ADC

TELECOMMUNICATIONS

TECHNICAL MANUAL
EXHIBIT IV

(PRELIMINARY)

BTS-7010

FREQUENCY AGILE
QAM UPCONVERTER

REV: 0

102 Rahway Road
McMurray, PA 15317 USA
Phone 412-941-1500
FAX 412-941-9421

SYSTEM DESCRIPTION

The Frequency Agile QAM Upconverter (Wavecom Electronics Inc. MA4040D) is a commercial quality IF upconverter designed for cable, MMDS and LMDS applications. The MA4040D upconverter operates from 53 to 857 MHz and maintains a phase noise specification that exceeds the DOCSIS requirements for 64 QAM. The MA4040D is a modular circuit card and operates in a card chassis (MA4002D)with a common power/control module (MA4011D) and can contain up to ten (10) MA4040D independent frequency agile upconverters.

The MA4040D functions as the IF to UHF upconverter component of the BTS-7010 system. The MA4040D inputs the 44 MHz IF from the WMTS and output a 222 – 408 MHz output signal that is fed to the input of the BTS-7010.

Excellence through innovation

FREQUENCY AGILE 256 QAM UPCONVERTER

MA4040D

INSTALLATION AND OPERATION GUIDE FOR SYSTEM OPERATORS

WAVECOM ELECTRONICS INC.

MA4040D Manual; MAN1L0901 REV 13(0104); Approved: D.P.

Specifications subject to change without notice — Printed in Canada

Thank-you for purchasing this product and welcome to WaveCom!

You have chosen an innovative solution from a leading technology design center in the ongoing TV & data delivery revolution.

No doubt you've been thinking that the future of your television delivery system includes new technologies like **Digital TV, Internet Over Cable, Wireless Cable**. **By selecting WaveCom,** you are benefiting from the same design powerhouse that since 1988 has created custom RF and digital products for technology leaders like Nortel Networks, Diva Systems and Cisco Systems.

WaveCom designs and manufactures:

✓Agile CATV Modulators **✓256 QAM Upconverters** **✓Digital Video Modulators**
✓Frequency Translators **✓Spread Spectrum Devices** **✓Off-Air Demodulators**
✓Video-On-Demand Products **✓Wireless Cable MMDS** **✓Wireless Cable LMDS**
✓Frequency Stackers **✓MMDS Transceivers** **✓Satellite Receivers**
and more! Designs to fill the market needs of the CATV industry – both foreign and domestic.

For additional product or corporate information, contact us:

On the web at: www.WaveCom.ca
By sending email to: sales@WaveCom.ca
By telephone: (306) 955-7075
By fax: (306) 955-9919
By snail mail: WaveCom Electronics Inc.
222 Cardinal Cres.
Saskatoon, SK Canada S7L 6H8

WaveCom's Corporate Mandate

is to be a leading worldwide designer and manufacturer of state-of-the-art communications equipment and components. Through the remarkable success of our customers and business partners, WaveCom innovations are achieving this goal.

SAFETY PRECAUTIONS

1. Before installing and operating this equipment, read all Safety, Installation and Operating sections. Retain this manual for future reference.

2. Follow all instructions — Failure to do so may result in damage to the unit or severe personal injury.

3. Servicing should not be attempted by the user. There are no user serviceable parts inside. Refer all servicing to factory qualified personnel.

4. Shock Hazard — An electrical shock hazard exists when the chassis cover is removed as is required to set internal controls. Always disconnect power from the unit before removing the cover.

5. Cleaning — Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

6. **"CAUTION: The WaveCom MA4000D system with the –48 V dc supply option is intended for use only in rack mounted or cabinet installations where the dc supply wiring is protected from access by user personnel and from the outside environment."**

Warning Do not work on the system or connect or disconnect cables during periods of lightning activity.

LES PRÉCAUTIONS DE SÉCURITÉ

1. Avant d'installer ou d'opérer cet équipement, lisez, toutes les sections de sécurités, d'installations et d'opérations. Gardez ce manuel comme source de référence.

2. Suivez toutes instructions - si non, vous risquez d'endommager la machine ou de vous blesser sérieusement.

3. N'essayez, pas de réparer cet équipement vous même. Référez toutes revisions nécessaire au personnel qualifié de la manufacture.

4. Risque de choc - Il y a un risque de décharge électrique qui existe quand la couverture du châssis est enlevée, comme est nécessaire pour ajuster les contrôlcs internes. Il faut toujours couper l'électricité avant d'enlever le couvercle pour faire aucun ajustage.

5. Le nettoyage - n'utilisez pas de nettoyeurs aérosols ou liquides. Utilisez un tissu humide pour nettoyer.

6. "ATTENTION": Le WaveCom MA4000D system qui peut approvisionner le courant continu -48 V, doit être employé seulement dans une étagère montée ou installée dans un cabinet où les fils électriques sont portégés contre les éléments et ne sont pas accessibles aux personnes non-qualifiées.

Attention Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage du foudre.

☛ Important Installation Instructions

INDEX

1.0 GENERAL INFORMATION

1.1 System Overview

The MA4040D is a modular circuit card, designed for use with the WaveCom MA4000D Series. Each MA4002D card chassis with common MA4011D (or MA4012D) power/control module can contain up to 10 - MA4040D independent frequency agile upconverters in a 4U (7") rack mount configuration. In addition to front panel control, each MA4002D chassis is also fully remote controllable via a serial RS232 /RS485 Interface or optional integral SNMP agent.

1.2 Functional Overview

The MA4040D is a fully agile commercial quality IF upconverter for cable, MMDS (Multichannel Multipoint Distribution System) and LMDS (Local Multipoint Distribution System) applications. The MA4040D also allows broadband data products to establish an RF channel and create a virtual bus topology on a coaxial backbone. Advanced design allows a single MA4040D card to cover a frequency band from 53 to 857 MHz, and maintain a phase noise specification that exceeds the DOCSIS requirements for 64/256 QAM. Remarkably low out of band noise performance and low spurious are achieved through high level mixing, a microwave frequency IF and multiple levels of filtering. This advanced, cost effective upconverter offers high performance, flexibility and space efficiency. Redundancy features make it suitable for the most demanding applications.

1.3 Module Features

- High level output, +61 dBmV 53 – 857 MHz
- Front panel selectable output frequency in 12.5 kHz step size
- Digital slope compensation to achieve <$\pm$0.3 dB slope over any channel
- A range of custom IF input frequencies available
- Auto IF AGC automatically corrects for input level changes
- Out-of-band noise performance <-12 dBmV/-30 dBmV/6 MHz
- Excellent in-band noise performance
- User defined soft alarms for IF and RF levels can be enabled from remote control
- RF output mutes when changing output configuration
- High reliability, state-of-the-art design using microstrip MMIC and surface mount technology
- Conservative component derating and 100% burn-in help ensure reliable operation
- Low power consumption
- All local oscillators are frequency synthesized and locked to a common internal high stability reference

1.4 System Features

- Local control via LCD and 4 soft touch push buttons
- Remote control via RS232/RS485/Terminal or optional SNMP
- FLASH memory for easy software updates
- Front panel displays IF and RF power levels
- International internal switching power supply (100 – 240 VAC) (Optional –48 VDC power supply)
- Internal high reliability fan ensures cool operation for long product life
- 1-to-1 Redundancy
- Durable design is reflected in the stainless steel chassis and lexan labels

1.5 Specifications

IF INPUT

IF Frequency (center of the band)	44.00 MHz (optional 36.125 MHz or 43.75 MHz)
Bandwidth	Passband 6 MHz (optional 8 MHz)
Input Level	+25 to +35 dBmV (total power)
Impedance	75 ohm
Return Loss	20 dB
Connector	F type (female)
IF Detector Accuracy 1 dB	
IF attenuator Step Size	0.05 dB typical
IF AGC	(for carrier/digital input) enable/disable

RF OUTPUT

Frequency Range	53 to 857 MHz (band center)
Frequency Step Size 12.5 kHz	
Frequency Accuracy 2 ppm	
Frequency Response (any 5 MHz band)	±0.3 dB
Frequency Response (any 7 MHz band)	±0.4 dB (for wide band options)
Group Delay (any 5 MHz band)	15 nsec p-p max (8 nsec typ)
Output Level	+61 dBmV max.
Output Level Step Size	0.05 dB typical
RF Detector Accuracy	±1.0 dB typical
Gain Control Range	+45 to +61 dBmV
Impedance	75 ohm
Return Loss (inband) 16 dB	
Connector	F type
RF Monitor Point (calibrated)	20 dB ± 0.5 dB
Spurious (50 MHz to 950 MHz)	-60 dBc (70 dBc typ)
Phase Noise	
1 to 10 kHz (double side band noise power)	-37 dBc (-40 dBc typ)
10 to 50 kHz (double side band noise power)	-54 dBc (-57 dBc typ)
50 kHz to 3 MHz (double side band noise power)	-53 dBc (-55 dBc typ)
10 kHz Offset (SSB)	-95 dBc/Hz @ 10 kHz (99 dBc/Hz typical)
Broadband Noise	
(average noise all Channels outside ± 18 MHz)	-12 dBmV/6 MHz (-15 dBmV/6 MHz typ) -11 dBmV/8 MHz (8 MHz option) -30 dBmV/6 MHz at twice RF frequency
Modulated Adjacent Noise (6 MHz channel)	
± 3 to 3.75 MHz	-58 dBc min (>60 typ)
± 3.75 to 9 MHz	-62 dBc min (>64 typ)
± 9 to 15 MHz	-65 dBc min
Modulated Adjacent Noise (8 MHz channel option)	
± 4 to 5 MHz	-58 dBc min
± 5 to 12 MHz	-61 dBc min
± 12 to 20 MHz	-64 dBc min
Carrier Mute	Automatic upon frequency change
Redundancy switching speed (1 to 1)	50 ms

ELECTRICAL AND MECHANICAL

Remote Control Serial Interface	RS232 or RS485 (software selectable) (Optional SNMP over IEEE802.3 10-Base-T Ethernet)
Connector	Dual RJ45
Power Requirement	100 to 240 VAC, 50 to 60 Hz (MA4011D) Optional –48 VDC (MA4012D)
Power Consumption 400 VA maximum	
Operating Temp	10 to 40◦C (50 to 104◦F)
Mounting	Standard 19” (48.3 cm), 4U (7”) rack space
Dimensions (MA4002D Chassis)	19” (w) x 14.25” (d) x 7” (h) (48.3 x 36.2 x 13.2cm)
Shipping Weight	
MA4002D Chassis with MA4011D P/C Module	18 lbs. (8.2 kg)
MA4040D Upconverter card (each)	1.2 lb. (0.6 kg)
F Connectors	ANSI SP 406-1998

INTERFACE

Power	+10.3 V @ < 1A +5V @ < 200 mA +24V @ < 400mA
Communication	I^2C

POWER/CONTROL MODULE (MA4011D AND/OR MA4012D)

Internal Output Power	+12V/+5V/+24V
Internal Communication Bus	I^2C
Internal Reference (10 MHz)	2 ppm
Remote Control	RS232 or RS485 (software selectable) (Optional SNMP)
Connector	Dual RJ45
Power Requirements	100 to 240 VAC, 50 to 60 Hz (MA4011D) -48VDC (MA4012D)
Power Consumption	400 VA max.
Operating Temperature	10 to 40°C (50 to 104°F)
Mounting	Standard 19" (48.3 cm) - 4U (7") rack space
Shipping Weight	5 lbs.

ACCESSORIES

RS232/485 Serial Interface Adapter
MA4000 COMKIT
SNMP Manual (with Option 2S1 only)

OPTIONS

MA4040D
1P1 - Input-Digital 44.00 MHz with 8 MHz Passband
1P2 - Input-Digital 36.125 MHz with 8 MHz Passband
1P4 - 43.75 MHz IF with 8 MHz Passband
1P5 - 44.00 MHz IF with 18 MHz Passband
2H1 - +63 dBmV RF Output
Chassis
8F1 - Front Intake - Fan Tray

Power/Control Module (MA4011D and/or MA4012D)
2S1 - SNMP Proxy Agent and Interface
2R1 - Additional PS4011D (100 to 240 VAC) Power Supply Module
2R2 - Additional PS4012D (-48 VDC) Power Supply Module

Specifications subject to change without notice.

2.0 INSTALLATION

2.1 Unpacking the Unit

Carefully remove the equipment from its packing material and set it on a solid surface, such as a table or desk. If it appears damaged in any way, notify the carrier, and keep all packing materials for inspection by the carrier's agent.

