
MiChroSat Modem Iridium Variant

Wireless Innovation

Version 1.0 (draft)

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1 OVERVIEW

MiChroSat is a low data rate communications solution developed by Wireless Innovation for deployment in remote locations. Operating via LEO (Low Earth Orbit) satellite networks, MiChroSat provides global coverage.

MiChroSat offers data connectivity either via direct internet dial-up connectivity or 'async' type modem to modem connections. The system can also now provide "closed network" SMS messaging service and also the unique Short Burst Data Messaging Service.

1.1 System Operation

The MiChroSat system can provide data connectivity through asynchronous data and direct internet. Data connections supported are from MiChroSat to another MiChroSat, MiChroSat to a PSTN user, PSTN user to MiChroSat user and MiChroSat to Internet.

1.1.1 Asynchronous Data

When providing async data services, the MiChroSat modem can be interfaced directly into existing applications utilizing PSTN or GSM modems. The modem provides async data connectivity at data rate of 2400. The MiChroSat system supports both Modem to PSTN/GSM connections and Modem to Modem connectivity.

The MiChroSat modem supports the full 'Hayes' AT command set allowing existing applications to be easily interfaced to the modem.

- **Modem to modem**

MiChroSat also provides direct modem to modem connectivity, allowing one modem to call another directly with no terrestrial network connectivity. This method of configuration allows a number of modems in the field to call (or to be called) directly via a bank of modems located at the customers premises. This provides a secure independent communications network, removing any reliance on the existing terrestrial infrastructure. Figure 1.1a) shows a typical modem to modem configuration.

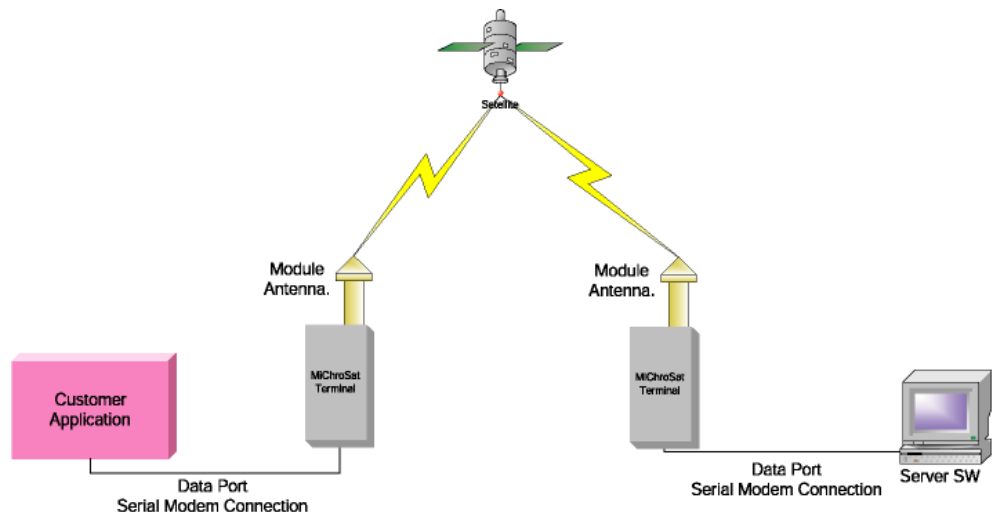


Fig 1.1a) Direct Modem to Modem Communication

- **Modem to PSTN**

Figure 1.1b) shows a typical application, where a MiChroSat modem is being used to extend a PSTN dial-up application to locations where there is no PSTN connectivity or GSM coverage. The MiChroSat modem can dial directly to PSTN/GSM numbers or can wait in 'auto-answer' mode to receive calls from PSTN/GSM as required.

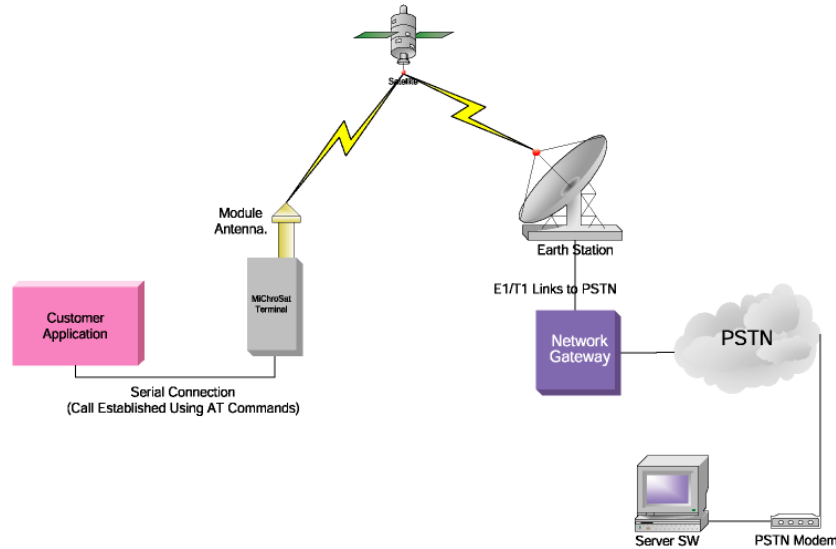


Fig 1.1b) A typical MiChroSat network configuration

1.1.2 Direct Internet Connectivity

The MiChroSat modem can be configured to provide a direct connection to the internet at 2400bps without having to dial an existing ISP via PSTN. To access the internet the modem dials a specific access number using standard Hayes 'AT' commands and the call is answered by the gateway. A PPP session is established connecting the user directly to the internet without the call being passed through the PSTN. Once the terminal is connected it allows the full suite of IP protocols to be used such as WWW, FTP, SMTP and Telnet. A typical direct internet connectivity application is shown in figure 1.1.2a) overleaf.

Direct internet connectivity allows customer applications to update web pages for tracking/logging applications or update servers via e-mail or file transfers directly via the internet. The direct internet connectivity reduces call costs by optimising the PPP negotiation process allowing the actual call duration to be reduced.

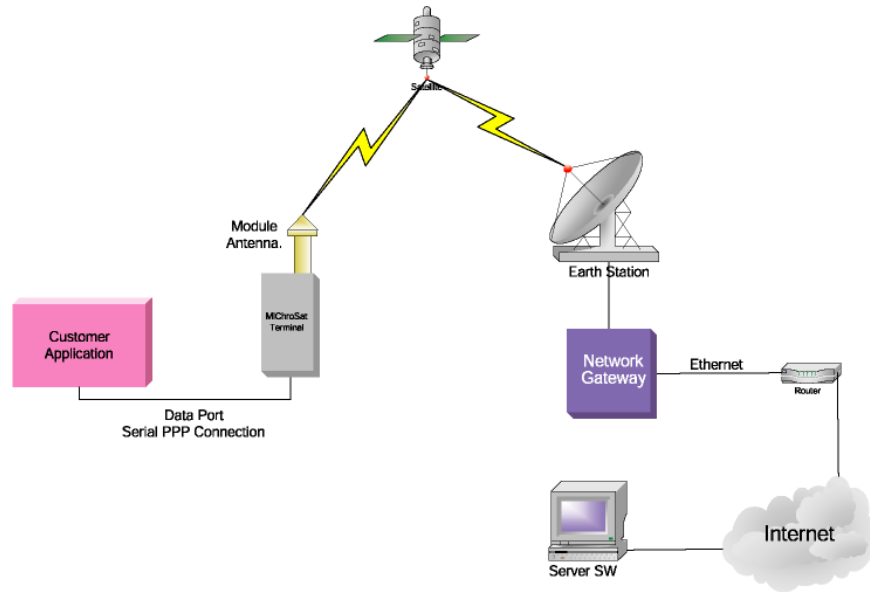


Fig 1.1.2a) Direct Internet Connectivity via MiChroSat

- **MichMail Service**

The MiChroSat Mail Service is a unique service offered by Wireless Innovation Ltd to support email based applications operating via dial-up connections across low earth orbit satellite networks. The service provides a uniquely optimized method of completing a dial up call to the internet via both the Iridium and Globalstar satellite networks.

Rather than dialling a terrestrial Internet Service Provider to gain internet access, the data-logger or field device simply dials a dedicated network specific access number which is actually answered within the satellite gateway and then passed directly onto the Internet via high speed backbone.

This service provides significant benefits as the call is immediately answered digitally within the satellite gateway equipment removing the need for lengthy modem negotiation prior to the PPP session being established. The field device will then send its email (as per usual), however the dedicated Mail Servers used to receive the Emails will be hosted and provided by Wireless Innovation Ltd.

Upon activation of the service each satellite modem is allocated its own account on the Mail servers, The Email address for each modem is pre-assigned upon delivery with the format phonenum@MiChroSat.com - where the phone number is the MSISDN/C (data phone number) of the modem.

As well as providing SMTP relay to deliver outbound Emails mail servers, the mail servers will also provide a POP3 mailbox for each modem. By having a dedicated mail servers used only to relay emails to/from the field based device or data loggers, significantly optimized mail filtering can be carried out (such as filtering by sender, subject, size, age or content) essentially allowing only valid emails destined for the device to be stored, reducing the data to be downloaded from the mailbox.

In addition authenticated SMTP may also be used via the dedicated MiChroSat mail servers to provide enhanced security for all outbound email. From the end users perspective, the service is no different to using a Terrestrial ISP and End Users are able to send email to the dedicated mailservers for updates and will receive data as if it was sent via any other ISP. The MichMail solution is shown in figure 1.1.2b) overleaf.

