8M046X01-01 REV-0

User's Manual

CHANNEL MODULE

FUTURECOM
SYSTEMS GROUP INC.

8M046X01-01 Rev. 0

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SYSTEMS GROUP INC.

CHANNEL MODULE™

User's Manual

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FCC Class A Digital Device or Peripheral - Information to User

NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, can cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by Futurecom Systems Group Inc. could void the user's authority to operate the equipment.

1 SAFETY INFORMATION

The following information may or may not be applicable to your product. In any case, precautions should always be taken when handling any electrical product.

- This manual contains important safety and operating instructions, therefore keep this manual always on hand!
- Prior to using any product, follow all warning, safety and operating instructions written on the product and in the user's manual. **All instructions should be saved for reference in the future!**
- Always keep product dry, never expose to any kind of moisture.
- Do Not expose product to extreme temperatures- as found near a hot radiator or stove.
- Do Not expose product to open flames, cigarettes, etc.
- Precautions should be taken to avoid objects falling or liquids spilling onto product.
- Do Not incorporate the use of other equipment that is not recommended or sold by the manufacturer. The result may be the risk of fire or electric shock injury.
- Connect DC power cord to DC power source as marked on the product..
- DANGER - Never alter the AC cord or plug! If plug does not fit outlet have a qualified electrician install a proper outlet. Failure to do so results in improper connection and increases the risk of electric shock.
- This product does not contain customer serviceable components, therefore never disassemble the product..
- Damage Requiring Service - This product should be serviced by qualified service personnel when:
  - A. The power supply cord or the plug has been damaged; or
  - B. Objects have fallen, or liquid has been spilled into the product; or
  - C. The product has been exposed to rain or moisture; or
  - D. The product does not appear to operate normally or exhibits a marked change of performance; or
- E. The product has been dropped, or the cabinet damaged.
- If an outdoor antenna is connected, make sure the system is always grounded to allow for protection against voltage surge and built-up static charges. Outdoor antennas should always be located away from power lines.

The operator of any mobile radio should be aware of certain hazards common to the operation of vehicular radio transmissions.

A list of possible hazards follows:

1. **Explosive Atmospheres**

   To ensure safety, make sure that the radio is off while fueling the vehicle. When the radio is mounted in the back of the trunk, never have containers of fuel in the trunk of the vehicle..

2. **Interference to Vehicular Electronics Systems**

   Typical types of electronic devices that malfunction are -Electronic fuel injection systems, electronic anti-skid braking systems, etc., The reason for this is due to the lack of protection from radio frequency energy present when transmitting. If the vehicle contains such equipment, consult the dealer of your vehicle and enlist his aid in determining if such electronic circuits perform normally when the radio is transmitting.

3. **Dynamite Blasting Caps**

   Dynamite blasting caps may be caused to explode by operating a radio within 500 feet of the blasting caps. Always obey the **"Turn Off Two Way Radios"** signs posted where dynamite is being used. When transporting blasting caps in your vehicle:

   a. Carry the blasting caps in a closed metal box with a soft lining.

   b. Leave the radio **OFF** whenever the blasting caps are being put into or removed from the vehicle.

4. **Radio Frequency Energy**

   Do not operate the transmitter when a person is outside of the vehicle within two feet of the antenna! Failure to heed this warning may result in burns or related physical injury to the person.

5. **Liquefied (LP) Gas Powered Vehicles**

Mobile radio installations in vehicles powered by liquefied petroleum gas with the LP gas container in the trunk or other sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association standard (NFPA) 58 requiring that:

a. The space containing the radio equipment shall be isolated by a seal from the space containing the LP gas container and its fittings.

b. Outside filling connections shall be used for the LP gas container.

c. The LP gas container shall be vented to the outside of the vehicle.

2 GENERAL RADIO OPERATING PROCEDURES

Industry Canada (IC) and the Federal Communications Commission (FCC). rules and regulations must be incorporated in the use of radio systems. Familiarity with these rules by the operator is essential for proper execution of the type of radio operation that is in question. Following these rules helps to eliminate confusion, assures the most efficient use of existing radio channels, and results in a smoothly functioning radio network. When using this unit remember these rules:

1. Emergency calls always have priority over all messages! To interrupt any distress or emergency message is a violation of the IC and FCC rules. When operating the radio make sure that the line is clear before sending messages. KEEP OFF THE AIR when an emergency message is being sent through.

