

AGILE MMDS UPCONVERTER MA4061

POWER AMPLIFIER MA4070B

INSTALLATION AND OPERATION GUIDE FOR SYSTEM OPERATORS



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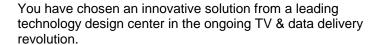
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MA4061/MA4070 Manual; MAN1L2301 Rev03 (Mar 2002); Approved: R. L.

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By snail mail: WaveCom Electronics Inc.

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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.

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 contrôles 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.

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



Caution: To comply with FCC RF exposure requirements in section 1.1307, any antenna which is connected to an MA4061/MA4070 requires a minimum distance of 1.5 meters between it and all persons.

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1.0 GENERAL INFORMATION

1.1 System Overview

The **MA4061B** is a fully agile commercial quality IF upconverter for MMDS and LMDS applications. Advanced design permits full frequency agility over the 2500 to 2686 MHz frequency band while still maintaining a phase noise specification which exceeds the requirement of 64 QAM. The MA4061B is a modular circuit card designed for use with the WaveCom MA4000 Series. The **MA4070B** is a solid state, fixed gain power amplifier for MMDS applications. Each MA4000 card chassis with common MA4010 power supply can contain up to 2 MA4061B independent frequency agile upconverters, and complementing MA4070B Power Amps in a 4U rack mount configuration. Up to 10 MA4061B's can also be configured in a MA4000 chassis. This advanced cost effective upconverter offers high performance, flexibility and space efficiency.

1.2 MA4061B Module Features

- Front panel selectable output frequency from 2500 to 2686 in 62.5 kHz steps
- RF output muted when changing output configuration or phase lock alarm
- 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
- Input IF AGC ensures very stable output level, even if input varies

1.3 MA4070B Module Features

- FCC emission mask approved for 31.5 dBm RF output
- 1.41W linear transmit power for 64 QAM modulation
- May be operated with video
- 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

1.4 System Features

- Local control via LCD and 4 soft touch push buttons
- Remote frequency and level agile via RS232/RS485
- Fully phase locked synthesized oscillators referenced to a TCXO for exceptional frequency stability
- Durable design is reflected in the stainless steel chassis and lexan labels
- International internal switching power supply (100 to 240 VAC)
- Front panel displays IF/RF power

1.5 Specifications

IF INPUT - MA4061B

IF Frequency (center of the band)

Channel Pass Band IF Input Level Impedance IF AGC

RF OUTPUT - MA4061B

Output Frequency Range Frequency Step Size

Output Level

Frequency Response (Over any 5 MHz band) Spurious Products (2500 to 2686 MHz)

Frequency Stability (10 to 40°C)

C/N In Band Phase Noise

Output Return Loss (2500 to 2686 MHz)

MA4070B

Output Frequency

Output Power Gain Gain Stability Gain Flatness Mute Level Spurious

> Inband Out of Band

Sync Pulse Compression Spectral Sideband Regrowth

Input Impedance Output connector Front Panel Indicators

MISCELLANEOUS

Remote Control Interface Remote Control Connector Operating Temperature IF Input Connector RF Output Connector MA4010 Power Supply Shipping Weight

MA4000 chassis with MA4010 PS MA4061 Modulator Card (each)

MA4070B Power Amplifier Module (each) Dimensions (MA4000 chassis) Mounting (MA4000 chassis)

OTHER FEATURES

Local and Remote Control RF Output Muting with Visual Indicator

OPTIONS

MA4070B FP1 - Frequency Plan 2.5 GHz to 2.6 GHz

FP2 - Frequency Plan 2.6 GHz to 2.7 GHz

8F1 - Front Intake - Fan Tray

44.00 MHz

6 MHz (custom BW possible) 25 to 35 dBmV (total power)

75 ohm enable/disable

2500 to 2686 MHz

62.5 kHz

-15 dBm to 3 dBm (adjustable)

±0.5 dB

-60 dBc

±3 kHz (MA4010 TCXO 1 ppm)

-60 dBc (4 MHz BW) -94 dBc/Hz at 10 kHz offset

-20 dB

2500 to 2600 MHz

(any 100 MHz band available from 2500 to 2700 MHz)