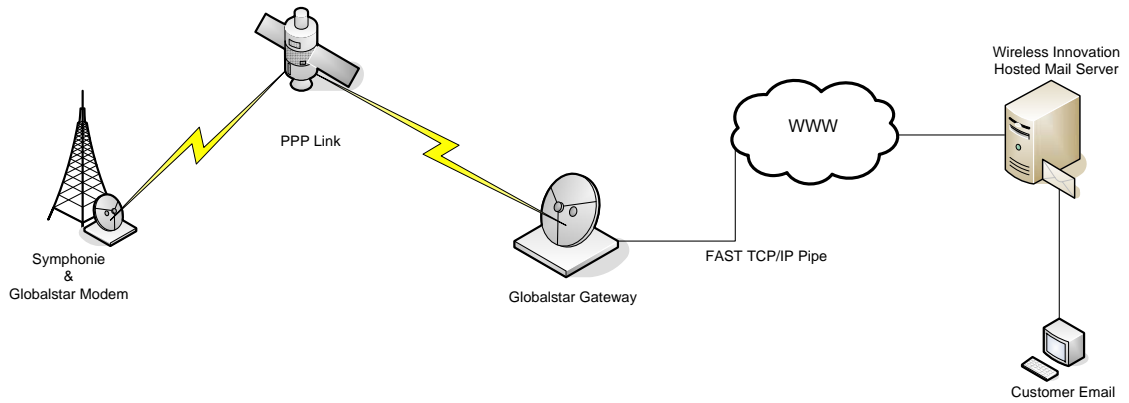


Figure 1.1.2b) Typical Setup for MichMail

Advantages

- Minimum possible call time
- No handshaking delays as modem directly connects to satellite gateway at 2400/9600bps rather than negotiating the connection speed down from 56K baud rate typically set on modems by terrestrial ISP's.
- Connection from the satellite gateway is now a high speed TCP/IP link.
- No terrestrial PSTN connection involved in the call path.
- Reduced call rates.
- Exceptional SPAM filtering of mailbox, to ensure only "update" emails reach the field device or data-logger.
- No setup of ISP specific parameters for each remote site, all parameters are common regardless of location where modem is operated.
- No requirement to change ISP dial up number.

1.2 Typical MiChroSat Uses

Leak Detection – A MiChroSat unit is deployed for 3 to 6 months in conjunction with a flow/pressure meter. It can then give data to prove or disprove the presence of a leak. This in turn enables water authorities to meet their legal obligation to reduce leakage.

Wind Generation and Survey – MiChroSat is used to communicate recorded wind speeds at temporary installations to survey the optimum position to erect wind turbines and generators – mainly deployed at sites whereby the terrestrial communications media cannot be relied upon.

Extension of PSTN Based Telemetry – MiChroSat is deployed on a permanent basis with a telemetry outstation to extend communication to sites not served by existing PSTN/GSM networks. Typically it would report in once per day with a health check message but MiChroSat can also report on an exception basis.

Water Management – MiChroSat is deployed to enable the customer to manage their usage effectively whilst their main communication media is in repair – typically a temporary installation at a large industrial site.

2 GENERAL PRODUCT DESCRIPTION

The MiChroSat OEM module contains an Iridium network compliant communications device designed for wireless data solutions. The following summarises key features of the modem module.

- Multi-Interface Connector via DB-25 incorporating RS-232, Audio and DC power
- AT Command Set for Commanding, Controlling, and Configuring the Modem
- TNC RF Connector
- Integral SIM Card Reader

2.1 DC Power Interface Specifications

The DC power requirements for the modem are summarised in the table below.

Parameter	Value
Main Input Voltage Nominal	+4.0 to 4.8Vdc
Main Input Voltage Ripple	40mv p-p

Please note that the dc source/power supply must be capable of providing 2.5A@4.4V.

2.2 RF Interface Specifications

The MiChroSat modem has a single TNC Female 50-ohm connection for both transmit and receive. General RF parameters are listed in the table below.

Parameter	Value
Frequency Range	1616 to 1626.5 MHz
Duplexing	Time Domain Duplex (TDD)
Osc. Stability	+/- 1.5 ppm
Input/output Impedance	50 ohms
Multiplex Method	TDMA/FDMA

2.3 SIM Interface Specifications

The MiChroSat modem contains an integrated SIM reader located beneath a cover plate. It uses and requires an Iridium SIM chip for operation.

2.4 Physical Connectors

The table depicts the connectors for interfacing to the modem.

Required Connector	Type
Antenna	TNC Female
RS232, Power, and Audio Connections	25 Way Pin Male D-Type

2.4.1 Antenna Connector

The MiChroSat modem uses a standard Female TNC antenna connector. . This single connector is used for both transmit and receive. The antenna cable must insure a loss of <3 dB at operating frequency of 1616 to 1626.5 MHz. The minimum link margin of 13.1 dB must be maintained.

2.4.2 Multi-interface Connector

The DB-25 connector provides an RS-232 interface, audio interface and power to the MiChroSat modem. The modem is controlled via AT commands. These commands are defined in the AT Command Reference Document at Appendix A. The Pin definitions are shown in the table below.

Pin	Signal Name	Signal Description	Interface
3	DC GND	External Ground input	DC Power
4	Vin	External 4.4 VDC input	DC Power
5	Spk	Audio Speaker Output	Audio
7	RI	RS232 Ring Indicate	RS232 Data
8	RTS	RS232 Request To Send	RS232 Data
9	Tx	RS232 Transmit Data	RS232 Data
10	DCD	RS232 Data Carrier Detect	RS232 Data
13	Rx	RS232 Receive Data	RS232 Data
14	Audio GND	Audio Ground Reference	Audio
15	Mic	Audio Microphone Input	Audio
16	Vin	External 4.4 VDC input	DC Power
17	DC GND	External Ground input	DC Power
19	DTR	RS232 Data Transfer Ready	RS232 Data
21	DSR	RS232 Data Set Ready	RS232 Data
22	CTS	RS232 Clear To Send	RS232 Data
23	RS232 GND	RS232 GND Signal Reference	RS232 Data

Note that two pins (4 and 16) are provided for the external 4.4 VDC input. Two pins (3 and 17) are also provided for the associated external ground input. This is done to distribute the current across two wires, and therefore all four pins should be utilized in the external power connection.

Please ensure that the DC cable is capable of providing the necessary current to the MiChroSat modem from the DC source.

2.5 RF Specifications

2.5.1 Antenna Specifications

Wireless Innovation offers several types of antennae for use with the MiChroSat Modem. If the specific application requires a custom antenna, it must meet the specifications in the following table.

Parameter	Value
Operating Temperature Range	-40 - +85 degrees C without loss of function
Measurement Frequency Range	1616 to 1626.5 MHz
Return Loss (minimum)	9.5 dB (<2:1 VSWR)
Gain	0.0 dB (weighted average minimum)
Minimum 'Horizon' Gain	-2.0 dB (82 degree conic average)
Nominal Impedance	50 Ohms
Polarisation	RHCP
Basic Pattern	Omni directional & Hemispherical

2.5.2 Existing Antenna Options

There are several existing antenna options for the application developer. These antennae include the fix mast, mobile magnetic/permanent mount, portable auxiliary, and Eurocom maritime. Refer to the pictures of each antenna below and Appendices B and C at the back of the manual for more information including installation instructions for the commonly used antennas.



2.5.3 Cabling

Cabling between the modem and the antenna is critical such that a minimal amount of signal loss is achieved. The loss between the antenna and the modem must not exceed 3dB at the operating frequency of 1616 to 1626.5 MHz. Loss is attributable to several factors. These factors include number of connections, cable length, quality of cable, etc. It should be noted that low loss cables are available from many commercial industry sources. The table below lists the losses and maximum distances a variety of commonly used cables (assuming a total connector loss of no more than 0.55dB):

Cable Type	Diameter (cm)	Loss dB/m	Max Length (m)	Max Length (ft)
RG213	1.03	0.32	7.66	24.96
LMR-195	0.5	0.49	5.00	16.30
LMR-240	0.95	0.33	7.42	24.20
LMR-400	1.03	0.17	14.41	46.98
LD-F250	0.95	0.95	2.58	8.41
LD-F400	1.27	0.1	24.50	79.87
LD-F450	1.56	0.07	35.00	114.10

2.6 Analogue Audio Specifications

The analog audio interface is comprised of the analog audio input (microphone) and output (speaker) signals referenced to the 0V signal ground (unbalanced signalling). Please note in order for the user to utilize these connections the modem must first be initialised correctly to switch on the audio capability (please refer to Appendix A for details). Also the user must provide the amplification circuitry required for both the microphone and speaker lines.

2.7 Environmental Specifications

2.7.1 Operating Temperature

The MiChroSat modem operates to specifications over a temperature range of -20° C – +60° C.

2.7.2 Storage Temperature

The modem may be stored to an extended temperature range of -40° C – +85° C.

2.7.3 Humidity

The modem operates to specifications at or below 75% relative humidity.