2. Use of profane or obscene language is prohibited by Federal law.

3. Sending false call letters, false distress or emergency messages is against the law.

4. IC and FCC demand that conversations are kept brief and content limited only to business. Coded messages are encouraged in order to save time.

5. Only messages that are essential for the business operations are allowed to be sent. Otherwise using the radio to send personal messages is a direct violation of the IC and FCC rules.

6. Conversations between others sharing a channel is regarded as confidential. Repeating anything overheard on the radio is against Federal Law.

7. The IC and FCC requires the operator to transmit station identification at certain times by means of call letters. Refer to the IC and FCC rules for your station's particular type of operation for the proper procedure.

8. No changes or adjustments shall be made to the equipment except by an authorized or certified electronics technician.

3 SPECIFICATIONS

Electrical Specifications	CM VHF LP	CM UHF LP	CM 800 LP
	136-174 MHz	403-470 MHz	806-960MHZ
Frequency of Operation			
Sensitivity		-117 dBm	
Input Carrier Detection Threshold		-110 to -50 dBm	
Carrier Detection Threshold Adjustment Step		2 dBm	
Carrier Detection Attack Time		<2 ms	
Maximum Gain Range On-Channel Repeater (OCR)		70 to 120 dB	
(Programmable) Translator		70 to 145 dB	
AGC Range		70 dB	
AGC Attack Time		<1 ms	
AGC Decay Time		<1 ms	
Output Power		-10 to +30 dBm	
Output Power Tolerance		-0 dB, +1 dB	
Duty Cycle		100%	
Output Frequency Stability		Tracks Input Signal Frequency	
On-Channel Repeater (OCR)/Translator			
Passband Frequency Stability (Internal TCXO)		+/-1.5 ppm (+/-0.2 ppm optional)	
Modulation Types		Narrowband FM Voice and Data	
Bandwidth		Application Specific	
Selectivity		Application Specific	
Receiver Spurious Response Rejection		>70 dB	
Receiver Intermodulation		>70 dB	
Receiver Conducted Spurious Emissions		<-57 dBm	
Transmitter Conducted Spurious Emissions		<-16 dBm and <-40 dBc	
Transmitter FM Hum and Noise		>43 dB	
Input Impedance		50 Ohms	
Output Impedance		50 Ohms	
Input VSWR		<1.5:1	
Output VSWR		<1.5:1	
Power Supply Voltage		10.8 to 28 VDC	
Power Supply Current Drain Standby		<0.7 A DC	
Transmit		<1.4 A DC	

Mechanical			Programming			Alarms/Monitoring	
RF Connectors	SMA Receptacles		Frequency of Operation	✓		Power	✓
Environmental	90% humidity @ 50 °C (122°F)		Output Power	✓		VSWR	✓
Operating Temperature Range	-30 to +60°C (-22 to +140°F)		Carrier Detection Threshold	✓		Temperature	✓
Dimensions	222 x 225 x 45 mm (8.74" x 8.86" x 1.77")		Carrier Detection Time-out	✓		Synt. Lock	✓
Weight	2.95 kg (6.5 lb)		Gain	✓			
			DCS/CTCSS	✓			

Electrical Specifications	CM VHF HP	CM UHF HP	CM 800 HP
Frequency of Operation	136-174 MHz	403-470 MHz	806-960MHZ
Sensitivity	-117 dBm		
Input Carrier Detection Threshold	-110 to -50 dBm		
Carrier Detection Threshold Adjustment Step	2 dBm		
Carrier Detection Attack Time	<2 ms		
Maximum Gain Range On-Channel Repeater (OCR)	70 to 120 dB		
(Programmable) Translator	70 to 160 dB		
	70 dB		
AGC Range	<1 ms		
AGC Attack Time	<1 ms		
AGC Decay Time	1W to 20 W		
Output Power	-0 dB, +1 dB		
Output Power Tolerance	100%		
Duty Cycle	Tracks Input Signal Frequency		
Output Frequency Stability On-Channel Repeater (OCR)/Translator			
Passband Frequency Stability (Internal TCXO)	+/-1.5 ppm (+/-0.2 ppm optional)		
Modulation Types	Narrowband FM Voice and Data		
Bandwidth	Application Specific		
Selectivity	Application Specific		
Receiver Spurious Response Rejection	>70 dB		
Receiver Intermodulation	>70 dB		
Receiver Conducted Spurious Emissions	<-57 dBm		
Transmitter Conducted Spurious Emissions	<-16 dBm and <-40 dBc		
Transmitter FM Hum and Noise	>43 dB		
Input Impedance	50 Ohms		
Output Impedance	50 Ohms		
Input VSWR	<1.5:1		
Output VSWR	<1.5:1		
Power Supply Voltage	22 to 28 VDC (13.8 VDC*)		
Power Supply Current Drain Standby	<0.7 A DC		
Transmit	<3.5 A (<4.5 A *)		

