



Operating Manual

**pMDDL2350
pMDDL2450
pMDDL2550**

2x2 MIMO OEM Wireless Digital Data Link

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pMDDL

Important User Information (continued)

About This Manual

It is assumed that users of the products described herein have either system integration or design experience, as well as an understanding of the fundamentals of radio communications.

Throughout this manual you will encounter not only illustrations (that further elaborate on the accompanying text), but also several symbols which you should be attentive to:



Caution or Warning

Usually advises against some action which could result in undesired or detrimental consequences.



Point to Remember

Highlights a key feature, point, or step which is noteworthy. Keeping these in mind will simplify or enhance device usage.



Tip

An idea or suggestion to improve efficiency or enhance usefulness.



Information

Information regarding a particular technology or concept.

Important User Information (continued)

Regulatory Requirements / Exigences Réglementaires



WARNING:

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 23 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.



WARNING:

Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation.



WARNING:

Changes or modifications not expressly approved by Microhard Systems Inc. could void the user's authority to operate the equipment. This device has been tested with UFL to Reverse Polarity SMA connectors with the antennas listed in Appendix A When integrated in OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).



WARNING:

MAXIMUM FIRP

MAXIMUM EIRP
FCC Regulations allow up to 36 dBm equivalent isotropically radiated power (EIRP). Therefore, the sum of the transmitted power (in dBm), the cabling loss and the antenna gain cannot exceed 36 dBm.



WARNING

WARNING

EQUIPMENT LABELING
The FCC and IC numbers depend on the model of the radio module. Do NOT use the Marketing Name of the product but the Model to distinguish the Certifications Numbers. This device has been modularly approved. The manufacturer, product name, and FCC and Industry Canada identifiers of this product must appear on the outside label of the end-user equipment.



WARNING

WARNING: This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

SAMPLE LABEL REQUIREMENT / EXIGENCE D'ÉTIQUETTE:

nMDDI2450

FCCID: NS918PMDDL2450
IC: 3143A-18PMDDL2450

Applicable Regulatory Approvals		
Model	FCC	Industry Canada
pMDDL2450	NS918PMDDL2450	3143A-18PMDDL2450
pMDDL2350	Not Applicable	Not Applicable
pMDDL2550	Not Applicable	Not Applicable

Please Note: These are only sample labels; different products contain different identifiers. The actual identifiers should be seen on your devices if applicable.

Important User Information (continued)

Regulatory Requirements / Exigences Réglementaires



WARNING:

Pour satisfaire aux exigences de la FCC d'exposition RF pour la base et mobiles sur une distance de séparation de 23 cm ou plus doit être maintenue entre l'antenne de cet appareil et des personnes lors de fonctionnement du dispositif. Pour assurer la conformité des opérations au plus près que cette distance n'est pas recommandée. L'antenne utilisée pour ce transmetteur ne doit pas être co-localisés en conjonction avec toute autre antenne ou transmetteur.



WARNING:

Son fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne doit pas causer d'interférences nuisibles et (2) cet appareil doit accepter toute interférence reçue, incluant les interférences qui peuvent provoquer un fonctionnement indésirable .



WARNING:

Les changements ou modifications non expressément approuvés par Microhard Systems Inc. pourraient annuler l'autorité de l'utilisateur à utiliser l'équipement . Ce dispositif a été testé avec MCX et connecteurs SMA à polarité inverse sur les antennes répertoriées à l'annexe A Lorsqu'il est intégré dans les produits OEM , antennes fixes nécessitent une installation empêchant les utilisateurs finaux de les remplacer par des antennes non approuvées . Antennes ne figurant pas dans les tableaux doivent être testés pour se conformer à la Section 15.203 (connecteurs d'antenne uniques) et à la Section 15.247 (émissions) .



WARNING:

MAXIMUM EIRP

Règlement FCC permettent jusqu'à 36 dBm puissance isotrope rayonnée équivalente (EIRP) . Par conséquent, la somme de la puissance émise (en dBm), la perte de câblage et le gain d'antenne ne peut pas dépasser 36 dBm.



WARNING:

ÉQUIPEMENT DE MARQUAGE

Les numéros FCC et IC dépendent du modèle du module radio . Ne pas utiliser le nom marketing du produit, mais le modèle de distinguer les numéros Certifications . Ce dispositif a été approuvé de façon modulaire . Le fabricant , nom du produit, et les identificateurs de la FCC et d'Industrie Canada de ce produit doivent figurer sur l'étiquette à l'extérieur de l'équipement de l'utilisateur final .



WARNING:

Cet appareil est conforme aux CNR exempts de licence d'Industrie Canada . Son fonctionnement est soumis aux deux conditions suivantes : (1) Ce dispositif ne peut causer des interférences ; et (2) Ce dispositif doit accepter toute interférence , y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

SAMPLE LABEL REQUIREMENT / EXIGENCE D'ÉTIQUETTE:

pMDDL2450:

FCCID: Pending IC: Pending
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation.

Approbations Réglementaires Applicables		
Type	FCC	Industrie Canada
pMDDL2450	En Attendant	En Attendant
pMDDL2350	Non Utilisé	Non Utilisé
pMDDL2550	Non Utilisé	Non Utilisé

Please Note: S'il vous plaît noter: Ce sont des exemples d'étiquettes seulement; différents produits contiennent des identifiants différents. Les identifiants réels devrait être vu sur vos périphériques le cas échéant.



Revision History

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1.0 Overview

The pMDDL is a feature rich, high power, 2x2 MIMO Wireless OEM Digital Data Link. The pMDDL is designed to provide high performance wireless capabilities in a compact and rugged OEM module for system integration. The pMDDL features simultaneous dual 10/100 Ethernet & Serial (RS232) Gateway capabilities for high speed wireless applications

The pMDDL can be configured using a built-in WebUI interface which does not require any additional software or tools to setup or download. The unit can operate as a Master, Slave or Relay (future) to establish robust long range wireless links between locations.

Providing reliable wireless Ethernet bridge functionality as well gateway service for most equipment types which employ an RS232 interface, the pMDDL can be used in various types of applications such as:

- High-speed backbone
- IP video surveillance
- Voice over IP (VoIP)
- Ethernet wireless extension
- UAV/UAS
- Legacy network/device migration
- SCADA
- Remote Telemetry
- Multicast Video

1.1 Performance Features

Key performance features of the pMDDL include:

- Adjustable, High Power Tx (up to 1W Total) w/ Excellent Rx Sensitivity
- Up to 25 Mbps data rate*
- Master, Slave/Remote, Relay (future) operating modes
- Point to Point, Point to Multipoint topology support
- Firewall with ACL Security, Port Forwarding
- Serial Gateway (RS232)
- Dual 10/100 Ethernet Ports
- RSSI LED pins for Antenna Alignments
- Industrial grade operating temperature (-40°C to +85°C)
- Administration via local console, telnet, web browser, SNMP
- Local and remote wireless firmware upgradable

* See [Section 1.3 Performance Specifications](#)



1.0 Overview

1.2 Specifications

For detailed specifications, please see the specification sheets available on the Microhard website @ <http://www.microhardcorp.com> for your specific model.

Electrical/General

Frequency:	pMDDL2350: 2.304 - 2.390 GHz pMDDL2450: 2.402 - 2.482 GHz pMDDL2550: 2.500 - 2.570 GHz
Link Rate:	See Section 1.3 Performance Specifications
TX Power:	20 dBm - 30 dBm Total (Adjustable)
Channel Bandwidth:	4, 8 MHz (Selectable)
Error Detection/Control:	CRC, ARQ
Data Encryption*: <small>(*Requires Export Permit)</small>	128-bit AES (Optional 256-bit)
Serial Port:	300bps to 921kbps - TTL Level RS232
Ethernet:	Dual 10/100 BaseT, Auto - MDI/X, IEEE 802.3
USB:	2.0
Network Protocols:	TCP, UDP, TCP/IP, ARP, ICMP, DHCP, HTTP, HTTPS*, SSH*, SNMP, FTP, DNS, Serial over IP (*May require an export permit)
Operating Modes:	Master, Slave/Remote, Relay (Future)
Management:	Local Serial Console, Telnet, WebUI, SNMP, FTP & Wireless Upgrade
Diagnostics:	Status LED's, RSSI, remote diagnostics, SNR
Input Voltage:	OEM: Digital Voltage: 3.3 VDC (500mA) RF Voltage: 5.0 VDC (1.5A) Enclosed: 7 - 30 VDC
Current:	

		MIMO ON		MIMO OFF	
		Tx Power (dBm)	Vcc @ 3.3V	VRF @ 5V	Vcc @ 3.3V
Peak Avg. Transmit Current (mA)	20	400 - 460	640	400 - 460	340
	22	400 - 460	720	400 - 460	390
	24	400 - 460	780	400 - 460	450
	26	400 - 460	860	400 - 460	520
	28	400 - 460	1000	400 - 460	620
	30	400 - 460	1200	400 - 460	790
Instantaneous Current Draw	-	500	1500	500	1000
Typical Receive Current Draw (mA)	-	400 - 460	-	400 - 460	-

Table 1-1: pMDDL Current Consumption



1.0 Overview

Environmental

Operation Temperature: -40°F(-40°C) to 185°F(85°C)

Humidity: 5% to 95% non-condensing

Mechanical

Dimensions:	OEM: 1.05" (26.5mm) X 1.3" (33mm) X 0.13" (3.5mm) ENC: 3.05" (77mm) X 2.2" (55mm) X 1.1" (28mm)
Weight:	OEM: Approx. 7 grams ENC: Approx. 170 grams
Connectors:	OEM: Antenna: UFL x2 (ANT1, ANT2) Data: 80 Pin SMT ENC: RP-SMA Femalex3 Data: RJ-45 x2 (Ethernet) Female DB9 (Serial) USB Type A Micro-AB USB (Console) 4 PIN Interlock (Vin)

1.0 Overview

1.3 Performance Specifications

MIMO (2x2) ON			
Modulation	Iperf Throughput (Mbps)	Throughput @ Sensitivity (dBm)	Maximum Total Tx Power (dBm) +/- 1dB
8 MHz Channel Bandwidth			
BPSK_1/2	3	-99.5	30dBm
QPSK_1/2	5.9	-98	30dBm
QPSK_3/4	8.8	-96	30dBm
16QAM_1/2	11.6	-92	30dBm
16QAM_3/4	17.1	-90	30dBm
64QAM_2/3	22.8	-85	30dBm
64QAM_3/4	25.5	-83.5	30dBm
64QAM_5/6	27.8	-81	30dBm
4 MHz Channel Bandwidth			
BPSK_1/2	1.51	-102.5	30dBm
QPSK_1/2	2.98	-101	30dBm
QPSK_3/4	4.4	-99	30dBm
16QAM_1/2	5.8	-95.5	30dBm
16QAM_3/4	8.6	-93	30dBm
64QAM_2/3	11.4	-88	30dBm
64QAM_3/4	12.8	-86	30dBm
64QAM_5/6	14	-83.5	30dBm
MIMO OFF			
Modulation	Iperf Throughput (Mbps)	Throughput @ Sensitivity (dBm)	Maximum Tx Power (dBm) +/- 1dB
8 MHz Channel Bandwidth			
BPSK_1/2	3	-96.5	30dBm
QPSK_1/2	5.8	-95	30dBm
QPSK_3/4	8.6	-93	30dBm
16QAM_1/2	11.5	-89	30dBm
16QAM_3/4	16.9	-87	30dBm
64QAM_2/3	22.2	-82	28dBm
64QAM_3/4	24.7	-80.5	28dBm
64QAM_5/6	27.4	-78	27dBm
4 MHz Channel Bandwidth			
BPSK_1/2	1.5	-99.5	30dBm
QPSK_1/2	2.9	-98	30dBm
QPSK_3/4	4.3	-96	30dBm
16QAM_1/2	5.7	-92.5	30dBm
16QAM_3/4	8.4	-90	30dBm
64QAM_2/3	11.3	-85	28dBm
64QAM_3/4	12.5	-83	28dBm
64QAM_5/6	14	-80.5	27dBm

Table 1-2: pMDDL Performance Specifications



2.0 Quick Start

This QUICK START guide will walk you through the setup and configuration of a few basic applications. The QUICK START will rely on the *WebUI* for configuration. This walkthrough also assumes the units used are installed in microhard interface/development boards or custom boards that allow access to the LAN port. See the appropriate section for pin-outs.

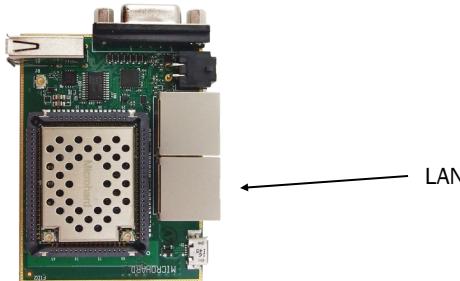
Note that the units arrive from the factory with a Radio Configuration of 'Master' and the Local Network setting configured as 'Static' (IP Address **192.168.168.1**, Subnet Mask 255.255.255.0). DHCP is enabled by default, and will assign an IP to a connected device or computer with DHCP enabled.

2.1 Getting Started

- ✓ Connect an appropriate Antenna to the **ANTENNA** connector of the pMDDL.
- ✓ Connect and/or apply a suitable power source to the unit. Allow the unit to boot up fully, the CPU LED (Blue) should be on in a solid state
- ✓ Connect A PC to the **LAN** port (eth0) of the pMDDL, using an Ethernet Cable.



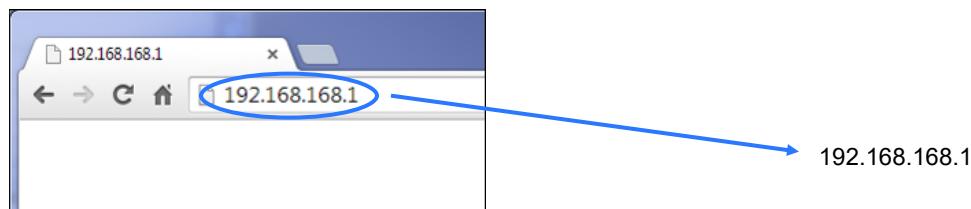
To reset to factory defaults, press and hold the CONFIG for 8 seconds with the pMDDL powered up. The pMDDL will reboot with factory default settings.



The factory default network settings:

IP: **192.168.168.1**
Subnet: **255.255.255.0**

- ✓ The PC must have its Network Setting (TCP/IP Properties) set to DHCP (The modem will assign a IP address to you), or STATIC with an IP Address of (e.g.) 192.168.168.10 and a Subnet Mask of 255.255.255.0.
- ✓ Open a Browser Window and enter the IP address 192.168.168.1 into the address bar.



2.0 Quick Start

- ✓ The pMDDL will then ask for a Username and Password. Enter the factory defaults listed below.



The factory default login:

User name: admin
Subnet: admin

You will be forced to change the default password upon logging in for the first time.

Authentication Required

The server http://192.168.168.1:80 requires a username and password. The server says: WebUI.

User Name:

Password:

The Factory default login:

User name: **admin**
Password: **admin**

Once successfully logged in for the first time, the pMDDL will force a password change

- ✓ Once successfully logged in, the System Summary window will be displayed.

System Information													
System Information													
Host Name		UserDevice		Description		mypDDL-MIMO							
Product Name		pDDL-MIMO		System Date		2017-11-02 13:38:38							
Hardware Version		Rev A		System Uptime		34 min							
Software Version		v1.4.0		Build Date		2017-11-02							
Software Build		1008		Build Time		08:58:58							
LAN Status													
MAC Address		00:0F:92:04:22:84											
IP Address		192.168.168.1		Connection Type		static							
Subnet Mask		255.255.255.0		Gateway		192.168.168.1							
WAN Status													
MAC Address		00:0F:92:05:22:84											
IP Address		N/A		Connection Type		dhcp							
Subnet Mask		N/A		Gateway		N/A							
Primary DNS		N/A		Secondary DNS		N/A							
RF Status													
General Status													
MAC Address	Operation Mode	Network ID	Compatibility Mode	Bandwidth	Frequency	Tx Power	Encryption Type						
00:0F:92:FA:94:CF	Master	MHK_Alpha	pDDL	8 MHz	2477 MHz	20 dBm	AES-128						
Traffic Status													
Receive Bytes		Receive Packets		Transmit Bytes		Transmit Packets							
0B		0		57.47KB		459							
Stop Refreshing				Interval: 20(in seconds)									

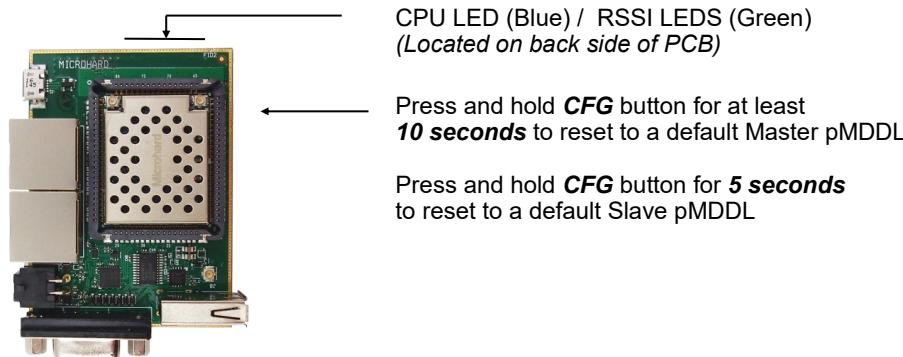
2.0 Quick Start

2.2 Simple Master and Slave - Auto (Using Defaults)

This **Quick Start** example requires (2) pMDDL units, one will be configured as a Master (M), the second unit will be configured as a Slave/Remote (S). This example will use factory defaults to set up each unit so that a simple network will be established.



- ✓ Use [Section 2.1 Getting Started](#) to power up a pair of pMDDL modules mounted in a Pico Ethernet Motherboard.
 - ✓ Master: Once the pMDDL is fully booted (solid blue CPU LED), press and hold the CFG button. Once the CPU LED begins to flash, continue to hold for at least **10 seconds**, then release.



- ✓ The pMDDL will then reset all settings to default values, and set the following settings that are required to automatically create a link with a slave:
 - IP Address: **192.168.168.1**, Operating Mode: **Master**
 - Network ID: **MHK_Alpha**, Channel Bandwidth: **8 MHz**
 - Channel-Frequency: **76 - 2477 MHz**
 - ✓ Slave: Ensure the pMDDL is fully booted (solid blue CPU LED), then press and hold the CFG button. Once the CPU LED begins to flash, continue to hold for **5 seconds**, then release.
 - ✓ The pMDDL will then reset all settings to default values, and set the following settings that are required to automatically create a link with a slave:
 - IP Address: **192.168.168.2**, Operating Mode: **Slave**
 - Network ID: **MHK_Alpha**, Channel Bandwidth: **8 MHz**
 - Channel-Frequency: **76 - 2477 MHz**
 - ✓ Once both units have finished changing settings (~60 seconds) a wireless link should automatically be established between them, this can be seen by observing the RSSI LEDS, they should be on solid, indicating a link (the more LEDs illuminated = stronger the link).

2.0 Quick Start

2.3 Simple Master and Slave – Manual Setup

This **Quick Start** example requires (2) pMDDL units, one will be configured as a Master (M), the second unit will be configured as a Slave/Remote (S). This example will show the basic steps required to set up each unit so that a simple network will be established.



For the best performance it is required to connect the Master to the video source (camera) and the remote to the video receiver. The pMDDL can support Point-to-Multipoint applications and multiple remotes could be used to view the video from multiple locations.

2.3.1 Configuring the Master

- ✓ Use [Section 2.1 Getting Started](#) to connect, power up and log in to a pMDDL unit.
 - ✓ Give the pMDDL unit a unique IP address.



To connect to an existing network, contact your Network Administrator for valid network settings.

Select **Network** from the top/main navigation.

Select **LAN** from the submenu list.
Select Edit on the LAN interface 1.

System	Network	Wireless	Firewall		
Status	LAN	WAN	Routes	Ports	Device
Network LAN Configuration					
LAN Interfaces Settings					
No.	Name	Static IP Address			
1	lan	192.168.168.1			

Choose *Static IP* for the ***Connection Type***.

LAN Configuration	
Spanning Tree (STP)	<input type="button" value="Off ▾"/>
Connection Type	<input type="button" value="Static IP ▾"/>
IP Address	<input type="text" value="192.168.168.11"/>
Netmask	<input type="text" value="255.255.255.0"/>
Default Gateway	<input type="text"/>

Enter the following Network Information:

IP Address: 192.168.168.11
IP Subnet Mask: 255.255.255.0

Click on the **Submit** button to write the changes to the pMDDL. The **Cancel** button will revert back to last values saved to the unit.

Refer to [Section 5.2.2 LAN](#) for additional information.

Once the IP Address is changed, you will need to type the new address into your browser to continue the configuration.

2.0 Quick Start

2.3.1 Configuring the Master (Con't)

- ✓ Configure the pMDDL as a Master

Select **Wireless** from the top/main navigation, and then **RF** from the submenu list.

A screenshot of a software interface showing the 'Wireless' tab selected. The top navigation bar includes tabs for System, Network, Wireless (which is highlighted with a red oval), and Firewall. Below the tabs, there are two buttons: 'Status' and 'RF' (also highlighted with a red oval). The main content area displays the 'Wireless Configuration' page, which further includes an 'RF Configuration' section.

RF Configuration	
Radio	<input checked="" type="radio"/> On <input type="radio"/> Off
Channel Bandwidth	8MHz ▾
Channel-Frequency	76 - 2477 MHz ▾
Tx Power	20 dbm ▾
Wireless Distance	3000
MIMO	<input checked="" type="radio"/> On <input type="radio"/> Off

In the RF Configuration ensure the **Compatibility Mode**, **Channel Bandwidth** and **Channel-Frequency** are set the same on each module.

For bench or close proximity testing it is best to use a lower power setting to prevent RF saturation. Select 20dBm from the **TX Power** setting.

Select **Master** from the **Operation Mode** dropdown box.

Set a **Network ID**, which will need to be the same on each unit in the network. This example uses **TEST_ID**.

Operation Mode	Master ▾
TX Rate	Auto ▾
Extended Addressing	<input checked="" type="radio"/> On <input type="radio"/> Off
Network ID	TEST_ID
Encryption Type	AES-128 ▾
Encryption Key	1234567890
Show password	<input checked="" type="checkbox"/>

The remaining settings in the **Wireless** menu should be left as defaults for this exercise.

Refer to **Section 5.3 Wireless** for additional information.

Click on the **Submit** button to write the changes to the pMDDL. The **Cancel** button will revert back to previously saved values



If any additional settings need to be changed, ensure they are also changed on the Slave.

System	Network	Wireless	Firewall	Serial	Diag	Ad
Status	RF					
Wireless Configuration						
RF Configuration						
Radio	<input checked="" type="radio"/> On <input type="radio"/> Off <input type="button" value="8MHz ▾"/>					
Channel Bandwidth	<input type="button" value="76 - 2477 MHz ▾"/>					
Channel-Frequency						
Tx Power	<input type="button" value="20 dbm ▾"/>					
Wireless Distance	<input type="button" value="3000 (m)"/>					
MIMO	<input checked="" type="radio"/> On <input type="radio"/> Off					
Operation Mode	<input type="button" value="Master ▾"/>					
TX Rate	<input type="button" value="Auto (recommended) ▾"/>					
Extended Addressing	<input type="button" value="ON ▾"/>					
Network ID	<input type="button" value="TEST_ID"/>					
Encryption Type	<input type="button" value="AES-128 ▾"/>					
Encryption Key	<input type="button" value="1234567890"/>					
Show password	<input checked="" type="checkbox"/>					

2.0 Quick Start

2.3.2 Configuring the Slave/Remote

The following procedure describes the steps required to set up a pMDDL unit as a Slave (S). A Slave provides a single wireless connection (i.e to an Master) and provides a wired connection to a PC or other devices.

- ✓ Use [Section 2.1 Getting Started](#) to connect, power up and log in to a second pMDDL unit.
 - ✓ Give the pMDDL unit an unique IP address.

Select **Network** from the top/main navigation.

Select **LAN** from the submenu list.
Select Edit on the LAN interface 1.



To connect to an existing network, contact your Network Administrator for valid network settings.

LAN Configuration	
Spanning Tree (STP)	Off ▾
Connection Type	Static IP ▾
IP Address	192.168.168.12
Netmask	255.255.255.0
Default Gateway	192.168.168.11

Refer to **Section 5.2.2 LAN** for additional information.

System	Network	Wireless	Firewall		
Status	LAN	WAN	Routes	Ports	Device
Network LAN Configuration					
LAN Interfaces Settings					
No.	Name	Static IP Address			
1	lan	192.168.168.1			

Choose *Static IP* for the **Connection Type**.