2.8 Physical Parameters

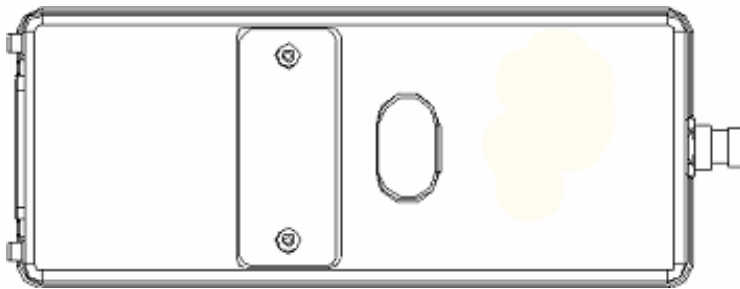
2.8.1 Weight

The modem's approximate weight is 659 g.

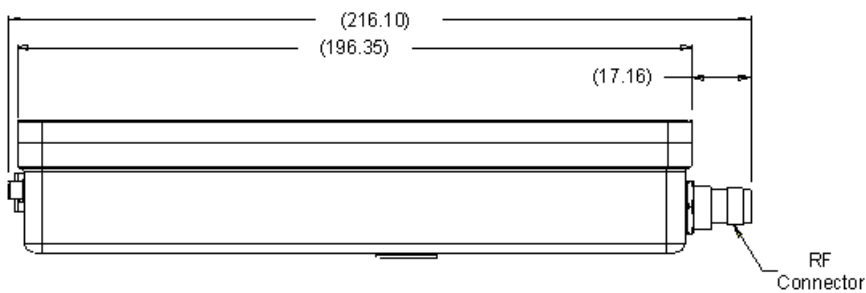
2.8.2 Dimensions

The maximum outside dimensions are length 216.1mm (8.51"), width 82.6mm (3.25"), and height 39mm(1.54)".

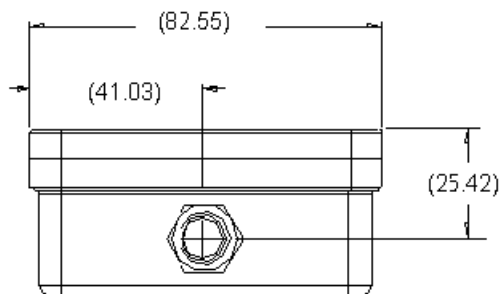
2.8.3 Mechanical Specification



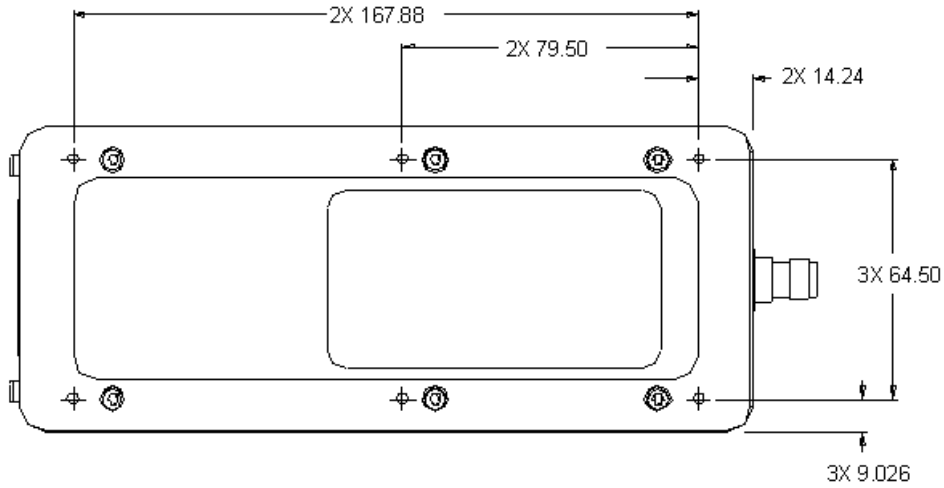
Top View



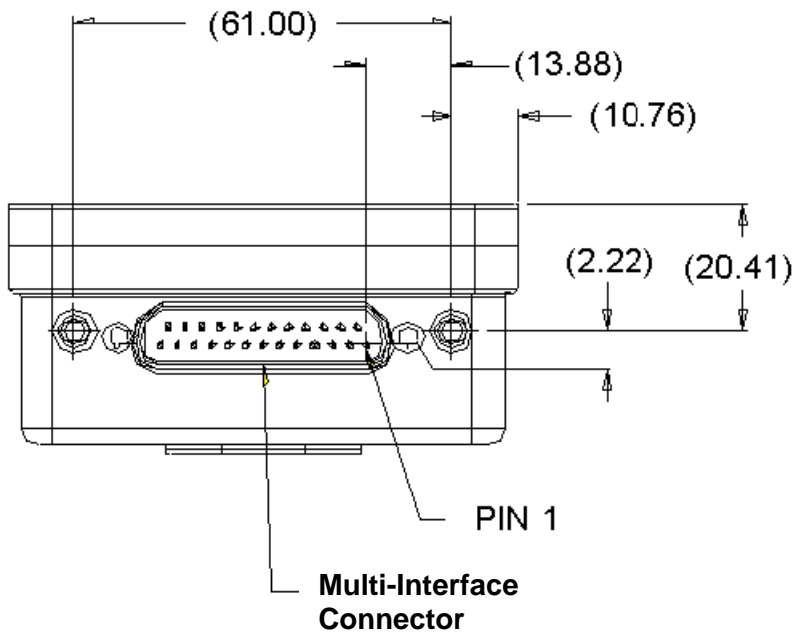
Side view



Antenna Connecting View



Bottom View



Multi Interface View

2.8.4 Mounting Recommendations

The MiChroSat modem incorporates 6 M3 mounting holes on its bottom surface that can aid in its mounting. See above for locations of these features (holes marked with cross-hairs). It is recommended that a thread-forming screw be used.

Note: Length of screw should be chosen to ensure that penetration into the MiChroSat Modem housing does not exceed 11 mm.

3 OPERATIONAL CONSIDERATIONS

3.1 DB-9 Pin Operation Description

The RS232 data interface is comprised of eight standard RS232 data, control, and status signals plus a ground level signal reference as summarised below. This interface allows a connected Data Terminal Equipment (DTE) to utilise the MiChroSat modem functionality via AT command control.

See Appendix A for supported AT commands.

Signal Name	Signal Description	Signal Direction (wrt Modem)
DCD	Data Carrier Detect	Output
Rx	Receive Data	Output
Tx	Transit Data	Input
DTR	Data Terminal Ready	Input
GND	Signal Ground	N/A
DSR	Data Set Ready	Output
RTS	Request To Send	Input
CTS	Clear To Send	Output
RI	Ring Indicator	Output

3.2 3-Wire Serial Operation

Setting &D0 and &K0 AT commands configure the MiChroSat module to allow an RS232 data interface using only the TX, RX, and GND signals. These three signals are shown in bold above.

Please note that these changes must be made to the MiChroSat modem using a full 9-way RS232 cable before connecting a 3-wire cable. Once changes have been permanently stored to the modem profiles, using the “at&w0&w1” command, a 3-wire cable may be connected.

3.3 Acceptable DTE Baud Rates

Under default settings the MiChroSat module will automatically adjust to the DTE baud rate. However certain applications require a fixed baud rate, this can be set as detailed below:

1. Connect to the modem using HyperTerminal (or similar terminal emulation software). Set the port speed to the modem's port speed (by default, it is 19200).
2. Issue the `+IPR=<rate>`, `<auto flag>` command, where rate can take on the following values:

<rate>	Meaning
1	600 BPS
2	1200 BPS
3	2400 BPS
4	4800 BPS
5	9600 BPS
6	19200 BPS

and autoflag can be either 0 (fixed rate), or 1 (autobauding – default).

e.g. `at+ipr=5,0` will initialise the modem to a fixed rate of 9600bps.

3. Immediately after the OK response is received, the change in data rate takes place. Change HyperTerminal settings to reflect the new port speed and communications can continue.
4. Unless these settings are permanently stored in the modem, it will revert to its old settings once power is cycled. See section 3.6 on Permanently Storing Configuration Settings for details on saving settings.

3.4 Operational Status via Serial Port

Determining if the modem is ON or OFF is simply accomplished by issuing an AT command to the modem. If an OK response is received, the modem is ON.

Signal strength can be indicated by issuing the `AT+CSQ` command. A value between 0 and 5 is returned. Zero indicates no coverage. Refer to Appendix A for further information.

Registration status can be indicated by issuing the `AT+CREG` command. Refer to Appendix A for further information.

Note: The modem takes approximately 20 seconds to register to the network before a data call can be attempted.

3.5 Setting the Modem to Auto Answer Incoming Data Call

The modem will answer an incoming data call if the S0 register is set to a non-zero value. If S0 is non-zero, it will answer the phone on the first ring. If S0 is zero, it will not answer any incoming calls.

The S0 register is set to 1 simply by issuing `ATS0=1`.

3.6 Permanently Storing Configuration Settings

Various settings (for instance, port speed) can be permanently stored on the modem so that the settings remain after a power cycle. The phone has two profiles in which it can store settings, and you can choose which profile is loaded by default. The relevant commands are &Wn and &Yn.

&Wn stores the present configuration in profile n, where n can be either 0 or 1.

&Yn designates which profile is loaded after reset or power-up, where n is either 0 or 1.