(handwritten: (7W max for 824-851MHZ BAND))

* Max. 15W Output Power

Mechanical		Programming		Alarms/Monitoring	
RF Connectors	SMA Receptacles	Frequency of Operation	✓	Power	✓
Environmental	90% humidity @ 50 °C (122°F)	Output Power	✓	VSWR	✓
Operating Temperature Range	-30 to +60°C (-22 to +140°F)	Carrier Detection Threshold	✓	Temperature	✓
Dimensions	222 x 225 x 75 mm (8.74" x 8.86" x 2.95")	Carrier Detection Time-out	✓	Synt. Lock	✓
Weight	4.09 kg (9.0 lb)	Gain	✓		
		DCS/CTCSS	✓		

4 INTRODUCTION

This manual describes the Futurecom Channel Module (CM). The Channel Module is a synthesized, microprocessor-based, high performance radio unit. It is designed to increase the coverage area of an existing radio site by receiving and rebroadcasting from host to user (downlink), and from user to host (uplink).

The operation of the Channel Module is fully transparent to the user of the host radio system. The Channel Module can be monitored and controlled remotely via digital communication with the remote system controller or Computer Aided Dispatch (CAD). This provides high level of radio system reliability.

The exact operation of the Channel Module depends on the operating mode. Most features described in this manual may be enabled or disabled through programming. The features of the Channel Module are always selected to suit the particular radio system which it is extending.

The unit has six indicators showing the current operating mode. The Channel Module can be programmed and controlled from the front panel as well.

5 MAIN FEATURES

The Channel Module is a fully software configurable, synthesized, narrow band device, with 20 Watt output power capability. It is available in VHF, UHF and 800/900MHz bands. Its purpose is to receive a single RF channel, amplify and filter the channel signal and re-transmit it.

The Front End (FE) stage receives a single channel off air using double heterodyne principle and downconverts the signal to an Intermediate Frequency (IF) stage. The Intermediate Frequency performs most of the signal filtering required for a given frequency band and channel spacing. Custom filters are available for customer specific applications. The rigorous filtering allows only the desired signal (channel) to pass and to be amplified assuring that all undesired signals on other frequencies are not transmitted. The filtered signal is upconverted to the output frequency and amplified by the Power Amplifier (PA).

The Channel Module can operate in a stand alone mode or it can be controlled/monitored by another Channel Module or CM Controller (OCN). The personality of the unit can be programmed directly from a personal computer via front panel serial port or from another CM or OCN. The Channel Module software resides in Flash memory and can be upgraded serially without opening and retesting

the unit. Software upgrade/change can be performed remotely in the same way as personality change.

The chassis of the Channel Module is made of cast aluminum. The rugged construction of the unit minimizes microphonics and internal feedback. The unit is in standard double Eurocard format. The installation of the Channel Module is performed by simply plugging it into a 19" rack mount card cage which is 6 Rack Unit high (10.5") and connecting RF input and output to SMA connectors.

The Channel Module is capable of operating in two different modes; either Translator or On Channel Repeater (OCR). In the Translator mode, the Channel Module transmits on a frequency which is different from the receive frequency. Cross-band Translators are possible. The maximum achievable gain in this mode is 160dB. The On Channel Repeater transmits on the receive frequency making the Channel Module transparent to the user. The maximum achievable gain in the OCR mode is 120dB.