2.2 Operating Environment

The MA4002D chassis includes an active cooling fan tray which forces cooling air from the bottom through to the top of the chassis. (See options (p 8) for selection of front air intake – rear air intake is factory default). **For adequate ventilation**, a space of 1U (1.75") should be left in the rack, directly above the MA4002D chassis for warm air exhaust. It is designed to operate at temperatures ranging from 10 to 40°C (50 to 104°F). As with all electrical equipment, operation at excessive temperature accelerates the deterioration of components. For this reason, measures should be taken to prevent the build up of excessive heat in the rack.

2.3 Power Requirements

The equipment has an international auto-ranging internal power supply which allows it to be powered from any 100 - 240 VAC; 50 - 60 Hz source. The power source should be capable of delivering a minimum of 400 watts per unit.

Check the total current consumption of all equipment on the same line before applying power to the MA4000D system. Avoid sharing an AC source that feeds heavy motors or other equipment, which require large current drains.

2.4 Rack Mounting

The MA4000D system is designed for standard rack mounting in a 19" equipment rack. It requires 4U (7.00") of vertical rack space. It should be installed in a rack allowing access to the back of the unit. The upconverter should be isolated from strong RF radiation emanating from local equipment in the rack. Power line transients that may cause damage to the unit should be avoided.

2.5 MA4040D Upconverter Module Installation/Replacement

1. Power off the chassis using the rear panel AC switch
2. Disconnect the RF cables from the rear of the corresponding module
3. Using a screwdriver, loosen the corresponding front panel captive screws until the module is free to pull forward
4. Insert the replacement module and retighten the front panel captive screws
5. Turn on the AC power switch
6. Reconnect the rear panel RF cables
7. Configure the output frequency, IF level, and RF level

2.6 MA4012D -48 VDC Redundant Power Supply Module Installation/Replacement

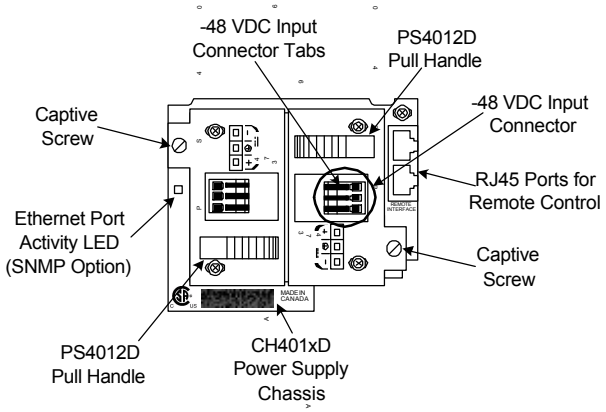
Caution! To avoid energy hazard from arcing, etc. from the 48v supply lines, the module being "hot swapped" must be powered down before removal. Separate switches for each module supply line are recommended.

Attention! Il est fortement recommande d'installer un interrupteur pour chaque fil electrique de 48v qui se rend aux modules afin d'eviter la formation d'une etincelle pendant le replacement d'un module

Achtung! zu vermeidet Energie Gefahr von Elektrodenüberschlag, usw. von die 48 Volt Versorgung Linien, der Modul wird ersetzt muß geschaltet werden ab vor Ersetzen. Getrennte Schalter für jede Modul Versorgung Linie werden für Sicherheit empfohlen.

1. Lift the tabs on the -48Vdc input connector to release the power wires. Then pull the power wires out of the connector.
2. Using a flat head screwdriver, disconnect the PS4012D module from the power supply chassis by unscrewing the captive screw on the back of the module.
3. Grip the handle of the PS4012D module and pull it out of the power supply chassis using your other hand to support the middle of the module as it slides out.
4. Replace with a new PS4012D module by reversing steps 3 through 1.

DIAGRAM 2.6A: MA4012D – DETAILED REAR PANEL



2.7 MA4011D 110/240 VAC Redundant Power Supply Module Installation/Replacement

Caution!

To avoid electrical shock hazard, disconnect power to the module being "hot swapped" before removal.

Do not reach into the open bay when module is removed.

Replacement of power supply modules must be performed by qualified service personnel only.

Attention!

Le remplacement de modules de l'alimentation électrique doit être réservé au personnel de l'entretien qualifié.

Pour éviter le danger du choc électrique, veuillez couper le courant du module à échanger avant de l'enlever.

Ne touchez pas le renforcement ouvert lorsque le module est enlevé.

Vorsicht!

Die Netzgerätbaugruppe darf nur von qualifiziertem Service-Personal ausgetauscht werden.

Zur Vermeidung eines Elektroschocks muß die Stromzuführung immer abgeschaltet werden, bevor die Netzgerätbaugruppe herausgenommen wird.

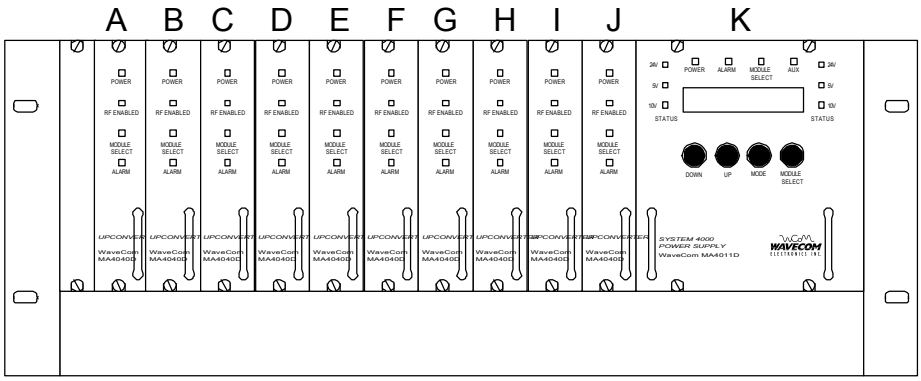
Nach der Herausnahme der Netzgerätbaugruppe nicht in den Hohlraum greifen.

1. Pull the ac line cord out of the power entry module on the PS4011D module to be swapped.
2. Using a flat head screwdriver, disconnect the PS4011D module from the power supply chassis by unscrewing the captive screw on the back of the module.
3. Grip the handle of the PS4011D module and pull it out of the power supply chassis using your other hand to support the middle of the module as it slides out.
4. Replace with a new PS4011D module by reversing steps 3 through 1.

3.0 OPERATION

3.1 Front Panel Description

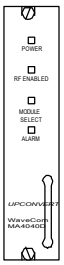
DIAGRAM 3.1A:FRONT PANEL - MA4000D SYSTEM



As shown in Diagram 3.1A, the power/control module front panel has an LCD display, four soft touch push buttons, and 4 indicator LEDs. All other modules have 4 indicator LEDs. Modules are configured using both the LCD display and push buttons on the power supply module, or via the remote interface. If no configuration adjustments are being made via the front panel controls, the display back light will shut off after a five minute time out. Pressing any of the front panel buttons will re-enable the back light.

3.1.1 MA4040D

DIAGRAM 3.1B: FRONT PANEL - MA4040D UPCONVERTER MODULE



POWER ON LED

When the green POWER ON indicator is illuminated, the module has been correctly installed and powered on.

RF ENABLED LED

When the green RF ENABLED indicator is illuminated, the internal output circuitry is enabled to provide an RF output. The RF ENABLED indicator does not necessarily indicate the presence of an output, it only reflects that the module is capable of an RF output if an IF input is applied and the levels configured.

MODULE SELECT LED

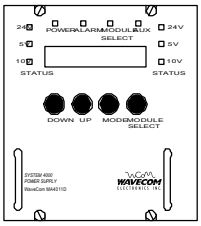
When the green MODULE SELECT indicator is illuminated, it indicates that the corresponding module has been selected from the front panel or via the remote control interface.

ALARM LED

The red MA4040D ALARM indicator has two modes. A flashing Alarm LED indicates a non-critical alarm condition (i.e. soft alarm). A constant Alarm LED indicates a critical alarm condition (i.e. hard alarm). Detailed alarm information is available by selecting the corresponding module from the front panel and observing the status and error codes on the LCD display.

3.1.2 MA4011D (or MA4012D) Power/Control Module

DIAGRAM 3.1C : FRONT PANEL - MA4011D POWER SUPPLY



☛ The MA4011D and the MA4012D power supplies have the same front panel functions and displays. Diagram 3.1C represents both the MA4011D and the MA4012D.

DISPLAY

The first line on the display is the Mode Information Line. It shows the settings for the currently selected mode. The possible operating modes depend upon the currently selected module. (See Section 3.2, Front Panel Operating Modes (pp 14, 15) for a detailed description of the available modes).

The second line on the display is the Status Information Line. The Status Line is divided as follows:

The two leftmost characters are “mX” where X is replaced by the currently selected module address. Looking at the front of the MA4000D system, the module addresses are assigned starting with module A in the leftmost slot in the chassis and module K in the Power Supply. The modules in between are lettered B through J. (As shown in Diagram 3.1A (p 12)). Modules can be installed in any open slot, and not all slots need to be filled.

The next two characters are “sXX” where “XX” indicate the status code for the currently selected module. Refer to Section 5.0, Status Codes (pp 23, 24) for a list of current status codes.

The next two characters are “eXX” where “XX” indicates the error code for the currently selected module. (This code is only displayed when it is non-zero). Refer to Section 6.0, Error Codes (pp 25, 26) for the list of current error codes.

The final three or four characters of the second line can display the following information:

- When under Remote Control and local control is disabled, it will read “RMT”
- When under Local Control and a MA4040x card is selected, it will display the current firmware revision of the MA4040x card (ex “r118”)
- When under Local Control and a module other than a MA4040x is selected, this area will be blank

MODULE SELECT BUTTON

The MODULE SELECT button allows the user to select the module to display and/or control (the MODULE SELECT LED will be lit on the selected module, and the LCD display will indicate the module address in the status line).

MODE BUTTON

The MODE button allows the user to cycle through each of the various modes for the selected module.

UP/DOWN BUTTONS

The UP/DOWN arrow buttons adjust the settings for the currently selected mode.

POWER ON LED

When the green POWER ON indicator is illuminated, the module has been correctly installed and powered on.

ALARM LED

A constant Alarm LED on the MA4011D indicates a critical alarm condition. Detailed alarm information is available by selecting the module from the front panel and observing the status and error codes on the LCD display.

MODULE SELECT LED

When the green MODULE SELECT indicator is illuminated, it indicates that the corresponding module has been selected from the front panel or via the remote control interface.

AUX LED

This LED is reserved for future use.

3.2 Front Panel Operating Modes

3.2.1 MA4040D Upconverter Modes

FREQUENCY

When this mode is selected, the display will read : **Frq XXX.XXXX MHz**

The displayed frequency is the current configured Output Frequency. To adjust the output frequency, use the UP/DOWN arrow buttons. Single stepping will allow 12.5 kHz adjustment, while holding the buttons depressed will change the frequency more quickly.

☛ The displayed frequency represents the center of the band.

☛ During frequency change, the output is muted and the RF ENABLED indicator is turned off for 5 seconds to avoid undesirable interference.

AUTO IF

When this mode is selected, the display will read: **IF AGC Enabled**

or

IF AGC Disabled

Pressing the UP/DOWN buttons will toggle the display between Enabled and Disabled. When enabled, the MA4040D will automatically optimize the IF level and ensure it is within a pre-set threshold range (default ±0.5 dB). When disabled, the IF level can be manually adjusted as described in the next section.

☛ The Auto IF mode should only be used for continuous IF inputs (non-bursty).

☛ The Auto IF mode should be used for proper operation in redundant mode.

☛ If the IF level is not within ±4.0 dBmV of the optimum level during Auto IF mode, the output will be muted to avoid undesirable interference, and the Alarm LED will be on.

☛ At the time of shipping, the AUTO IF is enabled.

☛ Because the IF AGC has been optimized for digital QAM signals, it is recommended that AUTO IF is disabled for analog signals.

IF LEVEL ADJUST

When this mode is selected, the display will read: **IFPwr ±XX.X dB**

The display indicates the approximate IF power level measured at the internal IF power detector. To adjust the IF level, use the UP/DOWN arrow buttons. To configure the MA4040D Upconverter for optimum performance, the IF level should be adjusted to read approximately 0.0 dB (-0.5 to +0.5). An IF level less than 0 dB will degrade noise performance and a level above 0 dB will promote intermodulation products.

☛ The IF level can only be adjusted if the Auto IF mode is disabled.

RF OUTPUT LEVEL ADJUST

When this mode is selected, the display will read: **RFPwr XX.X dBmV**

The display indicates the approximate RF output power level measured by the internal RF power detector. To adjust the RF level, use the UP/DOWN arrow buttons. The RF output level may be set within the range of 45 dBmV - 61 dBmV.