3.7 Short Message Service (SMS)

Wireless Innovation provides mobile originated and terminated SMS as part of the service offering. This provides the ability to send and receive SMS messages from or to another MiChroSat modem and also from modem to e-mail and vice versa. The message can be extracted over the serial port of the modem. Refer to the Appendix A (AT Command Reference Document) and Appendix C for additional information on commands and assistance to utilise/integrate SMS messaging. Please note that MiChroSat modem currently supports SMS messages in PDU format only.

3.8 Short Burst Data

Wireless Innovation provides mobile originated and terminated Short Burst Data messaging as part of the service offering. This provides the ability to send and receive messages from or to another MiChroSat modem, and also from modem to e-mail and vice versa. The message can be extracted over the serial port of the modem. Refer to the Appendix A (AT Command Reference Document) and Appendix D for additional information on commands required to utilise this unique messaging service.

3.9 Phone Numbers

All MiChroSat data subscribers have two phone numbers, a “MSISDN” for voice calls, and a “MSISDN-C” for PSTN-to-MiChroSat data calls.

The following dialling rules apply:

- When placing a voice call to a MiChroSat modem, the caller **must** dial the **MSISDN**.
- When placing a PSTN-to-MiChroSat data call, the caller **must** dial the **MSISDN-C**.
- When placing a MiChroSat-to-MiChroSat data call, the caller may dial either the MSISDN or the MSISDN-C.

An example of the current numbering scheme as of 2007 is below:

The MSISDN number is given by 8816214*****

The MSISDN/C number is given by 8816931*****

Where:

8816 is Iridium International prefix

214 depicts a voice call

931 depicts a data call

***** depicts the unique telephone number of MiChroSat modem.

3.10 Use of AT Commands with the MiChroSat Modem

The MiChroSat Modems are Hayes compatible. In addition to the standard Hayes commands, additional command support is provided. The additional command support includes support for some AT commands specified for GSM modems as well as some Iridium Network specific commands. Since the MiChroSat Modems are Hayes compatible, control and configuration is very much the same as for the vast majority of modems in use today. This also results in the MiChroSat modem being interoperable with most commonly used communications software.

3.11 Modem Mode of Operation

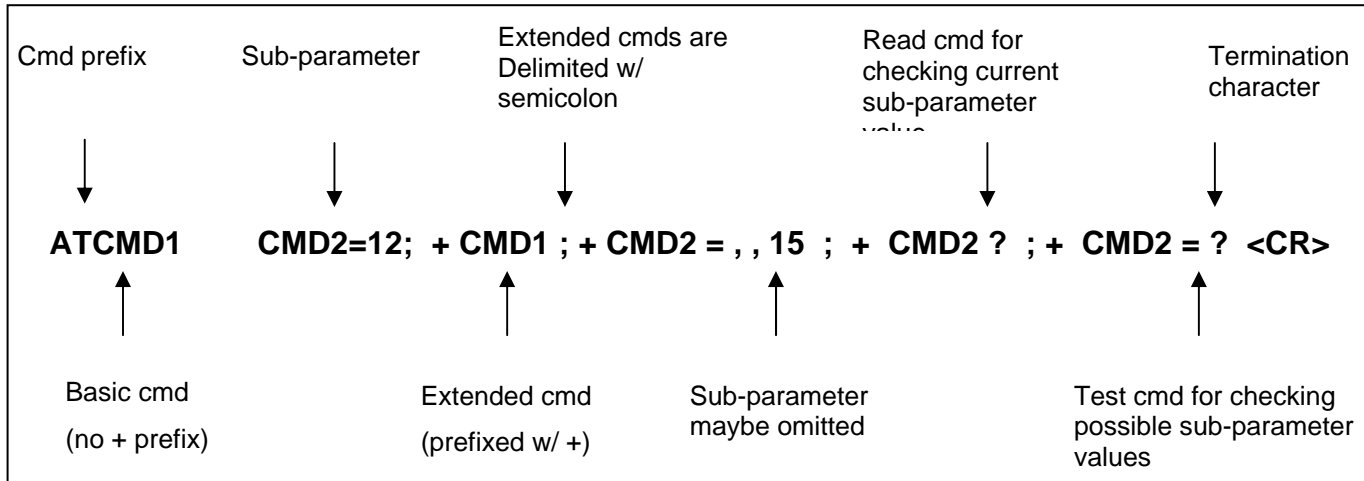
Like any Hayes compatible modem, the modem is always in one of two modes, either command mode or data mode. When the modem is in command mode (also known as off-line mode), AT commands can be entered to control the modem. When in data mode (also known as on-line mode), the modem is connected to a remote system and any characters sent to it will be transmitted to the remote system. It is possible to enter the command mode without terminating the call by using the `+++` escape sequence described in Appendix A.

3.12 Command Entry

An AT command consists of a string of characters sent by the computer to the modem while in command mode. A command string has a prefix, a body, and a terminator. The prefix consists of the ASCII characters `AT` or `at`. The body is a string of commands restricted to printable ASCII characters. The default terminator is the `<CR>` character (carriage return). The following rules apply to the entry of commands:

1. All commands (apart from `A/` and `+++`) start with `AT` or `at`. The commands in a command string (apart from `A/` and `+++`) are executed only after the return or enter key is pressed.
2. Use all upper or lower case letters, not a combination.
3. The maximum number of characters in a command string is 128. Multiple commands can be concatenated onto a single command line or by a semicolon.
4. Command editing can usually be performed by the backspace or delete keys.
5. If a parameter is missed from a basic command, a zero is implied (e.g. `ATH` implies `ATH0`). If an optional parameter is skipped from an extended command, the current value is implied. Optional parameters are enclosed by square brackets (`[...]`) in this document.
6. Spaces can be entered into a command string to increase clarity. These are ignored.
7. Characters that precede the `AT` prefix are ignored.
8. `Ctrl-x` can be used to abort a command line input.

The structure of an AT command is illustrated overleaf:



3.13 Responses

A result code is sent to the computer in response to the execution of an AT command. In addition, a result code may also result from other events such as an incoming call. If in verbose mode, result codes are returned in the form of human-readable text messages. Some common results codes are presented in the following table.

Numeric Code	Verbose Code	Description
0	OK	Command executed
4	ERROR	Command rejected
1	CONNECT	Connection established
3	NO CARRIER	Connection terminated
7	BUSY	Busy signal detected
8	NO ANSWER	No answer
2	RING	Incoming call received

4 COMMONLY USED MODEM AT COMMANDS

The list below summarises the most commonly used at commands from user to the modem. Please refer to Appendix A for full list of at commands and a more detailed explanation for each of the below.

AT – Attention Code

This is the prefix for all commands except *A/* and *+++*. When entered on its own, the modem will respond with the OK results code.

A/ – Repeat Last Command

Repeat the last command issued to the modem unless the power was interrupted or the unit is reset. *A/* is not followed by <CR>.

+++ – Escape Sequence

The escape sequence is used to transfer from data mode to command mode without disconnecting from the remote modem. After a pause, the modem will respond with OK. Register S2 can be used to alter the escape character from +, the factory default, to any hexadecimal value in the range 0 to 255.

A – Answer

Answer immediately. This causes the modem to answer the incoming call.

D – Dial

Dial a number. The dial command causes the modem to enter originate mode and act as an auto dialler for connection to other modems. The usual format is *ATDnx..x* where *n* is a Dial Modifier and *x* is a number. The following are valid numbers: 0123456789*#ABC. Dial modifiers are used to alter the manner in which the modem dials.

L Redial last number.

P Use pulse dialling (*No action, compatibility only*).

T Use tone dialling.

Any character received from the DTE during the call establishment phase will cause the call attempted to be terminated.

Hn – Hang-up

Control the hook switch.

This command is used to clear a connection.

0 Place the modem on hook.

+CBST – Select Bearer Service Type

Set Command: +CBST

Select the bearer calls to either **Iridium or PSTN**

AT+CBST=6,0,1

Select the bearer calls to **Iridium only**

AT+CBST=71,0,1

Read Command: +CBST?

Query the current bearer service type settings. Response is in the form:

+CBST: <speed>,<name>,<ce>

S0=n – Auto Answer

Assigning a value from 1 to 255 in register S0 tells the modem to automatically answer incoming calls after n rings, where n is in the range 0-255. The recommended setting is ATSO=1, which sets the modem to answer after one ring. The setting of 0 (ATSO=0) turns off the automatic answer feature.

+CREG? – Registration Status

This command returns the registration status of the modem.

If a modem has successfully registered response will be of the format 000,001.

+CSQ – Signal Strength

This command returns the signal strength of the modem.

Where range is 0 to 5. 5 is highest received signal strength.

5 MICHROSAT CONFIGURATION

The MiChroSat remote satellite terminal is a modular system and may be provided in a variety of configurations to fit any customer application.

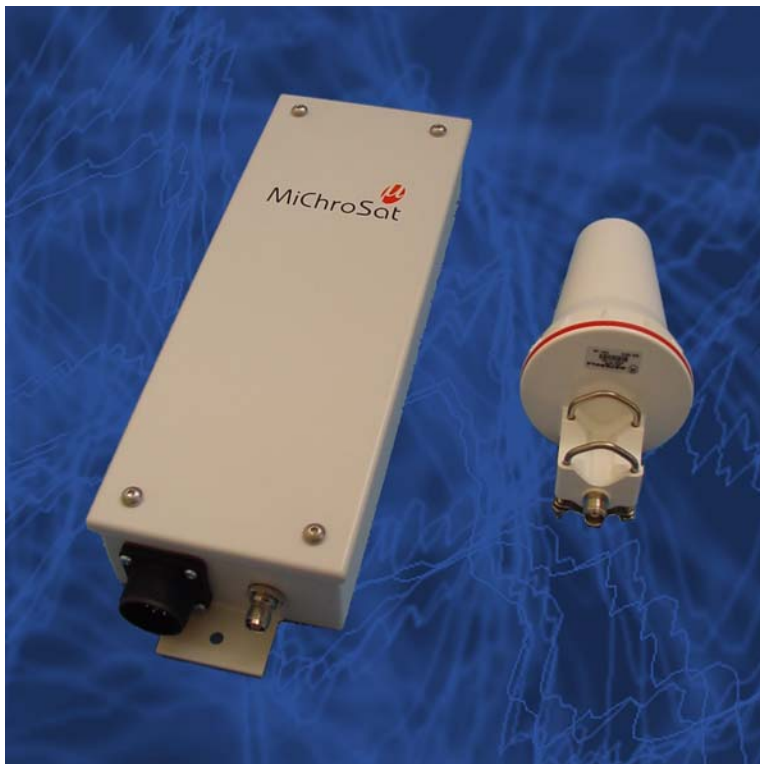
Options Available Include:

Standalone Modem *Modem in IP 65 enclosure includes In-Built Intelligence with power saving mode of operation and full isolation between the user and modem serial interface.*

Developer Kit *Modem in IP 65 enclosure with developer kit (PSU, Manuals and all cables).*

OEM *Modem, antenna and manuals.*

The MiChroSat remote satellite terminal is typically supplied fully integrated into an IP-65 enclosure (as shown below), however other designs such as re-inforced polyester street furniture bollard enclosures are also available upon request. The MiChroSat terminal is designed to be powered 9V to 15V DC supply, however for extreme remote applications a one-year battery option and solar/wind power solutions are also available. A nominal 24V option is also available on request.



5.1 Stand Alone Modem Features:

- Modem packaged in an IP-65 enclosure with MIL Spec. connectors to ensure operation in all environments.
- Standardised 12 V dc isolated voltage input, (24V available on request)
- Optional solar panel or 1 year standalone battery pack..
- Modems have standard 9 pin RS 232 interface
- Modem is controlled via standard Hayes AT commands.
- Supports standard RS 232 signalling levels.
- Modem may be configured for basic 3 wire RS 232 operation
- Supports DTE interface speeds of 1200 – 19,200 bps
- Option to power down modem for power saving applications.
- Full RS232 serial isolation between user and modem interfaces
- Supplied with Antenna and RF cable

5.2 Power Consumption

- Wideband DC input 9 – 15 V dc (Nominal input 12 VDC)
- Sleep Mode: Negligible
- Idle: 0.5W
- Transmit: 6W (peak), 4W (average)

Please note that the DC source/power supply must be capable of providing 2.5A at 4.4V.

5.3 Physical Connectors for Enclosure and Mating Cable Connectors

- RF Connector – TNC female (Mating connector TNC male)
- Serial Connector – 12 way Milspec. Manufacture: Bulgin Part No: PX0796/P
(Cable mating connector: PX0794/S; termination: solder terminals must be purchased seperately: SA3347/1 for pk10)
- Power Connector – 2 way Milspec. Manufacturer: Bulgin Part No: PX0735/P
(Cable mating connector: PX0736/S; termination: screw terminals)

5.4 MIL Spec Serial Connector Pin Outs

5.4.1 DC Power Connection:

2- Way IP65 MIL Spec. Connector	Signal Name
Pin L	+9 to +15V
Pin N	DC GND

5.4.2 Multi- Interface Connection:

This includes pin out for the full 9 way RS232 range of signalling and also the configuration pinout required to program internal intelligent subsystem:

12- Way IP65 MIL Spec. Connector	Signal Name
Pin 1	DCD
Pin 2	Rx
Pin 3	Tx
Pin 4	DTR
Pin 5	GND
Pin 6	DSR
Pin 7	RTS
Pin 8	CTS
Pin 9	RI
Pin 10	Not Connected
Pin 11	Configuration Only
Pin 12	Configuration Only

5.4.3 3-Way Basic RS232 Connection:

The connections for 3 wire operation are in bold text above.

Please note that these changes must be made to the MiChroSat modem using a full 9-way RS232 cable before connecting a 3-wire cable. Once changes have been permanently stored to the modem profiles, using the “at&w0&w1” command, a 3-wire cable may be connected.

5.5 Environment Specifications

5.5.1 Operating Temperature

Operates to specifications over a temperature range of -20° C to +60° C.

5.5.2 Storage Temperature

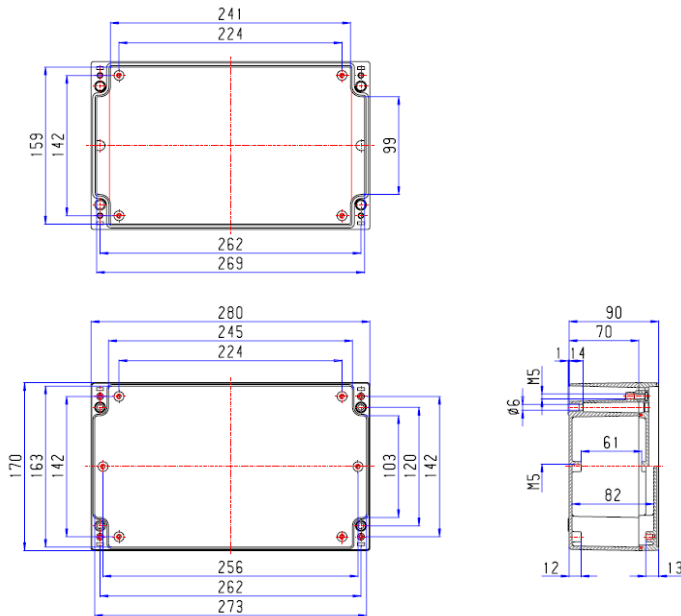
May be stored to an extended temperature range of -40° C to +85° C.

5.5.3 Humidity

Relative Humidity of 85% or lower.

5.6 Dimensions

The outside dimensions are length 280mm width 170mm, and height 90mm. The full mechanical specifications are as below:



5.7 Optional Power Up/Down Facility

The MiChroSat modem can be powered up/down through configuring the onboard Controller Interface via a user friendly GUI (Please see section 7 for MiChroSat Power Controller Configuration Guide). The options that may be configured are set out below:

- Power up and Power down at pre-determined configurable times
- Power up and Power Down by sensing the state of RS232 control lines from the User Application.

In this option the DTR and RTS control lines can be monitored and provide an input to power up and down the internal modem.

- Always On Mode (No Power Saving)
- 24 periodic Shutdown

Note:

- Ideal for power saving applications and with stand alone battery option.

5.8 MiChroSat Developer Kit

Features:

- Modem and Antenna supplied with all RF and interface cables. Also supplied with AC/DC Power Supply.
- Complete with all manuals and documentation
- Includes developer airtime package.

5.9 MiChroSat OEM Modem

Features:

- Modem and Antenna supplied for integration into OEM applications.

6 CALL SCENARIOS

6.1 Configure Originating Modem

In your terminal emulation program, the serial port on the computer should be configured to support a rate of from 600 bits per second to 19,200 bits per second with 8 bit characters; no parity and one stop bit. Section 7.1 describes how to do this using HyperTerminal.

The originating phone should be configured to request the appropriate Bearer Service using the following AT command:

AT+CBST=6,0,1<carriage return>,

OR

AT+CBST=7,0,1<carriage return>,

OR

AT+CBST=71,0,1<carriage return> (MiChroSat to MiChroSat only)

As with any Hayes compatible modem, the following AT command is used to dial the terminating modem:

ATDT<phone number><carriage return>

From MiChroSat to MiChroSat

Where <phone number> is the data phone number (the “MSISDN-C” or “MSISDN”) of the terminating MiChroSat modem. Since this is being dialled within the Iridium system, **international dialling applies**, so the number would be ‘+’ or “00” followed by the MSISDN-C or MSISDN of the terminating user (e.g., MSISDN/C +8816929012324).

From MiChroSat to PSTN

Where <phone number> is the data phone number (the “MSISDN-C” or “MSISDN”) of the PSTN modem being dialled. (e.g. 00441594861887)

After dialling has been initiated, a response code will be returned to indicate the disposition of the call (e.g., **CONNECT, BUSY, NO ANSWER, NO CARRIER**). Assuming a connection is established, both parties will enter the data mode and data exchange can occur.

The sequence to initiate a disconnect is similar to that used by any Hayes compatible modem. First, the following character sequence is sent to the modem in order to cause it to return to the command mode:

+++

Once the modem has returned to the command mode, the following Hayes AT command is used to disconnect the call:

ATH<carriage return>

6.2 Configure Originating PSTN Modem

The need for configuration of the modem prior to dialling is a function of the specific modem being used. Section 7.2 describes how to do this using HyperTerminal.

As with any Hayes compatible modem, the following AT command is used to dial the terminating modem:

```
ATDT <phone number><carriage return>
```

Where <phone number> is the data phone number (the "MSISDN-C") of the terminating modem (e.g., 00881692901234).

After dialling has been initiated, a response code will be returned to indicate the disposition of the call (e.g., **CONNECT**, **BUSY**, **NO ANSWER**, **NO CARRIER**). Assuming a connection is established, both parties will enter the data mode and data exchange can occur.

The sequence to initiate a disconnect is also similar to that used by any Hayes compatible modem. First, the following character sequence is sent to the modem in order to cause it to return to the command mode:

```
+++
```

Once the modem has returned to the command mode, the following Hayes AT command is used to disconnect the call:

```
ATH<carriage return>
```

6.3 Configure Terminating Modem

In your terminal emulation program, the serial port on the computer should be configured to support a rate of 19,200 bits per second, with 8 bit characters; no parity and one stop bit. Section 7.3 describes how to do this using HyperTerminal.

The terminating modem can be configured to automatically answer when an incoming call is received. This is accomplished using the following standard Hayes AT command:

```
ATS0=<N><carriage return>
```

Where <N> is an integer that corresponds to the number of rings that occur before the call is answered. In general, it is recommended to use a value of 1 for this (i.e. ATS0=1).

When an incoming call is received, a **RING** response code is presented. Likewise a corresponding response code is received if the connection is successfully established (e.g., **CONNECT**). Assuming a connection is established, both parties will enter the data mode and data exchange can occur.

The sequence to initiate a disconnect is similar to that used by any Hayes compatible modem. First, the following character sequence is sent to the modem in order to cause it to return to the command mode:

```
+++
```

Once the modem has returned to the command mode, the following Hayes AT command is used to disconnect the call:

```
ATH<carriage return>
```

7 MICHROSAT CONTROLLER CONFIGURATION GUIDE

7.1 Controller description

The main function of the MiChroSat Controller is to control the powering up/down of the MiChroSat modem in applications that require low power consumption such as remote rural sites that do not have a mains supply (battery supply only). The controller can also be used to initialise the modem correctly to match the requirements of the customer application. Furthermore the Controller provides isolation between the application RS232 interface and the modem interface.

Prior to use, the MiChroSat Controller must be configured using the MiChroFace software provided. This section will discuss in detail the procedures for configuring the software in the 4 modes of power saving operation:

- Mode 1: Modem Permanently Powered – No Power Saving Mode of Operation
- Mode 2: 24 Periodic Shutdown – Modem set to reboot every 24 hrs.
- Mode 3a: Preconfigured Timed Interval Window – Through the setting of an internal Real Time Clock the modem can be configured to power up and power down at configurable times.
- Mode3b: External/Application RS232 Interrupt – The Controller may be set to sense the state of a RS232 control line from the User Application to power up and power down the modem from when the application wishes to communicate with the modem.

7.2 User Configurable Software - MiChroFace

This section describes the procedure to install and setup the MiChroFace software, and in detail the methodology and description of each parameter required to setup the MiChroSat Controller in the 4 modes of operation. Please note the user must first connect the included MiChroSat Configuration Cable to the Stand Alone Modem and also to the PC RS-232 port.

7.2.1 Installation

7.2.1.1 Minimum requirements

1Ghz Windows Based PC – with “free” RS-232 interface

*Note: if a USB to RS-232 convertor is to be used, then FULL RS-232 replication is required.

512Mb RAM

Windows™ NT2000/XP/Vista – 32bit Edition

5MB free hard drive space

CD-ROM

In addition, the supplied programming cable for setting up the firmware parameters is also required.

Note: Uninstall previous versions of the graphical user interface prior to installing this version.

Insert the supplied MiChroFace CD into the CD-ROM drive. Users may wish to visit www.MiChroSat.com/MiChroFace to ensure that the latest version of MiChroFace is being installed.

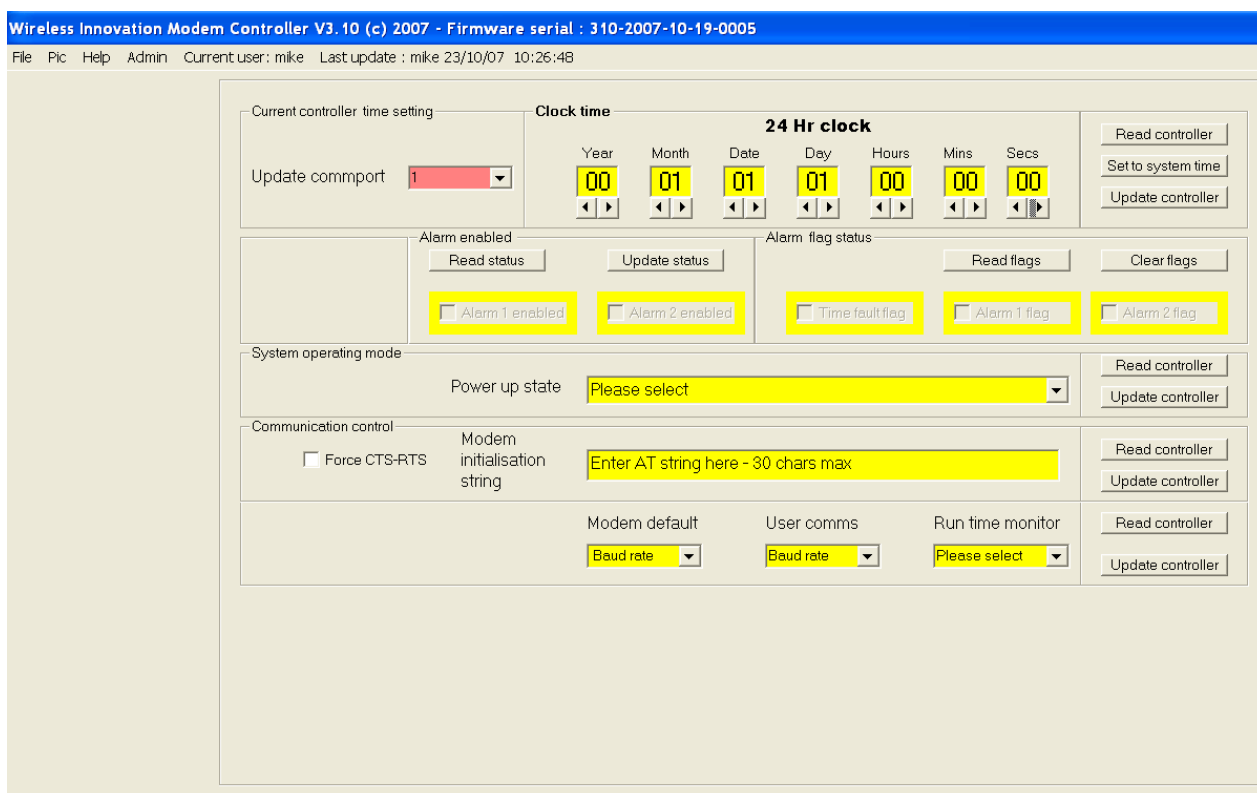
Run the SETUP.EXE file on the MiChroFace CD.

When MiChroFace is first run, the user will be prompted for an administrator name and password. This will be the name used to administer user rights to the program. The administrator account may be used to add or delete user accounts as required. It is recommended that this account should be used for this purpose and that standard user accounts be used to access MiChroFace.

All user names and passwords should be noted and kept safe by the individual user.

Access to MiChroFace is only permitted to user accounts set up from the administrator account, or from the administrator account.

7.2.2 General Screen Layout



The above is the initial screen of the User Software Interface. The red background denotes that no user entries have as yet been entered into the software.

The first entry from the user is to select the correct com port on the pc that is connected to the MiChroSat enclosure via the provided Configuration cable. If the com port selected is correct and connected to the MiChroSat enclosure correctly the background colour for this setting will change to green. Also the Controllers firmware revision will also be reported at the top of the window and the software “user” (e.g. Mike) and the last configuration update are also shown.

For all other parameter settings, once the user has selected a new option the background colour for that section will turn yellow. Finally once these new parameter settings have been set they will need to be sent to the MiChroSat Controller. This can be achieved in two ways; 1) pressing the Update controller button of each section or 2) via the PIC pull down menu at the top left hand side of the Configuration Program – Select Update. If either of the above is successful then the background colour for each/all parameter(s) will change to green. Note: Only those data entries which have been correctly updated will display a green background.

Also note that once set, the parameters can be saved to a user defined filename. These files can then be used to simplify future configuration downloading to the Controller. These are accessed from the file menu save/load functions.

7.2.3 Mode 1: Modem Permanently Powered – No Power Saving mode of operation

Wireless Innovation Modem Controller V3.10 (c) 2007 - Firmware serial : 310-2007-10-19-0005

File Pic Help Admin Current user: mike Last update : mike 23/10/07 14:07:42

Current controller time setting		Clock time							24 Hr clock		Read controller	
Update commport		Year	Month	Date	Day	Hours	Mins	Secs			Set to system time	
4		07	10	23	02	14	07	47			Update controller	
Alarm enabled		Update status		Alarm flag status		Read flags		Clear flags				
<input checked="" type="checkbox"/> Alarm 1 enabled		<input checked="" type="checkbox"/> Alarm 2 enabled		<input type="checkbox"/> Time fault flag		<input type="checkbox"/> Alarm 1 flag		<input type="checkbox"/> Alarm 2 flag				
System operating mode		Power up state							Permanently online, no shutdown		Read controller	
											Update controller	
Communication control		Modem initialisation string		AT		Read controller		Update controller				
<input type="checkbox"/> Force CTS-RTS												
Modem default		User comms		Run time monitor		Read controller		Update controller				
19200		19200		Modem comms								

No power saving options are used in this mode of operation. The function of the controller is to initialise the modem correctly and set the baud rate of modem to that used by required application. **Please note** the initialisation string should not include the “at+ipr=x” (set baud rate command) setting (see Appendix A for more details for at+ipr command).

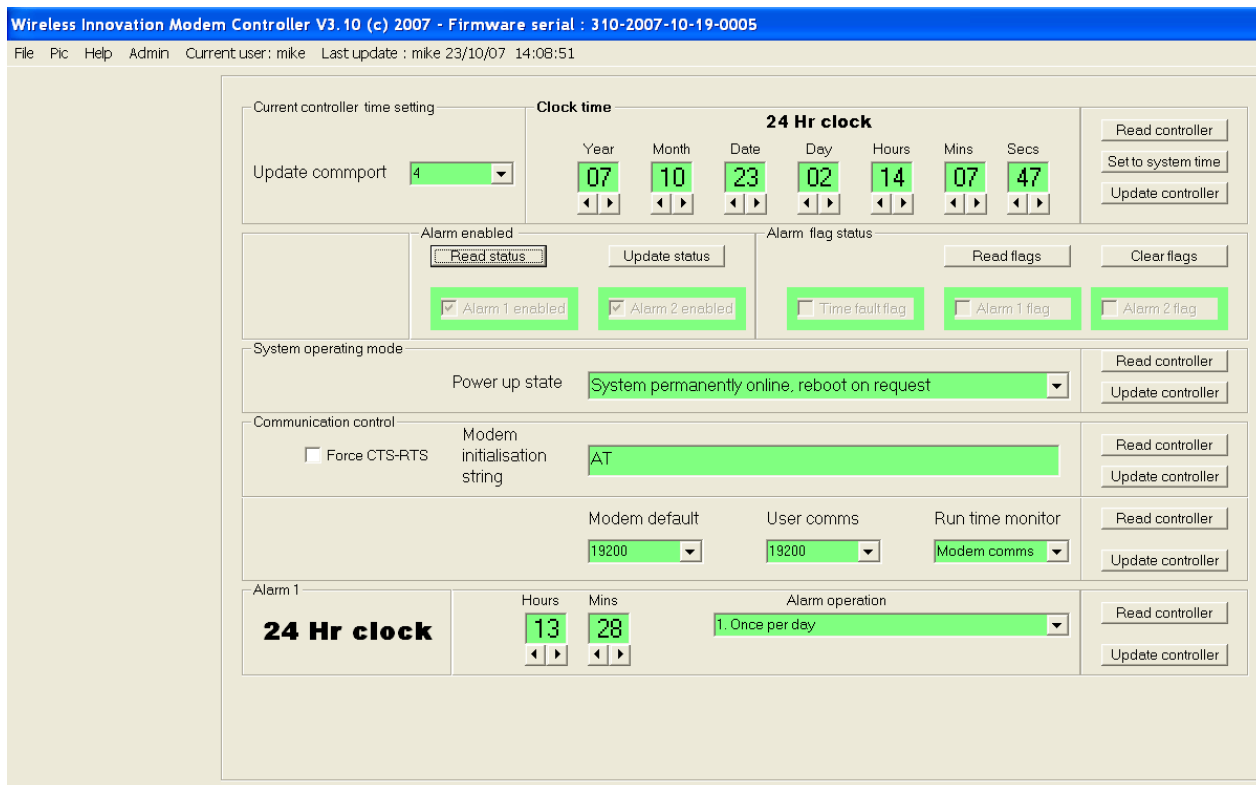
On first power up, the controller ensures the MiChroSat modem is operating correctly and initialises the modem. Following this the control of the modems RS232 interface is passed onto the application.

As before first the User selects the correct com port on PC.

In this mode of operation the user configures:

- 1) the onboard Real Time Clock (RTC),
- 2) from the “Power up state” pull down menu. – select “Permanently online, no shutdown”
- 3) if the application requires 3 wire RS232 mode of operation (i.e. no flow control) the user “checks” the Force CTS-RTS option, otherwise this option is “unchecked”.
- 4) the correct initialisation string may then be added for correct operation of modem from unique application (please refer to Appendix A for full AT Command Specification)
- 5) the application baud rate is set. From the Modem default and User comms menus select required baud rate for application (up to maximum of 19200bps); the Run time monitor is not required.
- 6) press the Update Controller Button for each section, or perform a whole configuration upload as described in Section 7.2.2.

7.2.4 Mode 2: 24 Periodic Shutdown – Modem set to reboot every 24 hrs



In this mode of operation the main use is to reset the power to the MiChroSat modem every 24 hrs. The modem is also initialised correctly and the required application baud rate set as before in section 7.2.3.

Therefore in addition to that of 7.2.3 the 24 shutdown time must be configured:

In this mode of operation the user configures:

- 1) the onboard Real Time Clock (RTC),
- 2) from the “Power up state” pull down menu. – select “System permanently online, reboot on request”

The Alarm 1 (time for daily reset) section will then appear. In this section of the screen:

- 3) From Alarm operation select once per day,
- 4) Set required time for daily shutdown (hours and minutes – 24 Hour Clock)
- 5) Press the Update Controller Button for each section, or perform a whole configuration upload as described in Section 7.2.2.

At the configured reset time the controller will check the modem Tx RS232 signal to ensure that there is no data being communicated, if there is no communication, the controller then waits approx 30 seconds. If there is still no data being transmitted by the modem then the controller will reset power and re-initialise the modem. This is to ensure that the modem does not power down if the modem is in use.

N.B. The “Run time Monitor” pull down menu **must** be set to “Modem comms” when using this mode of operation.

7.2.5 Mode 3a: Power Saving Mode - Preset Time Interval Window.

The screenshot shows the configuration page for a Wireless Innovation Modem Controller. At the top, it displays the firmware version (V3.10) and serial number (310-2007-10-19-0005). The main interface is divided into several sections:

- Current controller time setting:** Includes an 'Update commport' dropdown set to '4'.
- Clock time (24 Hr clock):** A digital clock showing Year: 07, Month: 10, Date: 23, Day: 02, Hours: 14, Mins: 07, and Secs: 47. It includes 'Read controller', 'Set to system time', and 'Update controller' buttons.
- Alarm enabled:** Contains checkboxes for 'Alarm 1 enabled' and 'Alarm 2 enabled', both of which are checked. It also has 'Read status' and 'Update status' buttons.
- Alarm flag status:** Contains checkboxes for 'Time fault flag', 'Alarm 1 flag', and 'Alarm 2 flag', all of which are unchecked. It includes 'Read flags' and 'Clear flags' buttons.
- System operating mode:** A dropdown menu is set to 'Intermittent online, preset time window'. It has 'Read controller' and 'Update controller' buttons.
- Communication control:** Includes a 'Force CTS-RTS' checkbox (unchecked) and a 'Modem initialisation string' field set to 'AT'. It has 'Read controller' and 'Update controller' buttons.
- Modem default, User comms, Run time monitor:** Three dropdown menus are set to '19200', '19200', and 'Modem comms' respectively. It has 'Read controller' and 'Update controller' buttons.
- Alarm 1:** Shows '24 Hr clock' for Hours: 13 and Mins: 30. The 'Alarm operation' dropdown is set to '1. Once per day'. It has 'Read controller' and 'Update controller' buttons.
- Alarm 2:** Shows '24 Hr clock' for Hours: 13 and Mins: 50. The 'Alarm operation' dropdown is set to '1. Once per day'. It has 'Read controller' and 'Update controller' buttons.

In this mode of operation the user may set a “time window” in which the controller will power the modem up and down at configured times. The main advantage of this mode of operation is to conserve power drawn by the MiChroSat modem at a remote site where the supply may be limited. Therefore the Controller may be configured to power up the modem at a pre-set time “window” when the host application (e.g. SCADA Top End) wishes to communicate with the local application (e.g. SCADA RTU), and when the local application wishes to dial the host application (e.g. exception reporting). At all other times the modem will be powered down.

The modem is initialised correctly and the required application baud rate set as before in section 7.2.3.

Therefore in addition to that of 7.2.3 the power up time and the power down time must be configured:

In this mode of operation the user configures:

- 1) the onboard Real Time Clock (RTC),
- 2) from the “Power up state” pull down menu. – select “intermittent online, preset time window”

The Alarm 1 (Power up time) and Alarm2 (Power 2 time) sections will then appear. In this section of the screen:

- 3) In Alarm1 section, from the Alarm Operation pull-down menu, select “once per day”,
- 4) Set required time for powering up of modem (hours and minutes – 24 Hour Clock)
- 5) In Alarm2 section, from the Alarm Operation pull-down menu, “select once per day”,

- 6) Set required time for powering down of modem (hours and minutes – 24 Hour Clock)
- 7) Press the Update Controller Button for each section, or perform a whole configuration upload as described in Section 7.2.2.

At the configured Alarm 1 time, the modem will power up the modem and initialise the modem correctly with configured values. At the configured Alarm 2 time, the controller will check to ensure that there is no data being communicated at that time from the modem to the application. If there is no communication the controller then waits approx 30 seconds, if there is still no data being transmitted by the modem then the controller power the modem down.

7.2.6 Mode 3b: Power Saving Mode - External/Application RS232 Interrupt

In addition to the setting of the time window above (Section 7.2.5) the user may also control the powering up/down of the MiChroSat modem through the sensing of one of the RS232 Control lines from the application. The main advantage of this is to allow for the powering up and down of the modem when the locally connected application is a low powered application. Some applications (e.g. Exception Reporting Low Power Telemetry RTUs) have their own on board power saving options and thus close down their RS232 serial port when not in use to conserve power. When they want to communicate with the attached modem they then power up their RS232 serial port. The MiChroSat controller can be setup in order to power up the MiChroSat modem when the low power application wishes to communicate. There are two RS232 control signals that can be monitored by the MiChroSat Controller (DTR and RTS) and furthermore the Controller can also monitor the application transmit line (Tx) if these control lines are not presented (to be used in 3 wire mode of operation).

This functionality must be enabled/disabled through the use of onboard jumpers that reside on the internal MiChroSat Controller pcb. The position of these jumpers/links for enabling and disabling this functionality is shown below:



For each interrupt (J13, J14 & J15):
 To disable: link Pins 1 and 2
 To Enable: link Pins 2 and 3

Where:

- J13 is the RTS control line user interrupt.
- J14 is the Tx user interrupt (used for power control in 3 wire mode).
- J15 is the DTR control line user interrupt.

When either the DTR or RTS signal interrupt jumpers are enabled, the Controller board will then sense the signal levels received from the application. If the signal is asserted then the Controller board will power up the modem. If the signal is not-asserted then the modem will remain un-powered.

However, if the RS232 control signal is asserted the modem will be powered immediately by the Controller and initialised correctly. When the Control Line is de-asserted, normally following successful communication by attached application, then the Controller will power down the modem 30 seconds after any data transmission ceases. If the application wishes to communicate with the modem again, then the application asserts the correct RS232 control signal once more.

When the Tx signal interrupt is enabled, the controller board will simply look for any data transmitted from the application. When data is detected the Controller will power up the modem, the controller will then monitor the user Tx line for more data, if there is a 30 second interval in transmit data from the user application then the controller will deem that communications has ceased and will then power down the MiChroSat modem. **Note:** This interrupt mode of operation should only be used if the application only has the capability of communicating via the RS232 port in 3 wires only (i.e. Tx, RX and GND).

In using the above in conjunction with the pre-set time window, this will ensure that the minimum amount of power consumption will be required by the MiChroSat modem for low power scenarios.

7.2.7 Menu Pull Down Options

The menu items at the top of the screen operate in the same manner as standard Windows menus. These are tailored to suit the functionality of the programming software.

The following functions are available from the menu items at the top of the main programming screen.

7.2.7.1 FILE menu

OPEN

This allows the user to retrieve data files containing a set of previously saved parameters. These files contain data for all parameters used by the controller and associated software.

SAVE

This allows the user to retrieve data files containing a set of previously saved parameters. These files contain data for all parameters used by the controller and associated software.

QUIT

This function closes down the software package. **NB: All unsaved data is lost.**

7.2.7.2 PIC menu

READ

This allows the user to retrieve data from the controller. The controller is automatically placed in programming mode by the programming cable. Note that pinout for this cable is non-standard. The programming serial port must be selected prior to use of this function. Data may be saved to a file for future use.

UPDATE

This allows the user to download all preset parameters to the controller, from the PC. It is necessary to select the programming serial port for this function to work. Data may be entered manually, or from a stored file. Real time data is not stored – the pc time is instead entered into software.

7.2.7.3 HELP menu

ABOUT

Displays the version data for the software.

HELP

This function accesses a standard Windows help file system. Selection of section required is from a contents file/window. Click on the book icon for the section required, then select the appropriate page from the subject listing beneath this.

7.2.8 Glossary of Parameters Used within Configuration Software

Alarm 1 enable

If selected, enables alarm 1 for use with operating modes 1 and 2

Alarm 1 flag

This flag is set by the real time clock when the real time setting matches the alarm1 time settings defined by alarm 1 operating mode.

Alarm 1 operation

Drop down menu allows selection of time of month, day, hour, minutes when alarm 1 activates when set in conjunction with alarm 1 time settings.

Alarm 1 time setting

This refers to the alarm 1 time setting which may indicate either of two actions depending on operation mode selected

1. Intermittent mode – Denotes start of operation window
2. Re-boot at preset time mode – denotes time for system re-boot

Alarm 2 enable

If selected, enables alarm 2 for use with operating mode 1

Alarm 2 flag

This flag is set by the real time clock when setting matches the alarm2 time settings defined by alarm 1 operating mode

Alarm 2 operation

Drop down menu allows selection of time of month, day, hours that alarm 2 activates

Alarm 2 time setting

Only used in intermittent mode. Denotes end of operation window

Clock time

This refers to the real time setting of the RTC controller. This only updates on screen at user read request. This may be set to PC system time or any time manually.

Force CTS-RTS

If selected, forces the CTS/RTS to the modem link during run time - for 3 wire mode of operation.

Modem default

Defines the default power up baud rate of the modem – by default this is set to 19200 bps

Power up state

Selects the operating mode of the controller

1. Permanently online – no shutdown
2. System permanently online, reboot on request
3. Intermittent online, pre-set time window

Run time monitor

Allows selection of which data transmit line the controller will monitor, user or modem, for shut down in modes 1 and 2. Default – user comms

Time fault flag

This flag is set when a power failure to the real time clock occurs. The real time clock settings are lost. The real time clock will start from an all zero setting and count on from there.

Note that these flags do not automatically display clock and alarm status. The controller must be re-read to obtain this.

Update comport

This function displays all available comports on the PC, allowing the user to select any available comport that is connected to the MiChroSat Enclosure via the included Configuration cable. **N.B. This must be set prior to reading/updating of any other parameters.**

User comms

Defines the operating baud rate of the user equipment

8 TROUBLESHOOTING

8.1 Cannot register with the Iridium network

- Is a SIM card inserted into the modem? Is PIN code deactivated?
- Check to see that the antenna connections are secure and that there is **clear line-of-site to the sky from horizon to horizon**.
- Turn the modem off and then on again and wait for the phone to register (approx. 30 seconds).

8.2 Modem is registered, but cannot make a mobile-terminated data connection.

8.2.1 General:

- Check the signal strength of modem(s) using the at command at+csq. Ensure that the response is not 0. For more details please refer to Appendix A.
- Is the power supply capable of supplying 2.5A at 4.4V?
- Is the terminating modem set to auto answer? (using the ATSO=1 command).
- If you type "AT" in your terminal emulation program, do you see the "OK" response? If not, check your terminal emulation settings, as described in Section 7

8.2.2 PSTN to MiChroSat modem:

- Was the number dialled in international format? (International Access Code + **MSISDN-C** of terminating modem.) For example, the international dialling pattern from a PSTN phone in the United Kingdom is 00 881692901234, where 00 is the international dialling format and 881692901234 is the **MSISDN-C** of the terminating modem.
- Check to make sure you are dialling the MSISDN-C (not the MSISDN) of the terminating modem.
- Is the problem external to the satellite network?
 - Are you calling from a PBX? Some PBX's will corrupt data transmissions. Try placing the call from another location, outside of the PBX on an external analogue line. (3.1KHz audio line).
 - In many countries, the PSTN can corrupt data calls. PSTN calls originating in the Middle East, Southeast Asia, China, India, Russia and Taiwan are particularly subject to problems.

Please Note:

The end-to-end data call quality and probability of connection is governed by the ability of modems at the Iridium gateway to synchronise with modems at the originating location. Modem synchronisation is directly impacted by voice compression that is used by international telephony carriers. International telephony carriers typically compress the analogue speech, and consequently modem tones, to reduce their bandwidth requirements for carrying calls. This compression can alter the modem tones resulting in reduced connection speeds, dropped connections, or no connections. Therefore the use of low cost leased lines is not recommended as some operators can use VOIP circuitry as backup fro their main communication links.

8.2.3 MiChroSat to MiChroSat:

- Have you configured the originating modem for the correct bearer service?
- When dialling from MiChroSat to MiChroSat, the dialling format is always “+” or “00” and either the **MSISDN-C** or **MSISDN** of terminating modem. For example: + 881692901234, where 881692901234 is the MSISDN-C of the terminating modem.

8.2.4 MiChroSat to PSTN modem:

- Have you configured the correct bearer service i.e. **not** entered at+cbst=71,0,1?
- Was the number dialled in international format? For example, the dialling pattern to a PSTN phone in the United Kingdom is 00 441594861887.
- Is the problem external to the satellite network?
 - Are you trying to call a modem connected to a PBX? Some PBX's will corrupt data transmissions. Try placing the call to another location, outside of the PBX on an external analogue line. (3.1KHz audio line).
 - In many countries, the PSTN can corrupt data calls. PSTN calls originating in the Middle East, Southeast Asia, China, India, Russia and Taiwan are particularly subject to problems.

Please Note:

The end-to-end data call quality and probability of connection is governed by the ability of modems at the Iridium gateway to synchronise with modems at the originating location. Modem synchronisation is directly impacted by voice compression that is used by international telephony carriers. International telephony carriers typically compress the analogue speech, and consequently modem tones, to reduce their bandwidth requirements for carrying calls. This compression can alter the modem tones resulting in reduced connection speeds, dropped connections, or no connections. Therefore the use of low cost leased lines is not recommended as some operators can use VOIP circuitry as backup for their main communication links.

8.2.5 Contact Details

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