6 BLOCK DIAGRAM AND DESCRIPTION

The block diagram of the Channel Module is shown in 8D046A14 drawing. The Channel Module consists of four blocks: Front End, Intermediate Frequency, Power Amplifier and Controller module.

6. 1 FRONT END

Front End starts with a band-pass filter that filters out of band unwanted frequencies. It is followed by an amplifier which can be switched in/out of the signal path under software control. A software 30dB controlled attenuator is next. It is used to control input sensitivity and to lower intermodulation products for stronger input signals. (Procedure to set up this attenuator can be found in the following section).

The next two stages consist of a Voltage Controlled Oscillator (VCO), mixer, band-pass filter and an amplifier. These two stages implement double heterodyne down conversion to Intermediate Frequency of 45.0MHz. Voltage Controlled Oscillator frequencies are based on a common Temperature Compensated Crystal Oscillator (TCXO).

The first VCO can be modulated with audio modulation.

6.2 INTERMEDIATE FREQUENCY

Proper selectivity of the Channel Module is achieved by the Intermediate Frequency stage. The selectivity is assured by the input filter together with other filters in this stage. The input filter is followed by a software 30dB controlled attenuator. This attenuator is used to control input sensitivity. (Procedure to set up this attenuator can be found in the following section).

The signal path continues with an Automatic Gain Control Loop (AGC). The Automatic Level Control Loop maintains a constant signal level irrespective of the input signal level. The IF signal is also used to produce baseband audio signal and provides Received Signal Strength (RSSI) indication.

The rest of the Intermediate Frequency section is mainly an up conversion circuitry with two mixers and associated filters. An additional Voltage Controlled Oscillator can be switched into the last mixer. This VCO can be modulated with audio modulation. It can add a subaudible tone in an OCR mode. The Channel Module is set up for a Translator mode of operation by programming proper frequency of this Voltage Controlled Oscillator.

The output from the Intermediate Frequency section is the final output frequency.

6.3 POWER AMPLIFIER

The Power Amplifier is capable of delivering up to 20W output. A band-pass filter filters out of band unwanted signals. The driver and the power amplifier provide the required output power. The output power level is set under software control. The real output power is compared with the desired output power level. An Automatic Level Control Loop adjusts the real output power to be precisely equal to the preset level.

An output low-pass filter assures that no unwanted higher harmonics are present on the output of the Channel Module.

The reflected power is monitored and the output power is reduced when the reflected power increases.

6.4 CONTROLLER BOARD

The Controller Board controls the operation of the Channel Module. It contains the microcontroller with Flash program and EEPROM personality storage. Communication with the outside world is facilitated with two RS-232, RS-485 and I^2C serial links. One RS-232 port is accessible via 8-pin mini DIN connector on the front panel. Eight digital Input/Output lines are provided for output and outside event monitoring (e.g. room or cabinet door opening). Six analog inputs and four analog outputs are provided as well.

The Controller Board contains DTMF encoder and low-speed data encoder and decoder.

The front panel reset (RESET) and Transmit Disable (TX DIS) inputs are monitored. These two inputs are accessed via two front panel holes with a round tool 2.5mm (0.1") in diameter. Finally, the front panel indicators are controlled by the Controller Board. These are: Tx disable (TX DIS), power (DC ON), transmit (TX ON), receive (RX ON), output power fault (PWR) and VSWR fault (VSWR).

7 SET UP

7.1 PROGRAMMING SOFTWARE INSTALLATION

Futurecom 6A046X01 Programming Software must be installed on a personal computer which will be used for the Channel Module field system installation. The personal computer must run under MS-DOS operating system. Software must be installed only once before the first Channel Module installation.

1. The following steps must be performed for the Futurecom Channel Module Programming Software installation:

2. Select the hard disk drive where software will reside, e.g. drive C: Determine 3.5 inch floppy diskette on your personal computer, e.g. A:.

3. Insert the Futurecom Channel Module Programming Software disk into proper floppy drive, e.g. drive A. Type A:\INSTALL A: C:<Enter>. This step creates C:\FUTURCOM directory and installs software into this directory.

7.2 CHANNEL MODULE CONNECTIONS

The Channel Module must be set up in the following way before field system installation:

1. The Channel Module must be plugged into the Futurecom subrack and supplied with proper DC power supply for all set up procedures.

2. The Receiver antenna must be connected to the upper SMA connector on the Channel Module. Transmit antenna must be connected to the lower SMA connector on the Channel Module.

3. Connect the antennas to the Uplink and Downlink Antenna Ports if the cabinet housing the Channel module is equipped with these ports.

4. Turn on the DC power supply.

7.3 MODE OF OPERATION SETTING

The procedure to set up the mode of operation for the Channel Module is as follows:

1. Make sure that the Futurecom Channel Module Programming Software is installed as described earlier.

2. Connect the Channel Module as described in Channel Module Connections section and power it up.

3. Connect the personal computer to the Channel Module front panel RS-232 connector with Futurecom CM Serial Programming Cable, part number 7W038X61-01.

4. Select the hard disk drive where the programming software is located. To select e.g. drive C type C: <Enter>. Switch to FUTURCOM directory by typing CD \FUTURCOM <Enter>.

5. Start the Channel Module Programming Software by typing OCRSET <Enter>.

6. Select "Setup" field and then select "RS-232Menu" using cursor keys. Press <Enter>. Using cursor keys and <Page Up>, >Page Down> and numeric keypad <->, <+> select the following settings:

Baud Rate	9600 b/s
Data Bits	8
Stop Bits	1
Parity	NO
Comm. Port	COM1 or COM2 depending on the personal computer

   Press <Esc>. With cursor keys select Yes as an answer to *Would you like to update config. file.* Press <Enter>.

7. Select "Program" field and then select "Block Diagram Menu" using cursor keys. . Press <Enter>. Wait for all the fields to be updated. Movement around the screen is done using cursor keys. Modification of values in different fields is done with <Page Up>, >Page Down> and numeric keypad <->, <+> keys.

8. Set the mode of operation in "Rx/Tx Mode" field to OCR or Translator.

9. Exit "Block Diagram Menu" by pressing <Esc>. >. With cursor keys select Yes as an answer to *Would you like to update the E^2PROM?.* Press <Enter>.

10. Select *"File"* field and then select *"Exit"* using cursor keys. Press <Enter>. With cursor keys select **Yes** as an answer to *Exit from program.* Press <Enter>.

7.4 FREQUENCY OF OPERATION SETTING

The procedure to set up the mode of operation for the Channel Module is as follows:

1. Follow Steps 1 to 7 in 7.3 **MODE OF OPERATION SETTING** section.

2. Set the frequency of operation in *"Rx Frequency"* field for the OCR mode. Set the frequencies of operation in *"Rx Frequency"* and *"Tx Frequency"* fields for the Extender mode. Frequencies can also be entered by typing the number in the given fiend and pressing <Enter>.

3. Exit *"Block Diagram Menu"* by pressing <Esc>. >. With cursor keys select **Yes** as an answer to *Would you like to update the E^2PROM?*. Press <Enter>.

4. Select *"File"* field and then select *"Exit"* using cursor keys. Press <Enter>. With cursor keys select **Yes** as an answer to *Exit from program.* Press <Enter>.

7.5 GAIN SETTING

7.5.1 Normal Gain Setting

The basic rule in the Channel Module application can be summarized as follows:

The total gain of the Channel Module must always be less than isolation between receive and transmit antennas and cables.

It is recommended that the gain is lower than the isolation by at least 5-6dB margin. A larger margin accounts for environmental, aging and other changes in the system.

The Channel Module will remain permanently keyed up after first valid transmission if this basic rule is not followed!

The procedure to setup the Channel Module is as follows:

1. Follow Steps 1 to 7 in 7.3 **MODE OF OPERATION SETTING** section. Note that fields starting with "?" are readings. All other fields are used to set desired parameters of the Channel Module.

2. Set power in "*RF Amp*" field to level over 30dBm.

3. Turn on the Tx power amplifier by setting the lowest possible RF level in "*Rx Level threshold comparator*". "*TX on*" indicator has to flash.

4. Set RSSI indication into its linear region by adjusting "*Front End sensitivity*" to approximately -95dBm. Verify that the RSSI indicator is operating in its linear range by changing "*Front End sensitivity*" by approximately +/- 3dB. "*?Rx/Tx Gain*" must remain approximately constant changing by +/_1dB at most. If "*?Rx/Tx Gain*" changes more that +/-1dB, select different "*Front End sensitivity*".

5. "*?Rx/Tx Gain*" shows System Isolation between input and output. Mark this value down.

6. Calculate proper "*Rx Level threshold comparator*" level as follows:

    Desired Output Power - System Isolation +6dB margin.

    Restore "*Front End sensitivity*" to maximum (or desired) sensitivity. Set "*Rx Level threshold comparator*" such that its internal voltage setting shows between 1.0V and 2.5V. Adjust "*Rx/Tx Max. Gain*" such that "*Rx Level threshold comparator*" is set to the calculated value. If the desired calculated value for "*Rx Level threshold comparator*" cannot be obtained, even with minimum "*Rx/Tx Max. Gain*", lower also "*Front End sensitivity*" until the calculated "*Rx Level threshold comparator*" level is obtained.

7. Set power in "*RF Amp*" field to Desired Output Power. The transmit indicator has to stop flashing and must show "*- off*".

8. Exit "*Block Diagram Menu*" by pressing <Esc>. >. With cursor keys select Yes as an answer to *Would you like to update the E^2PROM?*. Press <Enter>.

9. Select "*File*" field and then select "*Exit*" using cursor keys. Press <Enter>. With cursor keys select Yes as an answer to *Exit from program*. Press <Enter>.

7.5.2 Strong Signal Gain Setting

The *"Front End Sensitivity"* should be always lower (more sensitive) than *"Rx Level threshold comparator"* setting. If the input RF signal is a strong signal, i.e. *"Rx Level threshold comparator"* is set at -80dBm or stronger, *"Front End Sensitivity"* should be adjusted before *"Rx/Tx Max. Gain"*. Decreasing *"Front End Sensitivity"* decreases intermodulation products in the Front End which is important for stronger RF input signals. (Decreasing *"Rx/Tx Max. Gain"* does not affect *"Front End Sensitivity"*.

The programming of the Channel Module for strong input RF signals is the same as in the Normal Gain Setting section. The only difference is in point 12. Instead of restoring *"Front End sensitivity"* to maximum sensitivity, lower desired *"Front End sensitivity"* is set first. The rest of the procedure is the same as in the Normal Gain Setting section.

8 OPERATION

8.1 GENERAL

The Channel Module does not require any supervision once it is installed and set up. The status of the unit is indicated by Front Panel Indicators:

- TX DIS Indicator is a dual function indicator.
  - TX DIS Indicator is on when transmit is disabled as described later.
  - TX DIS Indicator is flashing when one of the synthesizers is out of lock (likely due to the Channel Module not being properly programmed).

- DC ON Indicator shows that the Channel Module is supplied by DC power supply.

- TX ON Indicator is on when the Channel Module is transmitting.

- RX ON Indicator is lit when the RF input signal is above the programmed *"Rx Level threshold comparator"* level.

- PWR Indicator is a dual function indicator.
  - PWR Indicator is permanently on when the output RF power is outside of the allowed output power tolerance.
  - PWR Indicator is flashing alternatively with VSWR Indicator when an error is found in the personality of the Channel Module.

- VSWR Indicator is a multifunction indicator.
  - VSWR Indicator is on when an excessive reflected power is detected on the Tx Antenna connector at the instant when the transmitter is turned on.
  - VSWR Indicator flashes shortly when a valid polling serial message is received from a controller.

8.2 TRANSMIT DISABLE

The Channel Module transmitter can be disable by TX DIS switch. TX DIS switch is accessed via the front panel hole with a round tool 2.5mm (0.1") in diameter. The first push disables the transmitter, a second push enables the transmitter. This function is useful during Channel Module set up and servicing.

8.3 RESET

RESET switch is accessed via the front panel hole with a round tool 2.5mm (0.1") in diameter. RESET switch is used to reset the Channel Module in an unlikely event of malfunction.

WARNING

Do not apply excessive force on the TX DIS and RESET switches not to cause damage!

9 PROGRAMMABLE OPTIONS

The Channel Module provides several programmable options. The only option of interest for the user is summarized below:

- Carrier Control Timer (CCT) sets the maximum time the Channel Module can remain keyed up. The Carrier Control Timer can be programmed for OFF and 0.25minutes to 60.0minutes in 0.25 minute (15sec) steps as follows:

  1. Follow Steps 1 to 7 in 7.3 **MODE OF OPERATION SETTING** section.

  2. Move around the screen using cursor keys till *"CCT Timer"* field is reached. Select the desired value of *"CCT Timer"* with **<Page Up>**, **>Page Down>** and numeric keypad **<->**, **<+>** keys

  3. Exit *"Block Diagram Menu"* by pressing **<Esc>**. **>**. With cursor keys select **Yes** as an answer to *Would you like to update the E^2PROM?*. Press **<Enter>**.

  4. Select *"File"* field and then select *"Exit"* using cursor keys. Press **<Enter>**. With cursor keys select **Yes** as an answer to *Exit from program*. Press **<Enter>**.

10 CLEANING INSTRUCTIONS

Never use an abrasive or a petroleum based solvent cleaner on equipment. The unit can be cleaned using a mild liquid detergent and water or a soft cloth with furniture polish.

)

the Channel Module.

.

PART NUMBER

7W038X61-01

NOTES:

CONFIDENTIAL

TITLE
CHANNEL MODULE

FIRST MADE FOR :

F.C.F.O.

FRONT END
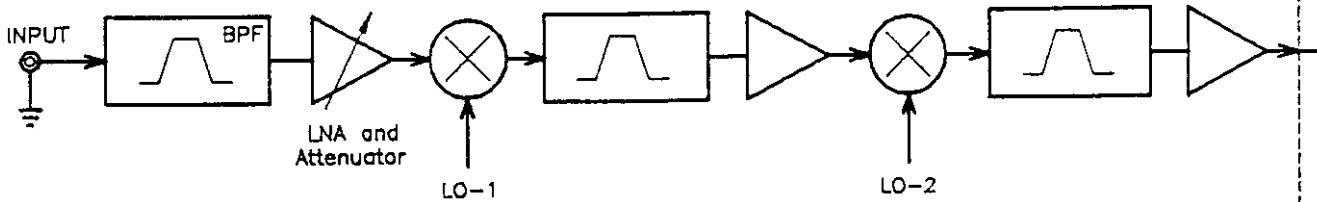
INPUT — BPF — LNA and Attenuator — ⊗ LO-1 — filter — amplifier — ⊗ LO-2 — filter — amplifier
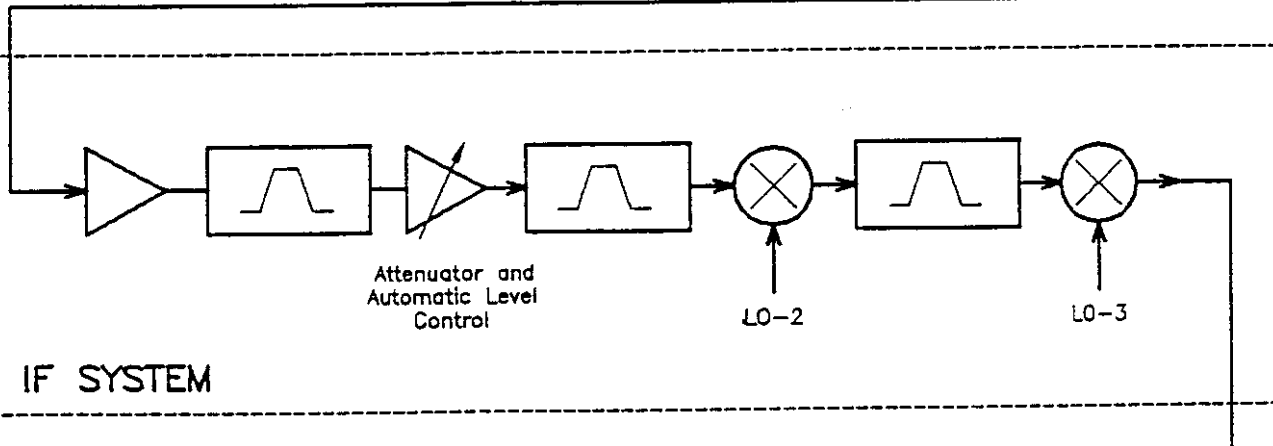
IF SYSTEM

amplifier — filter — Attenuator and Automatic Level Control — filter — ⊗ LO-2 — filter — ⊗ LO-3

PA SYSTEM

BPF — amplifier — PA — LPF — OUTPUT

Tx On/Off
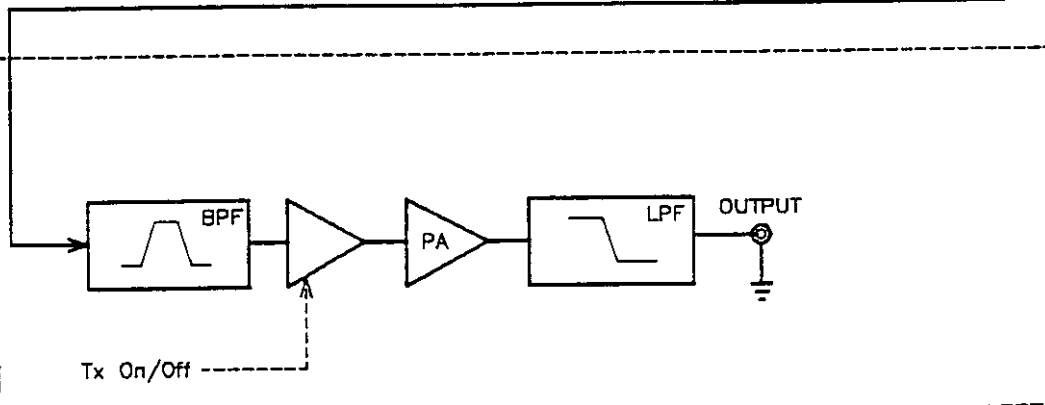
WARRANTY

Futurecom Systems Group Inc. warrants to the original purchaser all standard products sold by Futurecom Systems Group Inc. to be free of defects in material and workmanship for one (1) year from the date of shipment from Futurecom Systems Group Inc. Futurecom's warranty hereunder shall not apply if: (i) any repairs, alterations or other work has been performed by Buyer or others on such item, other than work performed with Futurecom's authorization and according to its approved procedures; or (ii) the alleged defect is a result of abuse, misuse, faulty installation, improper maintenance, accident or the negligence of any party other than Futurecom. The warranty set forth herein is conditioned upon proper storage, installation, use and maintenance in accordance with applicable written recommendation of Futurecom. The warranty furnished hereunder does not extend to damage to items purchased hereunder resulting in whole or in part from the use of components, accessories, parts of supplies not furnished by Futurecom Systems Group Inc.

Futurecom's sole obligation shall be to repair or replace, at Futurecom's option, any defective component or item and pay transportation expenses for such replacement at no charge to Buyer who shall provide labour for the removal of the defective component or item and installation of its replacement at no charge to Futurecom. Buyer shall bear all risk of loss or damage to returned goods while in transit. In the event no defect or breach of warranty is discovered by Futurecom upon receipt of any returned item, the item will be returned to Buyer at Buyer's expense and Buyer will reimburse Futurecom for the transportation charges, labour and associated charges incurred in testing the allegedly defective item.

Except as expressly provided herein, Futurecom makes no warranty of any kind, expressed or implied, with respect to any goods, parts and service provided by Futurecom including, but not limited to, the implied warranties or merchantability and fitness for a particular purpose. The sole and exclusive remedy for breach of any warranty is limited to the remedies provided in the paragraph above. Futurecom shall not in any event be liable for any other damages arising out of or in connection with furnishing of goods, parts or service hereunder, or the performance, use of, or inability to use any goods, parts or service, or otherwise, whether based on contract, tort or any other legal theory.

To exercise this warranty, contact Futurecom's Administration Department in Concord, Ontario Canada at (905) 660-5548 promptly, but no later than ten days following expiration of the warranty period, to obtain a return material authorization (RMA). No product will be accepted for return without a RMA. The repair of a product by Futurecom pursuant to this warranty is warranted for the balance of the original warranty period, or at least 90 days from date of shipment to Buyer of the repaired product.

FUTURECOM
SYSTEMS GROUP INC.

09/97 Printed in Canada