☛ Ensure that the IF level is correctly set before adjusting the RF level.

OUTPUT ENABLE/DISABLE

When this mode is selected, the display will read: **Output Enabled**

or

Output Disabled

Pressing the UP/DOWN buttons will toggle the display between Enabled and Disabled. When enabled, the RF output from the MA4040D Upconverter is enabled. When disabled, the RF output from the MA4040D Upconverter is disabled.

☛ An RF output is only present when there is a valid IF input configured as described in the previous sections. This means that at the time of shipping, the output is disabled until a valid input is applied.

REDUNDANCY ON/OFF

The redundancy feature can be turned ON or OFF by pressing the UP/DOWN Buttons. Refer to Section 3.9, Procedure for Using the MA4040D Redundancy Feature (p 19) for more details.

At time of shipping, Redundancy is **OFF**.

IF AND RF ALARM THRESHOLD SETTING

The IF and RF alarm threshold can be configured by the user via remote control.

Default settings are as follows: **IF** **+4, -4 dB, alarm function enabled**

RF **+62, +48 dBmV, alarm function enabled**

The IF and RF alarms can be independently enabled or disabled via remote control. Refer to Section 7.5, Detailed Command Descriptions and System Responses (pp 30 to 34) for instructions on how to adjust these settings.

DEFAULT SETTINGS

At the time of shipping from factory, the default settings of the MA4040D are:

AUTO IF enabled

IF & RF Threshold enabled

Output is disabled (until a valid input is supplied)

The default status code at the time of shipping is s0E. Once a valid input is applied, this status will change.

3.2.2 MA4011D (and/or MA4012D) Power/Control Module Modes

ADDRESS

When this mode is selected, the display will read: **Address XXX**

☛ The displayed address is the currently selected MA4002D Chassis Address. A different address can be selected by pressing the UP/DOWN buttons. The MA4002D chassis has an address from 001 - 999. The address is only used for remote control and monitoring purposes. The factory default address is 999.

RS232/RS485/TERMINL SELECT

When this mode is selected, the display will read: **RS232 Selected**

or

RS485 Selected

or

Terminl Selected

Pressing the UP/DOWN buttons will toggle the display between RS232, RS485 and Terminal.

☛ The Remote Interface Connector Pinout will change depending upon the Interface Type selected. Please refer to Section 4.2, Power/Control Module Rear Panel Connection (pp 21, 22) for details.

☛ When the SNMP option is installed, the user can also select the SNMP Interface in this mode.

3.3 Remote Control Operating Instructions

The MA4000 system may be controlled via the RS232/RS485 Remote Interface connector. (Refer to Section 4.2, Power/Control Module Rear Panel Connections (pp 21, 22) for the connector pin-out).

The input data rate can be 9600, 14400, or 28800 baud. The system controller will automatically determine which data rate is in use and adjust accordingly. There are no user settings relating to baud rate selection.
For additional information refer to Section 7.0, Detailed Remote Control (pp 27 to 34).

3.4 Remote Control Using Terminal Mode

This mode allows the MA4040D to be controlled using a standard terminal (or terminal emulation) program. In order to use this mode, the following information is required:

- Terminal mode must be selected from the front panel on the power supply. 1) Press the Module Select button until Module K is selected. 2) Press the Mode button until the Remote Interface type is selected (RS-232, RS-485). 3) Press Up or Down until TerminI Selected is displayed on the screen.
- The MA4011D does not provide a prompt and will only send a response when a command has been received.
- Local Echo should be enabled for the terminal (the Communications/Control Module will not echo the characters). (NOTE: If Windows 98 is being used, the local echo feature in Hyperterminal may not work. This issue is documented in the Microsoft Knowledgebase. For more information send an e-mail to mshelp@microsoft.com with Q192456 in the subject line).
- The terminal type can be TTY or VT100 or similar.
- CR -> CR/LF mapping should be disabled for both inbound and outbound traffic
- The only special characters that are implemented are carriage return (0x0D, ^M), linefeed (0x0A, ^J), and destructive backspace (0x08, ^H). All other characters are processed as part of the message.

The command syntax is as shown in Section 7.0,Remote Control (pp 27 to 34) with the following modifications:

- Commands should not have an initial asterisk
- The CRC ignored
- The maximum message length is 49 characters
- All commands are parsed from left to right. Only the first command on a line is processed, any additional characters are ignored

3.5 Remote Control Using Terminal Mode over a standard phone modem

It is possible to use the terminal mode to remote control the MA4000 system over a modem connection. The information in Section 3.4, Remote Control Using Terminal Mode (p 17) still applies to this configuration; however, there are two additional requirements:

1) The modem that is connected to the MA4002D chassis MUST be configured so that it's serial port (DTE) is locked at 9600 baud. Additional settings are hardware flow control (RTS/CTS), 8N1 data, auto-answer, no dial-out.

2) There are no special requirements for the modem that is connected to the PC used for remote control.

Note: This was tested with a US Robotics Sportster 33.6 external fax modem. Other modems in the US Robotics Courier or Sportster lines will also work. A set of general configuration instructions for a US Robotics Courier or Sportster modem can be found at:http://www.usr.com/modem/documents/10563.htm

Modems other than the specific ones mentioned may not support this configuration. If in doubt, consult with your modem vendor.

3.6 Remote Control Via SNMP

When the SNMP option is installed, the MA4011D (or MA4012D) Power/Control Module Mode will vary slightly as follows:

RS232/RS485//TERMINAL/SNMP SELECT

When this mode is selected, the display will read: **RS232 Selected**

Or

RS485 Selected

Or

Terminl Selected

Or

SNMP Selected

Pressing the UP/DOWN button will toggle the display between RS232, RS485, Terminal, and SNMP.

Refer to the SNMP Manual for more information regarding SNMP Operation.

3.7 FLASH Upgrade

The Flash Utility for upgrading the firmware on the Power Supply/Controller and the Upconverter Module is included in the Demonstration Software. For more information, refer to Appendix C – Remote Access Software Installation & Utility Instructions.

3.8 Demonstration Software

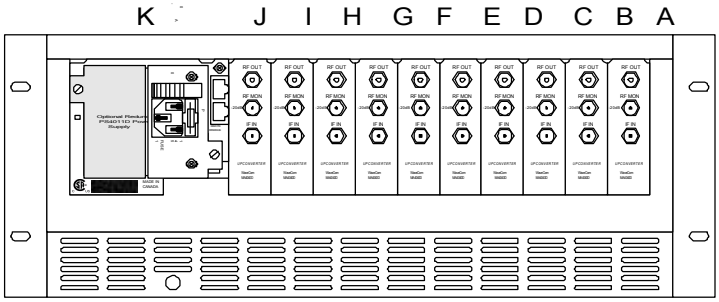
WaveCom has written a demonstration program for use with WaveCom products. This software is not required to operate the unit; however, it is designed to make remote control easier for the user. The Demonstration software is available as an option when ordering the product (Option SW4000), or it can be downloaded free of charge from the WaveCom Electronics technical support page at www.WaveCom.ca.

The software contains commands and controls for the Upconverters, Power Supply/Control Module, and the QAM Modulators. The Flash Utility for upgrading the Upconverters, and the Power Supply/Control Module is also included in the Demonstration Software.

Refer to Appendix C – Remote Access Software Installation & Utility Software for more detailed instructions on installing and using the Demonstration Software.

3.9 Procedure for Using the MA4040D Redundancy Feature

DIAGRAM 3.9: REDUNDANCY PAIRS



1. One-to-One redundancy works on the MA4040D modules in pairs. The available MA4040D pairs are A/B, C/D, E/F, G/H, I/J only. Any combination of one or more pairs can be configured for redundancy at any time.

2. In order to configure a module pair for redundancy, the following steps should be taken:

- Disable redundant mode on both modules in the pair to be configured. This is accomplished by sending the Redundant Mode Disable 'BD' command to either one of the modules in the pair or by selecting Redundant Off from the front panel.
- Connect the IF input cables.
- Configure both modules in the pair for the desired frequencies and levels etc.
- Enable redundant mode by sending the Redundant Mode Enable 'BE' command to either one of the modules in the pair or by selecting Redundant ON from the front panel.
- Enable IF AGC by sending the IF AGC Enable 'IAE' command to both modules or by selecting IF AGC Enabled from the front panel.

3. When configuring Module pairs for redundancy, send the Redundant Mode Enable 'BE' command to the desired active module or select Redundant ON from the front of the module that is to be the active output module. The second module in the pair automatically becomes the back-up (RF disabled).

4. Once the modules have been set up for redundancy mode, to switch the active module send the Redundant Mode Enable 'BE' command to the desired active module or select Redundant ON from the front of the module that is to be the active output module. The second module in the pair automatically becomes the back-up (RF disabled).

5. Sending the Redundant Mode Disable 'BD' command to either one of the modules in the pair or by selecting Redundant OFF from the front panel will disable redundancy on both modules in the pair.

6. In the event of a failure of the Active Module, it will disable its RF output and notify the Backup Module to become Active. When notified, the Backup Module will enable its RF output. This 'fail-over' will take less than 50 ms. It is then possible to determine what caused the failure using the failed Module Alarm LEDs and the corresponding front panel error code.

7. Once an alarm condition has occurred on a module that has the redundant mode enabled, the alarm will be locked on. In this state, the alarm must be manually cleared by replacing the card, or disabling and then re-enabling the redundant mode. It is possible to tell when the alarms have been 'locked' from the front panel display. When redundancy is OFF, the front panel will read, Redundant Off. When redundancy is on, the front panel will read "Redundant On". When alarms have been locked, the front panel will read "RdndntOn/AlrmLck".

8. In the event that a Redundant Pair switches to the Backup Module, the failed (formerly Active) Module is disabled. This module will remain disabled until it is either swapped for a new module, or it is reconfigured by a user. In order to configure a replacement module in a redundant pair, the following steps should be taken:

a) Disable Redundant Mode for either of the modules in the pair (this disables redundant mode for both cards).

b) If you have replaced the failed module connect the IF input cable .

c) Configure the module for the desired frequency and levels, etc.

d) Enable redundant mode on the module you wish to be the active (Output Enabled), the other module in the pair automatically becomes the backup (Output disabled).

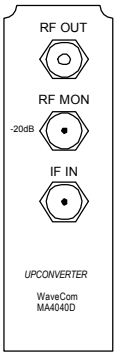
☛ One-for-One Redundancy can only be used in pairs of MA4040D cards. It is not compatible with A, B, or C

versions of the MA4040.

4.0 REAR PANEL CONNECTIONS

4.1 MA4040D

DIAGRAM 4.1A: REAR PANEL –MA4040D UPCONVERTER MODULE



RF OUT

The RF out F connector provides the RF output signal from 53 to 857 MHz with a level of 45 to 61 dBmV. The impedance is 75 ohm.

RF MON

The RF Monitor F connector provides a means of checking the RF output without disconnecting it from service. The RF Monitor will provide an output 20 dB down from the RF output. The test cable length (and return loss) should be kept to a minimum to maintain the 20 dB coupling accuracy.

IF IN

The IF Input F connector accepts an input signal at 44 MHz with up to a 6 MHz bandwidth from a 75 ohm source. The level should be from 25 to 35 dBmV.

4.2 MA4011D (and/or MA4012D) Power/Control Module

DIAGRAM 4.2A: REAR PANEL –MA4011D POWER/CONTROL MODULE

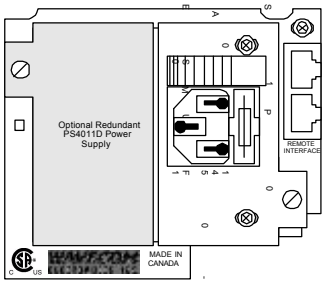
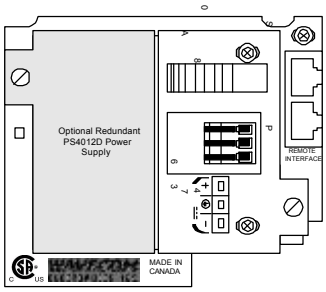


DIAGRAM 4.2B: REAR PANEL –MA4012D POWER/CONTROL MODULE



AC INPUT **(Only on MA4011D 110-240 VAC Power/control module, as shown in Diagram 4.2A)**

The AC input accepts input voltages from 100 - 240 VAC. The fuse is internal to the IEC holder. If the fuse requires replacement, ensure the voltage and current rating is correct. The AC power switch may be used for turning the power on and off to the entire chassis.