Enter the following Network Information:

IP Address: 192.168.168.12
IP Subnet Mask: 255.255.255.0
Default Gateway: 192.168.168.11

Click on the **Submit** button to write the changes to the pMDDL. The **Cancel** button will revert back to last values saved to the unit.

Once the IP Address is changed, you will need to type the new address into your browser to continue the configuration.

2.0 Quick Start

2.3.3 Configuring the Slave/Remote (Con't)

- ✓ Configure the pMDDL as a Slave

Select **Wireless** from the top/main navigation, and then **RF** from the submenu list.

A screenshot of a software interface showing the 'Wireless' tab selected. The top navigation bar includes tabs for System, Network, Wireless (which is highlighted with a red oval), and Firewall. Below the tabs, there are two main sections: 'Status' and 'RF' (Radio Frequency), with 'RF' also circled in red.

RF Configuration	
Radio	<input checked="" type="radio"/> On <input type="radio"/> Off
Channel Bandwidth	8MHz ▾
Channel Frequency	76 - 2477 MHz ▾
Tx Power	20 dbm ▾
Wireless Distance	3000
MIMO	<input checked="" type="radio"/> On <input type="radio"/> Off

In the RF Configuration ensure the **Compatibility Mode**, **Channel Bandwidth** and **Channel-Frequency** are set the same on each module.

For bench or close proximity testing it is best to use a lower power setting to prevent RF saturation. Select 20dBm from the **TX Power** setting.

Select **Slave** from the *Operating Mode* dropdown box.

Set a **Network ID**, which will need to be the same on each unit in the network. This example uses **TEST_ID**.

Operation Mode	<input type="button" value="Slave"/>
TX Rate	<input type="button" value="Auto (recommended)"/>
Extended Addressing	<input checked="" type="radio"/> On <input type="radio"/> Off
Network ID	<input type="text" value="TEST_ID"/>
Encryption Type	<input type="button" value="AES-128"/>
Encryption Key	<input type="text" value="1234567890"/>
Show password	<input checked="" type="checkbox"/>

System	Network	Wireless	Firewall	Serial	Diag	Adm					
Status	RF										
Wireless Configuration											
RF Configuration											
Radio		<input checked="" type="radio"/> On	<input type="radio"/> Off								
Channel Bandwidth		8MHz	▼								
Channel-Frequency		76 - 2477 MHz	▼								
Tx Power		20	dbm	▼							
Wireless Distance		3000	(m)								
MIMO		<input checked="" type="radio"/> On	<input type="radio"/> Off								
Operation Mode		Slave	▼								
TX Rate		Auto (recommended)	▼								
Extended Addressing		ON	▼								
Network ID		TEST_ID									
Encryption Type		AES-128	▼								
Encryption Key		1234567890									
Show password		<input checked="" type="checkbox"/>									



If any additional settings need to be changed, ensure they are also changed on the Slave.

The remaining settings in the **Wireless** menu should be left as defaults for this exercise.

Refer to **Section 5.3 Wireless** for additional information.

Click on the **Submit** button to write the changes to the pMDDL. The **Cancel** button will revert back to previously saved values

2.0 Quick Start

2.3.3 Testing the Connection

- ✓ Visually check to see if the pMDDL units are communicating.

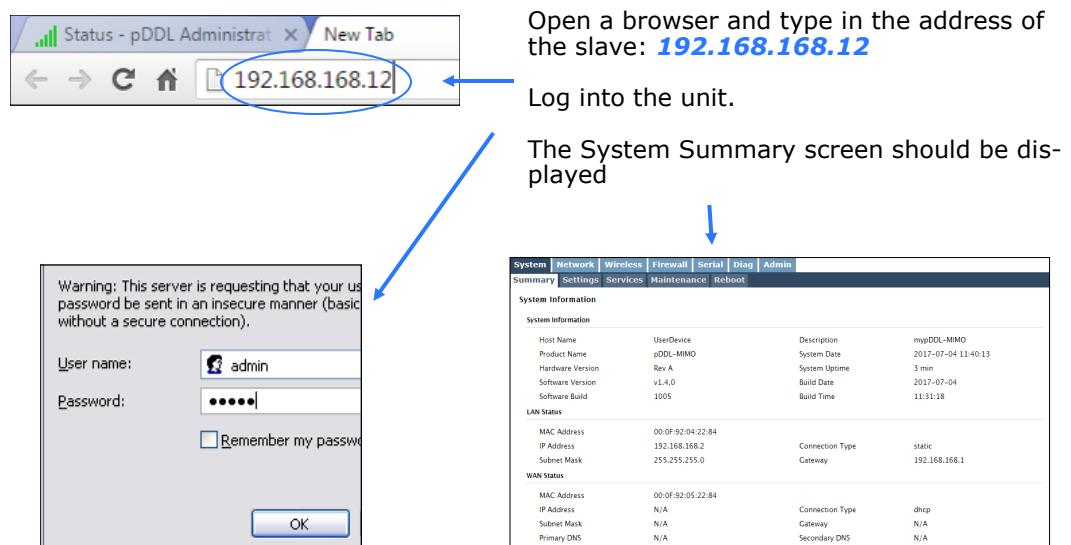
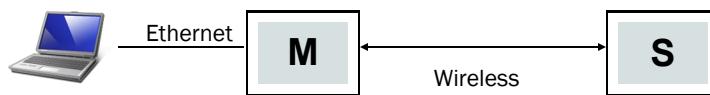
The **RSSI** LED's represent signal strength, the more LED's that are illuminated, the stronger the signal. The **Wireless > Status** window also has a Connection Status section similar to that seen below:



RSSI LED's that are 'cycling' or 'scanning' indicate that the unit is searching for a signal.

RF Status							
General Status							
MAC Address	Operation Mode	Network ID	Compatibility Mode	Bandwidth	Frequency	Tx Power	Encryption Type
00:0F:92:FA:37:C5 Master		TEST_ID	pDDL	8 MHz	2.477 GHz	20 dBm	AES-128
Traffic Status							
Receive Bytes	Receive Packets		Transmit Bytes		Transmit Packets		
104.895KB	404		77.873KB		562		
Connection Info (1)							
MAC Address	Tx Mod	Rx Mod	SNR (dB)	RSSI (dBm)	Signal Level	RSSI Graph	
00:0F:92:FA:37:CE	64-QAM FEC 5/6	64-QAM FEC 5/6	29	-62			

- ✓ With a PC connected to the Master (M), type in the IP address of the Slave (S) into the URL address bar of your browser. You should be able to connect, log in and view the WebUI of the Slave via the wireless connection.



If any additional settings need to be changed, ensure they are also changed on all radios.



101010101010101010
01010101010101010101
10101010101010101010
01010101010101010101

pMDDL

3.0 Hardware Features

3.1 pMDDL OEM Module

The pMDDL modems are available as OEM modules for complete integration into custom designs. The OEM module supplies all the required raw signals to allow the unit to be tightly integrated into applications to efficiently maximize space and power requirements. The Microhard development board can provide a convenient evaluation platform to test and design with the module. (Contact Microhard Systems for details)

Any pMDDL module may be configured as a Master, Slave(Remote), or Relay (future). This versatility is very convenient from a 'sparing' perspective, as well for convenience in becoming familiar and proficient with using the module: if you are familiar with one unit, you will be familiar with all units.



Image 3-1: pMDDL2450 Top View

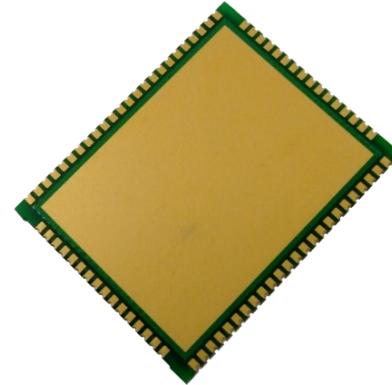
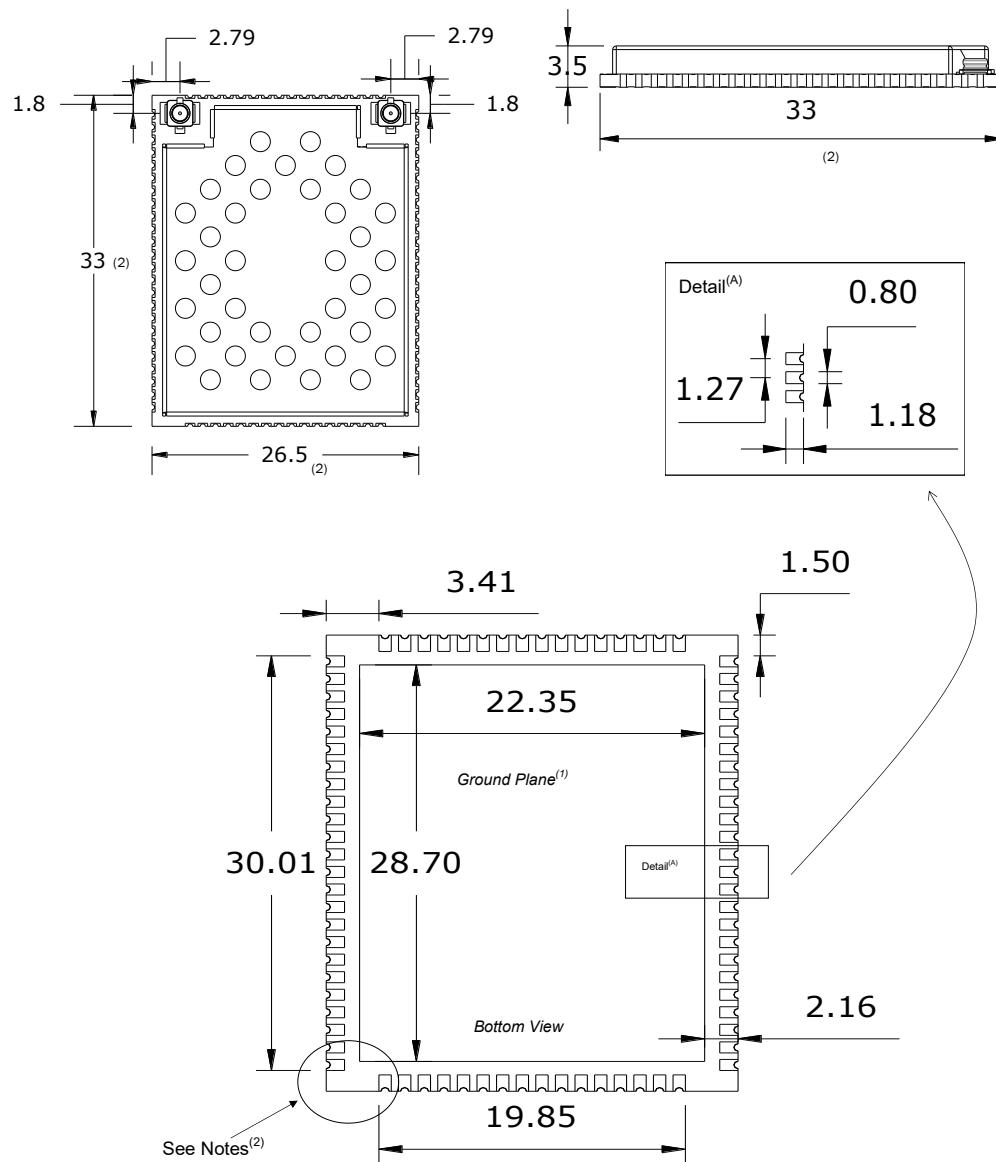


Image 3-2: pMDDL2450 Bottom View

3.0 Hardware Features

3.1.1 Mechanical Drawings

The pMDDL OEM Modules have an extremely small form factor as seen *below*.



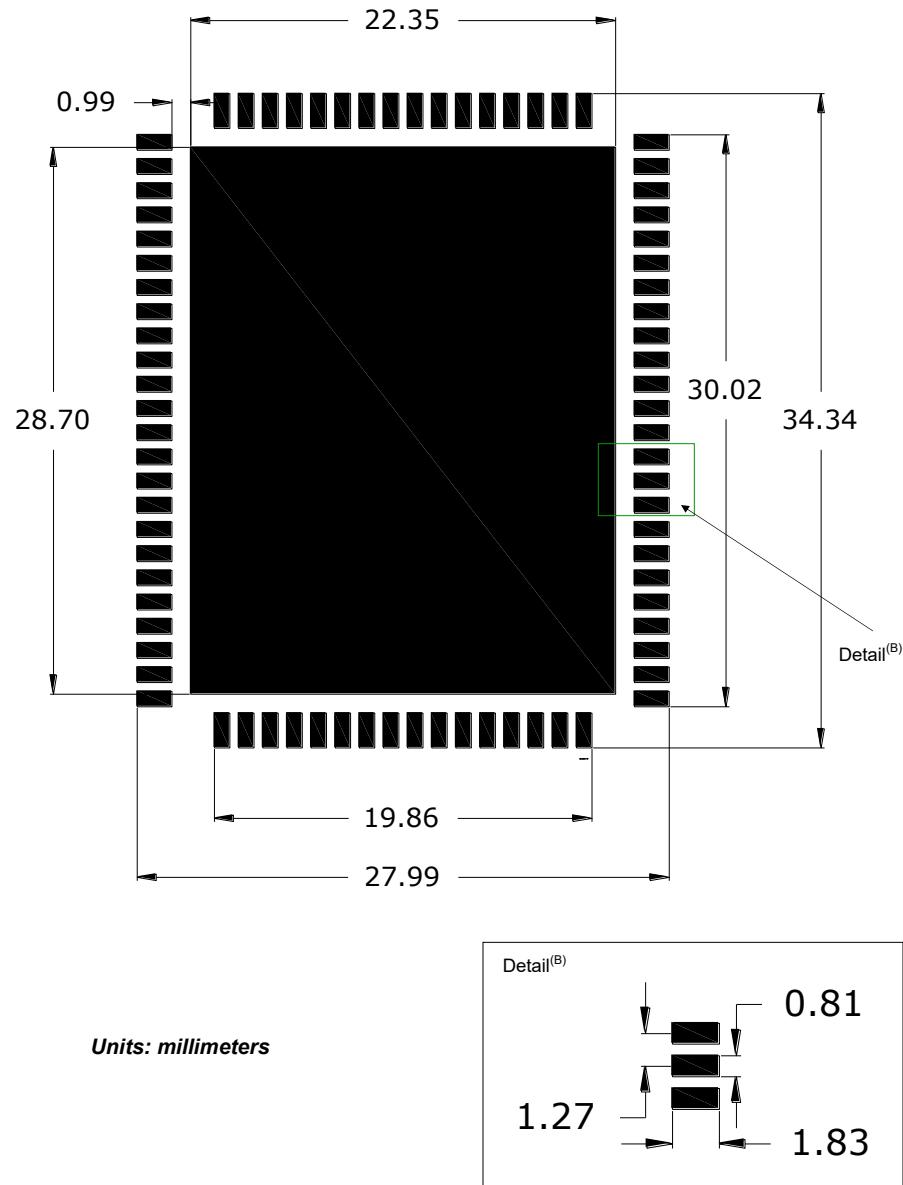
Units: millimeters

1. Ground plane must be connected to GND for required heat dissipation.
2. Due to manufacturing methods additional PCB material may be present on the corners that cannot be removed. Designs should allow for a small tolerance of this additional material, $\pm 0.25\text{mm}$

Drawing 3-1: pMDDL OEM Mechanical

3.0 Hardware Features

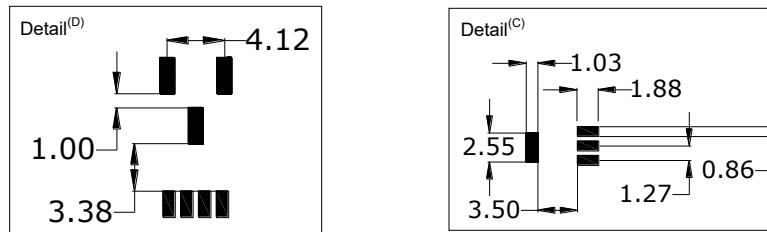
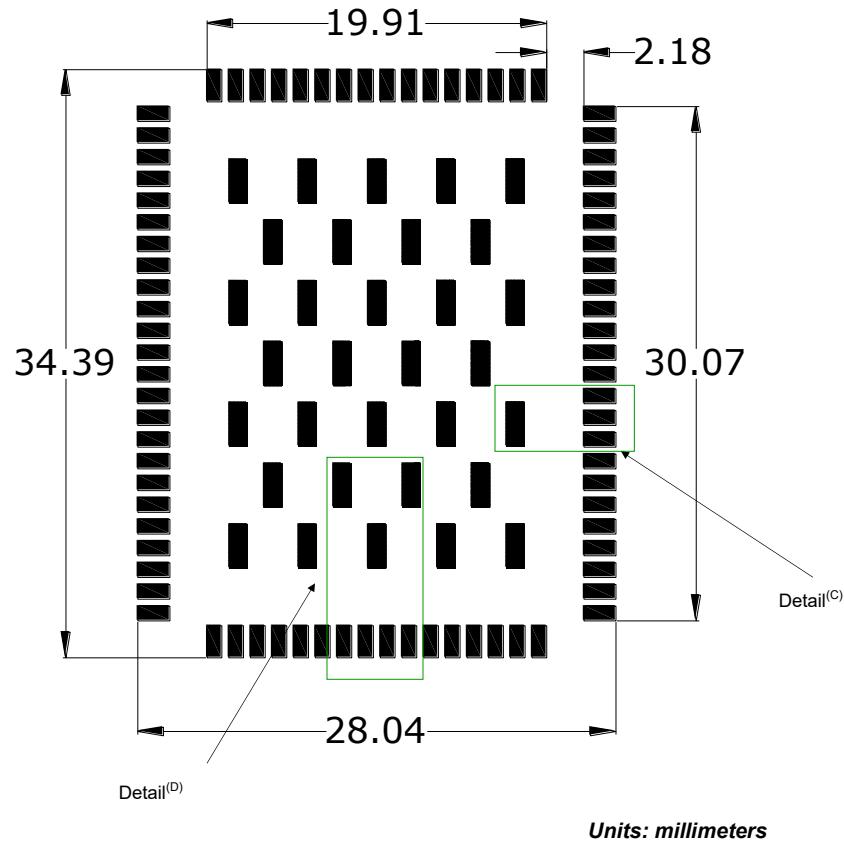
3.1.2 Recommended Solder Mask (Pad Landing)



Drawing 3-2: pMDDL Recommended Solder Mask

3.0 Hardware Features

3.1.3 Recommended Solder Paste Pattern



Drawing 3-3: pMDDL Recommended Solder Paste

3.1.4 OEM Connectors

Antenna

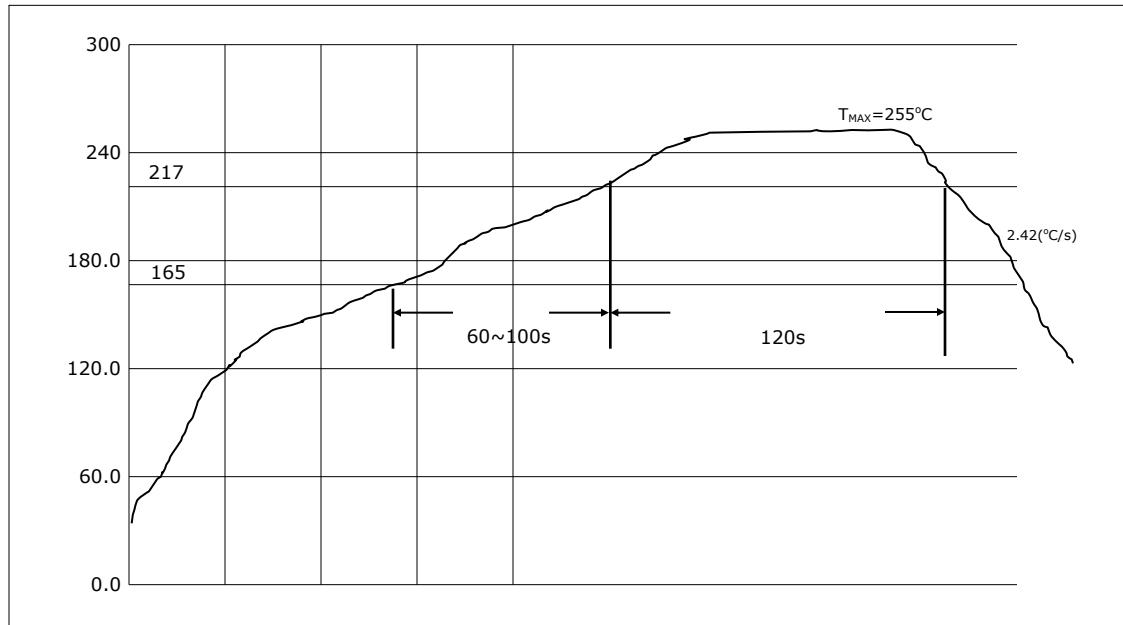
All pMDDL OEM Modules use an UFL connector for the antenna connection.

Data

The interface to the pMDDL OEM module is a tight integration using 80 pad SMT connections.

3.0 Hardware Features

3.1.5 SMT Temperature Profile



Drawing 3-4: pMDDL Reflow Profile

Temperature Zone	Time	Parameter
Preheat zone: (40°C - 165°C)	-	Heating rate: 0.5°C/s-2°C/s
Soak Zone: (165°C - 217°C)	60 - 100s	-
Reflow zone: (>217°C)	120s	Peak reflow: 255°C
Cooling zone	Cooling rate: 2°C/s ≤ Slope ≤ 5°C/s	

Table 3-1: *pMPDL Reflow Parameters*

Zone	Temperature (°C)
1	120
2	140
3	160
4	180
5	215
6	255
7	255
8	255
9	250
10	130

Table 3-2: pMDDL Oven Temperature Profile

3.1.6 SMT Baking Instructions (MSL)

The pMDLL OEM modules must be baked before mounting, the following baking instruction should be followed for the best results:

- a) Minimum of 8 to 12 hours at 125°C +/- 5°C for high-temperature device containers.
 - b) Unused modules should be stored at ≤ 10% RH

3.0 Hardware Features

3.1.7 Heat Dissipation

For optimal performance it is important to include adequate heat dissipation strategies that incorporate a heat sink or fan into any designs that integrate the pMDDL OEM module (also required for designs that utilize the optional socket).

Below are two recommended heat dissipation strategies:

Heat Sink (w/Thermal Gap Filler)

Heat Sink - Wakefield-Vette 625-25ABT4E*
25mm x 25mm x 6.4mm (Fin height)
12° C/W @ 500 LFM
5.45 grams

Thermal Gap Filler - Laird Technologies Tflex HR600*
25mm x 25 mm (Cut to Size)
5mm Thickness
3.0 W/m-K
5 grams

pMDDL OEM or OEM/Socket



Fan (Requires power source)



External Fan - Sunon MC25100V1-000U-A99*
25mm x 25mm x 10mm
3.5 CFM (0.099m³/min)
13,000 RPM
2.5~6VDC
7.71 grams

pMDDL OEM or OEM/Socket

* Or equivalent

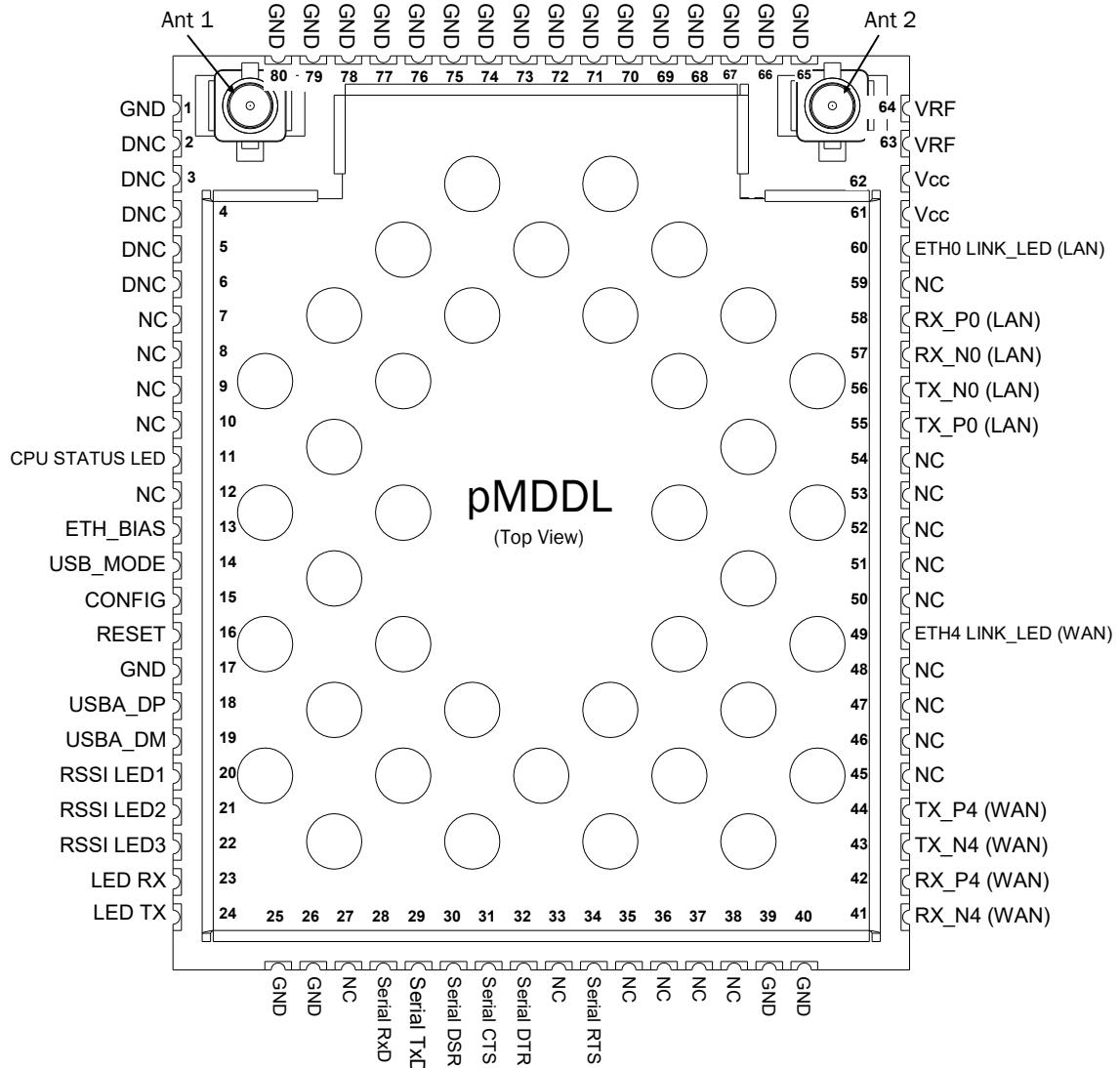


microhard

pMDDL

3.0 Hardware Features

3.1.8 pMDDL OEM Pin Descriptions



Drawing 3-5: pMDDL 80-pin OEM Connection Info

Inputs and outputs are 3.3V nominal (3.0V min — 3.6V max) unless otherwise specified.

The above drawing depicts a top view of the pMDDL OEM Module. A full description of the connections and function of each pin is provided on the pages that follow.

Heat Dissipation

For optimal performance it is important to include adequate heat dissipation including a heat sink in any designs that integrate the pMDDL OEM module (also required for designs that incorporate the optional socket).

3.0 Hardware Features



Caution: During power up or reset, output pins from the Pico are in an unknown state. It is advised to use pull up or pull down resistors as appropriate.

Pin Name	No.	Description	Dir
GND	1,17,25-26,39-40,65-80	Ground reference for logic, radio, and I/O pins.	
DNC	2,3,4,5,6	Reserved for factory use only.	
NC	7,8,9,10,12,27,33,35,36,37,38,45,46,47,48,50,51,52,53,54,59	*Currently Not Supported. For Future Expansion*	
CPU STATUS LED	11	Active high output indicates CPU/Module status. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
ETH_BIAS	13	Bias Voltage to Ethernet PHY transformer	
USB_MODE	14	Indicates if the interface is in host/device mode. 0 = Device (Connected through 1K resistor to GND), 1 = Host.	I
Config	15	Active low. In normal mode, pull it low and hold for more than 8 seconds will reset the system to default settings. Pull it low upon power up will put the module into recovery mode.	I
RESET	16	Active low input will reset module	I
USBDP	18	USB D+ signal; carries USB data to and from the USB 2.0 PHY	
USBDM	19	USB D- signal; carries USB data to and from the USB 2.0 PHY	
LED_1 (RSSI1)	20	Receive Signal Strength Indicator 1. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
LED_2 (RSSI2)	21	Receive Signal Strength Indicator 2. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
LED_3 (RSSI3)	22	Receive Signal Strength Indicator 3. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
LED_RX	23	Active high output indicates receive and synchronization status. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
LED_TX	24	Active high output indicates module is transmitting data over the RF channel. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
Serial RxD	28	Receive Data. Logic level input into the modem. It is recommended to wire this pin out through a zero ohm resister to a header and jumper block for external access to the serial port for modem recovery procedures.	I
Serial TxD	29	Transmit Data. Logic level Output from the modem. It is recommended to wire this pin out through a zero ohm resister to a header and jumper block for external access to the serial port for modem recovery procedures.	O
Serial DSR	30	Data Set Ready. Active low output. <i>The DSR line set high enables the transmitter of the RS485 driver.</i>	O
Serial CTS	31	Clear To Send. Active low output.	O
Serial DTR	32	Data Terminal Ready. Active Low output.	O
Serial RTS	34	Request To Send. Active low input.	I

Table 3-3: pMDDL Pin Description

All serial communications signals are logic level (0 and 3.3V). DO NOT connect RS-232 level (+12, -12VDC) signals to these lines without shifting the signals to logic levels.

3.0 Hardware Features



Caution: During power up or reset, output pins from the Pico are in an unknown state. It is advised to use pull up or pull down resistors as appropriate.

Pin Name	No.	Description	Dir
RX_N4	41	Ethernet Port 4 (WAN) Receive Pair	
RX_P4	42		
TX_N4	43	Ethernet Port 4 (WAN) Transmit Pair	
TX_P4	44		
ETH4 LINK_LED	49	Active high output indicates Ethernet port 4 link status. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
TX_P0	55	Ethernet Port 0 (LAN) Transmit Pair	
TX_N0	56		
RX_N0	57	Ethernet Port 0 (LAN) Receive Pair	
RX_P0	58		
ETH0 LINK_LED	60	Active high output indicates Ethernet port 0 link status. Active high, cannot drive LED directly. Requires current limiting resistor. 8mA maximum.	O
Vdd	61,62	Positive voltage supply voltage for the digital section of the module (3.3V).	I
Vpa	63,64	Positive voltage supply voltage for the radio module (3.3-5V).	I

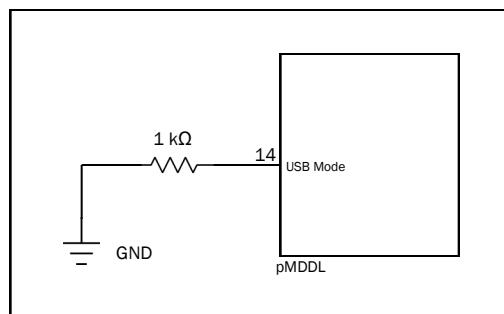
Table 3-3: pMDDL Pin Description (continued)

All serial communications signals are logic level (0 and 3.3V). DO NOT connect RS-232 level (+12, -12VDC) signals to these lines without shifting the signals to logic levels.

See **Appendix D: Sample Interface Schematic** for a sample schematic that can be used to interface to the pMDDL OEM module.

3.1.9 USB Device Mode

The pMDL can be set to operate as a USB Device. When set as a USB device, Microhard Composite Drivers can be installed on a USB Host to provide Ethernet and Serial functionality to the USB port on the pMDL. To enable USB Device mode, Pin 14 must be connect to GND through a 1K resistor as shown below:



Drawing 3-6: pMDDL USB Device Mode

3.0 Hardware Features

3.2 pMDDL Enclosed

The pMDDL-ENC is a robust and compact enclosed unit that provides easy access to all the standard interfaces for connecting and working with the pMDDL. The enclosed model is ideal for base stations and applications where a full integration is not required and the modem can be used right out of the box with only software configuration required.

The pMDDL-ENC includes the following standard indicators and interfaces:

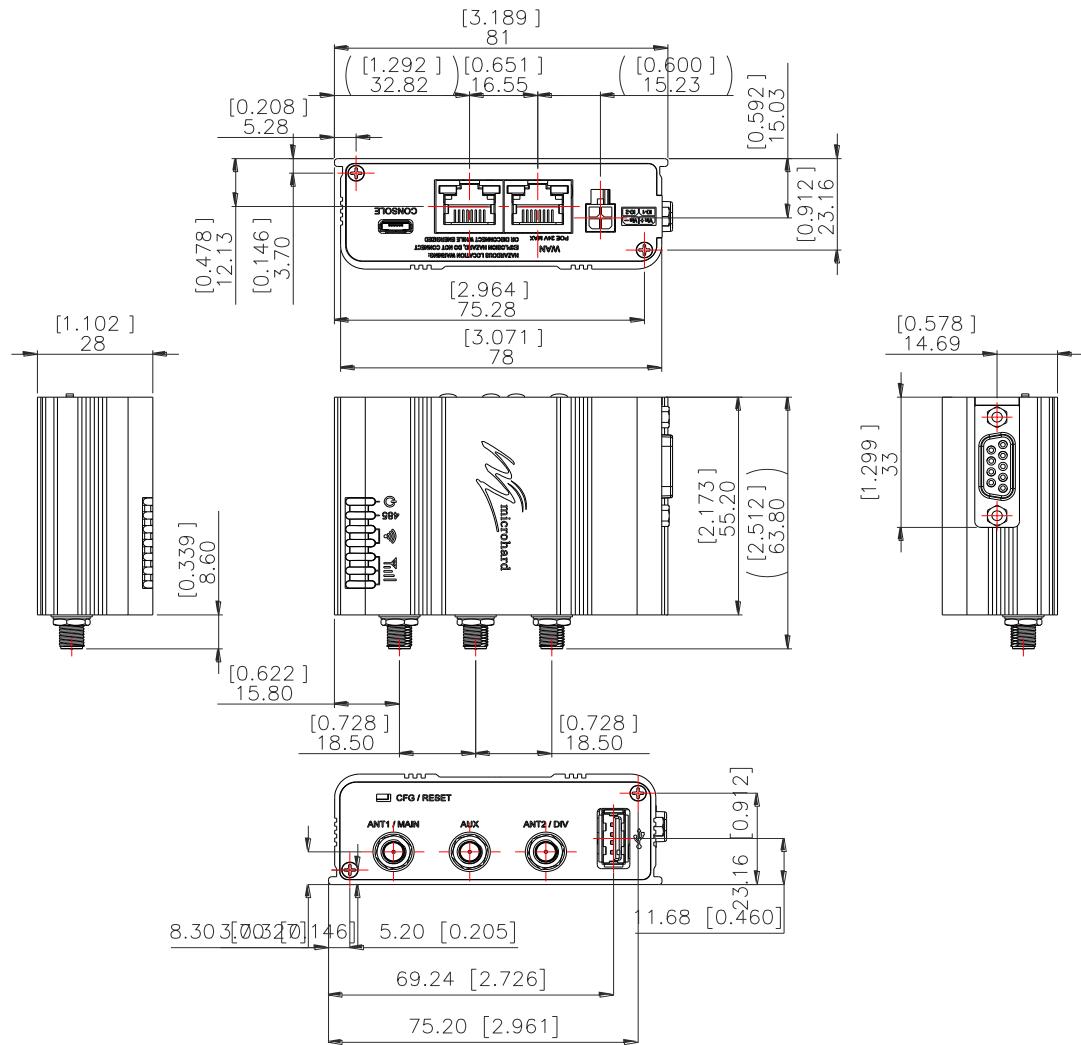
- 2x RJ45 Ethernet Ports
 - DE9 Female Serial Port Interface
 - USB Type A (Future)
 - Micro-AB USB (Console - Future)
 - Power / IO Connector (7-30 VDC)
 - Power / CPU Status LED (Blue)
 - Wireless Activity (Tx/Rx) LED's (Red/Green)
 - RSSI (x3) LED's (Green)
 - RS485 LED (Blue)
 - Config Button (Reset/Recovery Operations)
 - 3x RP-SMA Female Antenna (ANT1, ANT2, Aux)



Image 3-3: pMDDL-ENC

3.0 Hardware Features

3.2.1 pMDDL-ENC Mechanical Drawings



Drawing 3-7: pMDDL-ENC Mechanical

3.0 Hardware Features

3.2.2 pMDDL-ENC Connectors & Indicators

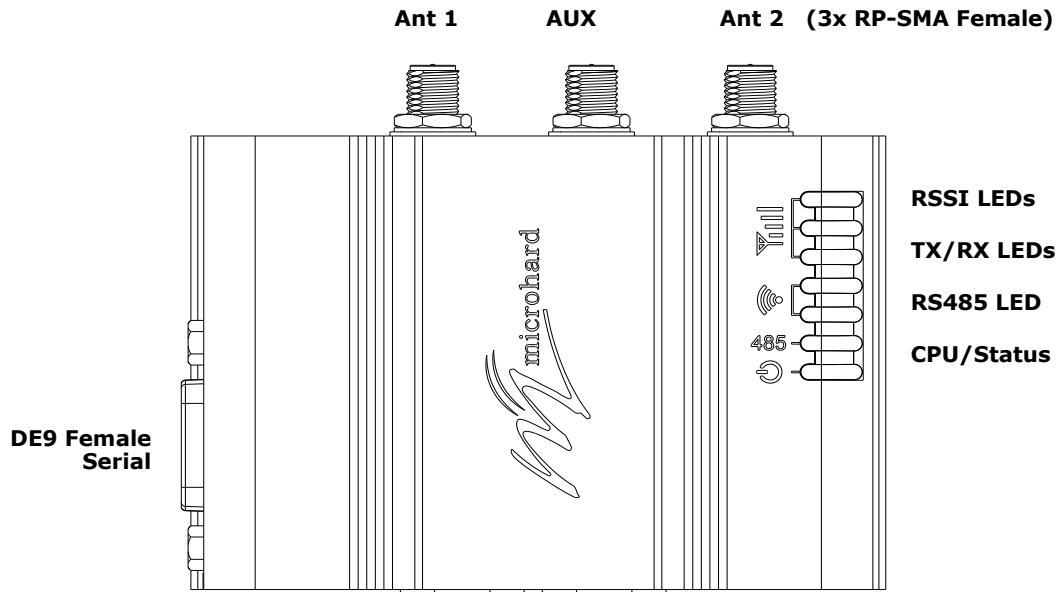


Figure 3-1: pMDDL-ENC Top View

Antennas:

The pMDDL-ENC module uses a RP-SMA Female connectors. ANT1 and ANT2 are marked on the Enclosure. AUX is used to trigger an external amplifier as it goes high (3.3V) during TX.

RSSI LEDs (Green):

The RSSI LEDs indicate the Received Signal Strength on the Wireless Link. On a Master it will indicate an average RSSI value based on connected units. On a Slave the RSSI LEDs will represent the signal strength between the Slave and the Master it is connected to. (The more LEDs illuminated, the stronger the signal)

TX/RX LEDs (Red/Green):

The TX/RX LEDs indicate wireless traffic to/from the pMDDL module.

RS485 LED (Blue):

The RS485 LED indicates that the serial port has been configured as a RS485 port.

CPU>Status (Blue):

The CPU/Status LED indicates that power has been applied to the module. A Solid LED indicates normal operation, while flashing indicates boot or firmware upgrade status.



3.0 Hardware Features

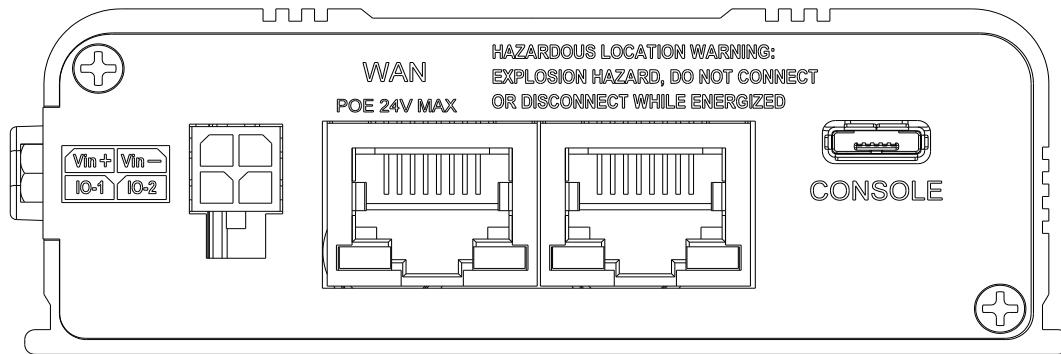


Figure 3-2: pMDDL-ENC Back View

Ethernet LAN:

The Ethernet LAN port is a standard RJ45 port to connect local network devices. The default IP address for this port is 192.168.168.1.

Ethernet WAN:

The Ethernet WAN port is a standard RJ45 Port that can be used as a separate WAN port for Router functions, or can be bridged (via software) to the LAN as a additional switch port for local devices.

The pMDDL-ENC can be powered using **Passive PoE from 12—30 VDC Maximum** on the WAN port using a PoE injector that meets the following requirements:

Ethernet RJ45 Connector Pin Number								
Source Voltage	1	2	3	4	5	6	7	8
12 - 30 Vdc	Data	Data	Data	DC+	DC+	Data	DC-	DC-

Table 3-2: Ethernet (WAN) PoE Connections

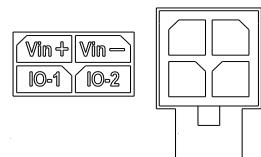
Power:

The pMDDL-ENC can be powered using an input voltage in the 7-30 VDC range.

Power

Console:

The console port is a Micro-AB USB port that uses a generic FTDI driver as a USB/Serial Interface. When a cable is connected to this port from a PC the FTDI driver should automatically be installed. (Future Development - Coming Soon)



3.0 Hardware Features

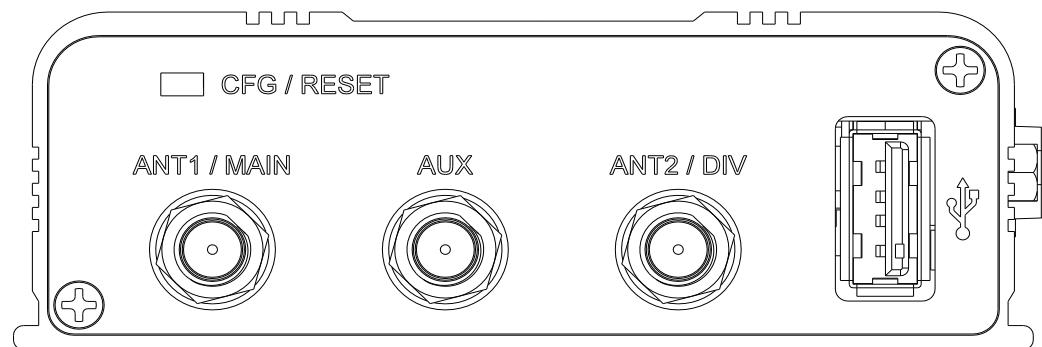


Figure 3-3: pMDDL-ENC End View

CFG/RESET Button:

The Config button on the pMDDL can be used to either reset the modem into its factory default configuration, or it can be used to perform a firmware recovery procedure.

Factory Default Settings: While power is applied and the pMDDL in an operational state, press and hold the *Config* Button for more than 10 seconds to reset to a factory default Master, alternatively hold the button for 5 seconds for a factory default Slave.

Firmware Recovery: To load the firmware on the unit it is recommended to use the normal WebUI to perform a firmware update (Maintenance). In the event that the firmware cannot be loaded using the standard WebUI (non responsive unit), pressing and holding the *Config* Button while powering-up the module will force the pMDDL into a firmware recovery mode. There are 3 main modes, HTTP, TFTP and Master Reset. The table below shows the time required to hold the *Config* button while power is applied:

0 to 5 seconds HTTP Recovery	5 to 10 seconds TFTP Recovery	10 to 15 seconds Master Reset	15+ seconds No Effect
---------------------------------	----------------------------------	----------------------------------	--------------------------

HTTP_Recovery: Set an IP on a PC to 192.168.1.1. Open a web browser and Navigate to 192.168.1.39. This will open a simple webpage which will allow a firmware file to be loaded.

TFTP Recovery: Set an IP on a PC to 192.168.1.1. Use a TFTP session to push the firmware file to the modems recovery IP of 192.168.1.39. See Appendix for Firmware Recovery Procedure.

Master Reset: Runs Master Reset, file system is erased.

DE9 Serial:

The RS232/485 Serial data port can be used to communicate with Serial devices or it can be configured to operate as a console port. See Table 3-3 for pin assignments.

RS232/RS485 modes are selected through the serial port configuration in the WebUI. The LED on the pMDDLE-ENC will illuminate when in RS485 mode.

USB (Type A, 2.0):

(Future Development)

Pin No.	RS232	RS485 Full-Dup	RS485 Half-Dup
1	DCD		
2	RXD	TX-	Data-
3	TXD	RX+	
4	DTR		
5	Ground		
6	DSR		
7	RTS	RX-	
8	CTS	TX+	Data+
9	N/C		

Table 3-3: DE9 Data Pin Assignment

3.0 Hardware Features

3.3 pMDDL Development Board

The pMDDL Development board provides a platform in which to test and evaluate the operation of the pMDDL without the need to design a custom interface PCB right from the start. The pMDDL includes a socket to insert the pMDDL and provides standard interfaces/indicators for:

- Ethernet (RJ45 x2)
- RS232 Serial Port
- USB Port (Type A)
- Power (9-30 VDC)
- CPU Status LED
- Tx/Rx LED's
- RSSI (x3) LED's
- Config Button (Reset/Recovery Operations)

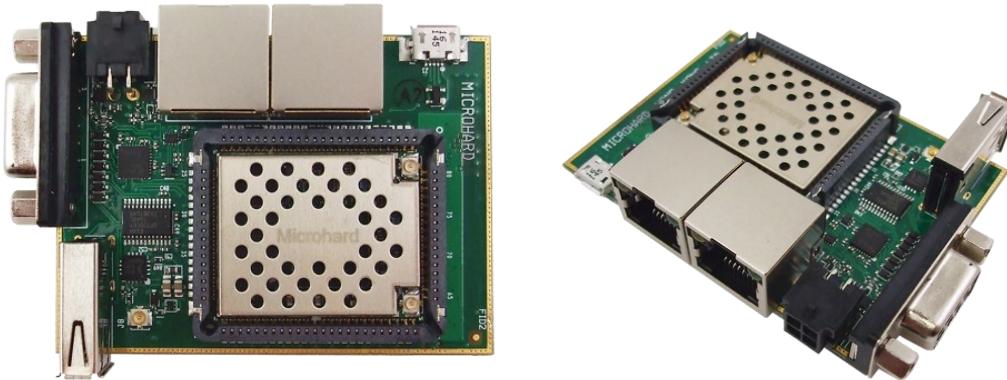
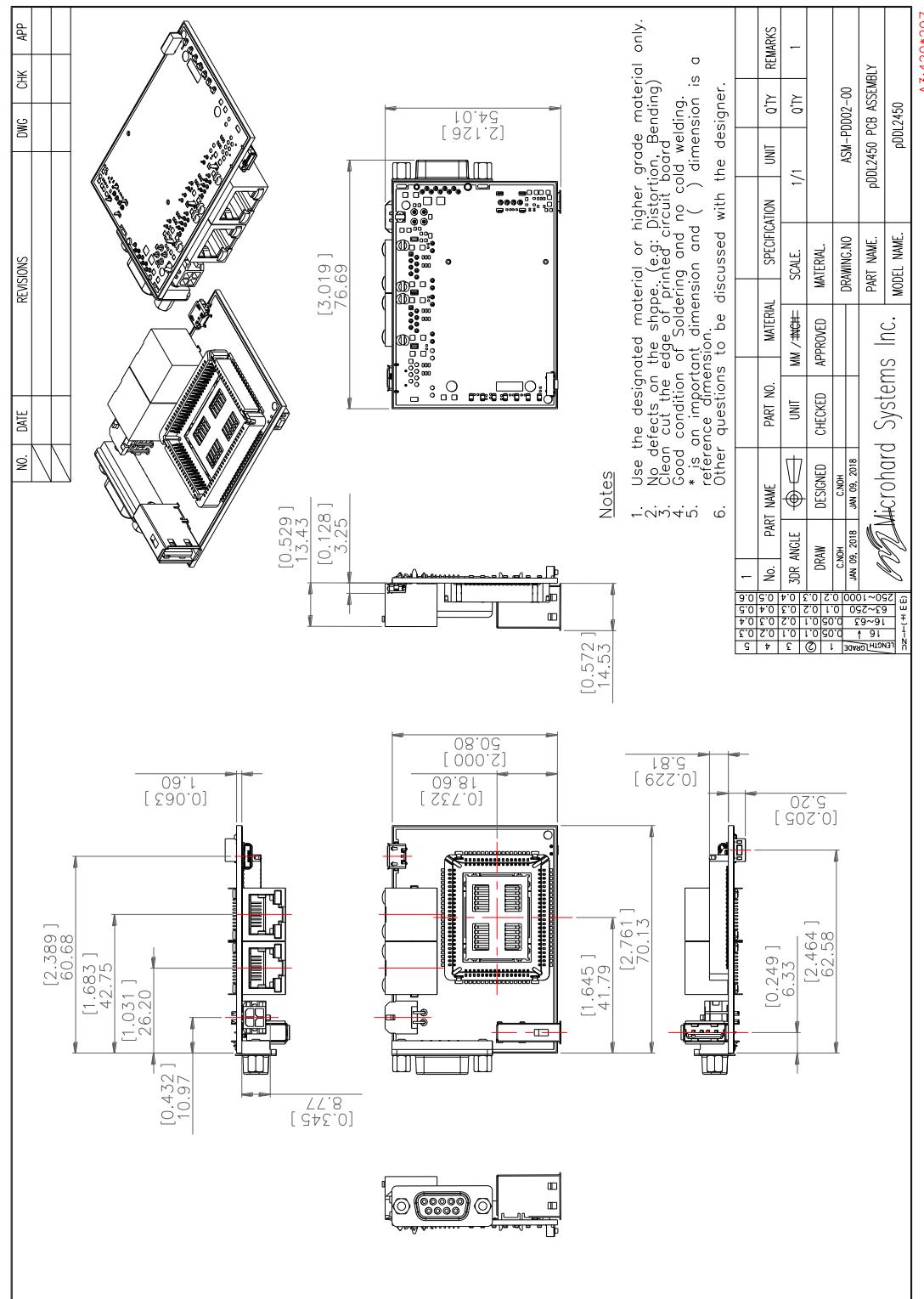


Image 3-3: pMDDL Development Board

3.0 Hardware Features

3.3.1 pMDDL Development Board Mechanical Drawings



3.0 Hardware Features

3.3.2 pMDDL Development Board Connectors & Indicators

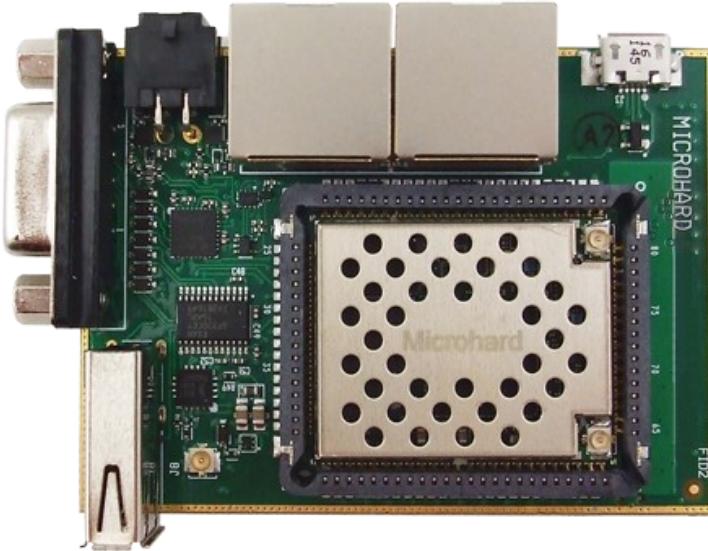


Figure 3-4: pMDDL Development Board

Antennas:

The pMDLL OEM module uses a UFL connectors. Ensure proper orientation as seen above to prevent damage to the pMDLL module and to the development board. ANT1 and ANT2 are marked on the module.

Ethernet LAN:

The Ethernet LAN port is a standard RJ45 port to connect local network devices. The default IP address for this port is 192.168.168.1.

Ethernet WAN:

The Ethernet WAN port is a standard RJ45 Port that can be used as a separate WAN port for Router functions, or can be bridged (via software) to the LAN as a additional switch port for local devices.

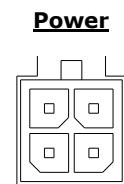
The pMDL development board can be powered using ***Passive PoE from 12—30 VDC Maximum*** on the WAN port using a PoE injector that meets the following requirements:

Ethernet RJ45 Connector Pin Number								
Source Voltage	1	2	3	4	5	6	7	8
12 - 30 Vdc	Data	Data	Data	DC+	DC+	Data	DC-	DC-

Table 3-2: Ethernet (WAN) PoE Connections

Power:

The pMDDL development board can be powered using an input voltage in the 9-30 VDC range.



3.0 Hardware Features

Config Button:

The Config button on the pMDDL can be used to either reset the modem into its factory default configuration, or it can be used to perform a firmware recovery procedure.

Factory Default Settings: While power is applied and the pMDDL in an operational state, press and hold the *Config* Button for more than 10 seconds to reset to a factory default Master, alternatively hold the button for 5 seconds for a factory default Slave.

Firmware Recovery: To load the firmware on the unit it is recommended to use the normal WebUI to perform a firmware update (Maintenance). In the event that the firmware cannot be loaded using the standard WebUI (non responsive unit), pressing and holding the *Config* Button while powering-up the module will force the pMDDL into a firmware recovery mode. There are 3 main modes, HTTP, TFTP and Master Reset. The table below shows the time required to hold the *Config* button while power is applied:

0 to 5 seconds HTTP Recovery	5 to 10 seconds TFTP Recovery	10 to 15 seconds Master Reset	15+ seconds No Effect
---------------------------------	----------------------------------	----------------------------------	--------------------------

HTTP Recovery: Set an IP on a PC to 192.168.1.1. Open a web browser and Navigate to 192.168.1.39. This will open a simple webpage which will allow a firmware file to be loaded.

TFTP Recovery: Set an IP on a PC to 192.168.1.1. Use a TFTP session to push the firmware file to the modems recovery IP of 192.168.1.39. See Appendix for Firmware Recovery Procedure.

Master Reset: Runs Master Reset, file system is erased.

RS232 Serial:

The RS232 Serial data port can be used to communicate with RS232 Serial devices or it can be configured to operate as a console port. See Table 3-3 for pin assignments.

CPU>Status:

The CPU/Status LED indicates that power has been applied to the module. A Solid LED indicates normal operation, while flashing indicates boot or firmware upgrade status.

TX/RX LEDs:

The TX/RX LEDs indication wireless traffic to/from the pMDDL module.

RSSI LEDs:

The RSSI LEDs indicate the Received Signal Strength on the Wireless Link. On a Master it will indicate an average RSSI value based on connected units. On a Slave the RSSI LEDs will represent the signal strength between the Slave and the Master it is connected to. (The more LEDs illuminated, the stronger the signal)

Table 3-3: Data DE9 RS232 Pin Assignment

Name	Data Port	Input or Output
DCD	1	O
RXD	2	O
TXD	3	I
DTR	4	I
SG	5	
DSR	6	O
RTS	7	I
CTS	8	O
RING	9	O



4.0 Configuration

4.0 Web User Interface

The screenshot displays the Microhard pMDDL Web User Interface (WebUI). The top navigation bar includes links for System, Network, Wireless, Firewall, Serial, Diag, Admin, Summary, Settings, Services, Maintenance, and Reboot. The main content area is divided into two main sections: System Information and Wireless Interfaces.

System Information:

Host Name	UserDevice	Description	mypDDL-MIMO
Product Name	pDDL-MIMO	System Date	2017-11-02 13:52:57
Hardware Version	Rev A	System Uptime	49 min
Software Version	v1.4.0		
Software Build	1008		

LAN Status:

MAC Address	00:0F:92:04:22
IP Address	192.168.168.1
Subnet Mask	255.255.255.0

WAN Status:

MAC Address	00:0F:92:05:22
IP Address	N/A
Subnet Mask	N/A
Primary DNS	N/A

RF Status:

General Status	MAC Address	Operation Mode	Network ID	Compatibility Mode	Bandwidth	Frequency	Tx Power	Encryption Type
00:0F:92:FA:94:CF Master	MHK_Alpha	pDDL	8 MHz	2477 MHz	20 dBm	AES-128		

Wireless Interfaces:

RF Status		General Status		Traffic Status				Connection Info (0)				
Receive Bytes	Receive Packets	Receive Bytes	Receive Packets	Transmit Bytes	Transmit Packets	MAC Address	Tx Mod (MIMO)	Rx Mod (MIMO)	SNR (dB)	RSSI (dBm)	Signal Level	RSSI Graph
0B	0	0B	0	60.700KB	489							

Copyright © 2017- Microhard Systems Inc. pDDL-MIMO

Image 4-0-1: WebUI



Initial configuration of an pMDDL using the Web User (Browser) Interface (Web UI) method involves the following steps:

The factory default network settings:

IP: 192.168.168.1
Subnet: 255.255.255.0

- configure a static IP Address on your PC to match the default subnet **or** if your PC is configured for DHCP, simply connect a PC to the LAN port of the pMDDL and it will be assigned a IP address automatically.
- connect the pMDDL LAN port to PC NIC card using an Ethernet cable
- apply power to the pMDDL and wait approximately 60 seconds for the system to load
- open a web browser and enter the factory default IP address (**192.168.168.1**) of the unit:
- logon window appears; log on using default Username: **admin** Password: **admin**
- use the web browser based user interface to configure the pMDDL as required.
- refer to **Section 2.0: Quick Start** for step by step instructions.

In this section, all aspects of the Web Browser Interface, presented menus, and available configuration options will be discussed.

4.0 Configuration

4.0.1 Logon Window

Upon successfully accessing the pMDDL using a Web Browser, the Logon window will appear.



For security, do not allow the web browser to remember the User Name or Password.



Image 4-0-2: Logon Window

The factory default User Name is: **admin**
The default password is: **admin**

Note that the password is case sensitive. It may be changed (discussed further along in this section), but once changed, if forgotten, may not be recovered.



It is advisable to change the login Password. Do not FORGET the new password as it cannot be recovered.

When entered, the password appears as 'dots' as shown in the image below. This display format prohibits others from viewing the password.

The 'Remember my password' checkbox may be selected for purposes of convenience, however it is recommended to ensure it is deselected - particularly once the unit is deployed in the field - for one primary reason: security.



Image 4-0-3: Logon Window : Password Entry

After successfully logging into the Pico DDL for the first time, you will be forced, and prompted to change the admin password.



4.0 Configuration

4.1 System

The main category tabs located at the top of the navigation bar separate the configuration of the pMDDL into different groups based on function. The System Tab contains the following submenus:

- Summary - Status summary of entire radio including network settings, version information, and radio connection status.
- Settings - Host Name, System Log Settings, System Time/Date.
- Services - Enable/Disable and configure port numbers for SSH, Telnet, HTTP and HTTPS services.
- Maintenance - Remote firmware Upgrades, reset to defaults, configuration backup and restore.
- Reboot - Remotely reboot the system.

4.1.1 System > Summary

The System Summary screen is displayed immediately after initial login, showing a summary and status of all the functions of the pMDDL in a single display. This information includes System Status, LAN/WAN network information, version info, Radio Status etc.

The screenshot displays the 'System Information' section of the pMDDL interface. It includes tables for System Information, LAN Status, WAN Status, RF Status, and Traffic Status. The 'System Information' table lists host name, product name, hardware and software versions, and build details. The 'LAN Status' table shows MAC address, IP address, subnet mask, and connection type. The 'WAN Status' table shows MAC address, IP address, subnet mask, and connection type. The 'RF Status' table provides general status information for the radio interface. The 'Traffic Status' table shows receive and transmit bytes and packets. A 'Stop Refreshing' button and an 'Interval: 20(in seconds)' input field are also visible.

System Information						
Host Name	UserDevice	Description	mypDDL-MIMO			
Product Name	pDDL-MIMO	System Date	2018-08-24 17:03:01			
Hardware Version	Rev A	System Uptime	4 min			
Software Version	v1.4.0	Build Date	2018-08-24			
Software Build	1012	Build Time	16:54:09			

LAN Status			
MAC Address	00:0F:92:04:22:84	Connection Type	static
IP Address	192.168.168.1	Gateway	192.168.168.1
Subnet Mask	255.255.255.0		

WAN Status			
MAC Address	00:0F:92:05:22:84	Connection Type	dhcp
IP Address	N/A	Gateway	N/A
Subnet Mask	N/A	Secondary DNS	N/A
Primary DNS	N/A		

RF Status						
General Status						
MAC Address	00:0F:92:FA:94:CF Master	Operation Mode	MHK_Alpha	Network ID	8 MHz	Frequency
					2477 MHz	Tx Power
					20 dBm	Encryption Type
						AES-128

Traffic Status			
Receive Bytes	0B	Receive Packets	0
		Transmit Bytes	34.000KB
		Transmit Packets	275

Interval: 20(in seconds)

Image 4-1-1: System Summary Window



4.0 Configuration

4.1.2 System > Settings

System Settings

Options available in the System Settings menu allow for the configuration of the Host Name, Description, Console Timeout, System Log server and System Time settings.

System	Network	Wireless	Firewall	Serial	Diag	Admin
Summary	Settings	Services	Maintenance	Reboot		
System Settings						
System Settings						
Host Name	UserDevice					
Description	mypDDL-MIMO					
Console Timeout (s)	120 [30 ~ 65535] 0-Disable					
CFG Reset to Default Button	<input checked="" type="radio"/> Enable <input type="radio"/> Disable					
System Log Server IP/Name	0.0.0.0 [0.0.0.0-Disable]					
System Log Server Port	514 [Default: 514]					
Time Settings						
Current Date(yyyy-mm-dd)	2017-07-04					
Current Time(hh:mm:ss)	11:43:52					
Date and Time Setting Mode	<input type="radio"/> Local Time <input checked="" type="radio"/> NTP					
Timezone	Mountain Time					
POSIX TZ String	MST7MDT,M3.2.0,M11.1.0					
NTP Server IP/Name	pool.ntp.org					
NTP Local Port	123					
NTP Client Interval (seconds)	0 [15 ~ 65535] 0-Disable					

Image 4-1-2: System Settings > System Settings

Host Name

The Host Name is a convenient identifier for a specific pMDDL unit. This feature is most used when accessing units remotely: a convenient cross-reference for the unit's WAN IP address. This name appears when logged into a telnet session.

Values (characters)

pMDDL (varies)

up to 64 characters

Description

The description is a text field that can be used to describe the unit or system. This value can be viewed on the System > Summary screen.

Values (characters)

pMDDL (varies)

up to 64 characters

Console Timeout (s)

This value determines when a console connection (made via Console Port or Telnet) will timeout after becoming inactive.

Values (seconds)

60
0-65535



4.0 Configuration

CFG Reset to Default Button	
Enabled by default, when the CFG button on the front of the pMDDL is held down for 10s while the unit is powered up, the unit will reset and all settings will be reset to factory defaults. When disabled the unit will reset, but the settings will not be overwritten.	Values (Selection)
	<input checked="" type="checkbox"/> Enable <input type="checkbox"/> Disable
System Log Server IP	
The pMDDL can report system level events to a third party System Log server, which can be used to monitor events reported by the pMDDL.	IP Address
	0.0.0.0
System Log Server Port	
Enter the UDP listening port of the System Log Server. The default port number is generally 514, but could vary from Server to Server.	UDP Port
	514

Time Settings

The pMDDL can be set to use a local time source, thus keeping time on its own, or it can be configured to synchronize the date and time via a NTP Server. The options and menus available will change depending on the current setting of the Date and Time Setting Mode, as seen below.

Time Settings	
Current Date(yyyy-mm-dd)	2016-01-12
Current Time(hh:mm:ss)	15:03:03
Date and Time Setting Mode	<input checked="" type="radio"/> Local Time <input type="radio"/> NTP
Date (yyyy-mm-dd)	2016-01-12
Time (hh:mm:ss)	15:03:03
Time Settings : Current Date(yyyy.mm.dd) 2015.11.27 Time(hh:mm:ss): 18:07:54	
Date and Time Setting Mode	<input checked="" type="radio"/> Local Time <input type="radio"/> NTP
Timezone	Mountain Time
POSIX TZ String	MST7MDT,M3.2.0,M11.1.0
NTP Server IP/Name	pool.ntp.org
NTP Server Port	123
NTP Client Interval (seconds)	0 [0 ~ 65535] 0-Disable

Image 4-1-3: System Settings > Time Settings



Network Time Protocol (NTP) can be used to synchronize the time and date or computer systems with a centralized, referenced server. This can help ensure all systems on a network have the same time and date.

Date and Time Setting Mode	
Select the Date and Time Setting Mode required. If set for 'Local Time' the unit will keep its own time and not attempt to synchronize with a network server. If 'NTP' is selected, a NTP server can be defined.	Values (selection)
	<input checked="" type="radio"/> Local Time <input type="radio"/> NTP



4.0 Configuration

Date	
The calendar date may be entered in this field. Note that the entered value is lost should the pMDDL lose power for some reason.	Values (yyyy-mm-dd)
Time	
The time may be entered in this field. Note that the entered value is lost should the pMDDL lose power for some reason.	Values (hh:mm:ss)
Timezone	
If connecting to a NTP time server, specify the time zone from the dropdown list.	Values (selection)
POSIX TZ String	
This displays the POSIX TZ String used by the unit as determined by the Timezone setting.	Values (read only)
NTP Server	
Enter the IP Address or domain name of the desired NTP time server.	Values (address)
pool.ntp.org	
NTP Port	
Enter the IP Address or domain name of the desired NTP time server.	Values (port#)
123	
NTP Client Interval	
By default the modem only synchronizes the time and date during system boot up (default: 0), but it can be modified to synchronize at a regular interval. <i>This process does consume data and should be set accordingly.</i>	Values (seconds)
0	

4.0 Configuration

4.1.3 System > Services

Certain services in the pMDDL can be disabled or enabled for either security considerations or resource/power considerations. The Enable/Disable options are applied after a reboot and will take affect after each start up.

System	Network	Wireless	Firewall	Serial	Diag	Admin
Summary	Settings	Services	Maintenance	Reboot		
Services						
Services Status						
FTP	<input checked="" type="radio"/> Enable <input type="radio"/> Disable			<input type="button" value="Update"/>		
Telnet	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	Port	23	<input type="button" value="Update"/>		
SSH	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	Port	22	<input type="button" value="Update"/>		
Web UI	<input checked="" type="radio"/> HTTP/HTTPS <input type="radio"/> HTTP <input type="radio"/> HTTPS	Port HTTP	80	<input type="button" value="Update"/>		
		Port HTTPS	443	<input type="button" value="Update"/>		

Image 4-1-4: System > Services

FTP

The FTP service can be enabled/disabled using the Services Status Menu. The FTP service is used for firmware recovery operations.

Values (port)

Enable / Disable

Telnet

Using the Telnet Service Enable/Disable function, you can disable the Telnet service from running on the pMDDL. The port used by the Telnet service can also be modified. The default is 23.

Values (port)

23

SSH

Using the SSH Service Enable/Disable function, you can disable the SSH service (Port 22) from running on the pMDDL. The port used by the SSH service can also be modified. The default is 22.

Values (port)

22

Web UI

The default web server port for the web based configuration tools used in the modem is port 80 (http) and port 443 (HTTPS).

Values (selection)

HTTP/H_T
HTTP
HTTPS



4.0 Configuration

4.1.4 System > Maintenance

Firmware Upgrade

Occasional firmware updates may be released by Microhard Systems which may include fixes and/or new features. The firmware can be updated wirelessly using the WebUI.

A screenshot of the Microhard pMDDL WebUI. The top navigation bar has tabs for System, Network, Wireless, Firewall, Serial, Diag, Admin, Summary, Settings, Services, Maintenance, and Reboot. The Maintenance tab is selected. Below the tabs is a section titled 'System Maintenance'. Under 'Version Information', there is a table with columns: Product Name (pDDL-MIMO), Hardware Type (1.0), Build Version (v1.4.0 build 1012), Build Date (2018-08-24), and Build Time (16:54:09). The next section is 'Firmware Upgrade', which contains fields for Erase Current Configurations (with a dropdown menu 'Keep All Configurations'), Firmware Image (with a 'Choose File' button and a message 'No file chosen'), and Upgrade (with a 'Upgrade Firmware' button). At the bottom is a 'Reset to Default Configurations' section with a 'Reset to Default' button and a checkbox for 'Wipeout data and logs'.

Image 4-1-5: Maintenance > Firmware Upgrade

Erase Current Configuration

Choose to keep or erase the current configuration. Erasing the configuration of the pMDDL unit during the upgrade process will upgrade, and return the unit to factory defaults, including the default IP Address and password.

Values (check box)

Keep ALL Configuration
Erase Configuration

Firmware Image

Use the Browse button to find the firmware file supplied by Microhard Systems. Select "Upgrade Firmware" to start the upgrade process. This can take several minutes.

Values (file)

(no default)

Reset to Default Configurations

The pMDDL may be set back to factory defaults by using the Reset to Default option under System > Maintenance > Reset to Default. ***Caution* - All configuration settings will be lost!!!**

Additionally you can select the "Wipeout data and logs" check box to delete all data including historical logs and any other data from the device. ***Caution* - All configuration settings & data/logs will be lost!!!**

4.0 Configuration

Security for Configurations / Backup & Restore Configuration

The configuration of the pMDDL can be backed up to a file at any time using the Backup Configuration feature. The file can be restored using the Restore Configuration feature. It is always a good idea to backup any configurations in case of unit replacement.

The configuration files cannot be edited offline, they are used strictly to backup and restore units. A password can be added to the Backup and Restore files. If the password is lost, files that have been backed up with a password can not be restored.

Security for Configurations													
Set Password 	<input type="text"/> <input type="button" value="Update"/>												
Backup Configurations													
Configuration File Name	<input type="text" value="MicrohardpDDL-MIMO.com"/>												
Backup	<input type="button" value="Backup Configurations"/>												
Restore Configurations													
Select Configuration File	<input type="button" value="Choose File"/> No file chosen												
Check Configuration File	<input type="button" value="Check Configuration File"/>												
<div style="border: 1px solid black; padding: 5px;"> Backup Configuration Downloading Configuration File, please wait ... Right click to save MicrohardpDDL-MIMO.config </div>													
<div style="border: 1px solid black; padding: 5px;"> Restore Configuration Configuration Verified! <table> <tbody> <tr> <td>Config file Name</td> <td>MicrohardpDDL-MIMO.config</td> </tr> <tr> <td>Generated</td> <td>Tue Jul 4 11:48:29 MDT 2017</td> </tr> <tr> <td>Vendor</td> <td>2014-2016 Microhard Systems Inc.</td> </tr> <tr> <td>Product</td> <td>pDDL-MIMO-pDDL2458</td> </tr> <tr> <td>Hardware Type</td> <td>Rev A</td> </tr> <tr> <td><input type="button" value="Restore"/></td> <td></td> </tr> </tbody> </table> </div>		Config file Name	MicrohardpDDL-MIMO.config	Generated	Tue Jul 4 11:48:29 MDT 2017	Vendor	2014-2016 Microhard Systems Inc.	Product	pDDL-MIMO-pDDL2458	Hardware Type	Rev A	<input type="button" value="Restore"/>	
Config file Name	MicrohardpDDL-MIMO.config												
Generated	Tue Jul 4 11:48:29 MDT 2017												
Vendor	2014-2016 Microhard Systems Inc.												
Product	pDDL-MIMO-pDDL2458												
Hardware Type	Rev A												
<input type="button" value="Restore"/>													

Image 4-1-6: Maintenance > Reset to Default / Backup & Restore Configuration

Configuration File Name / Backup

Use this field to name the configuration file. The .config extension will automatically be added to the configuration file.

Select Configuration file / Check Configuration File / Restore

Use the 'Browse' button to find the backup file that needs to be restored to the unit. Use the 'Check Restore File' button to verify that the file is valid, and then the option to restore the configuration is displayed, as seen above.

If the selected file is password protected the password must be set before restoring the file using the "Set Password" field under "Security for Configurations".



4.0 Configuration

4.1.5 System > Reboot

The pMDDL can be remotely rebooted using the System > Reboot menu. As seen below a button 'Reboot Now' is provided. Once pressed, the unit immediately reboots and starts its boot up procedure. An automatic Scheduled Reboot (up to 3) can also be configured to force the pMDDL to reboot daily, weekly or monthly.

System		Network		Wireless		Firewall		Serial		Diag		Admin			
Summary	Settings	Services	Maintenance									Reboot			
<input type="button" value="Reboot Now"/>															
Config Scheduled Reboot															
Schedule No.1															
Status <input type="button" value="Enable"/>		Type <input type="button" value="Reboot Daily"/>		Time <input type="button" value="01 : 01"/>											
Schedule No.2															
Status <input type="button" value="Enable"/>		Type <input type="button" value="Reboot Weekly"/>		Days <input type="button" value="1, (Example:1,2,3...)"/>		Time <input type="button" value="01 : 01"/>									
Schedule No.3															
Status <input type="button" value="Enable"/>		Type <input type="button" value="Reboot Monthly"/>		Days <input type="button" value="6, (Example:1,2,3...)"/>		Time <input type="button" value="01 : 01"/>									

Image 4-1-7: System > Reboot

Status	
Enable or disable the Scheduled Reboot.	
Values (selection)	
Enable / Disable	
Type	
Set the reboot schedule to reboot the modem once a day, week or month at a time and date specified below.	
Values (selection)	
Reboot Daily Reboot Weekly Reboot Monthly	
Days / Time	
When set to Weekly, set the day (1 is Sunday, 7 is Saturday) in which to reboot the modem. In a monthly configuration it is simply the date of the month (1 to 31). Once the day or date has been selected, specify the time (24hr clock) in which to initiate the scheduled reboot.	
Values	
(varies)	

4.0 Configuration

4.2 Network

4.2.1 Network > Status

The Network Summary display gives a overview of the currently configured network interfaces including the Connection Type (Static/DHCP), IP Address, Net Mask, Default Gateway, DNS, and IPv4 Routing Table.

System							
Network		Wireless		Firewall		Serial	
Status	LAN	WAN	USB	DHCP	Routes	Ports	Device List
Network Status							
LAN Port Status							
General Status							
IP Address	192.168.168.1	Connection Type	static	Subnet Mask	255.255.255.0	MAC Address	00:0F:92:02:AA:15
Traffic Status							
Receive bytes	355.176KB	Receive packets	3849	Transmit bytes	857.981KB	Transmit packets	3322
WAN Port Status							
General Status							
IP Address	N/A	Connection Type	dhcp	Subnet Mask	N/A	MAC Address	00:0F:92:03:AA:15
Traffic Status							
Receive bytes	0B	Receive packets	0	Transmit bytes	0B	Transmit packets	0
Default Gateway							
Gateway	192.168.168.1						
DNS							
DNS Server(s)	None						
IPv4 Routing Table							
Destination	Gateway	Subnet Mask	Flags	Metric	Ref	Use	Interface
0.0.0.0	192.168.168.1	0.0.0.0	UG	0	0	0	(br-lan)
192.168.168.0	0.0.0.0	255.255.255.0	U	0	0	0	(br-lan)

Image 4-2-1: Network > Network Status



4.0 Configuration

4.2.2 Network > LAN

LAN Port Configuration

The LAN Ethernet port(s) on the pMDDL are for connection of devices on a local network. By default, this port has a static IP Address. It also, by default is running a DHCP server to provide IP Addresses to devices that are connected to the physical LAN port (directly or via a switch).

No.	Name	Static IP Address	Connection Type	DHCP Server	Config
1	LAN	192.168.168.1	static	On	Edit
2	usb	N/A	static	Off	Remove Edit

Image 4-2-2: Network > Network LAN Configuration



DHCP: Dynamic Host Configuration Protocol may be used by networked devices (Clients) to obtain unique network addresses from a DHCP server.

Advantage:
Ensures unique IP addresses are assigned, from a central point (DHCP server) within a network.

Disadvantage:
The address of a particular device is not 'known' and is also subject to change.

STATIC addresses must be tracked (to avoid duplicate use), yet they may be permanently assigned to a device.



Within any IP network, each device must have its own unique IP address.

LAN Add/Edit Interface

By selecting the Add or Edit buttons the LAN network interface can be configured, or additional LAN interfaces can be created.

Spanning Tree (STP)	<input type="button" value="Off"/>
IGMP Snooping	<input type="button" value="On"/>
Connection Type	<input type="button" value="Static IP"/>
IP Address	<input type="text" value="192.168.168.1"/>
Netmask	<input type="text" value="255.255.255.0"/>
Default Gateway	<input type="text" value="192.168.168.1"/>
Default Route	<input type="button" value="Yes"/>
DNS Mode	<input type="button" value="Manual"/>
Primary DNS	<input type="text"/>
Secondary DNS	<input type="text"/>

Image 4-2-3: Network > LAN Port Configuration

Spanning Tree (STP)

Values (selection)

Off
On

4.0 Configuration



The factory default network settings:

IP: 192.168.168.1
Subnet: 255.255.255.0
Gateway: 192.168.168.1



A SUBNET MASK is a bit mask that separates the network and host (device) portions of an IP address.

The ‘unmasked’ portion leaves available the information required to identify the various devices on the subnet.



A GATEWAY is a point within a network that acts as an entrance to another network.

In typical networks, a router acts as a gateway.



Within any IP network, each device must have its own unique IP address.

IGMP Snooping

Values (selection)

On
Off

Connection Type

Values (selection)

DHCP
Static

IP Address

Values (IP Address)

192.168.168.1

Netmask

Values (IP Address)

255.255.255.0

Default Gateway

Values (IP Address)

(no default)

DNS

Values (IP Address)

(no default)

4.0 Configuration

LAN DHCP

A pMDDL may be configured to provide dynamic host control protocol (DHCP) service to all attached (either wired or wireless devices. By default the DHCP service is enabled, so devices that are connected to the physical Ethernet LAN ports, as well as any devices that are connected by Wireless will be assigned an IP by the pMDDL. The LAN DHCP service is available for each interface, and is located in the add/edit interface menus.

LAN DHCP	
DHCP Server	<input type="button" value="Enable ▾"/>
Start ①	<input type="text" value="192.168.168.100"/>
Limit ①	<input type="text" value="150"/>
Lease Time (in minutes) ①	<input type="text" value="720"/>
Alternate Gateway	<input type="text"/>
Preferred DNS server	<input type="text"/>
Alternate DNS server	<input type="text"/>
WINS/NBNS Servers	<input type="text"/>
WINS/NBT Node Type	<input type="button" value="none ▾"/>

Image 4-2-4: Network > DHCP Server



Prior to enabling this service, verify that there are no other devices - either wired (e.g. LAN) or wireless with an active DHCP SERVER service. (The Server issues IP address information at the request of a DHCP Client, which receives the information.)

DHCP Server	
The option is used to enable or disable the DHCP service for devices connected to the LAN Port(s).	Values (selection) Enable / Disable
	Start
Select the starting address DHCP assignable IP Addresses. The first octets of the subnet will be pre-set based on the LAN IP configuration, and can not be changed.	Values (IP Address) 192.168.168.100
	Limit
Set the maximum number of IP addresses that can be assigned by the pMDDL.	Values (integer) 150
	Lease Time
The DHCP lease time is the amount of time before a new request for a network address must be made to the DHCP Server.	Values (minutes) 720
	Alternate Gateway
Specify an alternate gateway for DHCP assigned devices if the default gateway is not to be used.	Values (IP Address) (IP Address)

4.0 Configuration



DNS: Domain Name Service is an Internet service that translates easily-remembered domain names into their not-so-easily-remembered IP addresses.

Being that the Internet is based on IP addresses, without DNS, if one entered the domain name www.microhardcorp.com (for example) into the URL line of a web browser, the website 'could not be found'.

Preferred DNS Server	
Specify a preferred DNS server address to be assigned to DHCP devices.	Values (IP Address) <i>(IP Address)</i>
Alternate DNS Server	
Specify the alternate DNS server address to be assigned to DHCP devices.	Values (IP Address) <i>(IP Address)</i>
Domain Name	
Enter the Domain Name for the DHCP devices.	Values (string) <i>(IP Address)</i>
WINS/NBNS Servers	
Enter the address of the WINS/NBNS (NetBIOS) Server. The WINS server will translate computers names into their IP addresses, similar to how a DNS server translates domain names to IP addresses.	Values (IP/Domain) <i>(no default)</i>
WINS/NBT Node Type	
Select the method used to resolve computer names to IP addresses. Four name resolution methods are available: B-node: broadcast P-node: point-to-point M-node: mixed/modified H-node: hybrid	Values (selection) none b-node p-node m-node h-node

4.0 Configuration

4.2.3 Network > WAN

WAN Configuration

The WAN configuration refers to the wired WAN connection on the pMDDL. The WAN port can be used to connect the pMDDL to other networks, the internet and/or other network resources.

System	Network	Wireless	Firewall	Serial	Diag	Admin
Status	LAN	WAN	USB	DHCP	Routes	Ports
Device List						

WAN Port Configuration

Configuration

Working Mode [?](#)

WAN Configuration

Connection Type	<input type="button" value="Static IP ▾"/>
IP Address	<input type="text"/>
Subnet Mask	<input type="text"/>
Default Route	<input type="button" value="Yes ▾"/>
Default Gateway	<input type="text"/>
DNS Mode	<input type="button" value="Manual ▾"/>
Primary DNS	<input type="text"/>
Secondary DNS	<input type="text"/>

Image 4-2-6: Network > WAN Configuration



DHCP: Dynamic Host Configuration Protocol may be used by networked devices (Clients) to obtain unique network addresses from a DHCP server.

Advantage:
Ensures unique IP addresses are assigned, from a central point (DHCP server) within a network

Disadvantage:

Disadvantage:
The address of a particular device is not 'known' and is also subject to change.

STATIC address

tracked (to avoid duplicate

tracked (to avoid duplicate use), yet they may be permanently assigned to device

STATIC addresses must be tracked (to avoid duplicate use), yet they may be permanently assigned to a device.

If 'Static' Connection Type is selected, a valid IPv4 Address for the network being used must be entered in the field. If 'DHCP' is chosen this field will not appear and it will be populated automatically from the DHCP server.

Working Mode

Values (selection)

Independent WAN Bridged with LAN Port Independent LAN

Connection Type

Values (selection)

DHCP Static

IP Address

Values (IP Address)

(no default)

Netmask

Values (IP Address)

(no default)



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Default Gateway	
If the pMDDL is integrated into a network which has a defined gateway, then, as with other hosts on the network, this gateway's IP address will be entered into this field. If there is a DHCP server on the network, and the Connection Type (see previous page) is selected to be DHCP, the DHCP server will populate this field with the appropriate gateway address.	Values (IP Address) <i>(no default)</i>
Default Route	
The Default Route parameter allows you to set this interface as the default route in the routing table. This is result in all data being sent to the WAN interface if there the destination network is not directly connected (LAN, Wireless etc), and no other route has been specified. In cases where the WAN is the primary connection this would be set to Yes.	Values (selection) No / Yes
DNS Servers	
The following section will allow a user to specify DNS Server(s) to be used by the WAN interface of the pMDDL.	Mode
Select between Manual or Auto for DNS server(s) for the WAN interface. If set to Auto the pMDDL will try to automatically detect the DNS servers to use, which is normally the case when the WAN is DHCP. Manual required the DNS addresses to be known and entered below.	Values (selection) Manual / Auto
Primary DNS	
DNS (Domain Name Service) Servers are used to resolve domain names into IP addresses. If set to auto and the Connection Type is set for DHCP the DHCP server will populate this field and the value set can be viewed on the Network > Status page. To add additional static servers, enter them here.	Values (IP Address) <i>(no default)</i>
Secondary DNS	
DNS (Domain Name Service) Servers are used to resolve domain names into IP addresses. If set to auto and the Connection Type is set for DHCP the DHCP server will populate this field and the value set can be viewed on the Network > Status page. To add additional static servers, enter them here.	Values (IP Address) <i>(no default)</i>

4.0 Configuration

4.2.4 Network > USB

USB Port Configuration

Normally, the pMDDL module is bootstrapped to USB host mode that allows select generic devices to be used to extend Ethernet and serial functions (USB to Ethernet Adapters, USB to Serial Converters).

Alternatively, the pMDL can be set to Device mode by pulling PIN 14 (on OEM module) low through an 1k resistor to switch the USB mode. Older development boards will not support this and will either need to be modified or new boards will need to be acquired. In USB device mode, there are two functions supported, RNDIS/CDC Ethernet and CDC Serial port, when connected a host machine (PC etc).

RDNIS Ethernet and CDC Serial composite drivers are available from Microhard Systems.

System		Network		Wireless		Firewall		Serial		Diag		Admin	
Status	LAN	WAN	USB	DHCP	Routes	Ports	Device List						
USB Port Configuration													
Configuration													
Working Mode	<input type="button" value="Independent LAN"/>												
LAN Configuration													
Connection Type	<input type="button" value="Static IP"/>												
IP Address	<input type="text"/>												
Netmask	<input type="text"/>												
Default Gateway	<input type="text"/>												
Default Route	<input type="button" value="No"/>												
DNS Mode	<input type="button" value="Manual"/>												
Primary DNS	<input type="text"/>												
Secondary DNS	<input type="text"/>												
DHCP Server													
Mode	<input type="button" value="Disable"/>												

Image 4-2-7: Network > USB

Working Mode

The RNDIS Ethernet USB port can be configured to operate as an additional LEN Ethernet Port with the current LAN (Bridged) or it can be configured to operate as an independent LAN (Subnet).

Values (selection)

Independent LAN
Bridge with LAN Port

LAN Configuration

When bridged with LAN the network parameters are set from the Network > LAN menu. When set to Independent the port can be configured as Static or DHCP. Again refer to the LAN configuration for help with the displayed fields and definitions.

DHCP Server

When in Independent mode the pMDDL can run a DHCP service on the USB port to assign IP addresses and lease information. Refer to Network > LAN > DHCP for help with parameters and definitions.

4.0 Configuration

4.2.5 Network > DHCP

Static IP Addresses (for DHCP Server)

In many applications it is required to know the IP address of connected devices in order to implement security and firewall rules as well as for Port Forwarding rules. The Static IP Address (for DHCP Server) features MAC binding to allow connected devices to automatically obtain a specific IP address.

For configuration of the LAN DHCP Service see Network > LAN > (Edit) > LAN DHCP.

System	Network	Wireless	Firewall	Serial	Diag	Admin	
Status	LAN	WAN	USB	DHCP	Routes	Ports	Device List
DHCP Configuration							
Static IP addresses (for DHCP Server)							
Name	<input type="text"/>						
MAC Address	<input type="text"/>						
IP Address	<input type="text"/>						
<input type="button" value="Add static IP"/>							
Static Addresses							
MAC Address	IP Address	Name			NetStatus		
Active DHCP Leases							
MAC Address	IP Address	Name			Expires in		
A6:12:20:F4:9A:0D	192.168.168.132	DMKT0002-2			9hr 59min 30sec		
<input type="button" value="Release All"/> <input type="button" value="Refresh"/>							

Image 4-2-8: Network > DHCP

Static Addresses

Displays the MAC Binding table that is configured in the pMDDL device.

Active DHCP Leases

Displays the active DHCP leases for any IP Addresses that have been assigned. This includes the IP address, the MAC, Device Name as well as the lease expiry.



4.0 Configuration

4.2.6 Network > Routes

Static Routes Configuration

It may be desirable to have devices on different subnets to be able to talk to one another. This can be accomplished by specifying a static route, telling the pMDDL where to send data.

 A screenshot of the pMDDL web interface. The top navigation bar has tabs for System, Network, Wireless, Firewall, Serial, Diag, and Admin, with Network selected. Below the tabs is a secondary navigation bar with Status, LAN, WAN, USB, DHCP, Routes, Ports, and Device List, with Routes selected. The main content area is titled "Static Routes Configuration". Under this, there is a section for "Add Static Route" with fields for Name (route1), Destination Subnet (192.168.168.0), Netmask (255.255.255.0), Gateway (192.168.168.1), Metric (0), and Interface (LAN). There is also a "Add Static Route" button. Below this is a "Static Route Summary" table with columns for Name, Destination, Netmask, Gateway, Metric, and Interface. The "Name" column header is bolded.

Name	Destination	Netmask	Gateway	Metric	Interface

Image 4-2-9: Network > Routes

Name	Values (characters)
Routes can be names for easy reference, or to describe the route being added.	(no default)
Destination	Values (IP Address)
Enter the network IP address for the destination.	(192.168.168.0)
Gateway	Values (IP Address)
Specify the Gateway used to reach the network specified above.	192.168.168.1
Netmask	Values (IP Address)
Enter the Netmask for the destination network.	255.255.255.0



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Metric
In some cases there may be multiple routes to reach a destination. The Metric can be set to give certain routes priority, the lower the metric is, the better the route. The more hops it takes to get to a destination, the higher the metric.
Values (Integer)
0
Interface
Define the exit interface. Is the destination a device on the LAN, LAN1 (If physical WAN port is bridged as an independent LAN), or the WAN?
Values (Selection)
LAN / LAN1 / WAN / USB / None

4.0 Configuration

4.2.7 Network > Ports

The Network > Ports menu can be used to determine the characteristics of the physical Ethernet interfaces on the pMDDL. As seen below the Mode (Auto/Manual), Auto-Negotiation, Speed (10/100Mbit/s) and the Duplex (Full/Half) can all be configured on the pMDDL.

System Configuration						
Status		Network		Wireless		Firewall
Serial	Diag	Admin				
Status	LAN	WAN	USB	DHCP	Routes	Ports
Ethernet Port Configuration						
Port	Mode		Auto-Negotiation		Speed	
WAN	<input checked="" type="radio"/> Auto	<input type="radio"/> Manual	<input checked="" type="radio"/> On	<input type="radio"/> Off	<input checked="" type="radio"/> 100Mbit/s	<input type="radio"/> 10Mbit/s
LAN	<input checked="" type="radio"/> Auto	<input type="radio"/> Manual	<input checked="" type="radio"/> On	<input type="radio"/> Off	<input checked="" type="radio"/> 100Mbit/s	<input type="radio"/> 10Mbit/s
Ethernet Port Status						
Port	Linked ?		Auto-Negotiation		Speed	Duplex
WAN	no		on		10Mb/s	Half
LAN	no		on		10Mb/s	Half

Image 4-2-10: Network > Ports

Mode

If set to Auto, the pMDDL will negotiate and determine the best connection speed and mode.

Values (selection)

Auto / Manual

Auto-Negotiation

Enable or disable auto-negotiation.

Values (selection)

On / Off

Speed

If the mode and auto negotiation are set you manual the connection speed can be specified.

Values (selection)

100Mbit/s / 10 Mbit/s

Duplex

Selection between full or half duplex for the direction of data.

Values (selection)

Full / Half

4.0 Configuration

4.2.8 Network > Device List

The Network > Device List shows the current ARP table for the local network adapter. The MAC address and IP address are shown, however not only DHCP assigned devices are listed in the device list, any devices, even those statically assigned, that are connected through the local network interface (s) are displayed, including those connected through a hub or switch.

Devices can also be filtered by the network that they are attached to. Devices with a MAC and no IP and vice versa can also be filtered.

Network Device List						
Select networks:	LAN	WAN	<input type="checkbox"/> Show MACs without IP	<input type="checkbox"/> Show IPs without MAC	Apply Filter	
Network	MAC Address	IP Address	State	Ageing Timer		
LAN	a6:12:20:f4:9a:0d	192.168.168.132	REACHABLE	0.22		

Image 4-2-11: Network > Device List

4.0 Configuration

4.3 Wireless

4.3.1 Wireless > Status

The Status window gives a summary of all radio or wireless related settings and connections.

The **General Status** section shows the MAC address of the current radio, the Operating Mode (Master, Slave etc), the Network ID being used, the Compatibility Mode, Channel Bandwidth and frequency information and the type of security used.

Traffic Status shows statistics about the transmitted and received data.

The pMDDL shows information about all Wireless connections in the **Connection Info** section. The MAC address, TX & RX Modulation, Signal to Noise ratio (SNR), Signal Strength (RSSI), and a graphical representation of the signal level or quality, as well as a RSSI Graph Link.

Image 4-3-1: Wireless > Status (RSSI Graph Shown Below)

4.0 Configuration

4.3.2 Wireless > RF

RF Configuration

The RF Configuration allows for the configuration of the radio module. You can turn the radio on or off, adjust the TX power, select the channel bandwidth and frequency, as well as the operating mode of the radio as seen below.

System		Network		Wireless		Firewall		Serial		Diag		Admin	
Status		RF											
Wireless Configuration													
RF Configuration													
Radio	<input checked="" type="radio"/> On <input type="radio"/> Off												
Channel Bandwidth	8MHz <input type="button" value="▼"/>												
Channel-Frequency	76 - 2477 MHz <input type="button" value="▼"/>												
Tx Power	20 dbm <input type="button" value="▼"/>												
Wireless Distance	3000 <input type="text" value=" (m)"/>												
MIMO	<input checked="" type="radio"/> On <input type="radio"/> Off												
Operation Mode	Master <input type="button" value="▼"/>												
TX Rate	Auto (recommended) <input type="button" value="▼"/>												
Extended Addressing	ON <input type="button" value="▼"/>												
Network ID	MHK_Alpha <input type="text"/>												
Encryption Type	AES-128 <input type="button" value="▼"/>												
Encryption Key	***** <input type="text"/>												
Show password	<input type="checkbox"/>												
RF Serial Port Configuration													
Serial Port TX Rate	<input checked="" type="radio"/> Data Mode Disabled												

Image 4-3-2: Wireless > RF Configuration

Radio
This option is used to turn the radio module on or off. If turned off Wireless connections can not be made. The default is On.

4.0 Configuration



Refer to FCC (or as otherwise applicable) regulations to ascertain, and not operate beyond, the maximum allowable transmitter output power and effective isotropic radiated power (EIRP).

Channel Bandwidth	
Select the channel bandwidth from the list. Refer to the specifications to see the relationship and performance between channel bandwidth, throughput and sensitivity.	Values (selection)
Generally a larger channel has greater throughput, at the cost of sensitivity, while a smaller channel tends to be more robust, but at the cost of throughput.	8 / 4 MHz
Channel-Frequency	
Set the Channel-Frequency. This must be the same on each unit in a network. The frequency shown is the center frequency and is available in 1 MHz increments, values shown will vary with the Channel Bandwidth selected above.	Values (MHz)
<i>The noise floor of the specified channel will dramatically affect the quality of the link, it is essential to select the cleanest channel for superior performance.</i>	pMDDL2350: 2304 - 2390 MHz pMDDL2450: 2405 - 2479 MHz pMDDL2550: 2500 - 2570 MHz
TX Power	
This setting establishes the transmit power level which will be presented to the antenna connector(s) of the pMDDL.	Values (selection)
Unless required, the Tx Power should be set not for maximum, but rather for the minimum value required to maintain an adequate system fade margin.	20 dBm 25 dBm 21 dBm 26 dBm 22 dBm 27 dBm 23 dBm 28 dBm 24 dBm 29 dBm 30 dBm
TX Power reflects the Total RF power for the pMDDL. In MIMO mode this means that the total RF power is split between antenna interfaces. When MIMO is disabled a total of 30 dBm can be presented to the ANT 1 Antenna.	
Wireless Distance	
The Wireless Distance parameter allows a user to set the expected distance the wireless signal needs to travel. The pMDDL sets various internal timeouts to account for this travel time. Longer distances will require a higher setting, and shorter distances may perform better if the setting is reduced.	Values (meters)
	3000
MIMO	
MIMO (2X2) features of the pMDDL can be enabled or disabled using this parameter. Disabling MIMO allows up to 30dBm to be presented	Values (selection)

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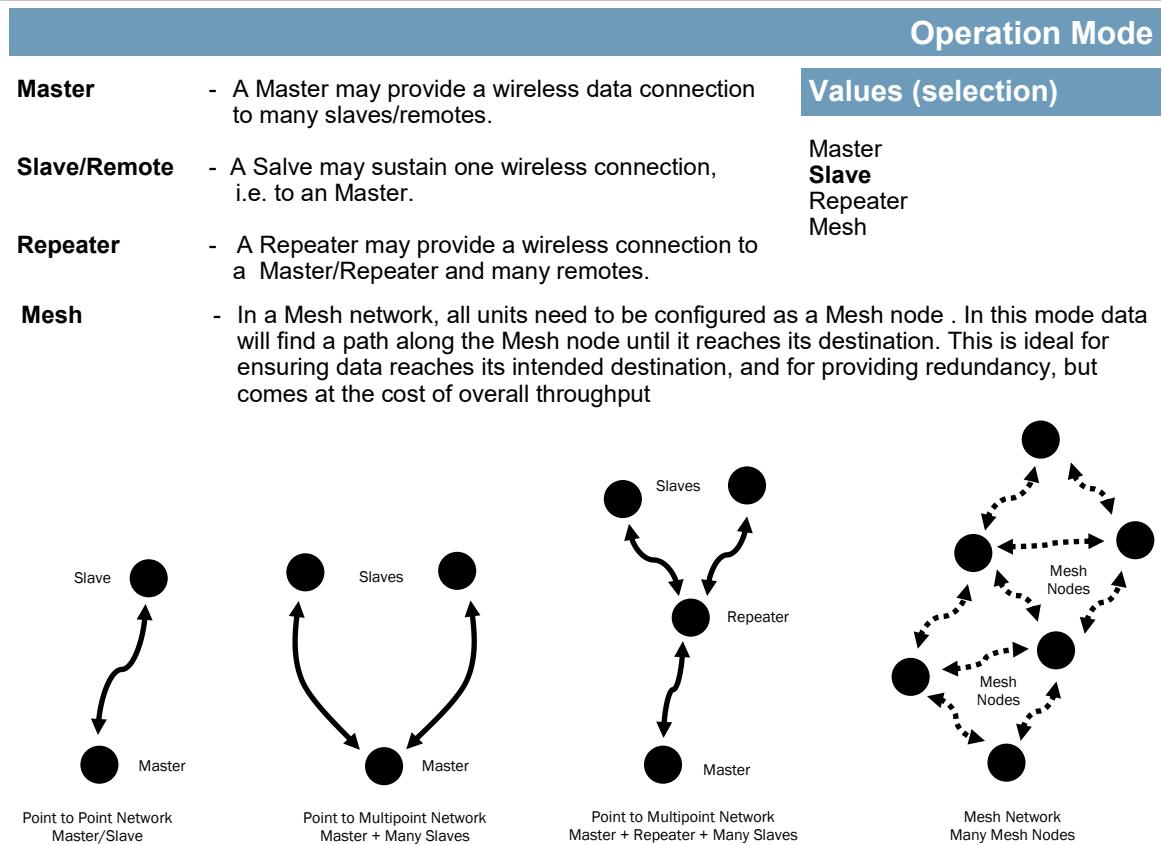


Diagram 4-3-1: Operating Modes

For video applications it is required to connect the video source (camera) to the radio designated as the Master. Video receivers would then be connected to the Slave radios, this would allow for multiple viewing stations. See the diagram below for an example.

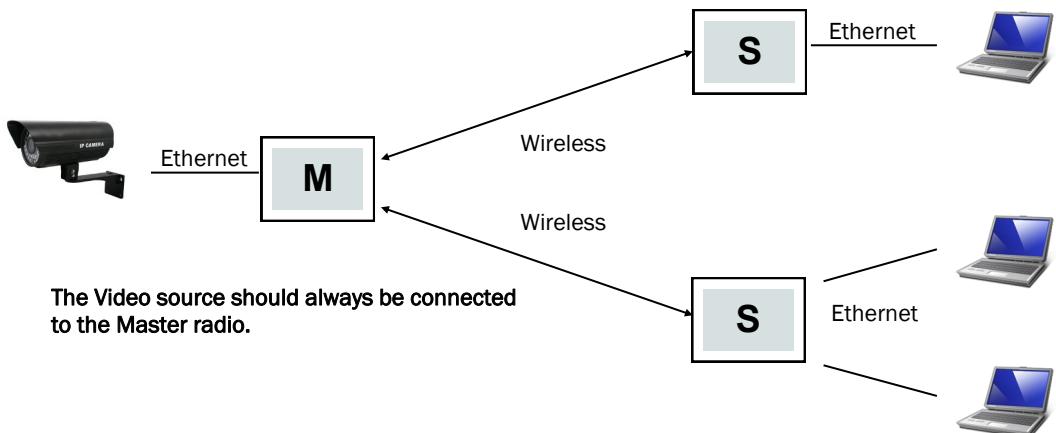


Diagram 4-3-2: Video Application

4.0 Configuration



Change the default value for the Network ID to something unique for your network. Do this for an added measure of security and to differentiate your network from others which may be operating nearby.

TX Rate

This setting determines the modulation type and in turn the rate at which the data is to be wirelessly transferred.

The default and recommended setting is ‘Auto’. When in ‘Auto’ the unit will transfer data at the highest possible rate in consideration of the receive signal strength (RSSI).

Refer to Section 1.3 Performance Specifications for a table breakdown of performance at selected rates. If setting a fixed TX Rate It is recommended to retain a fade margin of at least 10 dBm for optimum performance. For example, for a link (8MHz channel) with a signal strength of at least -75dBm, a TX rate of 16-QAM 3/4 FEC is recommended. Setting to the highest rate with a poor link may result in reduced performance.

Values (selection)

Auto (recommended)

- 64-QAM 5/6 FEC
- 64-QAM 3/4 FEC
- 64-QAM 2/3 FEC
- 16-QAM 3/4 FEC
- 16-QAM 1/2 FEC
- QPSK FEC 3/4
- QPSK FEC 1/2

Enable or disable extended addressing.

For multicast traffic sending from the Master to multiple receivers, it is recommended to configure the system with “Extended Addressing” disabled and also select a proper multicast rate defined by the link budget. In this case, the multicast traffic will be delivered on the specified RF rate to multiple receivers without adding extra overhead to the RF link. Devices on the Slaves side just need to subscribe the multicast address being used by the transmitting device connected on the Master side.

Extended Addressing

Values (selection)

- On / Off

Each network of pMDDL modules must have a unique Network ID. This Network ID must be set in each unit on the network.

When configured to operate as a Mesh Network, this becomes the Mesh ID and must be specified on every unit to participate.

Network ID / Mesh ID

Values

- pMDDL

That parameter controls the stability of the mesh path.

When mesh nodes self-discover other nodes and form a mesh path, a path table is established in each node. In real world applications, as the environment changes, a “better” mesh path may be generated dynamically.

This change to the path tables comes at a cost, for example, to re-establish a new path, the link may momentarily break. On one hand, the nodes try to keep the original path to keep the link more stable. On the other hand, the nodes need to refresh their tables to reflect new and changing environments. Overall, this parameter controls how sensitive the nodes refresh their mesh path tables.

The recommended setting is "Medium".

Degree of Mesh Path Agility

Values

- High
- Medium
- Low



4.0 Configuration

Encryption Type	Values (selection)
The encryption types defines the type of security used for the Wireless Interface, to join a network a device must know the correct Encryption Key. Security options are dependent on the version type. Export versions may not have all optional available to meet regulatory requirements set government policies.	Disabled AES-128
Encryption Key	Values (string)
This is the password, or preshared key that is required by any device to connect to the wireless interface of the pMDDL. It is strongly recommended to always have a password defined, and changed from the factory default.	1234567890
Show Password	Values (selection)
Check this box to show the currently configured password for the encryption passphrase.	<input checked="" type="checkbox"/> unchecked
Comport Tx Rate	Values (selection)
When using Ethernet and Serial data. If the volume of serial data is high, leave at the default (Normal Rate), if the volume of Ethernet data is high set com data to High Rate (Compressed).	Normal / High

4.0 Configuration

4.4 Firewall

4.4.1 Firewall > Summary

The Firewall Summary allows a user to see detailed information about how the firewall is operating. The All, Filter, Nat, Raw, and Mangle options can be used to view different aspects of the firewall.

System																
Network		Wireless		Firewall		Serial		Diag								
Summary		General		Port Forwarding		MAC-IP List		Rules								
Firewall Status			Status and Rules			All										
Target Filter																
Chain INPUT (policy ACCEPT 0 packets, 0 bytes)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						
1	76204	7440K	delegate_input	all	--	i	i	0.0.0.0/0	0.0.0.0/0							
Chain FORWARD (policy DROP 0 packets, 0 bytes)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						
1	0	0	delegate_forward	all	--	i	i	0.0.0.0/0	0.0.0.0/0							
Chain OUTPUT (policy ACCEPT 0 packets, 0 bytes)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						
1	70807	10M	delegate_output	all	--	i	i	0.0.0.0/0	0.0.0.0/0							
Chain delegate_forward (1 references)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						
1	0	0	forwarding_rule	all	--	i	i	0.0.0.0/0	0.0.0.0/0	/* user chain for forwarding */						
2	0	0	ACCEPT	all	--	i	i	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED						
3	0	0	zone_lan_forward	all	--	br-lan	i	0.0.0.0/0	0.0.0.0/0							
4	0	0	reject	all	--	i	i	0.0.0.0/0	0.0.0.0/0							
Chain delegate_input (1 references)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						
1	0	0	ACCEPT	all	--	lo	i	0.0.0.0/0	0.0.0.0/0							
2	76204	7440K	input_rule	all	--	i	i	0.0.0.0/0	0.0.0.0/0	/* user chain for input */						
3	65396	6648K	ACCEPT	all	--	i	i	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED						
4	2873	149K	syn_flood	tcp	--	i	i	0.0.0.0/0	0.0.0.0/0	tcp flags:0x17/0x02						
5	10808	793K	zone_lan_input	all	--	br-lan	i	0.0.0.0/0	0.0.0.0/0							
Chain delegate_output (1 references)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						
1	0	0	ACCEPT	all	--	i	lo	0.0.0.0/0	0.0.0.0/0							
2	70807	10M	output_rule	all	--	i	i	0.0.0.0/0	0.0.0.0/0	/* user chain for output */						
3	70807	10M	ACCEPT	all	--	i	i	0.0.0.0/0	0.0.0.0/0	ctstate RELATED,ESTABLISHED						
4	0	0	zone_lan_output	all	--	i	br-lan	0.0.0.0/0	0.0.0.0/0							
Chain forwarding_lan_rule (1 references)																
num	pkts	bytes	target	prot	opt	in	out	source	destination	options						

Image 4-4-1: Firewall > Status



4.0 Configuration

4.4.2 Firewall > General

The General Firewall settings allow users to enable or disable the firewall, and to decide which areas of the modem to protect. The Firewall can also be reset to factory defaults from this area of the WebUI.

System	Network	Wireless	Firewall	Serial	Diag	Admin
Summary	General	Port Forwarding	MAC-IP List	Rules	Firewall Default	
Firewall General						
Firewall General Configuration						
WAN Remote Management ?	<input checked="" type="radio"/> Enable <input type="radio"/> Disable					
WAN Request ?	<input checked="" type="radio"/> Block <input type="radio"/> Allow					
LAN to WAN Access Control ?	<input checked="" type="radio"/> Block <input type="radio"/> Allow					
Anti-Spoof ?	<input checked="" type="radio"/> Enable <input type="radio"/> Disable					
Packet Normalization ?	<input checked="" type="radio"/> Enable <input type="radio"/> Disable					

Image 4-4-2: Firewall > General

WAN Remote Management

Allow remote management of the pMDDL on the WAN side using the WebUI on port 80(HTTP), and 443 (HTTPS). If disabled, the configuration can only be accessed from the LAN.

Values

Enable / Disable

WAN Request

When Blocked the pMDDL will block all requests from devices on the WAN unless specified otherwise in the Access Rules, MAC List, IP List configurations. Access to ports 80 (HTTP) and 443 (HTTPS-if enabled), is still available unless disabled in the **WAN Remote Management** option.

Values

Block / Allow

LAN to WAN Access Control

Allows or Blocks traffic from the LAN accessing the WAN unless specified otherwise using the Access Rules, MAC, and IP List configuration.

Values

Block / Allow

Anti-Spoof

The Anti-Spoof protection is to create some firewall rules assigned to the external interface (WAN) of the firewall that examines the source address of all packets crossing that interface coming from outside. If the address belongs to the internal network or the firewall itself, the packet is dropped.

Values

Enable / Disable

Packet Normalization

Packet Normalization is the normalization of packets so there are no ambiguities in interpretation by the ultimate destination of the packet. The scrub directive also reassembled fragmented packets, protecting some operating systems from some forms of attack, and drops TCP packets that have invalid flag combinations.

Values

Enable / Disable

4.0 Configuration

4.4.3 Firewall > Port Forwarding

The pMDL can be used to provide remote access to connected devices. To access these devices a user must define how incoming traffic is handled by the pMDL. If all incoming traffic is intended for a specific connected device, DMZ could be used to simplify the process, as all incoming traffic can be directed towards a specific IP address.

In the case where there is multiple devices, or only specific ports need to be passed, Port forwarding is used to forward traffic coming in from the WAN to specific IP Addresses and Ports on the LAN. Port forwarding can be used in combination with other firewall features, but the Firewall must be enabled for Port forwarding to be in effect. If the WAN Request is blocked on the General Tab, additional rules and/or IP Lists must be set up to allow the port forwarding traffic to pass through the firewall.

System | **Network** | **Wireless** | **Firewall** | **Serial** | **Diag** | **Admin**

Summary | **General** | **Port Forwarding** | **MAC-IP List** | **Rules** | **Firewall Default**

Firewall Port Forwarding

Notice

Port Forwarding Rules are taken into consideration after the General firewall settings are applied. If the WAN traffic is blocked, additional rules must be created:

1. Add rules in the Rules configuration to open ports or allow IP addresses.
2. Create a firewall rule in the Firewall->Rules page to allow desired connections.

Firewall DMZ Configuration

DMZ Source: WAN

DMZ Mode	<input type="button" value="Disable ▾"/>
DMZ Server IP	<input type="text" value="192.168.200.100"/>
Exception Ports <small>?</small>	<input type="text" value="0"/>
Combined with source NAT <small>?</small>	<input type="button" value="No ▾"/>

Firewall Port Forwarding Configuration

Name	<input type="text" value="forward1"/>
Source	<input type="button" value="WAN ▾"/>
Internal Server IP	<input type="text" value="192.168.2.1"/>
Internal Ports <small>?</small>	<input type="text" value="3000"/>
Protocol	<input type="button" value="TCP ▾"/>
External Ports <small>?</small>	<input type="text" value="2000"/>
Combined with source NAT <small>?</small>	<input type="button" value="No ▾"/>
<input type="button" value="Add Port Forwarding"/>	

Firewall Port Forwarding Summary

Name	Source	Internal IP	Internal Port	Protocol	External Port	SNAT



If DMZ is enabled and an exception port for the WebUI is not specified, remote management will not be possible. The default port for remote management is TCP 80.

Image 4-4-3: Firewall > Port Forwarding

DMZ Mode
Enable or disable DMZ Mode. DMZ can be used to forward all traffic to the DMZ Server IP listed below.
Values (selection)
Disable / Enable
DMZ Server IP
Enter the IP address of the device on the LAN side of the pMDDL where all the traffic will be forwarded to.
Values (IP Address)
192.168.100.100

4.0 Configuration

Exception Port	
Enter a exception port number that will NOT be forwarded to the DMZ server IP. Usually a configuration or remote management port that is excluded to retain external control of the pMDDL.	Values (Port #) 0
<i>Up to 15 ports can be specified using list (port1, port2, etc) or by port range (start: stop)</i>	
Firewall Port Forwarding Configuration	
	Name
This is simply a field where a convenient reference or description is added to the rule. Each Forward must have a unique rule name and can use up to 10 characters.	Values (10 chars) Forward
Select the source for the traffic, if applicable.	Source Values (selection) (none)
Enter the IP address of the intended internal (i.e. on LAN side of the pMDDL) server. This is the IP address of the device you are forwarding traffic to.	Internal Server IP Values (IP Address) 192.168.2.1
Target port number of the internal server on the LAN IP entered above. <i>Single port or port ranged can be specified (start: stop)</i>	Internal Port Values (Port #) 3000
Select the type of transport protocol used. For example Telnet uses TCP, SNMP uses UDP, etc.	Protocol Values (selection) TCP / UDP / Both
Port number of the incoming request (from WAN-side). <i>Single port or port ranged can be specified (start: stop)</i>	External Port Values (Port #) 2000



If the firewall is set to block incoming traffic on the WAN interface, additional rules or IP/MAC lists must be configured to allow desired traffic access.



4.0 Configuration

4.4.4 Firewall > MAC-IP List

MAC List configuration can be used to control which physical LAN devices can access the ports on the pMDDL, by restricting or allowing connections based on the MAC address. IP List configuration can be used to define who or what can access the pMDDL, by restricting or allowing connections based on the IP Address/Subnet.

MAC-IP List can be used alone or in combination with LAN to WAN Access Control to provide secure access to the physical ports of the pMDDL.

System	Network	Wireless	Firewall	Serial	Diag	Admin
Summary	General	Port Forwarding	MAC-IP List	Rules	Firewall Default	
Firewall MAC/IP List						
Firewall MAC List Configuration						
Name	<input type="text" value="mac1"/>					
Action	<input type="button" value="Accept ▾"/>					
Mac Address	<input type="text" value="00:00:00:00:00:00"/>					
<input type="button" value="Add Mac List"/>						
Firewall IP List Configuration						
Name	<input type="text" value="ip1"/>					
Action	<input type="button" value="Accept ▾"/>					
Source <small>?</small>	<input type="button" value="LAN ▾"/>					
Source IP / Prefix <small>?</small>	<input type="text" value="0.0.0.0"/> / <input type="text"/>					
<input type="button" value="Add IP List"/>						
Firewall MAC List Summary						
Name	Action	Source	Mac Address			
Firewall IP List Summary						
Name	Action	Src	Src IP	Prefix		

Image 4-4-4: Firewall > MAC-IP List

Firewall MAC List Configuration

Rule Name
The Rule Name field is required to give the rule a convenient name for reference. Each rule must have a unique name, up to 10 characters in length.
Values (10 chars)
MAC_List
MAC Address
Specify the MAC Address to be added to the list. Must be entered in the correct format as seen above. Not case sensitive.
Values (MAC Address)
00:00:00:00:00:00

4.0 Configuration

Firewall MAC List Configuration (Continued)

Action	Values (selection)
The Action is used to define how the rule handles the connection request. ACCEPT will allow a connection, while REJECT (error) and DROP (quietly dropped), will refuse connections.	ACCEPT DROP REJECT

Firewall IP List Configuration

Rule Name	Values (10 chars)
The Rule Name field is required to give the rule a convenient name for reference. Each rule must have a unique name, up to 10 characters in length.	IP_List

Action	Values (selection)
The Action is used to define how the rule handles the connection request. ACCEPT will allow a connection, while REJECT (error) and DROP (quietly dropped), will refuse connections.	ACCEPT / DROP / REJECT

Source	Values (Selection)
Enter the specific zone that the IP List will apply to, LAN, WAN or None (both).	LAN/LAN1/WAN/USB NONE

Source IP Address	Values (IP Address)
Match incoming traffic from the specified source IP range. Boxes accept single IP Addresses without network masks, example: 192.168.1.0 to 192.168.1.255 represents all IP Addresses in the 192.168.1.0/24 network. (Put same IP in both boxes for a single IP match.)	192.168.0.0

Destination Address
Values (IP Address)
192.168.0.0

4.0 Configuration

4.4.5 Firewall > Rules

The Rules configuration can be used to define specific rules on how local and remote devices access different ports and services. MAC List and IP List are used for general access, and are applied before rules are processed.

It is highly recommended to block as much traffic as possible from the modem, especially when using a public IP address. The best security would be to allow traffic only from trusted IP addresses, and only the specific ports being used, and block everything else. Not configuring the firewall and the firewall rules correctly could result in unpredictable data charges from your provider.

Image 4-4-5: Firewall > Rules

Rule Name	The rule name is used to identify the created rule. Each rule must have a unique name and up to 10 characters can be used.	Values (10 Chars)	characters
Action	The Action is used to define how the rule handles the connection request. ACCEPT will allow a connection, while REJECT (error) and DROP (quietly dropped), will refuse connections. This is configured based on how the WAN Request and LAN to WAN Access Control are configured in the previous menus.	Values (selection)	ACCEPT DROP REJECT
Source	Select the zone which is to be the source of the data traffic. The LAN/WAN refers to local connections on the pMDDL.	Values	LAN/WAN/Independent LAN/None

4.0 Configuration

Source IPs	Match incoming traffic from the specified source IP range. Boxes accept single IP Addresses without network masks, example: 192.168.1.0 to 192.168.1.255 represents all IP Addresses in the 192.168.1.0/24 network. (Put same IP in both boxes for a single IP match.)	Values (IP Address) 192.168.0.0 to 192.168.0.0
Destination	Select the zone which is the intended destination of the data traffic. The selections shown will reflect any network interfaces configured.	Values (selection) LAN/WAN/None (varies)
Destination IPs	Match incoming traffic from the specified destination IP range. Boxes accept single IP Addresses without network masks, example: 192.168.1.0 to 192.168.1.255 represents all IP Addresses in the 192.168.1.0/24 network. (Put same IP in both boxes for a single IP match.)	Values (IP Address) 192.168.0.0 to 192.168.0.0
Destination Port	Match incoming traffic directed at the given destination port or port range. (To specify a port range use a From:To (100:200) format)	Values (port) 0
Protocol	The protocol field defines the transport protocol type controlled by the rule.	Values TCP UDP Both ICMP



4.0 Configuration

4.4.6 Firewall > Default

The firewall can be returned to default setting without requiring the entire modem to be reset to defaults. It is recommended to restart the modem once changes to the firewall or a reset is performed.

A screenshot of the Microhard pMDL web interface. The top navigation bar includes links for System, Network, Wireless, Firewall, Serial, Diag, Admin, Summary, General, Port Forwarding, MAC-IP List, Rules, and Firewall Default. The Firewall Default link is highlighted. The main content area is titled "Firewall Default". It contains a "Notice" section with instructions: "Firewall Default is available now. Please follow the steps: 1. Click the following button. 2. Wait couple of seconds." Below this is a button labeled "Let's go to default now". At the bottom right of the page, there is a copyright notice: "Copyright © 2014-2016 Microhard. pDDL".

Notice

Firewall Default is available now. Please follow the steps:

1. Click the following button.
2. Wait couple of seconds.

Firewall Default

Let's go to default now

Copyright © 2014-2016 Microhard. pDDL

Image 4-4-6: Firewall > Default

4.0 Configuration

4.5 Serial

4.5.1 Serial > Summary

The Serial > Summary window gives a summary of the on board serial data port. A second serial port can be added to the pMDDL OEM by interfacing a FTDI USB to Basic UART IC as shown in [Appendix D: Serial Port Extension](#).

GS0 - If the pMDDL has been set to USB Device mode (Pin 14 connected to GND through a 1K resistor), the GS0 tab will appear and the USB port can be used to connect to a USB host that has the Microhard Composite Drivers installed. The USB port will appear as a serial device on the host system.

The Summary window shows a number of status items that aid in viewing the operation, statistics, and troubleshooting of the RS232 & USB Serial Ports.

General Status

- Port Status - Shows if the RS232 has been enabled in the configuration.
 - Baud Rate - The current baud rate used to interface with the connected device.
 - Connect As - The type of IP Protocol Config is displayed here (TCP, UDP, SMTP, PPP, etc)
 - Connect Status - Shows if there are any current connections / if the port is active.

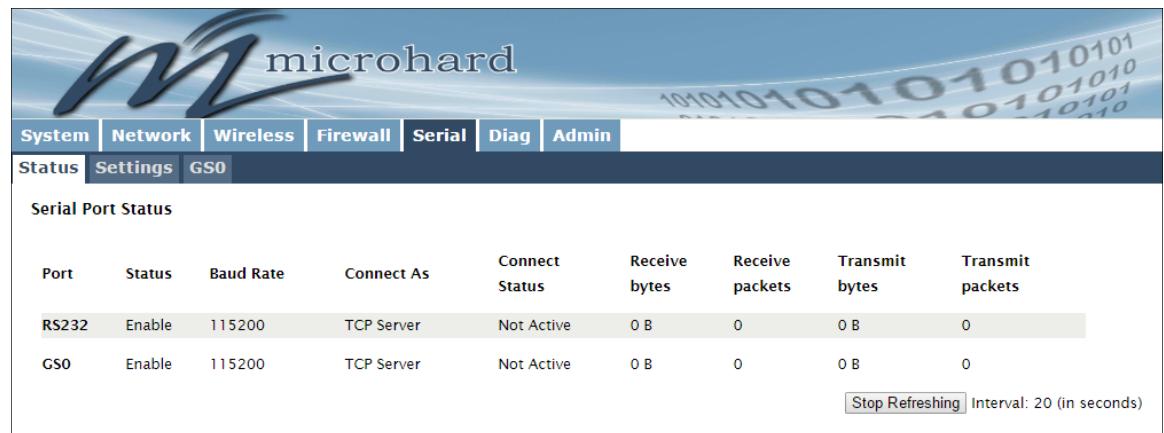


Image 4-5-1: Serial > Summary



4.0 Configuration

4.6.2 Serial > Settings

This menu option is used to configure the serial device server for the serial communications port. Serial device data may be brought into the IP network through TCP, UDP, or multicast; it may also exit the pMDDL network on another pMDDL serial port. The fully-featured RS232 interface supports hardware

The screenshot shows the 'Serial Port Configuration' section of the Microhard pMDDL web interface. The configuration is divided into two main sections: 'Port Configuration' and 'TCP Configuration'.
Port Configuration:
- Port status: Data
- Escape Sequence: Disabled
- Data Baud Rate: 115200
- Data Format: 8N1
- Data Mode: Transparent, Seamless
- Character Timeout: 24
- Maximum Packet Size: 256
- No-Connection Data: Disable, Enable
- MODBUS TCP Status: Disable, Enable
- IP Protocol Config: TCP Server
TCP Configuration:
- Server Mode: Monitor, Polling
- Polling Timeout (seconds): 10
- Local Listening port: 20002
- Incoming Connection Timeout(seconds): 300
- Fast Recovery: Disable, Enable

Image 4-5-2: Serial > Settings Configuration



4.0 Configuration

Port Status	
Select operational status of the Serial Port. The port is in console mode by default.	Values (selection)
Data / Console	
Escape Sequence	
Enabling the escape sequence allows users to temporarily exit data mode and enter console mode for the serial port.	Values (selection)
Enabled / Disabled	
Escape Guard Interval	
Appears only when the Escape Sequence is enabled. Enter the time interval in which the escape sequence must be entered fully.	Values (seconds)
1	
Escape Sequence String	
Only shown when the escape sequence is enabled. Enter the characters to be used for the escape sequence.	Values (characters)
+++	
Data Baud Rate	
The serial baud rate is the rate at which the modem is to communicate with the attached local asynchronous device.	Values (bps)
921600 460800 230400 115200 57600 38400 28800 19200 14400	9600 7200 4800 3600 2400 1200 600 300
Data Format	
This setting determines the format of the data on the serial port. The default is 8 data bits, No parity, and 1 Stop bit.	Values (selection)
8N1 8E1 8O1	



Note: Most PCs do not readily support serial communications greater than 115200bps.

The serial baud rate is the rate at which the modem is to communicate with the attached local asynchronous device.



4.0 Configuration

Data Mode	
This setting defines the serial output data framing. In Transparent mode (default), the received data will be output promptly from the pMDDL.	Values (selection) Seamless / Transparent
When set to Seamless, the serial port server will add a gap between data frames to comply with the MODBUS protocol for example. See 'Character Timeout' below for related information.	
Character Timeout	
In Seamless mode (see Data Mode described on the preceding page), this setting determines when the serial server will consider the recently-received incoming data as being ready to transmit. As per the MODBUS standard, frames will be marked as 'bad' if the time gap between frames is greater than 1.5 characters, but less than the Character Timeout value.	Values (characters) 24
The serial server also uses this parameter to determine the time gap inserted between frames. It is measured in 'characters' and related to baud rate.	
Example: If the baud rate is 9600bps, it takes approximately 1ms to move one character. With the Character Timeout set to 4, the timeout period is 4ms. When the calculated time is less than 3.5ms, the serial server will set the character timeout to a minimum value of 3.5ms.	
If the baud rate is greater than 19200bps, the minimum character timeout is internally set to 750us (microseconds).	
Maximum Packet Size	
Defines the buffer size that the serial server will use to receive data from the serial port. When the server detects that the Character Timeout criteria has been met, or the buffer is full, it packetizes the received frame and transmits it.	Values (bytes) 256
No-Connection Data	
When enabled the data will continue to buffer received on the serial data port when the radio loses synchronization. When disabled the pMDDL will disregard any data received on the serial data port when radio synchronization is lost.	Values (selection) Disable / Enable
MODBUS TCP Status	
This option will enable or disable the MODBUS decoding and encoding features.	Values (selection) Disable / Enable

4.0 Configuration

IP Protocol Config	
This setting determines which protocol the serial server will use to transmit serial port data over the pMDDL network.	Values (selection)
The protocol selected in the IP Protocol Config field will determine which configuration options appear in the remainder of the RS232 Configuration Menu.	TCP Client TCP Server TCP Client/Server UDP Point-to-Point PPP (Not supported on USB)

TCP Client: When TCP Client is selected and data is received on its serial port, the pMDDL takes the initiative to find and connect to a remote TCP server. The TCP session is terminated by this same unit when the data exchange session is completed and the connection timeout has expired. If a TCP connection cannot be established, the serial port data is discarded.

- **Remote Server Address**
IP address of a TCP server which is ready to accept serial port data through a TCP connection. For example, this server may reside on a LAN network server.
Default: **0.0.0.0**
 - **Remote Server Port**
A TCP port which the remote server listens to, awaiting a session connection request from the TCP Client. Once the session is established, the serial port data is communicated from the Client to the Server.
Default: **20001**
 - **Outgoing Connection Timeout**
This parameter determines when the pMDDL will terminate the TCP connection if the connection is in an idle state (i.e. no data traffic on the serial port).
Default: **60** (seconds)
 - **Fast Recovery**
Sets the TCP session parameters and buffers to be set such that TCP sessions recover faster in environments where the wireless link is weak/unstable. This is ideal for critical, near real time applications such as flight control data. Data is not buffered during outages.
Default: **Disable**

UDP: User Datagram Protocol does not provide sequencing information for the packets sent nor does it establish a 'connection' ('handshaking') and is therefore most suited to communicating small packets of data.

UDP: User Datagram Protocol does not provide sequencing information for the packets sent nor does it establish a 'connection' ('handshaking') and is therefore most suited to communicating small packets of data.

i

TCP: Transmission Control Protocol in contrast to UDP does provide sequencing information and is connection-oriented; a more reliable protocol, particularly when large amounts of data are being communicated.

Requires more bandwidth than UDP.

TCP Server: In this mode, the pMDDL Series will not INITIATE a session, rather, it will wait for a Client to request a session of it (it's being the Server—it 'serves' a Client). The unit will 'listen' on a specific TCP port. If a session is established, data will flow from the Client to the Server, and, if present, from the Server to the Client. If a session is not established, both Client-side serial data, and Server-side serial data , if present will be discarded.

- **Local Listening Port**
The TCP port which the Server listens to. It allows a TCP connection to be created by a TCP Client to carry serial port data.
Default: **20001**
 - **Incoming Connection Timeout**
Established when the TCP Server will terminate the TCP connection if the connection is in an idle state.
Default: **300** (seconds)
 - **Fast Recovery**
Sets the TCP session parameters and buffers to be set such that TCP sessions recover faster in environments where the wireless link is weak/unstable. This is ideal for critical, near real time applications such as flight control data. Data is not buffered during outages.
Default: **Disable**

4.0 Configuration

IP Protocol Config (Continued...)



A UDP or TCP port is an application end-point. The IP address identifies the device and, as an extension of the IP address, the port essentially ‘fine tunes’ where the data is to go ‘within the device’.

Be careful to select a port number that is not predetermined to be associated with another application type, e.g. HTTP uses port 80.

TCP Client/Server: In this mode, the pMDDL will be a combined TCP Client and Server, meaning that it can both initiate and serve TCP connection (session) requests. Refer to the TCP Client and TCP Server descriptions and settings described previously as all information, combined, is applicable to this mode.

UDP Point-to-Point: In this configuration the pMDDL will send serial data to a specifically-defined point, using UDP packets. This same pMDDL will accept UDP packets from that same point.

- **Remote IP Address**
IP address of distant device to which UDP packets are sent when data received at serial port.
Default: **0.0.0.0**
- **Remote Port**
UDP port of distant device mentioned above.
Default: **20001**
- **Listening Port**
UDP port which the IP Series listens to (monitors). UDP packets received on this port are forwarded to the unit’s serial port.
Default: **20001**
- **UDP Timeout(s)**
UDP Timeout in seconds.
Default: **10**

UDP Point-to-Multipoint (P): This mode is configured on an Bullet which is to send multicast UDP packets.

- **Multicast IP Address**
A valid multicast address this unit uses to send multicast UDP packets upon receiving data from the serial port. The default value is a good example of a valid multicast address.
Default: **224.1.1.2**
- **Multicast Port**
A UDP port that this Nano IP will send UDP packets to. The Multipoint (MP - see the UDP Point-to-Multipoint (MP) description) stations should be configured to listen to this point in order to receive multicast packets from this Nano IP Series.
Default: **20002**
- **Listening Port**
The UDP port that this unit receives incoming data on from multiple remote units.
Default: **20012**
- **Time to Live**
Time to live for the multicast packets.
Default: **1** (hop)
- **Multicast Interface**
Select, if applicable, which interface to send/listen for Multicast packets.
Default: **default**

UDP Point-to-Multipoint (MP): This protocol is selected on the units which are to receive multicast UDP packets. See the previous description of UDP Point-to-Multipoint (P).

- **Remote IP Address**
The IP address of a distant device (IP Series or, for example, a PC) to which the unit sends UDP packets of data received on the serial port. Most often this is the IP address of the Master IP Series.
Default: **0.0.0.0**
- **Remote Port**
The UDP port associated with the Remote IP Address (above). In the case of this ‘Remote’ being the Master Nano IP Series, the value in this field should match the Listening Port of the Master (see UDP Point-to-Multipoint (P)).
Default: **20012**



4.0 Configuration

IP Protocol Config (Continued...)

- **Multicast IP Address**

A valid MULTICAST address that this unit will use to receive multicast UDP packets sent by a UDP Point-to-Multipoint (P) unit. Note that the default value for this field matches the default Multicast IP Address of the UDP Point-to-Multipoint (P) configuration described on the previous page.

Default: **224.1.1.2**

- **Multicast Port**

The UDP port that this unit will use, along with the Multicast IP Address detailed above, to receive the multicast UDP packets sent by the UDP Point-to-Multipoint (P) unit.

Default: **20002**

- **Multicast Interface**

Select, if applicable, which interface to send/listen for Multicast packets.

Default: **default**

PPP: The serial port can be configured as a PPP server for a serial connection with a PC or other device. The attached PC could then use a dedicated serial (WindowsXP - dialup/modem) type PPP connection to access the network resources of the pMDDL.

- **PPP Mode**

Can be set for Active or Passive. If set for Active, the PPP server will initiate the PPP connection with a PPP client. The server will periodically send out link requests following PPP protocol. If set to Passive, the PPP server will not initiate the PPP connection with PPP client. The server will wait passively for the client to initiate connection.

Default: **Passive**

- **Expected String**

When a client (PC or device) initiates a PPP session with the modem, this is the handshaking string that is expected in order to allow a connection. Generally this does not need to be changed.

Default: **CLIENT**

- **Response String**

This is the handshaking string that will be sent by the modem once the expected string is received. Generally this does not need to be changed.

Default: **CLIENTSERVER**

- **PPP LCP Echo Failure Number**

The PPP server will presume the peer to be dead if the LCP echo-requests are sent without receiving a valid LCP echo-reply. If this happens, PPP server will terminate the connection. Use of this option requires a non-zero value for the LCP Echo Interval parameter. This option can be used to enable PPP server to terminate after the physical connection has been broken (e.g., the modem has hung up).

Default: **0**

- **PPP LCP Echo Interval**

The PPP server will send an LCP echo-request frame to the peer every 'n' seconds. Normally the peer should respond to the echo-request by sending an echo-reply. This option can be used with the LCP-echo-failure option to detect that the peer is no longer connected.

Default: **0**

- **PPP Local IP**

Enter the local PPP IP Address, the IP Address of the pMDDL COM Port.

Default: **192.168.0.1**

- **PPP Host IP**

Enter the PPP Host IP here. This is the IP of the PC or attached device.

Default: **192.168.0.99**

- **PPP Idle Timeout(s)**

It is the timeout for tearing down the ppp connection when there is no data traffic within the time interval. When there is data coming, new ppp connection will be created.

Default: **30**



4.0 Configuration

4.6.3 Serial > GS0

This tab only appears if the pMDDL has been set to operate as a USB Device (Pin 14 connected to GND through a 1k resistor). Microhard USB Serial Composite Drivers are available which allow the pMDDL to appear as a serial device to a USB Host (PC etc.)

The USB port can be set to "Idle" or to operate as a Data port as seen below:

A screenshot of the Microhard pMDDL web interface. The top navigation bar includes links for System, Network, Wireless, Firewall, Serial, Diag, Admin, Status, Settings, and GS0. The GS0 link is highlighted. The main content area is titled "GS0 Serial Port Configuration". It contains two sections: "Port Configuration" and "TCP Configuration".

Port Configuration

Port status	Data
Data Baud Rate	115200
Data Format	8N1
Flow Control	none
Data Mode	<input checked="" type="radio"/> Seamless <input type="radio"/> Transparent
Character Timeout	24
Maximum Packet Size	256
No-Connection Data	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
MODBUS TCP Status	<input checked="" type="radio"/> Disable <input type="radio"/> Enable
IP Protocol Config	TCP Server

TCP Configuration

Server Mode	<input checked="" type="radio"/> Monitor <input type="radio"/> Polling
Polling Timeout (seconds)	10
Local Listening port	20003
Incoming Connection Timeout(seconds)	300
Fast Recovery	<input type="radio"/> Disable <input checked="" type="radio"/> Enable

Image 4-5-2: Serial > Settings Configuration

GS0 Serial Port Configuration

The USB port configuration is identical to the Serial Port > Settings parameters. For help or definitions of each field, refer to the previous section of this manual which describes the available settings.



4.0 Configuration

4.6 Diag

4.6.1 Diag > Ping

The Network Tools Ping feature provides a tool to test network connectivity from within the pMDDL unit. A user can use the Ping command by entering the IP address or host name of a destination device in the Ping Host Name field, use Count for the number of ping messages to send, and the Packet Size to modify the size of the packets sent.

The screenshot shows the 'Ping' tab selected in the top navigation bar. The configuration section includes fields for 'Ping Host Name' (192.168.168.141), 'Ping Count' (4), and 'Ping Size' (56). Below the configuration is a text area displaying the output of the ping command:

```
Please wait for output of "ping -c 4 -s 56 192.168.168.141"...
PING 192.168.168.141 (192.168.168.141): 56 data bytes
13:10:35.548663 -- sending icmp request
64 bytes from 192.168.168.141: seq=0 ttl=128 time=4.112 ms
13:10:36.549214 -- sending icmp request
64 bytes from 192.168.168.141: seq=1 ttl=128 time=1.457 ms
13:10:37.549686 -- sending icmp request
64 bytes from 192.168.168.141: seq=2 ttl=128 time=1.770 ms
13:10:38.550206 -- sending icmp request
64 bytes from 192.168.168.141: seq=3 ttl=128 time=1.642 ms
```

Image 4-6-1: Diagnostics > Ping

4.6.2 Diag > Traceroute

The **Traceroute** command can be used to provide connectivity data by providing information about the number of hops, routers and the path taken to reach a particular destination.

The screenshot shows the 'Traceroute' tab selected in the top navigation bar. The configuration section includes a 'Traceroute Host Name' field (192.168.168.141) and buttons for 'Start', 'Stop', and 'Clear'. Below the configuration is a text area displaying the output of the traceroute command:

```
Begin traceroute test at 13:12:37...
traceroute to 192.168.168.141 (192.168.168.141), 30 hops max, 38 byte packets
 1 PaulH-Desktop (192.168.168.141)  3.928 ms * 0.366 ms
```

Image 4-6-2: Diagnostics > Trace Route

4.0 Configuration

4.6.3 Diag > Iperf

The pMDDL features an integrated Iperf server/client to use to measure and analyze throughput of TCP/UDP packets to and/or from the pMDDL. Iperf is a 3rd party utility that can be loaded on any PC to measure network performance. For additional information about Iperf, please visit the [Iperf website](#).

The pMDDL can be configured to operate as a Server, listening for an incoming connection from another device (with Iperf), or PC running an Iperf client. If set to Iperf client, the pMDDL will connect to or send packets to a specified Iperf server.

System		Network		Wireless		Firewall		Serial		Diag		Admin	
Ping		Traceroute		Iperf		USB Tethering							
Throughput Testing													
Iperf Configuration													
Iperf Mode		<input style="width: 100px; height: 25px;" type="button" value="Server"/>											
Server Status		<input type="radio"/> Enable <input checked="" type="radio"/> Disable											
Protocol		<input style="width: 100px; height: 25px;" type="button" value="TCP"/>											
TCP Window Size		<input style="width: 100px; height: 25px;" type="text" value="128K"/>		(0 for 85.3KByte)									
TCP Maximum Segment Size		<input style="width: 100px; height: 25px;" type="text" value="0"/>		(default=0)									
<input style="width: 150px; height: 30px;" type="button" value="Save Server Settings"/>													
Iperf Configuration													
Iperf Mode		<input style="width: 100px; height: 25px;" type="button" value="Client"/>											
Protocol		<input style="width: 100px; height: 25px;" type="button" value="TCP"/>											
Remote Server IP Address		<input style="width: 100px; height: 25px;" type="text" value="192.168.168.100"/>											
Duration(seconds)		<input style="width: 100px; height: 25px;" type="text" value="5"/>											
TCP Window Size		<input style="width: 100px; height: 25px;" type="text" value="128K"/>		(0 for default 85.3KByte)									
TCP Maximum Segment Size		<input style="width: 100px; height: 25px;" type="text" value="0"/>		(0 for default)									
Report Format		<input style="width: 100px; height: 25px;" type="button" value="Mbits"/>											
<input style="width: 150px; height: 30px;" type="button" value="Save & Run Test"/>													

Image 4-6-3: Diag > Iperf

Iperf Mode	Select between an Iperf Server (listens for incoming connections) and client (initiates a connection with a server)	Values (selection)	Server / Client
Server Status	If the Iperf mode is set to Server, this Server Status allows a user to Enable or Disable the server.	Values (selection)	Enable / Disable
Protocol	Select the type of packets to be sent to test the throughput. TCP packets are connection oriented and require additional overhead for the handshaking that occurs, while UDP is a connectionless, best effort oriented protocol.	Values (selection)	TCP / UDP



4.0 Configuration

4.6.4 Diag > USB Tethering

The pMDDL can be Tethered to certain Android Mobile Devices to view a video stream from a remote video encoder. ***This is a preliminary feature that has limited support at this time. Contact Microhard for more information.***

A screenshot of the pMDDL web interface. The top navigation bar includes links for System, Network, Wireless, Firewall, Serial, Diag (which is currently selected), Admin, Ping, Traceroute, Iperf, and USB Tethering. The main content area is titled "USB Tethering". It contains three configuration fields: "USB Tethering Enable" (ON/OFF switch, ON), "Forward Video" (ON/OFF switch, ON), and "Encoder's IP Address" (text input field, empty) and "Encoder's Port" (text input field, value 554). At the bottom right are "Submit" and "Cancel" buttons.

Image 4-6-4: Diag > USB Tethering

USB Tethering Mode	
Enable USB Tethering. Enabling USB Tethering will open all WAN requests on the firewall to allow for proper operation	Values (selection)
ON/OFF	
Forward Video	
If enabled the pMDDL will allow video to be viewed from an attached android device from a remote video source.	Values (selection)
Enable / Disable	
Encoder's Address	
Enter the IP address of the external encoder of which the video source is located.	Values (IP Address)
(no default)	
Encoder'sPort	
Enter the port number for the video encoder's.	Values (IP Address)
554	



4.0 Configuration

4.7 Admin

4.7.1 Admin > Users

Password Change

The Password Change menu allows the password of the user 'admin' to be changed. The 'admin' username cannot be deleted, but additional users can be defined and deleted as required as seen in the Users menu below. After the modem has been reset to factory defaults, it is mandatory to change the default password for admin, the modem will prompt a user to do so upon the first login.

Access Control

New password will take effect immediately after pressing "Change Password" button.

Account Name	admin
Change Password 	<input type="text"/> (5-64 characters, no space)
Confirm Password	<input type="text"/> <input type="button" value="Change Password"/>

Add User (It will take effect immediately after pressing "Add User" button)

Username	<input type="text"/> (5-32 characters)
Password 	<input type="text"/> (5-64 characters, no space)
Confirm Password	<input type="text"/>
System	<input type="button" value="Hide Submenu ▾"/>
Network	<input type="button" value="Hide Submenu ▾"/>
Wireless	<input type="button" value="Hide Submenu ▾"/>
Firewall	<input type="button" value="Hide Submenu ▾"/>
Serial	<input type="button" value="Hide Submenu ▾"/>
Diag	<input type="button" value="Hide Submenu ▾"/>
Admin	<input type="button" value="Hide Submenu ▾"/>
Add User	<input type="button" value="Add User"/>

Image 4-7-1: Users > Password Change

New Password	Values (characters)
Enter a new password for the 'admin' user. It must be at least 5 characters in length. The default password for 'admin' is 'admin'.	admin
Confirm Password	Values (characters)
The exact password must be entered to confirm the password change, if there is a mistake all changes will be discarded.	admin

4.0 Configuration

Add Users

Different users can be set up with customized access to the WebUI. Each menu or tab of the WebUI can be disabled on a per user basis as seen below.

Image 4-7-2: Access Control > Users

Username	Values (characters)
Enter the desired username. Minimum or 5 character and maximum of 32 character. Changes will not take effect until the system has been restarted.	<i>(no default)</i> Min 5 characters Max 32 characters
Password / Confirm Password	Values (characters)
Passwords must be a minimum of 5 characters. The Password must be re-entered exactly in the Confirm Password box as well.	<i>(no default)</i> min 5 characters

4.0 Configuration

4.7.2 Admin > SNMP

The pMDDL may be configured to operate as a Simple Network Management Protocol (SNMP) agent. Network management is most important in larger networks, so as to be able to manage resources and measure performance. SNMP may be used in several ways:

- configure remote devices
 - monitor network performance
 - detect faults
 - audit network usage
 - detect authentication failures

i

SNMP: Simple Network Management Protocol provides a method of managing network devices from a single PC running network management software.

Managed networked devices are referred to as SNMP agents.

A SNMP management system (a PC running SNMP management software) is required for this service to operate. This system must have full access to the pMDDL. Communications is in the form of queries (information requested by the management system) or traps (information initiated at, and provided by, the SNMP agent in response to predefined events).

Objects specific to the pMDDL are hosted under private enterprise number **21703**.

An object is a variable in the device and is defined by a Management Information Database (MIB). Both the management system and the device have a copy of the MIB. The MIB in the management system provides for identification and processing of the information sent by a device (either responses to queries or device-sourced traps). The MIB in the device relates subroutine addresses to objects in order to read data from, or write data to, variables in the device.

An SNMPv1 agent accepts commands to retrieve an object, retrieve the next object, set and object to a specified value, send a value in response to a received command, and send a value in response to an event (trap).

SNMPv2c adds to the above the ability to retrieve a large number of objects in response to a single request.

SNMPv3 adds strong security features including encryption; a shared password key is utilized. Secure device monitoring over the Internet is possible. In addition to the commands noted as supported above, there is a command to synchronize with a remote management station.

The pages that follow describe the different fields required to set up SNMP on the pMDDL. MIBS may be requested from Microhard Systems Inc.

The MIB file can be downloaded directly from the unit using the '**Get MIB File**' button on the Network > SNMP menu.





4.0 Configuration

SNMP Settings

System		Network		Wireless		Firewall		Serial		Diag		Admin	
												Users	
												SNMP	
												Discovery	
												Logout	
SNMP Settings													
SNMP Settings													
SNMP Agent Status	<input type="button" value="Enable ▾"/> <input type="text" value="public"/>												
Read Only Community Name	<input type="text" value="private"/>												
Read Write Community Name	<input type="text" value="161"/>												
Listening Port	<input type="button" value="Version 3 ▾"/>												
SNMP Version	<input type="text" value="userV3"/>												
V3 User Name	<input type="button" value="Read Only ▾"/>												
V3 User Read Write Limit	<input type="button" value="AuthPriv ▾"/>												
V3 User Authentication Level	<input type="button" value="MD5 ▾"/>												
V3 Authentication Protocol	<input type="text" value="....."/> <input checked="checked" type="checkbox"/> Show Secret												
V3 Authentication Password	<input type="text" value="....."/> <input checked="checked" type="checkbox"/> Show Secret												
V3 Privacy Protocol	<input type="button" value="DES ▾"/>												
V3 Privacy Password	<input type="text" value="....."/> <input checked="checked" type="checkbox"/> Show Secret												
SNMP Trap Settings													
SNMP Trap Status	<input type="button" value="Disable ▾"/>												
Download MIB File													
<input type="button" value="Get MIB File"/>													

Image 4-7-3: Admin > SNMP

SNMP Agent Status

If disabled, an SNMP service is not provided from the device. Enabled, the device - now an SNMP agent - can support SNMPv1, v2, & v3.

Values (selection)

Disable / Enable

Read Only Community Name

Effectively a plain-text password mechanism used to weakly authenticate SNMP queries. Being part of the community allows the SNMP agent to process SNMPv1 and SNMPv2c requests. This community name has only READ priority.

Values (string)

public

Read Write Community Name

Also a plain-text password mechanism used to weakly authenticate SNMP queries. Being part of the community allows the SNMP agent to process SNMPv1 and SNMPv2c requests. This community name has only READ/WRITE priority.

Values (string)

private

Listening Port

Enter the UDP port on which the pMDDL listens for incoming SNMP get/set messages. The default is port 161.

Values (UDP Port)

161



4.0 Configuration

SNMP Version	
Select the SNMP version used. Only SNMP version 1 & 2 support SNMP traps (See MIB).	Values (selection)
	Version 1 / Version 2 / Version 3
SNMP V3 User Name	
Defines the user name for SNMPv3.	Values (string)
	V3user
V3 User Read Write Limit	
Defines accessibility of SNMPv3; If Read Only is selected, the SNMPv3 user may only read information; if Read Write is selected, the SNMPv3 user may read and write (set) variables.	Values (selection)
	Read Only / Read Write
V3 User Authentication Level	
Defines SNMPv3 user's authentication level: NoAuthNoPriv: No authentication, no encryption. AuthNoPriv: Authentication, no encryption. AuthPriv: Authentication, encryption.	Values (selection)
	NoAuthNoPriv AuthNoPriv AuthPriv
V3 User Authentication Password	
SNMPv3 user's authentication password. Only valid when V3 User Authentication Level set to AuthNoPriv or AuthPriv.	Values (string)
	00000000
V3 User Privacy Password	
SNMPv3 user's encryption password. Only valid when V3 User Authentication Level set to AuthPriv (see above).	Values (string)
	00000000
Auth Failure Traps	
If enabled, an authentication failure trap will be generated upon authentication failure. (SNMP v1 & v2 only).	Values (selection)
	Disable / Enable
Trap Community Name	
The community name which may receive traps. (SNMP v1 & v2 only).	Values (string)
	TrapUser
Trap Manage Host IP	
Defines a host IP address where traps will be sent to (e.g. SNMP management system PC IP address). (SNMP v1 & v2 only).	Values (IP Address)
	0.0.0.0



4.0 Configuration

SNMP Trap Settings

SNMP Trap Settings	
SNMP Trap Status	<input type="button" value="Enable ▾"/>
Trap Community Name	<input type="text" value="TrapUser"/> 0.0.0.0-Disable
Trap Manage Host IP	<input type="text" value="0.0.0.0"/> 0.0.0.0-Disable
Auth Failure Traps	<input type="button" value="Disable ▾"/>
Trap Selection:	
RSSI	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
RSSI Threshold	<input type="text" value="90"/> [30 - 120] (- dBm)
Resend Interval (seconds)	<input type="text" value="90"/> [0 - 65535] 0-Disable
WAN IP	<input type="radio"/> Disable <input checked="" type="radio"/> Enable

Image 4-7-4: Admin > SNMP Trap Settings

SNMP Trap Status	
Enable or disable autonomous SNMP traps from the device.	Values (selection)
	Disable / Enable
Trap Community Name	
Effectively a plain-text password mechanism used to weakly authenticate SNMP queries. Being part of the community allows the SNMP agent to process SNMP traps.	Values (string)
	TrapUser
Trap Manage Host IP	
Enter the IP address of the SNMP host to which SNMP traps are sent from the device.	Values (IP Address)
	0.0.0.0
Auth Failure Traps	
Enable or Disable authentication requirements for outgoing configured SNMP event traps.	Values (selection)
	Disable / Enable
RSSI	
Enable or Disable RSSI traps. The threshold in which that traps are triggered can also be configured, as well as the frequency at which the traps are sent when the threshold has been crossed.	Values (selection)
	Disable / Enable
	90 (30-120) in -dBm
	90 (0 - 65535 seconds, 0=disabled.)



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4.0 Configuration

WAN IP	Values (selection)
Enable or Disable WAN IP Traps. Device will send a trap any time the WAN IP has been changed. Generally used with dynamic IP addresses.	Disable / Enable



4.0 Configuration

4.7.3 Admin > Discovery

Server Status Settings

Microhard Radios employ a discovery service that can be used to detect other Microhard devices on a network. This can be done using a stand alone utility from Microhard System's called 'IP Discovery' or from the Tools > Discovery menu. The discovery service will report the MAC Address, IP Address, Description, Product Name, Firmware Version, Operating Mode, and the Network ID.

The screenshot shows the Microhard Admin interface with the 'Discovery' tab selected. The main section is titled 'Network Discovery' and contains two tabs: 'Server status Settings' and 'Network Discovery'. Under 'Server status Settings', there is a radio button for 'Discovery server status' with options 'Disable' and 'Enable', currently set to 'Enable'. Under 'Network Discovery', there is a table with columns: MAC Address, IP Address, Description, Product Name, Firmware Ver, Operation Mode, and Network ID. One row is shown with values: 00:0F:92:04:22:84, 192.168.168.1, UserDevice, pDDL-MIMO, v1.4.0-r1005, Master, MHK_Alpha. At the bottom is a button labeled 'Start discovery network again'.

Image 4-7-5: Admin > Discovery

This screenshot shows the 'Discovery Service Status' and 'Server Port Settings' sections of the Admin > Discovery page. The 'Discovery Service Status' section has a blue header 'Discovery Service Status' and a white body with text 'Use this option to disable or enable the discovery service.' and a 'Values (selection)' button with options 'Disable / Enable'. The 'Server Port Settings' section has a blue header 'Server Port Settings' and a white body with text 'Specify the port running the discovery service on the pMDDL unit.' and a 'Values (Port #)' button with the value '20097'.

Network Discovery

The Network discovery tool allows the pMDDL to send a broadcast to all Microhard devices on the same network. Other units on the network will respond to the broadcast and report their MAC address, IP address (With a hyperlink to that units WebUI page), description, firmware version.

The discovery service can be a useful troubleshooting tool and can be used to quickly find and identify other units on the network.

4.0 Configuration

4.7.4 Admin > Logout

The logout function allows a user to end the current configuration session and prompt for a login screen.

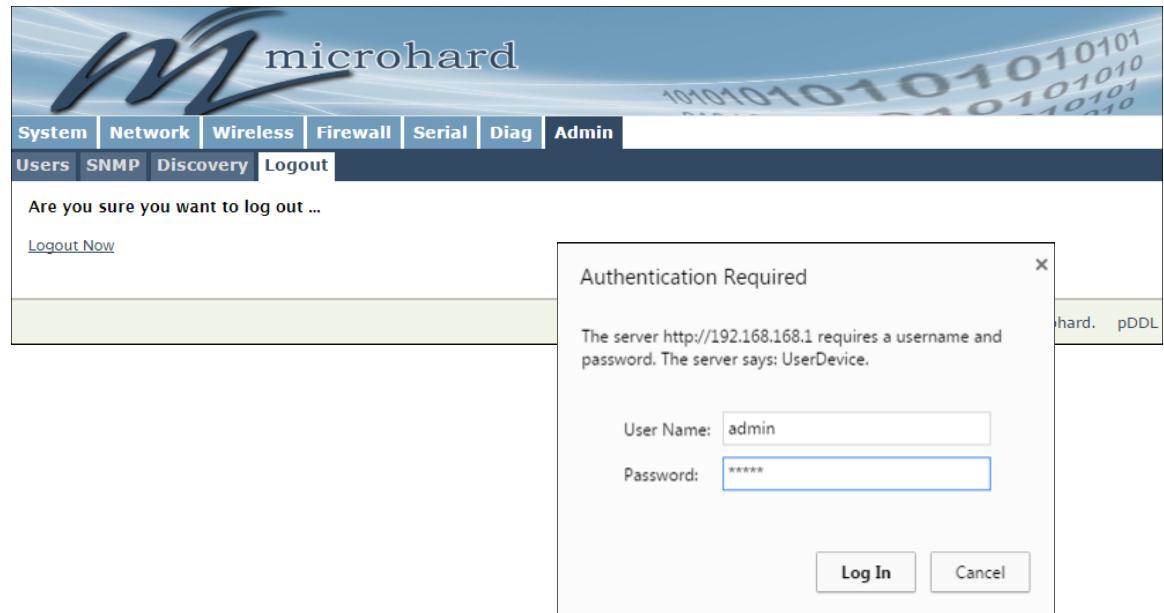


Image 4-7-6: Admin > logout

5.0 AT Command Line Interface

5.1 AT Command Overview

AT Commands can be issued to configure and manage the pMDDL, via TCP/IP (telnet).

5.1.1 Telnet (TCP/IP)

Telnet can be used to access the AT Command interface of the pMDDL. The default port is TCP Port 23. A telnet session can be made to the unit using any Telnet application (Windows Telnet, Tera Term, ProComm etc). Once communication is established, a login is required to continue.

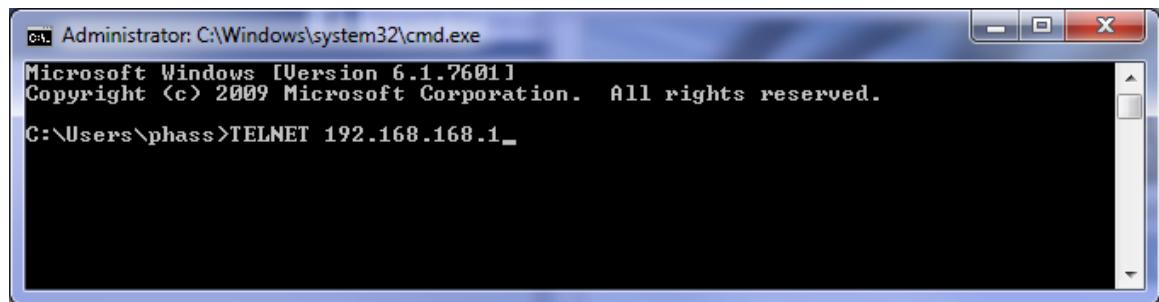


Image 5-1: Establishing a Telnet Session

A session can be made to the WAN IP Address (if allowed in the firewall settings) for remote configuration, or to the local RJ45 interface.



The factory default network settings:

**IP: 192.168.168.1
Subnet: 255.255.255.0
Gateway: 192.168.168.1**

Once a session is established a login is required to continue. As seen in the Serial port setup, the default login is **admin**, and the password is **admin**. Once verified, the AT Command Line Interface menu is shown and AT Commands can now be issued. (Type “?” or Help to list the commands).

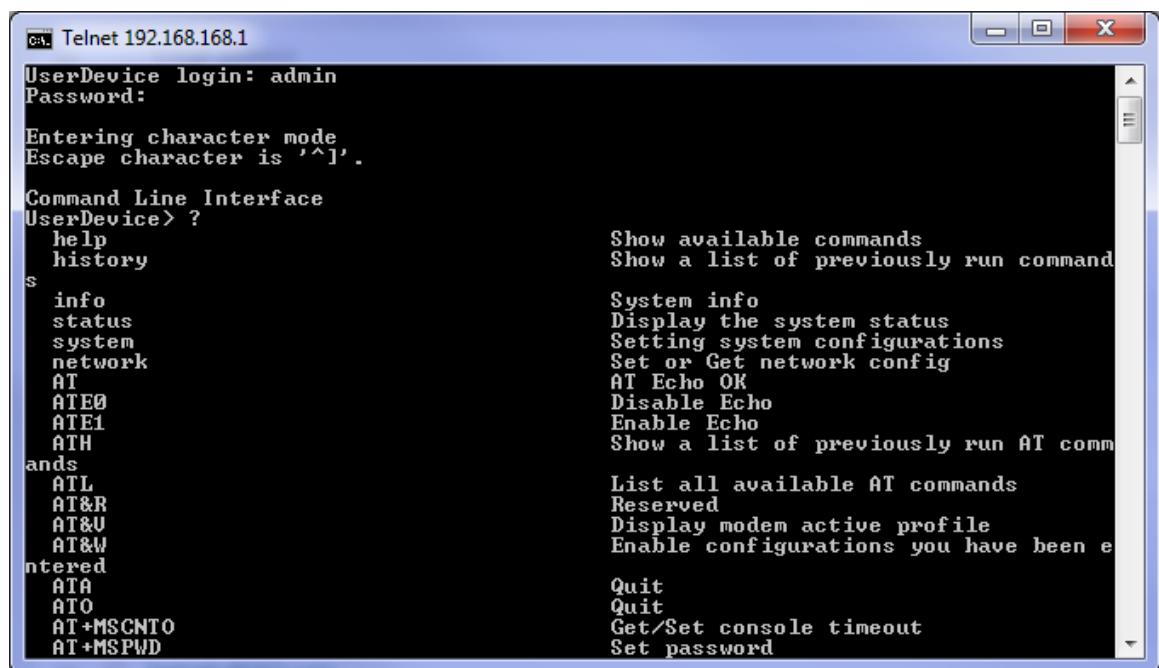


Image 5-2: Telnet AT Command Session

5.0 AT Command Line Interface

5.2 AT Command Syntax

The following syntax is used when issuing AT Commands on the pMDDL.

- All commands start with the AT characters and end with the <Enter> key
 - Microhard Specific Commands start with +M
 - Help will list top level commands (ATL will list ALL available AT Commands)
 - To query syntax of a command: AT+<command_name>=?
 - Syntax for commands that are used only to query a setting:
AT<command_name>
 - Syntax for commands that can be used to query *and* set values:
AT<command_name>=parameter1,parameter2,... (Sets Values)
AT<command_name>? (Queries the setting)

Query Syntax:

AT+MSCNTO=? <Enter>

+MSCNTO:

Command Syntax: AT+MSCNTO=<Timeout_s>

Parameter:

<Timeout_s> 30 to 65535 in seconds, 0-Disable

OK

Setting a value:

AT+MSCNTO=300 <Enter>

OK

Query a setting:

AT+MSCNTO? <Enter>

+MSCNTO: 300 seconds

OK

A screen capture of the above commands entered into a unit is shown below:

```
Telnet 192.168.168.1
UserDevice> AT+MSCNT0=?
+MSCNT0:
Command Syntax:
  AT+MSCNT0=<Timeout_s>
Parameter:
  <Timeout_s> : 30 to 65535 in seconds, 0=Disable
OK
UserDevice> AT+MSCNT0=300
OK
UserDevice> AT+MSCNT0?
+MSCNT0: 300 seconds
OK
UserDevice> AT+MSCNT0
```

Image 5-3: Telnet AT Command Syntax

Once AT commands are entered, they must be saved into the file system to enable the changes.

AT&W Saves changes.

ATO or ATA Exits the AT Command Line Interface, if used before AT&W, changes are discarded.



5.0 AT Command Line Interface

5.3 Supported AT Commands

Basic AT Commands			
AT Command	Description	Syntax	Effect
AT	AT echo OK	AT <enter>	Immediate
ATE0	Disable echo	ATE0 <enter>	Immediate
ATE1	Enabled local echo	ATE1 <enter>	Immediate
ATH	Show a list of previously run commands	ATH <enter>	Immediate
ATL	Show a list of all available AT Commands	ATL <enter>	Immediate
AT&R	Read modem profile to editable profile. (Reserved)	AT&R <enter>	Immediate
AT&V	Read modem active profile	AT&V <enter>	Immediate
AT&W	Enable configuration changes that have been entered	AT&W <enter>	Immediate
ATA	Quit. Exits AT command session and returns to login prompt	ATA <enter>	Immediate
ATO	Quit. Exits AT command session and returns to login prompt	ATO <enter>	Immediate

Administrative AT Commands

AT Command	Description	Syntax	Effect
AT+MADISS	Get/Set discovery service used by the modem	AT+MADISS[=<Mode>[,<Port>]] Mode: 0 - Disable 1 - Discoverable Port: 1 to 65535. Default is 20097	AT&W
AT+MASNMP	Get/Set SNMP service	AT+MASNMP[=<Mode>[,<ROCommunity>,<RWCommunity>,<Port>,<Version>]] <Mode>: 0 - Disable 1 - Enable <ROCommunity>: Read Only Community Name 1 to 32 characters <RWCommunity>: Read Write Community Name 1 to 32 characters <Port>: Listening Port 0 to 65535. Default is 161 <Version>: SNMP version 1 - Version 1 2 - Version 2 3 - Version 3 (Use AT+MASNMPV3 to set Authentication and Privacy parameters)	AT&W
AT+MASNMPV3	Get/Set SNMP Version 3	AT+MASNMPV3=<UserName>,<RWLimit>,<AuthLevel>[,<Auth>,<AuthPassword>[,<Privacy>,<PrivacyPassword>]] <UserName> : V3 User Name 1 to 32 characters <RWLimit> : V3 User Read Write Limit 0 - Read Only 1 - Read Write <AuthLevel> : V3 User Authentication Level 0 - NoAuthNoPriv 1 - AuthNoPriv 2 - AuthPriv <Auth> : V3 Authentication Protocol 0 - MD5 1 - SHA <AuthPassword> : V3 Authentication Password 5 to 64 characters <Privacy> : V3 Privacy Protocol 0 - DES 1 - AES <PrivacyPassword>: V3 Privacy Password 5 to 64 characters Usage: NoAuthNoPriv : AT+MASNMPV3=<UserName>,<RWLimit>,0 AuthNoPriv : AT+MASNMPV3=<UserName>,<RWLimit>,1,<Auth>,<AuthPassword> AuthPriv : AT+MASNMPV3=<UserName>,<RWLimit>,2,<Auth>,<AuthPassword>,<Privacy>,<PrivacyPassword>	AT&W

5.0 AT Command Line Interface

Administrative AT Commands (Continued)			
AT Command	Description	Syntax	Effect
AT+MASNMPTRAP	Get/Set SNMP Trap	AT+MASNMPTRAP=<Mode>[,<Name>,<IP>[,<AuthFailureTraps>]] <Mode>: 0 - Disable 1 - Enable <Name>: Trap Community Name. 1 to 32 characters <IP>: Trap Manage Host IP. Default 0.0.0.0 (Disable) <AuthFailureTraps>: 0 - Disable 1 - Enable Usage: AT+MASNMPTRAP AT+MASNMPTRAP=0 AT+MASNMPTRAP=1[,<Name>,<IP>[,<AuthFailureTraps>]]	AT&W
Serial Port AT Commands			
AT Command	Description	Syntax	Effect
AT+MCPS2	Get/Set Serial port	AT+MCPS2=<Mode> Parameters: COM2 Mode: 0 - Console 1 - Data	AT&W
AT+MCBR2	Get/Set Serial port baud rate	AT+MCBR2=<Baud Rate Type> Parameters: COM2 Baud Rate Type: 0 - 300 1 - 600 2 - 1200 3 - 2400 4 - 3600 5 - 4800 6 - 7200 7 - 9600 8 - 14400 9 - 19200 10 - 28800 11 - 38400 12 - 57600 13 - 115200 14 - 230400 15 - 460800 16 - 921600	AT&W
AT+MCDF2	Get/Set Serial port data format	AT+MCDF2=<Data Formate Type> Parameters: COM2 Data Formate Option: 0 - 8N1 2 - 8E1 3 - 8O1	AT&W
AT+MCDM2	Get/Set Serial port data mode	AT+MCDM2=<Data Mode Type> Parameters: COM2 Data Mode Option: 0 - Seamless 1 - Transparent	AT&W
AT+MCCT2	Get/Set Serial port character timeout	AT+MCCT2=<timeout> Parameters: COM2 timeout: 1 to 65535 in seconds	AT&W
AT+MCMPS2	Get/Set Serial port maximum packet size	AT+MCMPS2=<size> Parameters: COM2 maximum packet size: 1 to 2048	AT&W
AT+MCNCDI2	Get/Set Serial port no-connection data intake	AT+MCNCDI2=<Mode> Parameters: COM2 Mode Option: 0 - Disable 1 - Enable	AT&W
AT+MCMTC2	Get/Set Serial port Modbus tcp configuration	AT+MCMTC2=<Status> Parameters: COM2 Modbus Status: 0 - Disable 1 - Enable	AT&W



5.0 AT Command Line Interface

Serial Port AT Commands (Continued)			
AT Command	Description	Syntax	Effect
AT+MCIPM2	Get/Set Serial port IP protocol mode	AT+MCIPM2=<IP Protocol Config> Parameters: COM2 IP Protocol Config: 0 - TCP Client 1 - TCP Server 2 - TCP Client/Server 3 - UDP Point to Point 4 - UDP Point to Multipoint(P) 5 - UDP Point to Multipoint(MP) 8 - PPP	AT&W
AT+MCTC2	Get/Set Serial port tcp client configuration when IP protocol mode is TCP Client	AT+MCTC2=<Remote Server IP>,<Remote Server Port>,<Outgoing timeout> Parameters: COM2: Remote Server IP : valid IP address Remote Server Port : 1 to 65535 Outgoing timeout : 1 to 65535 in seconds	AT&W
AT+MCTS2	Get/Set Serial port tcp server configuration when IP protocol mode is TCP Server	AT+MCTS2=<Server Mode>,<Polling Timeout>,<Local Listening Port>,<Connection timeout> Parameters: Server Mode : 0 - Monitor; 1 - Polling Polling timeout : 1 to 65535 in seconds Local Listening Port : 1 to 65535 Connection timeout : 1 to 65535 in seconds	AT&W
AT+MCTCS2	Get/Set Serial port tcp client/server configuration when IP protocol mode is TCP Client/Server	AT+MCTCS2=<Remote Server IP>,<Remote Server Port>,<Outgoing timeout>,<Server Mode>,<Polling Timeout>,<Local Listener Port>,<Incoming timeout> Parameters: Remote Server IP : valid IP address Remote Server Port : 1 to 65535 Outgoing timeout : 1 to 65535 in seconds Server Mode : 0 - Monitor; 1 - Polling Polling timeout : 1 to 65535 in seconds Local Listening Port : 1 to 65535 Incoming timeout : 1 to 65535 in seconds	AT&W
AT+MCUPP2	Get/Set Serial port UDP point to point configuration when IP protocol mode is UDP point to point	AT+MCUPP2=<Remote IP>,<Remote Port>,<Listening Port>,<UDP Timeout> Parameters: Remote IP : valid IP address Remote Port : 1 to 65535 Listening Port : 1 to 65535 UDP Timeout : 1 to 65535 in seconds	AT&W
AT+MCPPP2	Get/Set Serial port PPP configuration when IP protocol mode is PPP	AT+MCPPP2[=<Mode>,<CCP negotiation>,<LCP Echo Failure Number>,<LCP Echo Interval>,<Local IP>,<Host IP>,<Idle Timeout>[,<Expected String>,<Response String>]] Parameters: COM2: Mode : 0 - Active; 1 - Passive CCP negotiation : 0 - Disable; 1 - Enable LCP Echo Failure Number : [0 .. 65535] LCP Echo Interval : [0 .. 65535] Local IP : Valid IP address Host IP : Valid IP address Idle Timeout : 1 to 65535 in seconds Expected String : (Optional) 0 - 63 characters Response String : (Optional) 0 - 63 characters	AT&W
AT+MCUPMP2	Get/Set Serial port UDP point to multipoint as point configuration when IP protocol mode is set to UDP point to multipoint (P)	AT+MCUPMP2[=<Multicast IP>,<Multicast Port>,<Listening Port>,<Time To Live>,<Multicast Interface>] Parameters: COM2: Multicast IP : valid IP address Multicast Port : 1 to 65535 Listening Port : 1 to 65535 Time To Live : 1 to 255 in seconds Multicast Interface : 0 - default 1 - LAN	AT&W
AT+MCUPMM2	Get/Set Serial port UDP point to multipoint as MP configuration when IP protocol mode be set to UDP point to multipoint (MP)	AT+MCUPMM2[=<Remote IP>,<Remote Port>,<Multicast IP>,<Multicast Port>,<Multicast Interface>] Parameters: COM2: Remote IP : valid IP address Remote Port : 1 to 65535 Multicast IP : valid IP address Multicast Port : 1 to 65535 Multicast Interface : 0 - default 1 - LAN	AT&W
AT+MCESCP2	Get/Set Serial support escape sequence configuration	AT+MCESCP2[=<Escape Mode>[,<Escape Guard Interval>,<Escape Sequence String>]] Parameters: COM2: Escape Mode : 0 - Disabled; 1 - Enabled Escape Guard Interval : 1 to 10 seconds Escape Sequence String : 3 to 7 characters	AT&W

5.0 AT Command Line Interface

Firewall AT Commands				
AT Command	Description	Syntax	Effect	
AT+MFGEN	Get/Set firewall general configuration	AT+MFGEN[<Config>[,<Mode>]] Parameters: Config : 0 - WAN Remote Management 1 - WAN Request 2 - LAN to WAN Access Control 3 - