer Lock), and when receiving and an actual data packet is being received (RX Data). In typical applications, either RX Synthesizer Lock or RX Data is selected.

RED TX LED-This indicator can be programmed to be illuminated when the modem is transmitting, regardless of whether the unit is transmitting data or voice or to be never illuminated.

4 OPERATION

4.1 CHANNEL SELECTION

Via the 15-pin connector, the DTXM supports one channel if the A/B pin (pin 4) is programmed for high/low power and two channels if the A/B pin is programmed as a channel select input. Channel A is set when the A/B pin is activated and the A/B pin is in the logic high state i.e. above 2.0 volts DC or left unconnected (There is an internal pullup resistor on the A/B pin). Channel B is set when the A/B pin is activated and the A/B pin is in the logic low state i.e. below 0.5 volts DC. If the A/B pin is programmed for high/low power, channel A is always selected.

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

4.2 POWER SUPPLY VOLTAGE

The DTXM-260 units use 7.5 volt RF power modules. Two supply voltage options are available for these units depending upon whether the control/loader board has a regulator installed. If a regulator is not installed, the voltage should be 7.5 volts +/-10 %. This voltage should be "clean" and preferably regulated since the RF power module is powered directly from this source. Variations in voltage will cause variations in transmitted output power. Conversely, if the control/loader board has a regulator installed, the supply voltage can be at any voltage between 11 and 16 volts. Switching power supplies can be used, but in models without the internal regulator, care must be taken that the output waveform is low noise. Also, the module antenna should never be placed near an unshielded switching power supply.

4.3 CURRENT DRAIN VS SUPPLY VOLTAGE

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

Receive Mode

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

Transmit Mode – 1 watt output power

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

Warning: Although the output power can be set as low as 1 watt, and the module is certified as low as 1 watt, operation below 2.5 watts output power is not recommended. At

low power levels, the output power can vary by 50% or more with variations in ambient temperature.

Transmit Mode – 3 watt output power

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

Transmit Mode – 6 watt output power

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

4.4 DUTY CYCLE/KEY-DOWN LIMITATIONS

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

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

Blowing air across the unit and/or adding a heat sink to the rear of the unit where the PA module is located can significantly improve the duty cycle/key-down times. Ritron offers an option where the case screws at the rear of the module are longer allowing heat sinks to be attached. Also, a fan option is available from Ritron which can significantly increase the duty cycle, up to 100% at room temperature in some cases. Contact Ritron for additional information on these options and special instructions on attaching heat sinks without compromising the mechanical integrity of the RF PA module.

4.5 INSTALLATION

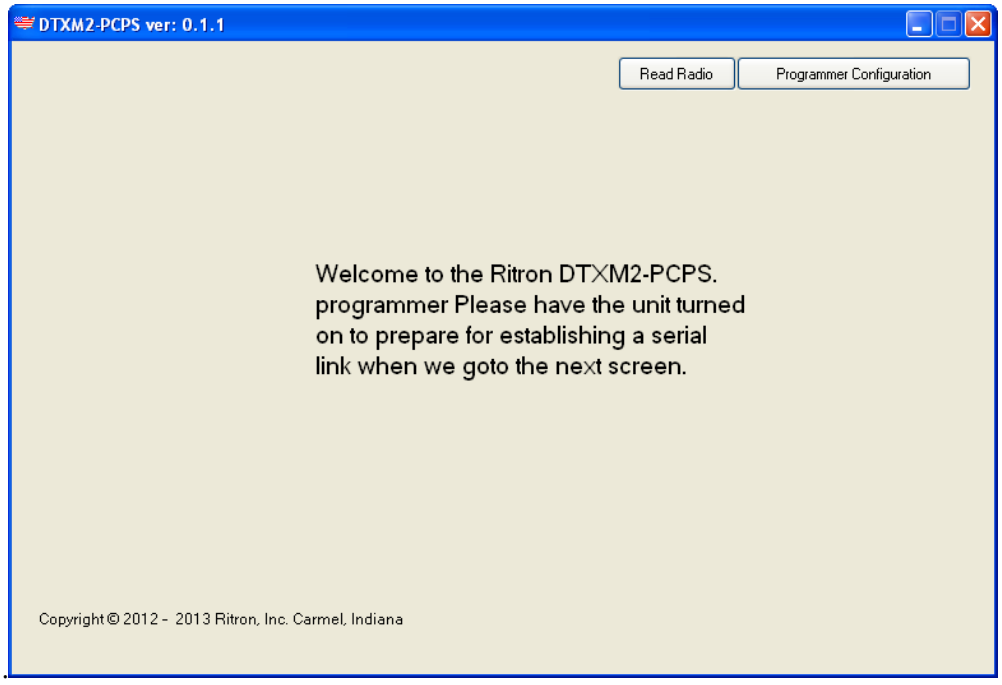
The DTXM modem has two connectors, a BNC for the RF (Antenna) connection and a 15-pin D-subminiature for the data/programming interconnection. The BNC connector should be connected to a suitable antenna or RF dummy load or attenuator, depending upon the installation. If an antenna is connected, it should be placed at least 10 ft. away from the radio itself to prevent RF interference. Also, any antenna must present a good 50-ohm RF load (low VSWR) at the operating frequency. The 15-pin connector is usually used with a Ritron programming cable which provides for DC power connections and a serial connection for programming and for the data to transmitted and received.

5.0 PROGRAMMING THE MODEM

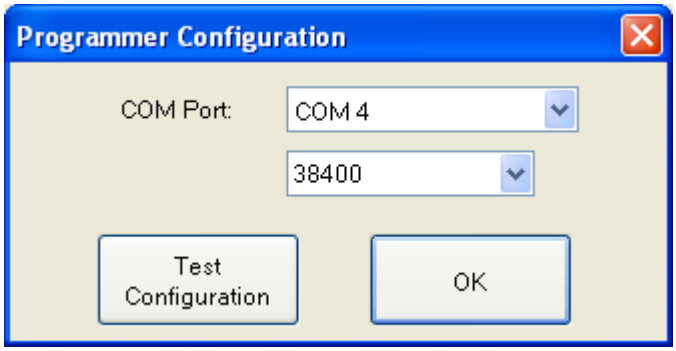
The operating parameters of the DTXM modem can be set and adjusted via the Ritron DTXM-X60 series programmer, DTXM2-PCPS. Note that the programmer for the previous Ritron wireless modem, i.e. the DTXM-X54 series will **NOT** work with this product.

The programming software should be loaded on a host computer by loading the CD-ROM disc into the host computer's appropriate drive. The programming software itself should be self-extracting. If it does not load automatically, it can be manually loaded by running "Setup.exe" on the CD Rom.

The Ritron modem should be connected to the host computer by the 9-pin connector. The red wire in the cable should be connected to positive supply voltage for the modem while the black should be connected to the negative side. The voltage itself should be compatible with that required by the modem. In programming mode, the current required by the modem is about 150 mA and the power supply should be capable of supplying that current. Note that in transmit, it can be much, much higher, 2 to 3 amperes is not unusual. It is possible to transmit with the programmer program running, but the power supply must be able to supply the necessary current and a suitable RF load must be provided on the BNC connector. Once the modem is connected to the host computer and a power supply is connected, the programming software program can be opened and the power supply turned on.The first screen to become visible is the "welcome" screen shown below:



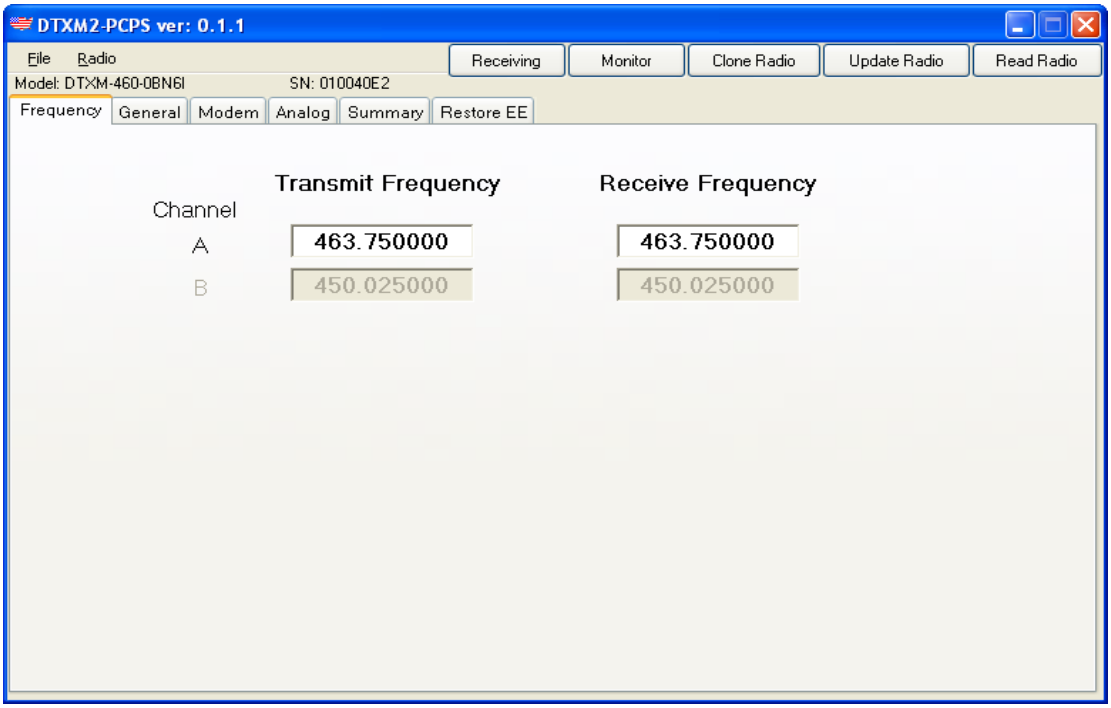
The button at the upper right is the Programmer Configuration button and is used to set the serial communications baud rate for communications between the programmer and the host computer. It defaults to 38400 baud, but can be set to other common serial rates. In addition, if the host computer baud rate is unknown, the Test Configuration button can be selected to auto-detect the baud rate. Selecting OK confirms the choice of baud rate.



The other button is used to read the contents of the radio into the programmer so that the current configuration of the radio can be observed and edited.

5.1 FREQUENCY TAB

Upon selecting the Read Radio button, the Frequency tab is opened as shown below.



This page shows the frequencies programmed into the modem. Depending upon how the A/B pin is programmed either one or two pairs of frequencies will be displayed. Frequencies can be programmed into the device by clicking on the appropriate field and typing in the desired frequencies. The frequencies must be within the operating range of the radio and must be divisible by the synthesizer step size for the particular model use. In addition, there are five other tabs and five buttons that can be selected. These are summarized below:

5.2 PAGE TABS

The page tabs show up on all of the pages. Clicking on a tab moves one to that page.

Frequency-as explained above, this page allows the observing and entering of operating frequencies.

The other tabs are shown below and their contents will be detailed in later sections.

General-shows the general operating parameters of the modem.

Modem-shows the modem parameters such as protocol, etc.

Analog-shows the parameters of the analog/voice path.

Summary-shows all of the parameters of the modem on one page.

Restore EE-allows the configuration of the programmed radio modem to be saved.

5.3 BUTTONS

There are five buttons which show up on all of the pages. These are:

Receiving-This is a software (programmer) PTT selection. Selecting this button will put the radio modem in transmit mode, regardless of the state of the PTT pin. Selecting this button again will return the radio back to receive.

Monitor- This is a software (programmer) Monitor selection. Selecting this button will unmute theanalog/voice receiving path of the radio modem. Selecting this button again will return the radio back to normal squelched operation. Note that if unsquelched operation is selected on the Analog page, this button will have no effect.

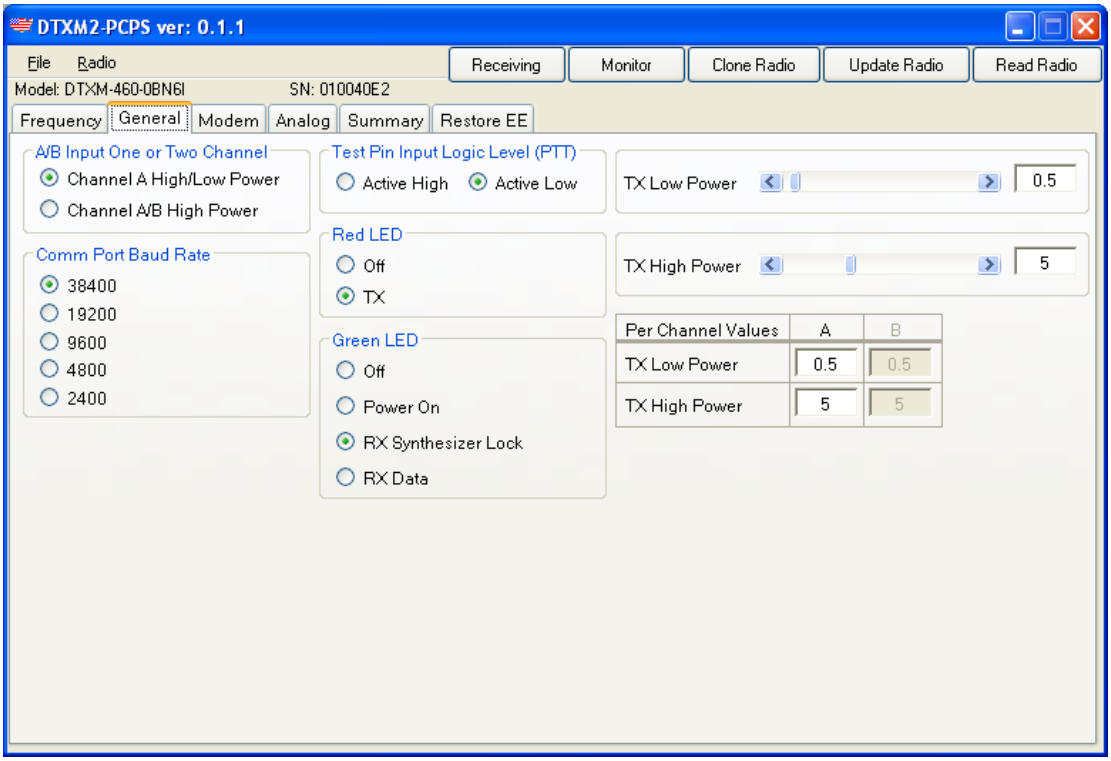
Clone Radio-This allows the radio parameters to be copied into another radio.

Update Radio-Loads the programmer's parameters into the radio. Note that changes made via the programmer are **NOT** permanently saved into the radio until this button is selected. **The radio's behavior will change as changes are made via the programmer, but will be lost on power-down unless, and until, this selection is made.**

Read Radio- Reads the radio modem's parameters into the programmer for observation and editing.

5.4 GENERAL TAB PAGE

The General Page is shown below:



The selections are:

A/B Input One or Two Channel-Determines the function of the A/B pin. This pin can be used to control the power selection, high or low, for one channel, channel A or it can be used to choose between channel A and channel B, in which case, the output power is high for both.

Comm Port Baud Rate-Determines the baud rate for communications between the data device and the radio modem. This number should match that shown on the Programmer Configuration screen.

Test Pin Input Logic Level (PTT)-Determines the polarity of the test pin. The test pin is used to put the radio in transmit in analog/voice mode or to send test patterns in modem mode. This pin has an internal pullup resistor and thus, assumes a logic high state when not connected. Therefore, active low is the normal, default setting.

Red LED-Determines the behavior of the Red LED indicator. The choices are that it can be set to never be illuminated or illuminated when the radio is transmitting.

CD Output Logic Level-Determines the polarity of the CD (Carrier Detect) output pin.

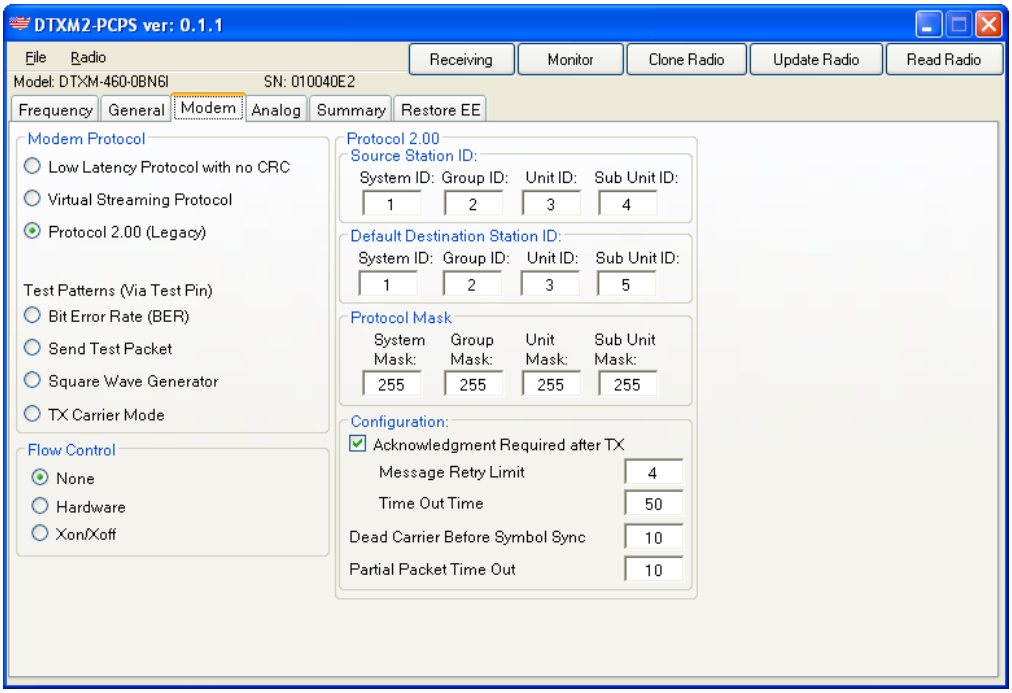
Green LED-Determines the behavior of the Red LED indicator. The choices are for it to never be illuminated (off), be illuminated whenever the radio is powered (Power On), when the receiver is locked and receiving (RX Synthesizer Lock), or data/analog information is being received (RX Data). In the latter mode, the indicator would come on whenever one of two conditions is met, the squelch level (carrier detect level) is exceeded, even when Squelch is never muted, or when the receive data has detected a valid data stream.

TX Low Power/TX High Power-This allows setting the RF output power for the two states of the low/high power pin. The low-power selection corresponds to the low logic level of the pin while the high-power selection corresponds to the high logic level. Note that the high-power selection does not necessarily have to be greater than the low-power selection. Each is independent of the other and only corresponds to a state of the power select pin.

Per Channel Values-Summarizes the high and low power settings for the channels used by the radio.

5.5 MODEM TAB PAGE

The modem page allows selecting the parameters of the modem mode operation and is shown below:



The selections are:

Modem Protocol-This selects the over-the-air protocol. The three choices are detailed below:

Low Latency Protocol with no CRC-This is as close to a bit in/bit out protocol which can be supported by the Ritron radio modem. A synchronization pattern is affixed to the beginning of the transmitted stream, but after that, each symbol transmitted directly corresponds to two input bits. No error detection or correction is used within the protocol itself. This protocol provides for the fastest overall data rate, but sacrifices data accuracy.

Virtual Streaming Protocol-This is similar to the low latency protocol, but the data is divided into blocks and an error detecting CRC word is added to each block. This word is removed before the data is passed to the data device on the receiving end. Blocks with errors are not passed on to the data device.

Protocol 2.00 (Legacy)-This is the protocol used by the DTXM-X54 family. This is a very robust, packet protocol useful for large data blocks, but not for fast streaming or fast polling. This protocol is useful when interfacing a system with the legacy Ritron DTXM-X54 family and/or when data errors cannot be tolerated.

Test Patterns (via Test Pin)-Selecting any of the selections in this box will cause a test pattern to be transmitted when the Test Pin (PTT) is active. If no selection is made, activating the Test Pin will cause the radio to transmit in analog/voice mode. The choices are:

Bit Error Rate (BER)-A pn pattern is generated which allows for the computation of bit error rate, setting deviation, or observing an eye pattern. The pattern is 511 symbols long with no synchronization symbols and repeats continually. It is a maximal length pattern with feedback taps at the 5 and 9 bit positions.

Send Test Pattern-A packet which transmit over and over with a constant data structure. This pattern can be used to test the system in the low latency and streaming modes.

Square Wave Generator-Transmits a 400 Hz square wave. Used to set the deviation and modulation balance during alignment or to hear the transmitted 400 Hz tone on a receiver or radio modem in analog/voice mode.

TX Carrier Mode-An unmodulated carrier is transmitted.

Protocol 2.00-The items is this box select the identification parameters used in the legacy 2.00 protocol.

Source Station ID-Source Station ID-Sets the address of the modem itself. It is made up of 4 parts, from most general to most specific: System ID, Group ID, Unit ID, and Sub-unit ID.

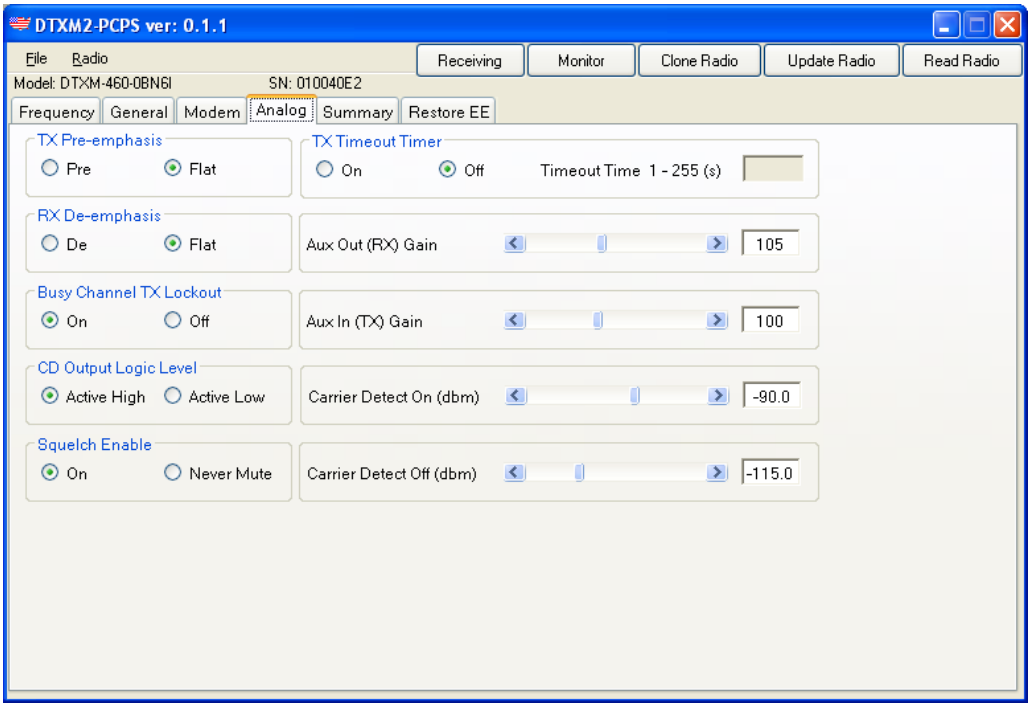
Default Destination ID-Sets the destination ID of the intended recipient.

Protocol Mask-The protocol mask determines how close a mask must exist between the modem's ID and the destination ID in the message before accepting and outputting to the host the message. A '1' for any location in the mask requires a perfect match, while a '0' means a 'don't care' situation. This is useful for 'broadcast' i.e. one unit transmitting to more than one unit situation. Note: In broadcast applications, the 'Acknowledgement after TX' selection should NOT be selected to prevent multiple units from responding and interfering with each other. See below.

Configuration Acknowledgement required after transmit-When checked, the modem requires an acknowledgement after each transmission or the transmission will be repeated. Message Retry Limit and Timeout Time-The amount of time in ms that the modem will wait for an acknowledgement and the number of times it will repeat a message can be set in the Message Retry Limits box and the Time Out Time boxes Dead Carrier before Symbol Sync-The amount of time in ms that an unmodulated carrier will exist before the beginning of the symbol sync pattern. Partial Packet Timeout-The amount of time in ms of no data from the data device that must exist before a packet is formed and transmitted.

5.6 ANALOG TAB PAGE

The analog page allows selection of the analog/voice mode parameters and is shown below:



The selections are:

TX pre-emphasis-Selects whether the external audio signal is pre-emphasized i.e. had its high-frequency audio content boosted or whether the signal is sent with a flat audio response. Voice signals typically use pre-emphasis.

RX de-emphasis-Selects whether the external audio output signal is de-emphasized i.e. had its high-frequency content attenuated or whether the signal is outputted with a flat frequency response. Pre-emphasis and de-emphasis are normally used together.

Busy Channel TX Lockout-This selection will allow a transmission to be inhibited if there is activity on the receive frequency. This would normally be used when the transmitter and receiver operate on the same frequency and is used to avoid interference to a transmission already in progress. The presence of activity of the channel is determined by signals which exceed the Carrier Detect On setting (see below).

CD Output Level-Sets the logic level of the Carrier Detect Output pin.

Squelch Enable-Selects whether signals below the Carrier Detect Off level will be muted (squelched) or whether all signals are allowed to pass to the audio output pins.

TX Timeout Timer-Selects whether the transmitter in limited in the maximum time that it is allowed to transmit continuously and how long that time would be. This is designed to avoid overheating the transmitter when the Test (PTT) pin is taken active for a long time.

Aux Out (RX) Gain-Sets the audio output level for the audio output pins.

Aux In (TX) Gain-Sets the gain, not the maximum deviation, for signals at the audio input pins.

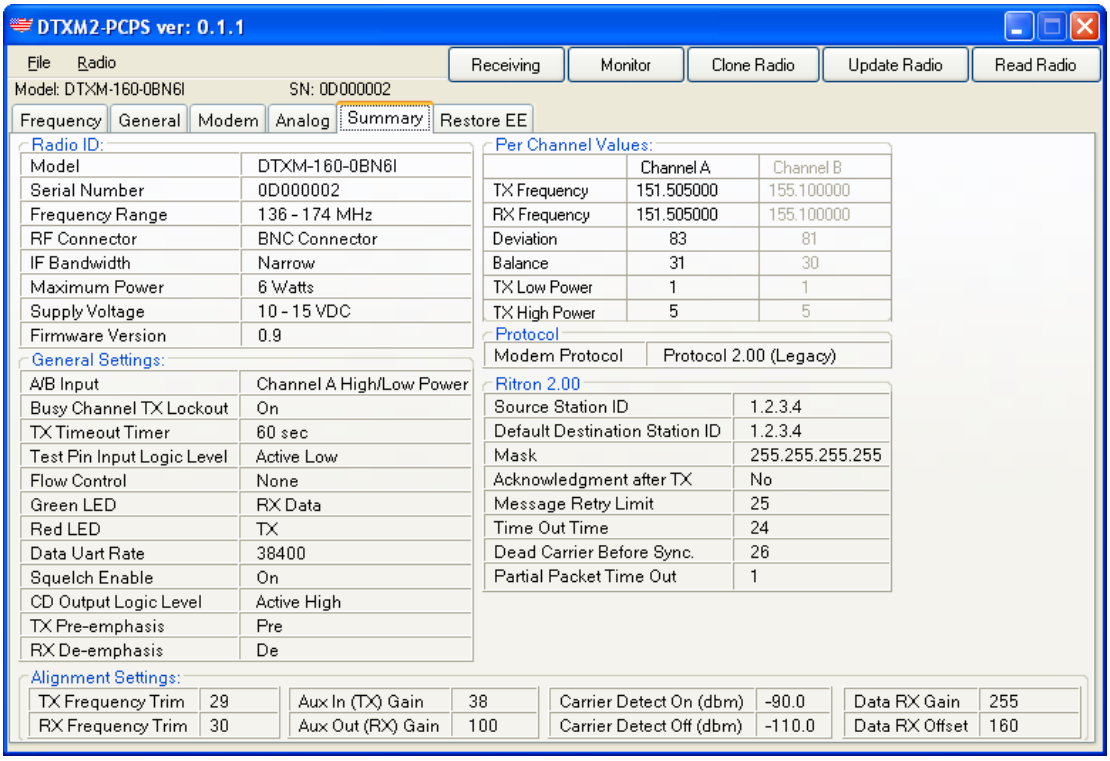
Carrier Detect On (dBm)-Sets the RF signal level in dBm such that the carrier detect pin will go active and the output audio, if squelch is selected, will go unmute.

Carrier Detect Off (dBm)-Sets the RF signal level in dBm such that the carrier detect pin will go inactive and the output audio, if squelch is selected, will be muted.

Note: The Carrier Detect On level must be set to be higher (less negative) than the Carrier Detect Off level.

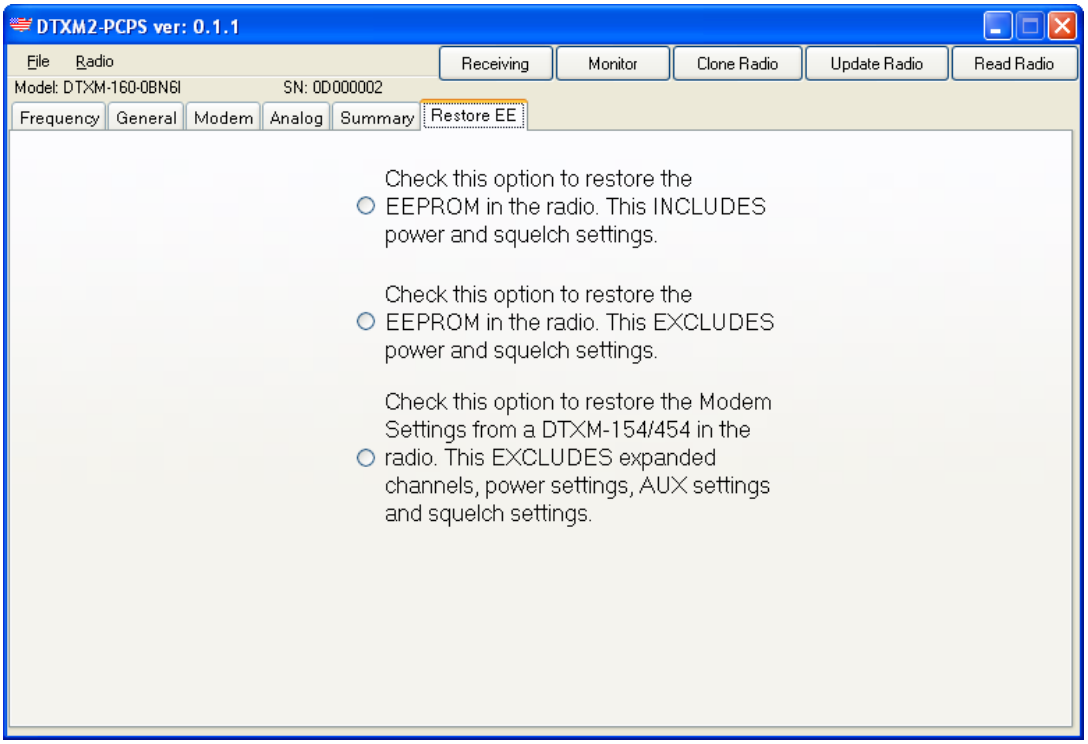
5.7 SUMMARY TAB PAGE

The summary page summarizes all of the selections from the previous pages and is shown below:



5.8 RESTORE EE PAGE

This page allows the configuration of the radio to be saved for loading into other DTX Series II radio modems. This page is shown below:



If it is desired to save the current configuration, one of the three boxes should be checked. Besides not saving a configuration by not checking any option, there are three options: Saving all parameters, saving all except the squelch and RF power level (useful is the a radio modem already has power and squelch settings with are to be retained), and an option to convert older DTXM-X54 series products to the configuration of the Series II modems.