DC INPUT **(Only on MA4012D -48 VDC Power/control module, as shown in Diagram 4.2B)**

The DC input accepts voltages from 36 to 60 VDC. There are three terminal strip connectors. Each connector is labeled. Use care in matching the correct attaching wires to each terminal strip connector. It is recommended that all three terminal strips, including the chassis ground, be connected prior to system use. The power entry assembly also contains an integral fuse holder. The fuse rating appears on the label beneath the assembly. If the fuse requires replacement, ensure the voltage and current rating is correct.

ALARM

This connector is reserved for future use.

REMOTE INTERFACE

The Remote Interface connector is a dual RJ45. Both sockets in the connector are identical. The pin-out for the matching RJ45 plug is shown in the following table and diagram:

DIAGRAM 4.2C : DUAL RJ45 INTERFACE CONNECTOR

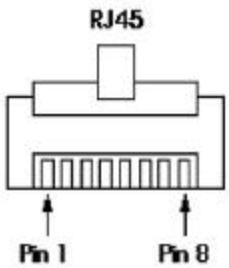


TABLE 4.2A : RS232 PIN-OUT

Terminal				Upconverter
RJ45 Pin	**Signal**	**Direction**	**Signal**	**RJ45 Pin**
1	CTS	←	CTS	1
2	DSR	←	DSR	2
3	RXD	←	TXD	3
4	RXD/GND	—	RXD/GND	4
5	TXD/GND	—	TXD/GND	5
6	TXD	→	RXD	6
7	DTR	→	DTR	7
8	RTS	→	RTS	8

☛ **Note:** The above pin-out allows a straight through RJ45 cable to be used for connection between the terminal and the MA4002D chassis. It is also possible to use an RJ45 - DB25 adapter to connect to a PC or similar RS232 standard serial port.

TABLE 4.2B: RS485 PIN-OUT

Terminal				Upconverter
RJ45 Pin	**Signal**	**Direction**	**Signal**	**RJ45 Pin**
1	NC		NC	1
2	NC		NC	2
3	A	↔	A	3
4	GND	—	GND	4
5	GND	—	GND	5
6	B	↔	B	6
7	NC		NC	7
8	NC		NC	8

☛ **Note:** The above pin-out allows connection to an RS485 communications bus. If desired, an RS485 - RS232 converter and an RJ45 - DB25 adapter can be used to connect to a PC or similar RS232 serial port.

ETHERNET LINK LED

This LED is only present when SNMP (Option 2S1) is installed at the factory.

When the Ethernet Link LED is lit, the unit has been successfully connected to an Ethernet Hub. When the LED is not lit, there is no connection between the unit and an Ethernet Hub.

5.0 STATUS CODES

5.1 MA4040D Status Codes

The status code is displayed on line 2 of the LCD display. It consists of an 's' character followed by a 2 digit hexadecimal number. The following tables can be used to interpret the meaning of the digits.

TABLE 5.1A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Backup Relay Enabled	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 5.1B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Output is disabled
2	IF AGC is enabled
3	IF AGC is enabled, Output is disabled
4	IF Threshold Detection is enabled
5	IF Threshold Detection is enabled, Output is disabled
6	IF Threshold Detection is enabled, IF AGC is enabled
7	IF Threshold Detection is enabled, IF AGC is enabled, Output is disabled
8	RF Threshold Detection is enabled
9	RF Threshold Detection is enabled, Output is disabled
A	RF Threshold Detection is enabled, IF AGC is enabled
B	RF Threshold Detection is enabled, IF AGC is enabled, Output is disabled
C	RF Threshold Detection is enabled, IF Threshold Detection is enabled
D	RF Threshold Detection is enabled, IF Threshold Detection is enabled, Output is disabled
E	RF Threshold Detection is enabled, IF Threshold Detection is enabled, IF AGC is enabled
F	RF Threshold Detection is enabled, IF Threshold Detection is enabled, IF AGC is enabled, Output is disabled

5.2 MA4011D (or MA4012D) Power/Control Module Status Codes

The status code is displayed on line 2 of the LCD display. It consists of an 's' character followed by a 2 digit hexadecimal number. The following tables can be used to interpret the meaning of the digits.

TABLE 5.2A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Reserved	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 5.2B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Local Control Locked Out	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

6.0 ERROR CODES

6.1 MA4040D Error Codes

When the error code is non-zero, it is displayed on line 2 of the LCD display. It consists of an 'e' character followed by a 2 digit hexadecimal number. The following table can be used to interpret the meaning of the digits.

TABLE 6.1A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Fixed LO Error
2	IF AGC Error
3	IF AGC Error, Fixed LO Error
4	IF Threshold Error
5	IF Threshold Error, Fixed LO Error
6	IF Threshold Error, IF AGC Error
7	IF Threshold Error, Fixed LO Error
8	RF Threshold Error
9	RF Threshold Error, Fixed LO Error
A	RF Threshold Error, IF AGC Error
B	RF Threshold Error, IF AGC Error, Fixed LO Error
C	RF Threshold Error, IF Threshold Error
D	RF Threshold Error, IF Threshold Error, Fixed LO Error
E	RF Threshold Error, IF Threshold Error, IF AGC Error
F	RF Threshold Error, IF Threshold Error, IF AGC Error, Fixed LO Error

TABLE 6.1B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Output is Muted
2	Hard Alarm condition
3	Hard Alarm condition, Output is Muted
4	Soft Alarm condition
5	Soft Alarm condition, Output is Muted
6	Soft Alarm condition, Hard Alarm condition
7	Soft Alarm condition, Hard Alarm condition, Output is Muted
8	Variable LO Error
9	Variable LO Error, Output is Muted
A	Variable LO Error, Hard Alarm condition
B	Variable LO error, Hard Alarm condition, Output is Muted
C	Variable LO Error, Soft Alarm condition
D	Variable LO Error, Soft Alarm condition, Output is Muted
E	Variable LO Error, Soft Alarm condition, Hard Alarm condition
F	Variable LO Error, Soft Alarm condition, Hard Alarm condition, Output is Muted

6.2 MA4011D (or MA4012D) Power/Control Module Error Codes

When the error code is non-zero, it is displayed on line 2 of the LCD display. It consists of an 'e' character followed by a 2 digit hexadecimal number. The following table can be used to interpret the meaning of the digits.

TABLE 6.2A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	5 Volt Supply Under voltage	9	Reserved
2	Reserved	A	Reserved
3	Reserved	B	Reserved
4	Reserved	C	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 6.2B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Hard Alarm condition
2	Reserved
3	Reserved
4	Reserved
5	24 Volt Supply Under voltage, Hard Alarm
6	Reserved
7	Reserved
8	Reserved
9	10 Volt Supply Under voltage, Hard Alarm
A	Reserved
B	Reserved
C	Reserved
D	10 Volt Supply Under voltage, 24 Volt Supply Under voltage, Hard Alarm
E	Reserved
F	Reserved

7.0 DETAILED REMOTE CONTROL

7.1 Operation

The Multi Agile System may be controlled via the RS232/RS485 Remote Interface connector. (See Section 4.2, Power/Control Module Rear Panel Connections (pp 21, 22) for the connector pin-out).

The input data rate can be 9600, 14400, or 28800 baud. The system controller will automatically determine which data rate is in use and adjust accordingly. There are no user settings relating to baud rate selection.

7.2 Message Format

All messages to the system controller consist of a sequence of ASCII characters. Messages must meet the following guidelines in order to be correctly interpreted by the system controller.

- There can be no more than 75 ms between consecutive message bytes.
- After receiving the entire message, the system controller will require approximately 200 ms to process and respond to the message.
- Only one message can be processed at a time, consequently the user must wait for a reply before sending a new message.
- Commands sent to an invalid chassis address will be discarded without a response.

7.3 Command Structure

The command structure consists of a sequence of ASCII characters terminated by a carriage return. All ASCII characters are case-insensitive unless otherwise indicated. Commands are to be in one of the following two general formats:

<start>ADD<sp>MOD<sp>CC<sp>CRC<cr>

or

<start>ADD<sp>MOD<sp>CC<sp>PARM<sp>CRC<cr>

<start> ASCII Asterisk character

<sp> ASCII Space character

<cr> ASCII Carriage Return character

ADD = Address (3 ASCII characters)

Addresses are 3 digit numbers. Three digits (including leading zeros) are required to correctly define an address.

MOD = Module (1 ASCII character)

A = Module A (Leftmost module)

B = Module B

.

.

J = Module J (Next to Power Control Module)

CC = Command Code (2 or 3 ASCII characters)

FL = Load Frequency	IAS = Set IF AGC Threshold	RTE = Enable RF Threshold
AI = Set IF Attenuation	IAE = Enable IF AGC Threshold	RTD = Disable RF Threshold
AR = Set RF Attenuation	IAD = Disable IF AGC Threshold	SU = Unit Status Request
OE = Enable Output	ITS = Set IF Threshold	SC = Configuration Status Request
OD = Disable Output	ITE = Enable IF Threshold	LE = Enable Local Control
BE = Backup Relay Enable	ITD = Disable IF Threshold	LD = Disable Local Control
BD = Backup Relay Disable	RTS = Set RF Threshold	

CRC = CRC-16 checksum (3 characters)

The checksum is preferred, but not required. If the checksum is used, the first character is an ASCII "V" followed by the low and high bytes respectively of the computed CRC 16 checksum (the checksum characters are not necessarily ASCII). The checksum is to be computed on all characters after the initial <start> character up to, and including, the first "V" character in the CRC section. If the checksum is not used, the 3 characters should be ASCII "NNN" (they must be uppercase).

PARM is one or more characters, and is command specific.

☛ The command syntax for **Terminal Mode** is the same as above with the following modifications:

1) Commands should not have an initial asterisk

2) The CRC is ignored

3) The maximum length is 49 characters

4) All commands are parsed from left to right. Only the first command on a line is processed, any additional characters are ignored.

7.4 Response Structure

The response structure will consist of a sequence of ASCII characters, terminated by a carriage return. Responses will be in one of the two following general formats:

<start>ADD<sp>R<sp>RC<sp>CRC<cr>

or

<start>ADD<sp>R<sp>RC<sp>PARM<sp>CRC<cr>

There will be one response returned for all commands.

<start> ASCII Asterisk character

<sp> ASCII Space character

<cr> ASCII Carriage Return character

ADD = Address (3 characters)

The address of the unit that is responding to the command.

R = ASCII “R” character (1 character)

Indicates that this is a response to a previous message.

RC = Response Code (3 characters)

OK = Command Accepted

MOD = Command Denied because the addressed module is invalid

ERR = Command Denied because of Syntax Error

CRC = Command Denied because of CRC-16 error

CRC = CRC-16 checksum (3 characters)

The response checksum is always valid. The first character will be an ASCII “V” followed by the low and high bytes respectively of the computed CRC 16 checksum (the checksum characters are not necessarily ASCII). The checksum will be computed on all characters after the initial <start> character up to, and including, the first “V” character in the CRC section.

PARM is one or more characters, and is command specific.

7.5 Detailed Command Descriptions and System Responses

This section defines each of the command codes and the associated parameters.

FL - Load Frequency

Description: Loads the frequency for the specified module.

Parameters: Desired frequency in MHz, in the form XXX.XXXX. Leading zeros are optional, but not required. The decimal point and four trailing characters are required. Valid input frequencies are between 53.0000 MHz and 857.0000 MHz. Valid trailing characters are multiples of 0.0125 MHz, all others will be denied.

Example: *999<sp>A<sp>FL<sp>800.0625<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

AI - Set IF Attenuation

Description: Sets the IF attenuation for the specified module.

Parameters: Desired IF attenuation in dB, in the form XX.XX. Leading zeros are optional, but not required. The decimal point and two trailing characters are required. Valid attenuation values are between 0 dB and 31.75 dB in 0.25 dB steps. Valid trailing characters are 00, 25, 50 or 75.

Example: *999<sp>A<sp>AI<sp>10.50<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

AR - Set RF Attenuation

Description: Sets the RF attenuation for the specified module.

Parameters: Desired RF output attenuation in dB, in the form XX.XX. Leading zeros are optional, but not required. The decimal point and two trailing characters are required. Valid attenuation values are between 0 dB and 31.75 dB in 0.25 dB steps. Valid trailing characters are 00, 25, 50 or 75.

Example: *999<sp>A<sp>AR<sp>4.25<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

ITS - Set IF Threshold

Description: Sets the IF thresholds for the specified module.

Parameters: Desired IF thresholds in dB, in the form X.X<sp>-X.X. Leading zeros are optional, but not required. The decimal point and trailing character is required. The first parameter is the positive threshold and can range between 4.0 and 0.0 dB. The second parameter is the negative threshold and can range between 0.0 and -4.0 dB. The trailing character can range between 0.0 and 0.9.

Example: *999<sp>A<sp>ITS<sp>1.5<sp>-1.5<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

ITE - Enable IF Threshold

Description: Enables IF Threshold detection for the specified module.

Parameters: None

Example: *999<sp>A<sp>ITE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

ITD - Disable IF Threshold

Description: Disables IF Threshold detection for the specified module.

Parameters: None

Example: *999<sp>A<sp>ITD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

IAS - Set Auto IF Threshold

Description: Sets the Auto IF Thresholds for the specified module.

Parameters: Desired IF thresholds in dB, in the form X.X<sp>-X.X. Leading zeros are optional, but not required. The decimal point and trailing character is required. The first parameter is the positive threshold and can range between 4.0 and 0.0 dB. The second parameter is the negative threshold and can range between 0.0 and -4.0 dB. The trailing character can range between 0.0 and 0.9.

Example: *999<sp>A<sp>IAS<sp>1.5<sp>-1.5<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

IAE - Enable Auto IF

Description: Enables Auto IF Mode for the specified module.

Parameters: None

Example: *999<sp>A<sp>IAE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

IAD - Disable Auto IF

Description: Disables Auto IF Mode for the specified module.

Parameters: None

Example: *999<sp>A<sp>IAD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

RTS - Set RF Threshold

Description: Sets the RF Thresholds for the specified module.

Parameters: Desired RF thresholds in dBmV, in the form XX.X<sp>XX.X. Leading zeros are optional, but not required. The decimal point and trailing character is required. The first parameter indicates the high threshold, and the second indicates the low threshold. The trailing character can range between 0.0 and 0.9.

Example: *999<sp>A<sp>RTS<sp>60.0<sp>50.0<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

RTE - Enable RF Threshold

Description: Enables RF Threshold detection for the specified module.

Parameters: None

Example: *999<sp>A<sp>RTE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

RTD - Disable RF Threshold

Description: Disables RF Threshold detection for the specified module.

Parameters: None

Example: *999<sp>A<sp>RTD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

OE - Enable Output

Description: Turns on the Output from the specified module.

Parameters: None

Example: *999<sp>A<sp>OE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

OD - Disable Output

Description: Turns off the Output from the specified module.

Parameters: None

Example: *999<sp>A<sp>OD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

BE - Backup Relay Enable

Description: Enables the backup relay on the specified module. This allows the IF input to the card to be switched to a redundant card in the event of module failure.

Parameters: None

Example: *999<sp>A<sp>BE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

BD - Backup Relay Disable

Description: Disables the backup relay on the specified module. This returns the card to normal functioning.

Parameters: None

Example: *999<sp>A<sp>BD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

LE - Enable Local Control

Description: Enables local control of the MA4002D chassis. The module address must indicate a valid module even though the command does not change any module settings.

Parameters: None

Example: *999<sp>A<sp>LE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

LD - Disable Local Control

Description: Disables local control of the MA4002D chassis. The module address must indicate a valid module even though the command does not change any module settings.

Parameters: None

Example: *999<sp>A<sp>LD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

SU - Status Unit Request

Description: The Status Unit Request command returns the factory model and revision history for the specified module. The detailed contents of the reply are shown in the response section.

Parameters: None

Example: *999<sp>A<sp>SU<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

If the response is OK, then the following parameters will also be returned in the order shown below. (Note: X may be replaced by any valid character. All other characters will be as shown).

TABLE 7.5A : RESPONSE PARAMETERS FOR STATUS UNITS REQUEST

Parameter (Units)	Format	Example
Model	XXXXXXXXXXX	Upconverter
Module SN	XXXXXXX	0123456
Hardware Revision	XXX	010 (i.e. Rev 1.0)
Microcontroller Revision	XXX	010 (i.e. Rev 1.0)
PLD Revision	XXX	010 (i.e. Rev 1.0)
Miscellaneous	16 chars	

SC - Status Configuration Request

Description: The Status Configuration Request command returns the active configuration, including error codes and alarm status for the addressed module. It also returns the current status of the power supply module. The detailed contents of the reply are shown in the response section.

Parameters: None

Example: *999<sp>A<sp>SC<sp>CRC<cr>

Response: OK or ERR or CRC or MOD

If the response is OK, then the following parameters will also be returned in space delimited format in the order shown below. (Note: X may be replaced by any valid character. All other characters will be as shown). Error codes are the last two digits reported on the status code line. Refer to Section 6.0, Error Codes (p 25, 26) for more details.

TABLE 7.5B : RESPONSE PARAMETERS FOR STATUS CONFIGURATION REQUEST

Parameter (Units)	Format	Example
MA4040D Status Code & Error Code	XXXX	0101
MA4040D Output Freq. (MHz)	XXX.XXXX	110.0000
Reserved for Future Use	XXX	XXX
MA4040D IF Attenuation (dB)	XX.XX	10.25
MA4040D RF Attenuation (dB)	XX.XX	15.50
MA4040D IF Power (relative dB)	XXX.X	< -4.0
MA4040D RF Power (dBmV)	XX.X	57.0
Power/Control Module Status Code & Error Code	XXXX	0000

7.6 CRC Calculation

The CRC calculations are performed using a table driven approach. The polynomial used is **X^16+X^15+X^2+1**.

Only the basic algorithm and lookup table will be described here. Refer to Appendix A for the CRC lookup table. Sample code is available on request. For further information, this approach is described in detail in the following paper:

Perez, Aram; Byte-wise CRC Calculations, IEEE Micro, June 1983, pp. 40 - 50

The algorithm for the CRC calculation is as follows:

Exclusive-OR the input byte with the low-order byte of the CRC register to get X.

Shift the CRC register 8 bits to the right.

Exclusive-OR the CRC register with the contents of the table, using X as an index.

Repeat steps 1 - 3 for all message bytes.

☛ **Note:** The CRC register is 16 bits long, and should be cleared to 0 before beginning the calculations.

For the transmit message: After all the message bytes have been processed, the CRC is tagged on to the end of the message with the least significant byte first.

For the received message: After all the received message bytes have been processed, the resulting CRC should be zero. If it is not zero, at least one bit error has occurred. If it is zero, it is assumed that no errors have occurred.

8.0 WARRANTY AND SERVICE POLICIES

8.1 Warranty Statement

WaveCom warrants its products to be free from defects in workmanship or materials for a period of two years. The warranty begins on the date of the original shipment from WaveCom to its customer. No claim may be allowed for expenses incurred in installation or use. No other expressed or implied warranties shall apply to the goods sold. WaveCom is not responsible for delayed shipments, other loss beyond WaveCom's control, or consequential damages of any kind arising in connection with the use of its products. This warranty is a return-to-factory warranty only. During the warranty period WaveCom will at its option, replace, repair or refund the price paid for any item which is returned for service. This warranty does not apply to physically or environmentally abused units.

8.2 Service Policies: How to Return an Item for Service

Before returning any item for service, an R.M.A. (Returned Material Authorization) number must be assigned by WaveCom. A unique R.M.A. number will be assigned for each item being returned. When requesting an R.M.A. number, please be prepared to provide the model, WaveCom serial number, original invoice number, your purchase order number and an adequate fault description. R.M.A. service is available Monday to Friday from 8:30 a.m. to 4:30 p.m. CST (statutory holidays excepted).

To obtain an R.M.A. number you may: **Call: (306) 955-7075, press '0' for Operator or '2' for Service Dept.**

Or Fax: (306) 384-0086 — Attention: R.M.A. Request

Once an R.M.A. number has been assigned, please refer to it in all correspondence and make certain that all applicable R.M.A. numbers are clearly marked on the outside of each package being returned. You must also ensure that each product is shipped to WaveCom in its original shipping container (or equivalent) via Prepaid carrier, with appropriate insurance and customs documentation (where required). WaveCom will not accept collect shipments, damaged shipments or shipments unaccompanied by an R.M.A. number.

Items will be returned from WaveCom to the customer via prepaid ground carrier. Any alternate means of shipment must be requested by the customer and will be subject to additional charges.

Please ship authorized returning items to:

Repair Center
WaveCom Electronics Inc.
202 Cardinal Crescent
Saskatoon, SK Canada S7L 6H8

8.3 Repair Charges and Warranty Exemptions

Items returned beyond the warranty period or items that do not qualify for warranty service are subject to additional out-of-warranty repair charges. Descriptions of these charges and warranty exemptions are below:

1) Repair turnaround time is typically 5-10 working days after receipt of the item at WaveCom. A Flat Rate Repair Charge will apply to all out-of-warranty items. Flat Rate Repair Charges are subject to change without notice.

2) Any faults due to customer error (ie - incorrect set-up or configuration settings) are subject to the current Test Fee and will be exempt from warranty.

3) Items returned with inadequate fault descriptions are subject to the current Test Fee and are exempt from warranty.

4) In the event that no fault is found, the item is subject to the current Test Fee and will be exempt from warranty.

5) Any product exhibiting external damage (either from shipping, improper handling or use) will be subject to inspection. If said damages are determined to be the cause of failure, the item will be exempt from warranty. All repairs to correct the external damage are subject to Time & Materials Charges (parts and labor at current rates).

6) Items with damage caused by unauthorized repairs or by external devices are subject to current out-of-warranty Flat Rate Repair Charges and are exempt from warranty.

7) All products returned for Factory Optioning are subject to the applicable current Option Charge plus Test Fee. Factory-optioned products carry the balance of the original warranty or a 90 day warranty, whichever is greater.

All out-of-warranty repairs must be approved by the customer in writing. No repairs will be made until the customer's Purchase Order or Out-Of-Warranty Repair Authorization is received.

APPENDIX A – CRC – 16 CALCULATIONS TABLE

All values in the table are in Hex format.

X TERM	ENTRY
0	0
1	C0C1
2	C181
3	140
4	C301
5	3C0
6	280
7	C241
8	C601
9	6C0
A	780
B	C741
C	500
D	C5C1
E	C481
F	440
10	CC01
11	CC0
12	D80
13	CD41
14	F00
15	CFC1
16	CE81
17	E40
18	A00
19	CAC1
1A	CB81
1B	B40
1C	C901
1D	9C0
1E	880
1F	C841
20	D801
21	18C0
22	1980
23	D941
24	1B00
25	DBC1
26	DA81
27	1A40
28	1E00
29	DEC1
2A	DF81
2B	1F40
2C	DD01
2D	1DC0
2E	1C80
2F	DC41
30	1400
31	D4C1
32	D581
33	1540
X TERM	ENTRY
34	D701
35	17C0
36	1680
37	D641
38	D201
39	12C0
3A	1380
3B	D341
3C	1100
3D	D1C1
3E	D081
3F	1040
40	F001
41	30C0
42	3180
43	F141
44	3300
45	F3C1
46	F281
47	3240
48	3600
49	F6C1
4A	F781
4B	3740
4C	F501
4D	35C0
4E	3480
4F	F4441
50	3C00
51	FCC1
52	FD81
53	3D40
54	FF01
55	3FC0
56	3E80
57	FE41
58	FA01
59	3AC0
5A	3B80
5B	FB41
5C	3900
5D	F9C1
5E	F881
5F	3840
60	2800
61	E8C1
62	E981
63	2940
64	EB01
65	2BC0
66	2A80
67	EA41
X TERM	ENTRY
68	EE01
69	2EC0
6A	2F80
6B	EF41
6C	2D00
6D	EDC1
6E	EC81
6F	2C40
70	E401
71	24C0
72	2580
73	E541
74	2700
75	E7C1
76	E681
77	2640
78	2200
79	E2C1
7A	E381
7B	2340
7C	E101
7D	21C0
7E	2080
7F	E041
80	A001
81	60C0
82	6180
83	A141
84	6300
85	A3C1
86	A281
87	6240
88	6600
89	A6C1
8A	A781
8B	6740
8C	A501
8D	65C0
8E	6480
8F	A441
90	6C00
91	ACC1
92	AD81
93	6D40
94	AF01
95	6FC0
96	6E80
97	AE41
98	AA01

99	6AC0
9A	6B80
9B	AB41

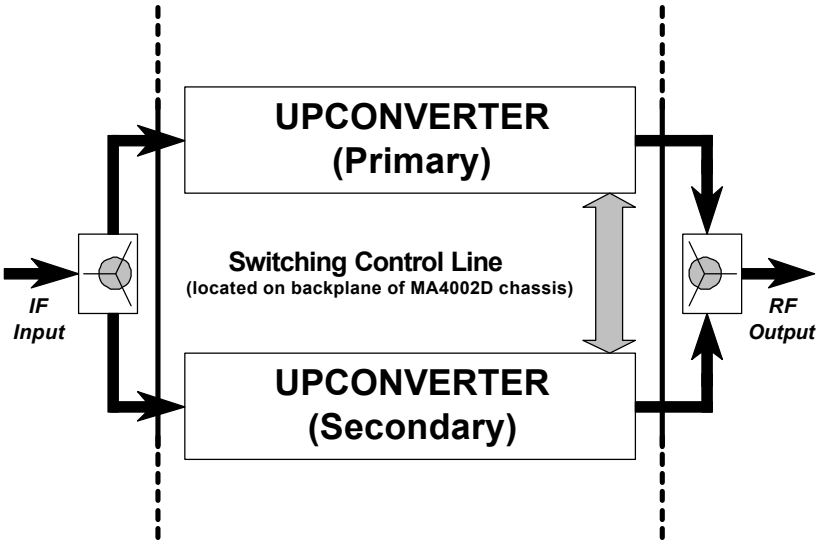
X TERM	ENTRY
9C	6900
9D	A9C1
9E	A881
9F	6840
A0	7800
A1	B8C1
A2	B981
A3	7940
A4	BB01
A5	7BC0
A6	7A80
A7	BA41
A8	BE01
A9	7EC0
AA	7F80
AB	BF41
AC	7D00
AD	BDC1
AE	BC81
AF	7C40
B0	B401
B1	74C0
B2	7580
B3	B541
B4	7700
B5	B7C1
B6	B681
B7	7640
B8	7200
B9	B2C1
BA	B381
BB	7340
BC	B101
BD	71C0
BE	7080
BF	B041
C0	5000
C1	90C1
C2	9181
C3	5140
C4	9301
C5	53C0
C6	5280
C7	9241
C8	9601
C9	56C0
CA	5780
CB	9741
CC	5500
CD	95C1
CE	9481
CF	5440
D0	9C01
D1	5CC0
D2	5D80
D3	9D41
D4	5F00

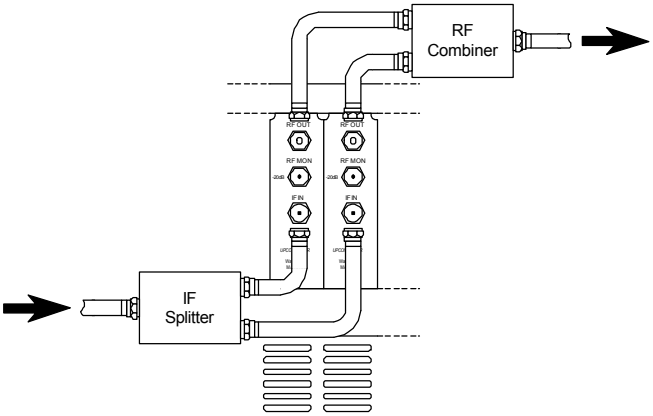
X TERM	ENTRY
D5	9FC1
D6	9E81
D7	5E40
D8	5A00
D9	9AC1
DA	9B81
DB	5B40
DC	9901
DD	59C0
DE	5880
DF	9841
E0	8801
E1	48C0
E2	4980
E3	8941
E4	4B00
E5	8BC1
E6	8A81
E7	4A40
E8	4E00
E9	8EC1
EA	8F81
EB	4F40
EC	8D01
ED	4DC0
EE	4C80
EF	8C41
F0	4400
F1	84C1
F2	8581
F3	4540
F4	8701
F5	47C0
F6	4680
F7	8641
F8	8201
F9	42C0
FA	4380
FB	8341
FC	4100
FD	81C1
FE	8081
FF	4040

APPENDIX B - MA4040D REDUNDANCY DIAGRAMS

When configuring Module pairs for redundancy, the first module in a pair to have the Redundant Mode enabled becomes the active (Primary) Module and its RF Output is automatically enabled. The second module becomes the backup (Secondary) Module and its RF output is automatically disabled.

In the event of a failure of the Active Module, it will disable its RF output and notify the Backup Module to become Active. When notified, the Backup Module will enable its RF output.





APPENDIX C - REMOTE ACCESS SOFTWARE INSTALLATION & UTILITY INSTRUCTIONS

C1.0 Multi Agile Remote Access Software Installation

C1.0.1 Installation from Diskettes:

Disk 1 of 2 contains the files: MADEMO1.cab, setup.exe, Setup.lst

Disk 2 of 2 contains the files: MADEMO2.cab, MA_Software_Apnv7_0006.doc, MA_Terminal_Apnv1_9910.pdf, MA_Physical_Apnv3_0003.doc.

Procedure:

(1) Copy all the files from the diskettes to a common directory on your PC. (e.g. C:\Temp)

(2) Run the program "setup.exe" to install the Multi Agile Remote Software. Installation will create a folder called "WaveCom" on your Windows95 or Windows98 START Menu.

C1.0.2 Installation from emailed or downloaded files

The Multi Agile Remote Access Software distributed via email or downloaded from WaveCom's web site www.WaveCom.ca comes as two ZIP files:

SW4000_Disk1_ *DDMthYY*.zip

SW4000_Disk2_*DDMthYY*.zip

(where *DDMthYY* is the software revision release date)

The Multi Agile Remote Access Software can also be downloaded from WaveCom's web site as a single ZIP file: **SW4000_DDMthYY.zip**

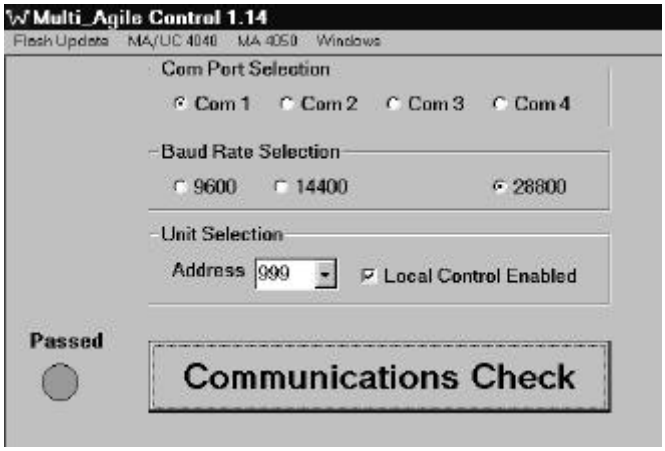
Procedure:

(1) Extract the contents of all ZIP files to a common directory on your PC using an Unzip utility. The following files will be created in your directory: **MADEMO1.cab, MADEMO2.cab, setup.exe, Setup.lst**

(2) Run the program "setup.exe" to install the Multi Agile Remote Software. Installation will create a folder called "WaveCom" on your Windows95 or Windows98 START Menu.

C2.0 Multi Agile Remote Access Software Overview

C2.0.1 Multi Agile Remote Access Software Main Window



The Multi Agile Remote Access Software is intended for use with WaveCom's MA4000 Series, UC4040x, and DUAL4040x products.

Please refer to MA401xx, UC4040x, DUAL4040x Application Note Remote Access Connection to a Local Computer or Modem for details on physical connection.

The Menu Selection Bar at the top of the window has the following choices:

Flash Update Flash Update utility for the MA401xx, UC4040x, or DUAL4040x Display/Controller
Flash update utility for the x4040D Upconverter card.

MA/UC 4040 WaveCom MA4040x, UC4040x, or DUAL4040x Upconverter control utility

MA 4050 WaveCom MA4050 QAM Modulator control utility

Windows Allows switching between the currently opened windows.

C2.0.2 Communications Configuration

Procedure:

(1) Select the COM Port and Baud Rate that you are using on your PC.

(2) Type in the Address** number that matches MA401xx, UC4040x or DUAL4040x unit that you are connected to. Please refer to the User Manuals for these products to find out how to view or set the unit Address number.

**The MA401xx, UC4040x and DUAL4040x units are shipped with default Address 999 from the factory. When daisy chaining several units on an RS485 bus, you must assign a unique Address to each unit to allow access/control of a specific unit on the bus.

☛ When the **Local Control Enabled** box is CHECKED, you may control the unit using the software or the front panel (Default Setting).

When the **Local Control Enabled** box is NOT CHECKED, you may control the unit using the software only. This is indicated on the second line of the Controller display by 'RMT'

(3) Confirm communications settings are functional

Just to the left of the **Communications Check** button, you will see a Yellow dot with "Unknown" typed above it. Click on the button with the mouse to check the status of your communication connection.

If all your settings are correct, then the dot will turn Green and state "Passed" above it. Remote control of the unit is now possible.

If your settings are NOT correct, then the dot will turn Red and state "Failed" above it. Remote control of the unit is NOT possible. Please check your settings and cable connection before you try again.

C3.0 Multi Agile Remote Access Software Utilities

C3.0.1 Flash Update – Controller / Display

☛ Do not power cycle the unit or use the Front Panel Buttons to configure the unit while it is programming.

The operation of the Upconverters should not be affected during programming.

The Controller for the MA401xx, UC4040x and the DUAL4040x stores operating code in Flash Memory in order to make it possible to update using the RS232 interface.

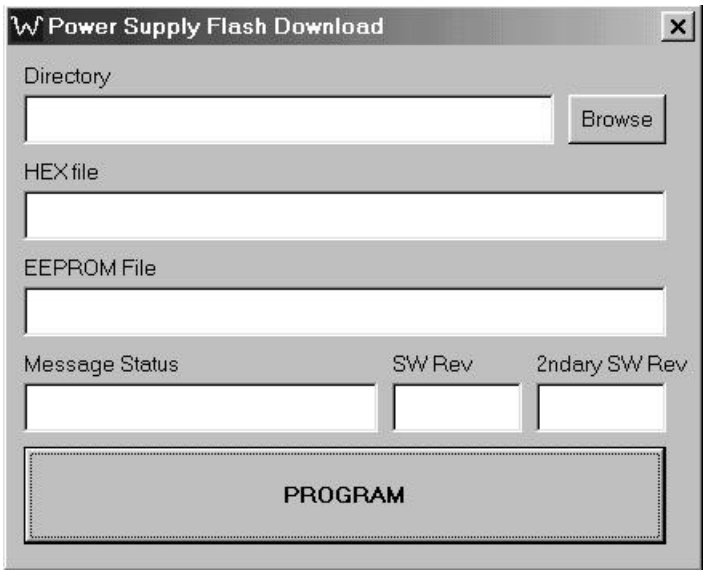
Procedure:

(1) Make sure that the MA401xx; UC4040x or DUAL4040x is in program mode:

To place the unit in program mode first press the module select button to ensure the display is active (back light is on), press and hold the "Module Select" button and then press the "Up" button. A display on the LCD should indicate that the unit is in program mode. To exit from program mode, simply repeat the key sequence.

(2) Run the Multi Agile Remote Access Software and ensure that the COM Port settings are correctly chosen for your PC.

(3) Select Flash Update from the menu then 4011 Flash. The Flash Update Utility will open another window displaying:



(4) The **latest revision flash files are automatically selected** from the same directory as the Multi Agile executable file. If the Multi Agile program was not installed to the default directory use the browse buttons to locate the directory for the Multi Agile files.

(5) Click on the PROGRAM button to update the Flash memory. This button will first program the FLASH memory with the new code, and then verify the FLASH memory to confirm that programming was successful.

(NB: Occasionally during this process, a message box indicating an Unknown Error will be displayed. You may close this box by pressing OK. If this error occurs repeatedly, please exit and restart the Multi Agile software and choose a slower baud rate before retrying the programming operation.)

C3.0.2 Flash Update – x4040D Upconverter module

The 4040 FLASH utility is only intended for: **MA4040D UC4040D DUAL4040D**

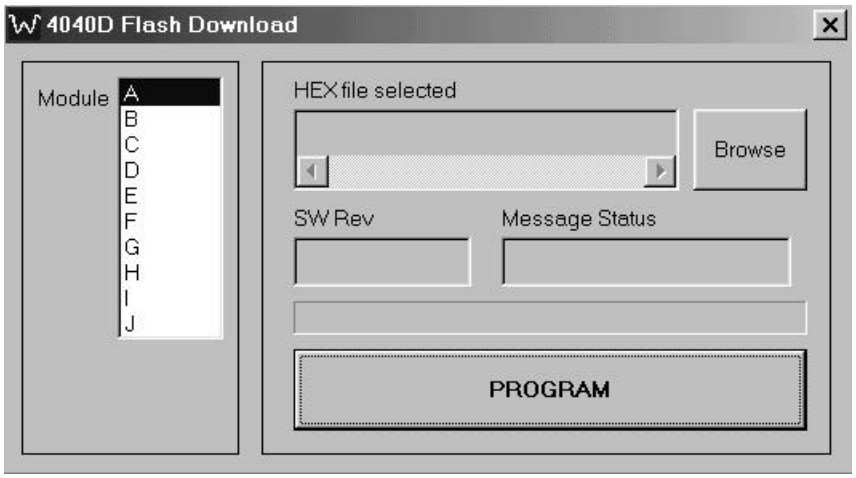
You can identify which Upconverter model you have from the label on the front of the card or unit. If you are unsure as to whether or not your particular Upconverter can be flashed, contact WaveCom Technical Support by phone or email support@wavecom.ca with the model number and serial number.

☛ Do not power cycle the unit or use the front panel buttons to configure the unit while it is programming.

The operation of the Upconverters should not be affected during programming.

(1) Run the Multi Agile Remote Access Software and ensure that the COM Port settings are correctly chosen for your PC.

(2) Select Flash Update from the menu then 4040 Flash. The Flash Update Utility will open another window displaying:



(3) When using this software with the MA4040D or DUAL4040D you will need to select the appropriate slot position of the Upconverter module that you wish to control. Looking at the FRONT of the MA4002x Chassis, the slot positions are labeled A though J from left to right and the DUAL4040x will use slots A and B.

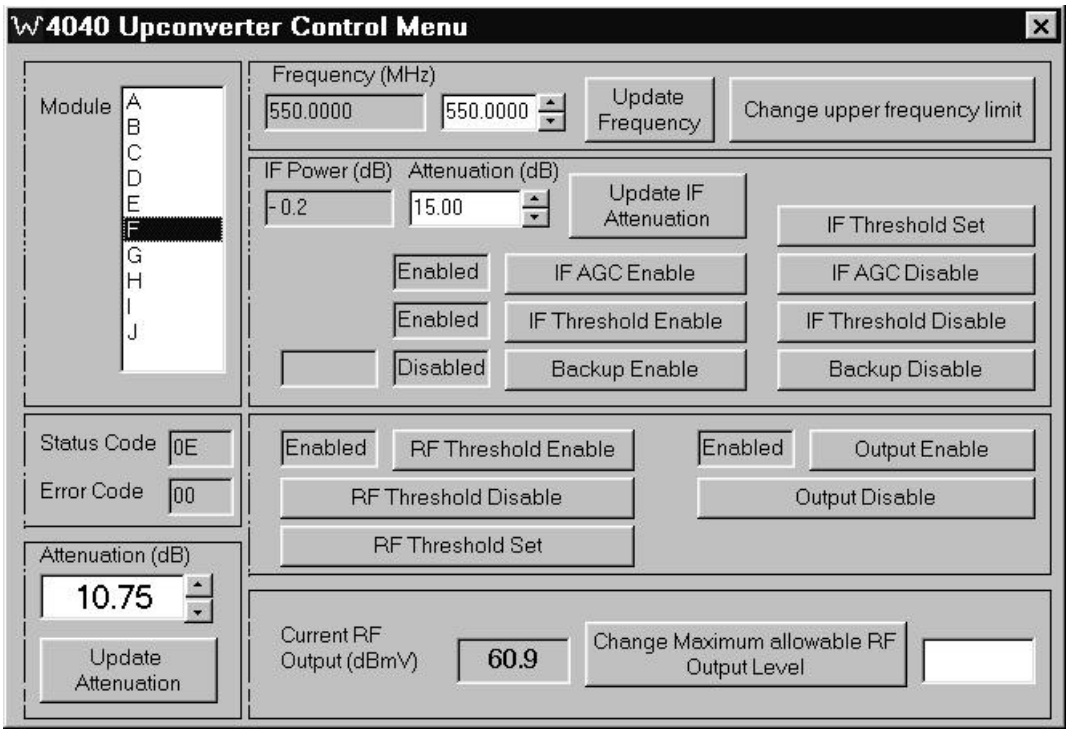
When using this software to control the UC4040x, you MUST select slot position A.

(4) The **correct revision file for your Upconverter is automatically selected** from the same directory as the Multi Agile executable file. If the Multi Agile program was not installed to the default directory use the browse buttons to locate the directory for the Multi Agile files.

(5) Click on the PROGRAM button to update the Flash memory. This button will first program the FLASH memory with the new code, and then verify the FLASH memory to confirm that programming was successful.

C3.1 MA/UC 4040

From the Menu Selection Bar, click on MA/UC 4040 and select Demo. The following window will open:



C3.1.1 MA/UC 4040 Utility Description

Module Selection

When using this software with the MA4040x or DUAL4040x you will need to select the appropriate slot position of the Upconverter module that you wish to control. Looking at the FRONT of the MA4002x Chassis, the slot positions are labeled A though J from left to right and the DUAL4040x will use slots A and B

☛ When using this software to control the UC4040x, you MUST select slot position A.

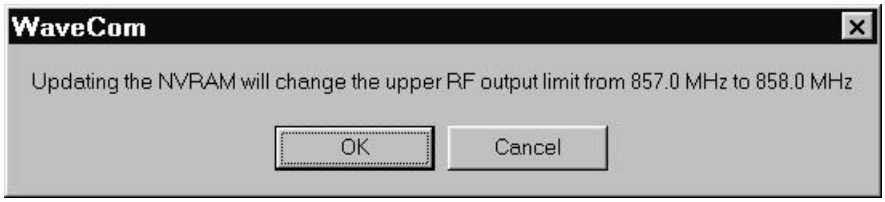
The information that is displayed for the module selected reflects the current condition of the Upconverter at the time that the module is selected. To update this information you must double click the desired module again.

Frequency

Frequency (MHz) displays the current center RF output frequency setting. The center RF output frequency may be adjusted from 53 to 857 MHz in 12.5 kHz step sizes. Click on the Update Frequency button to send the new center RF frequency setting to the Upconverter. *Entering an invalid frequency value will generate a Syntax Error response.*

Change Upper Frequency Limit

EuroDOCSIS specifies that the upper frequency limit shall be 858.0 MHz center. In order to accommodate customers that would like to use WaveCom's products for EuroDOCSIS, the user has the ability to modify standard Upconverters with an upper frequency of 857.0 MHz center to an upper frequency limit of 858.0 MHz. Pressing the Change Upper Frequency Limit button brings up the following dialog box:



Selecting "OK" from the dialog box will change the NVRAM on the Upconverter to reflect the new upper frequency limit of 858.0 MHz. This only has to be done once per Upconverter. Selecting "Cancel" will have no effect on he upper frequency limit.

☛ The Unit must be power cycled after changing the upper frequency limit on each Upconverter. A dialog box will appear asking the user to power cycle the unit. Power cycle the unit, then wait approximately 5 seconds before selecting "OK" to exit.

IF Power

IF Power (dB) displays the current IF power sensed at the input port. The IF power may be attenuated by 0 to 39.75 dB in 0.05 dB step sizes. Click on the Update IF Attenuation button to send the new attenuation setting to the Upconverter. *Entering an invalid attenuation value will generate a Error response.*

IF Threshold Set

Clicking the **IF Threshold Set** button prompts for high and low IF threshold limits to be entered. The high IF threshold limit may be 0.0 to 4.0 dB. The low IF threshold limit may be -4.0 to 0.0 dB. *Initially, the low IF threshold level is set to -4.0 dB and the high RF threshold is set to +4.0 dB.*

IF AGC

IF AGC is current condition will be displayed in a box next to the IF AGC Enable button. This will show Enabled when IF AGC is Enabled or Disabled if the IF AGC is currently disabled. To change the current sate of the IF AGC simply click on the IF AGC Enable button or the IF AGC Disable button. The use of IF AGC for digital signals is recommended.

IF AGC should be enabled for proper operation in redundant mode.

IF Threshold

IF Threshold current condition will be displayed in a box next to the IF Threshold Enable button. This will show Enabled when IF Threshold is Enabled or Disabled if the IF Threshold is currently disabled. To change the current sate of the IF Threshold sensing simply click on the IF Threshold Enable button or the IF Threshold Disable button

When **IF Threshold is enabled**, and the IF power is outside the IF Threshold limits, a non-critical alarm will be triggered.

Redundant Operation

There are two indication boxes used for redundant mode. The first box will indicate Alarm/Lock if the module selected failed while it was the active module in redundant mode. The second box will indicate whether or not the selected module is currently in redundant mode. The **Backup Enable** and **Backup Disable** buttons are used to enable or disable redundant mode for the selected module.

Please refer to the Installation and Operation Guide that shipped with your product for details on using the Redundant features of your Upconverters.

RF Threshold

RF Threshold current condition will be displayed in a box next to the **RF Threshold Enable** button. This will show Enabled when RF Threshold is Enabled or Disabled if the RF Threshold is currently disabled. To change the current sate of the IF Threshold sensing simply click on the **RF Threshold Enable** button or the **RF Threshold Disable** button.

RF Threshold Set

Clicking the **RF Threshold Set** button prompts for high and low RF threshold limits to be entered. The high RF threshold limit may be set as high as +63 dBmV. *Initially, the low RF threshold level is set to +45 dBmV and the high RF threshold is set to +63 dBmV.*

When **RF Threshold is enabled**, and the RF power is outside the RF Threshold limits, a non-critical alarm will be triggered.

RF Output

RF Output current condition will be displayed in a box next to the **Output Enable** button. This will show Enabled when RF Output is Enabled or Disabled if the RF Output is currently disabled. To change the current state of the RF Output simply click on the **Output Enable** button or the **Output Disable** button.

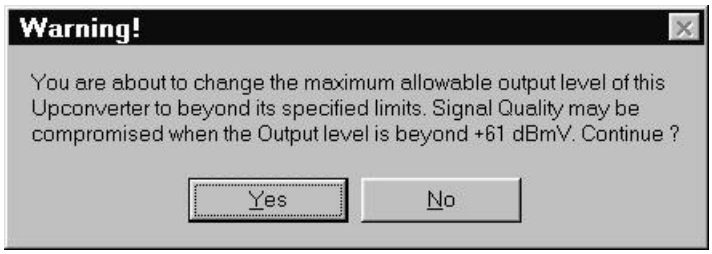
RF Output Level Section

RF Output Level (dBmV) displays the current RF output level sensed at the output port. The RF output level may be attenuated by 0 to 39.75 dB in 0.05 dB step sizes. Click on the **Update RF Attenuation** button to send the new attenuation setting to the Upconverter. *Entering an invalid attenuation value will generate a Syntax Error response.*

Change Maximum allowable RF Output Level

WaveCom specifies a maximum output of +61 dBmV for performance that meets or exceeds the DOCSIS specifications. At the factory, the maximum output is limited to +63 dBmV for each Upconverter card. Any attempt to exceed the maximum RF limit will cause the unit to automatically attenuate the signal to a level below +63 dBmV.

For test purposes, the unit may be required to have a higher output level. The user can specify an upper power limit between +45 dBmV and +66 dBmV by entering the value in the box to the right of "Change Maximum allowable RF Output Level" button. When the user has entered a new value into this box and pressed the "Change Maximum allowable Output Level" button, the following warning box appears:

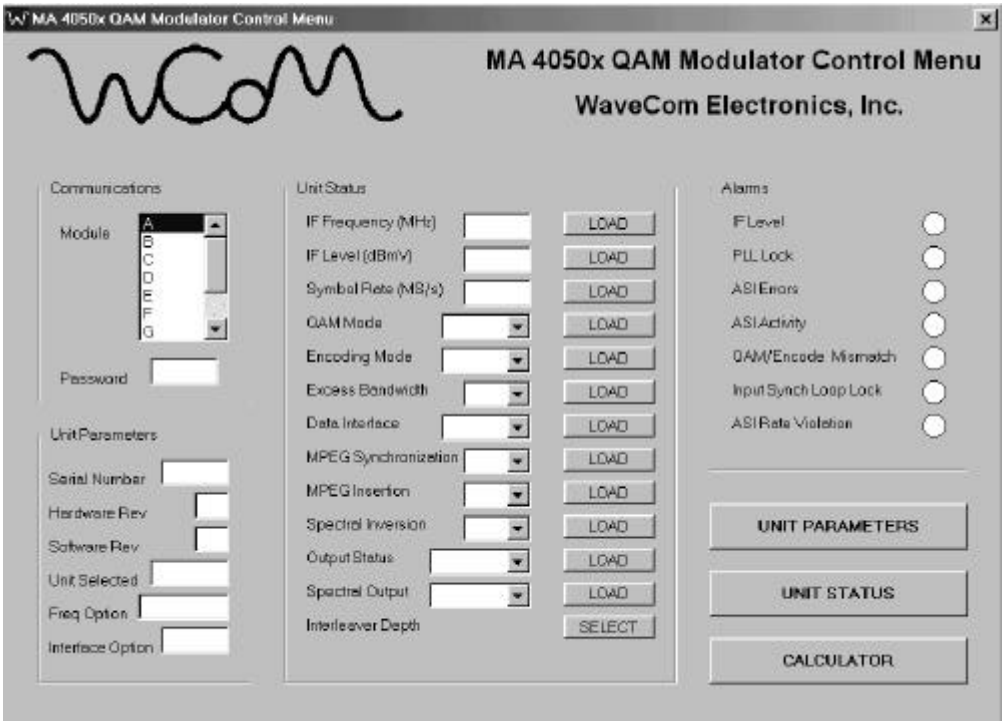


By selecting "Yes", the maximum allowable RF limit will be changed in NVRAM to the value specified. Any attempt to exceed the maximum RF limit specified will cause the unit to automatically attenuate the signal to a level below the value entered.

- Signal Quality may be compromised when the Output level is +61 dBmV.
- The unit must be power cycled after changing the upper frequency limit on each Upconverter. A dialog box will appear asking the user to power cycle the unit. Power cycle the unit, then wait approximately 5 seconds before selecting "OK" to exit. Selecting "Cancel" will have no effect on the upper frequency level.

C3.2 MA 4050

From the Menu Selection Bar, click on MA 4050 and select Demo. The following window will open:



C3.2.1 MA4050 Utility Description

Communications Section:

You will need to select the appropriate slot position of the MA4050x module that you wish to control. Looking at the FRONT of the MA4002x Chassis, the slot positions are labeled A though J from left to right.

The password is not required for normal operation of the program.

Unit Parameters Section:

The Unit Parameters are read from the MA4050x board. Clicking the **UNIT PARAMETERS** button will update this section:

SERIAL NUMBER	Serial number of MA4050x PCB
HARDWARE REV	Hardware revision number of MA4050x PCB
SOFTWARE REV	Revision of software in MA4050x microcontroller
UNIT SELECTED	Type of unit selected - this should read MA4050
FREQ OPTION	(Informational Only) Indicates VARIABLE or FIXED IF frequency selection. This option is loaded at the factory. Selecting VARIABLE will allow the IF frequency to be varied with 100 Hz resolution. Normally it is set to FIXED since a fixed frequency SAW filter is used in the MA4050x.
INTERFACE OPTION	This will indicate the data interface selected. Options are ASI, ASI 188, ASI 204, DVB Ser, or DVB Par.

Unit Status Section:

☛ This program will work only with the MA4050x module. It will give a "No Response" error if another type of module (such as a MA4040x upconverter) is in the selected location.

The parameters in the Unit Status section are read from the MA4050B modulator, and may also be set from the program. To change a parameter, enter a value or choose one of the selections, and then click the LOAD button adjacent to that parameter. The selected value will be changed, and all values will be updated as if the UNIT STATUS button was used. Note that only one parameter should be changed at a time. When a LOAD button is clicked, only its corresponding parameter is changed in the MA4050x.

Click the UNIT STATUS button to update all the parameters in both the Unit Status section and the Alarms section. The update takes two to three seconds.

IF FREQUENCY (MHZ)

This is the IF frequency in MHz. It cannot be changed unless the program indicates VARIABLE in the *Freq Option* window. Normally it is set to FIXED since a fixed frequency SAW filter is used in the MA4050x.

IF LEVEL (DBMV)

This is the measured IF output level in dBmV. The display will typically be accurate to within +/- 1.5 dB. This level may be set to values between +25 dBmV and +40 dBmV. The MA4050B will adjust the level and then return the measured result.

The setting algorithim is accurate to only approximately 0.5 dB, so if greater resolution is desired, the front panel control can be used to set the level.

☛ For a valid level reading into 75 Ohms, the output should be correctly terminated.

SYMBOL RATE (MS/S)

This indicates the symbol rate of the modulator. It may be set from the program to the desired value, within the limits described in the manual. Note that the symbol rate is set rather than the bit rate. The relationship is described in the manual. For your convenience a symbol rate calculator is included with this software.

QAM MODE

This indicates the type of modulation in use. The desired selection may be made from the list, (QPSK to 256QAM).

ENCODING MODE

This selects the type of error control coding. There are three choices available: Digicipher II (DCII), DVB or DAVIC. Note that DCII coding is only defined for 64QAM and 256QAM modulations. Other selections will result in an error.

EXCESS BANDWIDTH

The rolloff rate of the baseband filters may be selected to be 13%, 15% or 18%. The percentage corresponds to the alpha of the square-root raised cosine filters. Note that the 13% setting is compatible with a 12% rolloff as well.

DATA INTERFACE

The appropriate data interface may be chosen from this list. The options are ASI, ASI 188, ASI 204, DVB Ser or DVB Par. The ASI choice is provided for older versions of the MA4050B and should not be used.

☛ The MPEG synchronization must be turned to ON for operation with ASI 188 input and turned OFF for operation with ASI 204 when using DVB or DAVIC coding with MPEG-2 data.

MPEG SYNCHRONIZATION

The MA4050B may be configured to automatically synchronize to the MPEG sync byte. This mode may only be selected via the remote control (and through this software). It is not available via the front panel. When this is turned to "ON", the MA4050B auto-synchronizes to the MPEG sync byte ($47) by searching for the sync byte in the data stream rather than using the PSYNC signal. This must be turned on for correct operation in ASI 188 mode with DVB or DAVIC coding.

MPEG INSERTION

The MA4050B may be configured to automatically insert the MPEG sync byte separated by 187 bytes of data. Note that the insertion may not preserve the original input byte boundary. This mode may only be selected via the remote control (and through this software). It is not available via the front panel. This mode may be used in conjunction with input data or the internal pseudo-random data sequence to produce a bit stream that can be accepted by MPEG-2 equipment.

SPECTRAL INVERSION

The MA4050B may be configured to invert the data spectrum to compensate for spectral inversions performed by other equipment such as upconverters. This mode may only be selected via the remote control (and through this software). It is not available via the front panel. For use with the MA4040B and similar upconverters, the spectral inversion should be "ON".

OUTPUT STATUS

When ENABLED, the IF output from the MA4050B Modulator is enabled. When DISABLED, the IF output is turned off, with the IF signal attenuated 60 dB or more. The output remains 75 Ohms whether enabled or disabled.

SPECTRAL OUTPUT

The MA4050B may be configured for three different outputs - NORMAL, RANDOM, or CW.

"NORMAL" is used for regular operation. It takes data from the selected input interface and modulates the IF carrier.

"RANDOM" may be selected for test purposes. The modulator will produce a pseudo-random data sequence to modulate the carrier, and the input data will be ignored. The MA4050B will produce a standard sequence of length 2^23-1. The polynomial used is X^18 + X^23 + 1. As mentioned above, MPEG insertion may also be enabled to produce a bit stream with MPEG sync bytes. MPEG insertion will operate only with DVB and DAVIC coding, not DCII.

"CW" mode configures the MA4050B to produce a CW carrier on the output. This may be used for test purposes for setting frequencies, etc. When the output is set to CW, the resulting level is approximately 12 dB higher than the modulated signal level. This means that if the CW signal is to be used to set system levels, it must be adjusted down until the desired level is displayed on the front panel. Note that the CW signal level range is 12 dB higher than the normal output range, so it may not be possible to adjust the level below approximately +37 dBmV. Note that if the CW level is adjusted downwards, the level must be readjusted back to the desired operating level when the modulated signal is re-enabled.

INTERLEAVER DEPTH

The data interleaving depth is set automatically, based on the coding selected. See the MA4050B Installation and Operation Guide for the default settings of the interleaver. If necessary, the interleaver settings can be checked or changed by clicking the Interleaver Depth Select button. Clicking on a choice will cause the change to be made immediately to the MA4050B (no LOAD button used).

Alarms Section:

This section indicates the alarm status of the modulator with simple red/green indicators.

IF LEVEL

The MA4050B module has detected a low level from the IF output power detector in the MA4050B module. The alarm does not activate if the IF output has been manually disabled. This alarm condition may occur if there is no data fed into the MA4050B module, or if the wrong interface is selected. It may also occur due to a hardware failure in the module.

PLL LOCK

The MA4050B module has detected an unlock condition in the reference Local Oscillator (LO). In these circumstances, the IF output frequency and symbol rate may be invalid. A hard alarm condition is declared, and the IF output is disabled. This condition is most likely due to a major problem such as faulty AC input power, or a hardware failure in the MA4010B power supply module or the MA4050B module itself.

ASI ERRORS

Errors have been detected in the ASI data stream that violate the coding of the data. This most likely indicates a poor ASI signal due to low level or interference. This status appears only when the ASI input is selected.

ASI ACTIVITY

A lack of data activity has been detected on the ASI input. This is most likely due to the ASI input being disconnected. This status appears only when the ASI input is selected.

QAM/ENCODE MISMATCH

This indicates that the QAM mode and the data coding are not correctly matched. Valid combinations are indicated in the MA4050B manual under QAM Modulator Operating Modes.

INPUT SYNCH LOOP LOCK

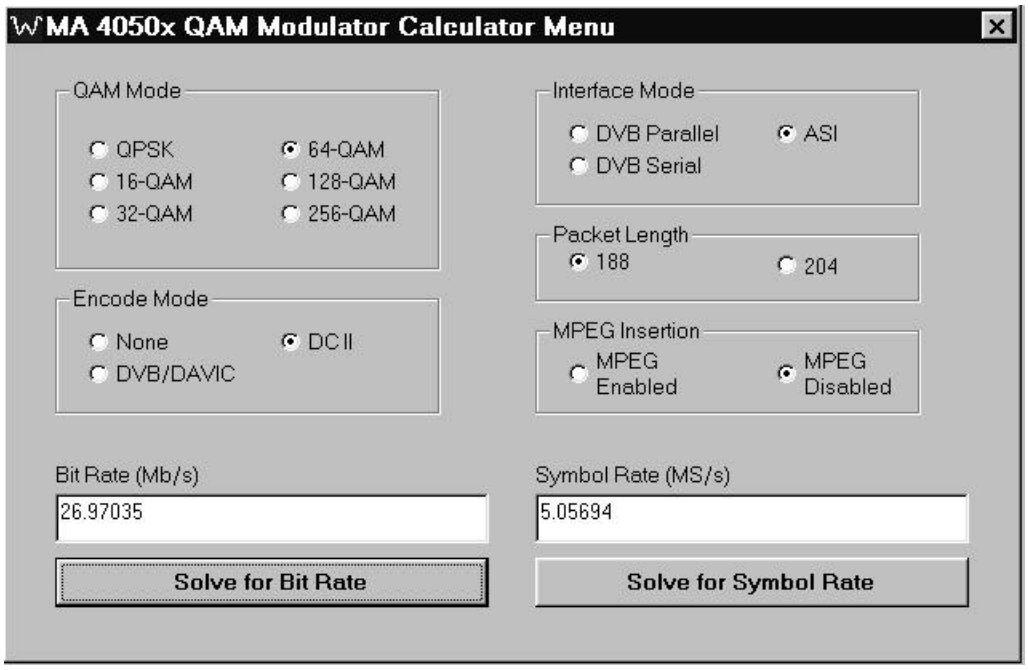
The MA4050B is unable to synchronize to the input data. This may mean that the symbol rate does not match the input data rate, modulation type, coding, and MPEG synchronization byte insertion if appropriate. Recheck the calculations. Ensure that the correct data input mode is selected, and that there is valid data at the selected input.

ASI RATE VIOLATION

This indicates that the symbol rate has been set too low when operating with the ASI input. See the manual for the lower limits of the symbol rate (typically 0.3 MS/s for 64QAM and 256QAM).

C3.2.2 Calculator

From the Menu Selection Bar, click on MA 4050 and select Calculator. The following window will open:



By selecting the proper configuration from the different sections of the calculator you can determine the correct Bit Rate for a given Symbol Rate or the correct Symbol Rate for a given Bit Rate. The example above is for 64QAM, Annex B, ASI 188, MPEG Insertion off, and a Symbol Rate of 5.05694 MS/s. The resulting Bit Rate is 26.97035 Mb/s

The calculator will not allow you to make invalid calculations (i.e. 128-QAM DCII)

222 Cardinal Crescent
Saskatoon, Saskatchewan
S7L 6H8
Canada
Tel: (306) 955-7075
Fax: (306) 955-9919
www.WaveCom.ca
sales@WaveCom.ca