FCC emission mask approved for 31.5 dBm

34 dB ±2 dB, fixed ±0.5dB (10 to 40° C) ±0.3 dB over 6 MHz

-60 dBc

-55 dBc -55 dBc

2 IRE max (analog video, 7 W) -35 dBc max (64 QAM, 2 W)

50 ohm

N female

DC Power, RF High, RF Low, High Reverse Power

RS232/RS485 RJ45 (in and out) 10 to 40°C (50 to 104°F) F female (75 ohm) SMA female (50 ohm) 100 to 240 VAC; 50/60 Hz

18 lbs. (8.2 kg) 1.2 lbs. (0.6 kg) 6.2 lbs. (2.8 kg)

19" (w) x 13.7" (d) x 7" (h) (48.3 x 34.8 x 17.8 cm)

Standard 19" rack - 4U (7.0")

Power/Control Module (MA4011D and/or MA4012D)

2R1 - Additional PS4011D (100 to 240 VAC) Power Supply Module

2R2 - Additional PS4012D (-48 VDC) Power Supply Module

Specifications subject to change without notice.

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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 MA4001B 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 MA4001B 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.

2.2.2 Antenna Requirements

The MA4070B is used with a user-supplied antenna. Please consult table 2.2A for further information. Mount the antenna according to the manufacturer's instructions.

Transceiver Power Antenna Type **Antenna Gain Safe Distance** (Watts) (dBm) (dBi) (meters) 1.41 31.5 Omni 10 0.3353 1.41 31.5 Omni 15 0.5962 31.5 Cardioid Horizontal 20 1.0602 1.41 1.41 31.5 Cardioid Vertical 20 1.0602

TABLE 2.2A: ANTENNA LIST

A self-adhesive RF exposure label is supplied with each MA4070B unit for the user to affix to their antenna. To operate the MA4070B in compliance with FCC regulations, you must apply the included label on to the antenna. Peel off the protective backing from the label and affix it to the front of the antenna such that the label is readable from a distance of 3 feet.



Caution: To comply with FCC RF exposure regulations in section 1.1307, a minimum separation distance of 1.5 meters is required between this antenna and all persons.

2.3 Power Requirements

The equipment has an international auto-ranging internal power supply which allows it to be powered from any 100 to 240 VAC; 50 to 60 Hz source.

Check the total current consumption of all equipment on the same line before applying power to the MA4000B system. Avoid sharing an AC source that feeds heavy motors or other equipment, which require large current drains.

2.4 Rack Mounting

The MA4000 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.

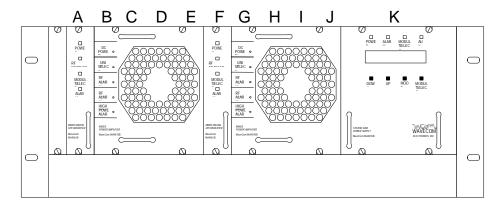
2.5 Module Installation/Replacement

- 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. Configure the output frequency and configure IF/RF levels
- 7. Reconnect the rear panel RF cables

3.0 OPERATION

3.1 Front Panel Description

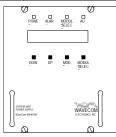
DIAGRAM 3.1a: FRONT PANEL - MA4200 SYSTEM



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 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 MA4010B Power/Control Module

DIAGRAM 3.1B: FRONT PANEL - MA4010B



DISPLAY

<u>The first line on the display</u> is the Mode Information Line. It shows the settings for the currently selected module. The possible operating modes depend upon the currently selected module (See Section 3.2, Front Panel Operating Modes (pp 15 to 17) 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. 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. When used with the MA4070B Power Amp Modules, the MA4061B Upconverter Modules can only be installed in slots A and F. The MA4070B Power Amp Modules can only be installed in slots B thru E and slots G thru J (as shown in Diagram 3.1A).

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 to 25) 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 27 to 29) for the list of current error codes.

The final three characters indicate if local front panel control of the MA4001B chassis is enabled ("L/R") or disabled ("_R_"). Remote control of the chassis is always available.

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 of the selected module.

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 MA4010B 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.

3.1.2 MA4061B - Upconverter Card

DIAGRAM 3.1c: FRONT PANEL - MA4061B



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

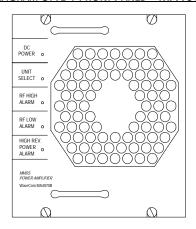
When the green MODULE SELECT indicator is illuminated, it indicates that the corresponding module has been selected from the front panel or via the remote control interface.

ALARM LED

The red MA4061 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.

3.1.3 MA4070B - Power Amplifier

DIAGRAM 3.1D: FRONT PANEL - MA4070B



DC POWER LED

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

UNIT SELECT LED

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

RF HIGH ALARM LED

When the RF HIGH ALARM LED is illuminated, detected power levels have exceeded acceptable limits. Limits will depend on whether default or custom thresholds are set.

RF LOW ALARM LED

When the RF LOW ALARM LED is illuminated, detected power levels have exceeded acceptable limits. Limits will depend on whether default or custom thresholds are set.

HIGH REV POWER ALARM LED

When the HIGH REV POWER ALARM LED is illuminated, detected power levels have exceeded acceptable limits. Limits will depend on whether default or custom thresholds are set.

3.2 Front Panel Operating Modes

3.2.1 MA4061 Upconverter Modes

FREQUENCY

When this mode is selected, the display will read: Frq XXXX.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 62.5 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 or Down buttons will toggle the display between Enabled and Disabled. When enabled, the MA4061 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).

If the IF level is not within ± 4.0 dB 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.

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 MA4061 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 dBm

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 -15 dBm to +3 dBm.

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 or Down buttons will toggle the display between Enabled and Disabled. When enabled, the RF output from the MA4061 Upconverter is enabled. When disabled, the RF output from the MA4061 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.

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 -15, +4 dBm, 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 34 to 40) for instructions on how to adjust these settings.

DEFAULT SETTINGS

At the time of shipping from factory, the default settings of the MA4061 are:

AUTO IF AGC enabled

IF & RF Thresholds enabled

Output is disabled (until a vaild 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 MA4070 Upconverter Modes

FORWARD POWER ADJUST

When this mode is selected, the display will read: Fwd Pwr XX.X dB

The display indicates the approximate RF power level measured before the output. To adjust the RF level, use the UP/DOWN arrow buttons. The RF output level may be set within the range of +20 dBm to +40 dBm.



The RFlevel can only be adjusted if a MA4061 is in the preceding slot

REVERSE POWER

When this mode is selected, the display will read: Rev Pwr XX.X dBm

The display indicates the approximate RF power level returned to the card from mismatched connections, etc. The detector measures from +20dBm to +40dBm

OUTPUT ENABLE/DISABLE

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

or

Output Disabled

Pressing the Up or Down buttons will toggle the display between Enabled and Disabled. When enabled, the RF output from the MA4070 Power Amplifier is enabled. When disabled, the RF output from the MA4070 Power Amplifier 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.

FORWARD AND REVERSE ALARM THRESHOLD SETTING

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

Default settings are as follows: ForwardHigh +41 dB, alarm function enabled

ForwardLow +20 dB, alarm function enabled

ReverseHigh +40 dBm, alarm function enabled

The alarms can be independently enabled or disabled via remote control. Refer to Section 7.5, Detailed Command Descriptions and System Responses (pp 34 to 40) for instructions on how to adjust these settings.

3.2.3 MA4010B Power/Control Module Modes

ADDRESS

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



The displayed address is the currently selected MA4001B chassis Address. A different address can be selected by pressing the Up or Down buttons. The MA4001B 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 SELECT

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

or

RS485 Selected

Pressing the Up or Down buttons will toggle the display between RS232 and RS485.



The Remote Interface Connector Pinout will change depending upon the Interface Type selected. Please refer to Section 4.1, Power/Control Module Rear Panel Connection (pp 19, 20) for details.

3.3 Remote Control Operating Instructions

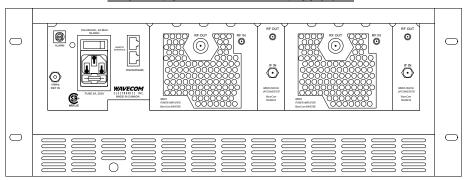
The MA4000 system may be controlled via the RS232/RS485 Remote Interface connector. (Refer to Section 4.1, Power/Control Module Rear Panel Connections (pp 19, 20) for the connector pin-out).

The input data rate can be 9600, 14400, or 28800 baud. The MA4000 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 31 to 41).

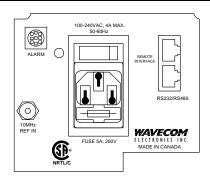
4.0 REAR PANEL CONNECTIONS

DIAGRAM 4.0A: REAR PANEL - MA4200 SYSTEM



4.1 MA4010B - Power/Control Module

DIAGRAM 4.1A: REAR PANEL - MA4010B



AC INPUT

The AC input accepts input voltages from 100 to 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.

10 MHZ REF IN

If this option is installed, it will allow the user to use an external 10 MHz reference. When a signal of the specified level is present, it will override the internal reference and automatically use the external reference.

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 4.1B: RJ45 PLUG CONNECTIONS

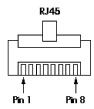


TABLE 4.1A: RS232 PIN-OUT

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	\rightarrow	RXD	6
7	DTR	\rightarrow	DTR	7
8	RTS	\rightarrow	RTS	8



Note: The above pin-out allows a straight through RJ45 cable to be used for connection between the terminal and the MA4001B chassis. It is also possible to use an RJ45 - DB25 adapter to connect to a PC or similar RS232 standard serial port.

TABLE 4.1B: RS485 PIN-OUT

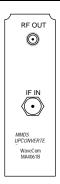
Terminal				Upconverter
RJ45 Pin	Signal	Direction	Signal	RJ45 Pin
1	NC		NC	1
2	NC		NC	2
3	А	\leftrightarrow	А	3
4	GND	_	GND	4
5	GND	_	GND	5
6	В	\leftrightarrow	В	6
7	NC		NC	7
8	NC		NC	8



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.

4.2 MA4061B - MMDS Upconverter Card

DIAGRAM 4.2A: REAR PANEL - MA4061B



RF OUT

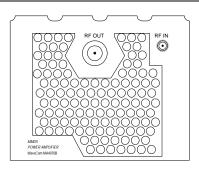
The RF out SMA connector provides the RF output signal from 2500 to 2686 MHz with a level of -15 to 4 dBm. The impedance is 50 ohm.

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.

4.3 MA4070B - Power Amplifier

DIAGRAM 4.3A: REAR PANEL - MA4070B



RF OUT

The RF output N connector provides the RF output signal from 2500 to 2600 MHz or 2600 to 2686 MHz. The impedance is 50 ohm.

RF IN

The RF Input SMA connector accepts an input signal at 2500 to 2686 MHz with up to a 6 MHz bandwidth from a 50 ohm source.

5.0 STATUS CODES

5.1 MA4061B 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	Α	Reserved
3	Reserved	В	Reserved
4	Reserved	С	Reserved
5	Reserved	D	Reserved
6	Reserved	Е	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
Α	RF Threshold Detection is enabled, IF AGC is enabled
В	RF Threshold Detection is enabled, IF AGC is enabled, Output is disabled
С	RF Threshold Detection is enabled, IF Threshold Detection is enabled
D	RF Threshold Detection is enabled, IF Threshold Detection is enabled, Output is disabled
Е	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 MA4070B 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	Α	Reserved
3	Reserved	В	Reserved
4	Reserved	С	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 5.2B: LEAST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Output is disabled
2	Forward Power High Threshold Detection is enabled
3	Forward Power High Threshold Detection is enabled, Output is disabled
4	Forward Power Low Threshold Detection is enabled
5	Forward Power Low Threshold Detection is enabled, Output is disabled
6	Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled
7	Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled, Output is disabled
8	RF Threshold Detection is enabled
9	RF Threshold Detection is enabled, Output is disabled
Α	RF Threshold Detection is enabled, Forward Power High Threshold Detection is enabled
В	RF Threshold Detection is enabled, Forward Power High Threshold Detection is enabled, Output is disabled
С	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled
D	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled, Output is disabled
E	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled
F	RF Threshold Detection is enabled, Forward Power Low Threshold Detection is enabled, Forward Power High Threshold Detection is enabled, Output is disabled

5.3 MA4010B 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 5.3A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	Reserved	9	Reserved
2	Reserved	А	Reserved
3	Reserved	В	Reserved
4	Reserved	С	Reserved
5	Reserved	D	Reserved
6	Reserved	Е	Reserved
7	Reserved	F	Reserved

TABLE 5.3B: 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	В	Reserved
4	Reserved	С	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

6.0 ERROR CODES

6.1 MA4061B 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
Α	RF Threshold Error, IF AGC Error
В	RF Threshold Error, IF AGC Error, Fixed LO Error
С	RF Threshold Error, IF Threshold Error
D	RF Threshold Error, IF Threshold Error, Fixed LO Error
Е	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
Α	Variable LO Error, Hard Alarm condition
В	Variable LO error, Hard Alarm condition, Output is Muted
С	Variable LO Error, Soft Alarm condition
D	Variable LO Error, Soft Alarm condition, Output is Muted
Е	Variable LO Error, Soft Alarm condition, Hard Alarm condition
F	Variable LO Error, Soft Alarm condition, Hard Alarm condition, Output is Muted

6.2 MA4070B Error Codes

TABLE 6.2A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description
0	None
1	Reverse Power Threshold Error
2	Reserved
3	Reverse Power Threshold Error, Reserved
4	Reserved
5	Reverse Power Threshold Error, Reserved
6	Reserved
7	Reverse Power Threshold Error, Reserved
8	Reserved
9	Reverse Power Threshold Error, Reserved
Α	Reserved
В	Reverse Power Threshold Error, Reserved
С	Reserved
D	Reverse Power Threshold Error, Reserved
Е	Reserved
F	Reverse Power Threshold Error, Reserved

TABLE 6.2B: LEAST SIGNIFICANT DIGIT DESCRIPTION

	T
Digit	Description
0	None
1	Hard Alarm condition
2	Soft Alarm condition
3	Soft Alarm condition, Hard Alarm condition
4	Forward Power High Threshold Error
5	Forward Power High Threshold Error, Hard Alarm condition
6	Forward Power High Threshold Error, Soft Alarm condition
7	Forward Power High Threshold Error, Soft Alarm condition, Hard Alarm condition
8	Forward Power Low Threshold Error
9	Forward Power Low Threshold Error, Hard Alarm condition
Α	Forward Power Low Threshold Error, Soft Alarm condition
В	Forward Power Low Threshold Error, Soft Alarm condition, Hard Alarm condition
С	Forward Power Low Threshold Error, Forward Power High Threshold Error
D	Forward Power Low Threshold Error, Forward Power High Threshold Error, Hard Alarm condition
Е	Forward Power Low Threshold Error, Forward Power High Threshold Error, Soft Alarm condition
F	Forward Power Low Threshold Error, Forward Power High Threshold Error, Soft Alarm condition, Hard Alarm condition

6.3 MA4010B 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 6.3A: MOST SIGNIFICANT DIGIT DESCRIPTION

Digit	Description	Digit	Description
0	None	8	Reserved
1	5 Volt Supply Under voltage	9	Reserved
2	Reserved	Α	Reserved
3	Reserved	В	Reserved
4	Reserved	С	Reserved
5	Reserved	D	Reserved
6	Reserved	E	Reserved
7	Reserved	F	Reserved

TABLE 6.3B: 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		
Α	Reserved		
В	Reserved		
С	Reserved		
D	10 Volt Supply Under voltage, 24 Volt Supply Under voltage, Hard Alarm		
Е	Reserved		
F	Reserved		

7.0 DETAILED REMOTE CONTROL

7.1 Operation

The MA4001B chassis may be controlled via the RS232/RS485 Remote Interface connector. (See Section 4.1, Power/Control Module Rear Panel Connections (pp 19, 20) for the connector pin-out).

The input data rate can be 9600, 14400, or 28800 baud. The MA4000 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 MA4000 system controller consist of a sequence of ASCII characters. Messages must meet the following guidelines in order to be correctly interpreted by the controller.

- There can be no more than 75 ms between consecutive message bytes.
- After receiving the entire message, the MA4000 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

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)

MA4061B Command Codes

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

MA4070B Command Codes

OE = Enable Output

FPHS = Forward Power High Set

OD = Disable Output

FPHE = Forward Power High Disable

SU = Unit Status Request

FPHD = Forward Power High Disable

SC = Configuration Status Request

FPLS = Forward Power Low Set

LE = Enable Local Control

FPLE = Forward Power Low Enable

LD = Disable Local Control

FPLD = Forward Power Low Disable

RPS = Reverse Power Threshold Set

RPE = Reverse Power Threshold Enable

RPE = Reverse Power Threshold Disable

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.

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

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

7.5.1 MA4061B Upconverter Detailed Command Descriptions and System Responses

This section defines each of the command codes and the associated parameters for the MA4061B Upconverter module.

FL - Load Frequency

Description: Loads the frequency for the specified module.

Parameters: Desired frequency in MHz, in the form XXXX.XXXX. Leading zeros are optional, but not required. The

decimal point and four trailing characters are required. Valid input frequencies are between 2500.0000 MHz and 2686.0000 MHz. Valid trailing characters are multiples of 0.0625 MHz, all others will be

denied.

Example: *999<sp>A<sp>FL<sp>2500.0625<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

25 dB in 0.25 dB steps. Valid trailing characters are 00, 25, 50 or 75.

Example: *999<sp>A<sp>Al<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 39.75 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 dBm, 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

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Approved: R. L.

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

LE - Enable Local Control

Description: Enables local control of the MA4001B 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 MA4001B 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 7.5.1A: RESPONSE PARAMETERS FOR STATUS UNITS REQUEST

Parameter (Units)	Format	Example
Model	XXXXXXXXXX	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	

7.5.2 MA4070B Upconverter Detailed Command Descriptions and System Responses

This section defines each of the command codes and the associated parameters for the MA4070B Power Amplifier module.

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

LE - Enable Local Control

Description: Enables local control of the MA4001B 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 MA4001B 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 7.5.2A: RESPONSE PARAMETERS FOR STATUS UNITS REQUEST

Parameter (Units)	Format	Example
Model	XXXXXXXXXX	MA4070
Module SN	XXXXXXX	0123456
Hardware Revision	XXX	010 (i.e. Rev 1.0)
Microcontroller 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 (pp 27 to 29) for more details.

TABLE 7.5.2B: RESPONSE PARAMETERS FOR STATUS CONFIGURATION REQUEST

Parameter (Units)	Format	Example
MA4070 Status Code	XXXX	0101
MA4070 RF Power (dBm)	XXX.X	31.5
MA4070 RF Reverse Power (dBm)	XX.X	< 20

FPHS - Forward Power High Set

Description: Sets the Forward Power High for the specified module. When the Forward Power High is enabled, and

the RF Power is above the threshold limit, a non-critical alarm will be triggered.

Parameters: Desired RF Thresholds in dBm, in the form XX.X. The decimal point and trailing characters are

required. The trailing character can range between 0.0 and 0.9

Example: *999<sp>B<sp>FPHS<sp>38.0<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPHE - Enable Forward Power High

Description: Enables the Forward Power High for the specified module. When the Forward Power High is enabled,

and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

Parameters: None

Example: *999<sp>B<sp>FPHE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPHD - Disable Forward Power High

Description: Disables the Forward Power High for the specified module.

Parameters: None

Example: *999<sp>B<sp>FPHD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPLS - Set Forward Power Low

Description: Sets the Forward Power Low for the specified module. When the Forward Power Low is enabled, and

the RF Power is below the threshold limit, a non-critical alarm will be triggered.

Parameters: Desired RF Thresholds in dBm, in the form XX.X. The decimal point and trailing characters are

required. The trailing character can range between 0.0 and 0.9

Example: *999<sp>B<sp>FPLS<sp>34.0<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPLE - Enable Forward Power Low

Description: Enables the Forward Power Low for the specified module. When the Forward Power Low is enabled,

and the RF Power is below the threshold limit, a non-critical alarm will be triggered.

Parameters: None

Example: *999<sp>B<sp>FLPE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

FPLD - Disable Forward Power Low

Description: Disables the Forward Power Low for the specified module.

Parameters: None

Example: *999<sp>B<sp>FPLD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

RPS - Set Reverse Power Threshold

Description: Sets the Reverse Power Threshold for the specified module. When the Reverse Power Threshold is

enabled, and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

Parameters: Desired RF Thresholds in dBm, in the form XX.X. The decimal point and trailing characters are

required. The trailing character can range between 0.0 and 0.9

Example: *999<sp>B<sp>RPS<sp>25.0<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

RPE - Enable Reverse Power Threshold

Description: Sets the Reverse Power Threshold for the specified module. When the Reverse Power Threshold is

enabled, and the RF Power is above the threshold limit, a non-critical alarm will be triggered.

Parameters: None

Example: *999<sp>B<sp>RPE<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

RPD – Disable Reverse Power Threshold

Description: Disables the Reverse Power Threshold for the specified module.

Parameters: None

Example: *999<sp>B<sp>RPD<sp>CRC<cr>

Response: OK or MOD or ERR or CRC

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. 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.

0 0 34 D701 68 E 1 C0C1 35 17C0 69 2 2 C181 36 1680 6A 2 3 140 37 D641 6B E 4 C301 38 D201 6C 2 5 3C0 39 12C0 6D E 6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	EA41 EE01 2EC0 2F80 EF41 2D00 EDC1 EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640 2200
1 C0C1 35 17C0 69 2 2 C181 36 1680 6A 2 3 140 37 D641 6B E 4 C301 38 D201 6C 2 5 3C0 39 12C0 6D E 6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	2EC0 2F80 EF41 2D00 EDC1 EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
2 C181 36 1680 6A 2 3 140 37 D641 6B E 4 C301 38 D201 6C 2 5 3C0 39 12C0 6D E 6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	2F80 EF41 2D00 EDC1 EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
3 140 37 D641 6B E 4 C301 38 D201 6C 2 5 3C0 39 12C0 6D E 6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	EF41 2D00 EDC1 EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
4 C301 38 D201 6C 2 5 3C0 39 12C0 6D E 6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	2D00 EDC1 EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
5 3C0 39 12C0 6D E 6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	EDC1 EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
6 280 3A 1380 6E E 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	EC81 2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
6 280 3A 1380 6E E F 7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	2C40 E401 24C0 2580 E541 2700 E7C1 E681 2640
7 C241 3B D341 6F 2 8 C601 3C 1100 70 E	E401 24C0 2580 E541 2700 E7C1 E681 2640
	24C0 2580 E541 2700 E7C1 E681 2640
9 6C0 3D D1C1 71 2	2580 E541 2700 E7C1 E681 2640
	E541 2700 E7C1 E681 2640
	2700 E7C1 E681 2640
	2700 E7C1 E681 2640
	E7C1 E681 2640
	E681 2640
	2640
F 440 43 F141 77 2	
	UU
	E2C1
	E381
	2340
	E101
	21C0
	2080
	E041
	A001
	60C0
	6180
	A141
	6300
	A3C1
	A281
	6240
	6600
	A6C1
	A781
	6740 A501
	65C0
	6480
	A441 6C00
	ACC1
	AD81
	6D40
	AF01
	6FC0
	6E80
	AE41
	AA01
	ENTRY
	6AC0
<u>X Term</u> <u>Entry</u> 66 2A80 9A 6	6B80

WaveCom Electronics Inc
MA4061/MA4070 Manual; MAN1L2301 Rev03 (Mar 2002)
Approved: R. L.

9B 9C 9D 9F A0 A1 A2 A3 A4 A6 A6 A7 A8 A6 A6 A7 A8 A6 A7 A6 A7 A7 A7 A7 A7 A7 A7 A7 A7 A7 A7 A7 A7	AB41 6900 A9C1 A881 6840 7800 B8C1 B981 7940 BB01 7BC0 7A80 BA41 BE01 7EC0 7F80 BF41 7D00 BDC1 BC81 7C40 B401 74C0 7580 B541 7700 B7C1 B681 7640 7200 B2C1 B381 7340 B101 71C0 7080 B2C1 B381 7340 B101 71C0 7080 B041 5000 90C1 9181 5140 9301 53C0 5280 9241 9601 56C0 5780 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741 5500 9741	D4 D5 D6 D7 D8 D9 DA DB DC DD DE E1 E2 E3 E4 E5 E6 E7 E8 E8 E8 EB EC EE EF F7 F7 F8 F9 FA FF FF FF FF FF FF FF FF FF FF	5F00 9FC1 9E81 5E40 5A00 9AC1 9B81 5B40 9901 59C0 5880 9841 4B00 8BC1 8A81 4A40 4E00 8CC1 8F81 4F40 8CO1 4C80 8C41 4400 8C41 4400 8C41 4540 8C1 8581 4540 8701 47C0 4680 8641 8201 42C0 4380 8341 4100 81C1 8081 4040
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222 Cardinal Crescent Saskatoon, Saskatchewan S7L 6H8 Canada

Tel: (306) 955-7075 Fax: (306) 955-9919 www.WaveCom.ca sales@WaveCom.ca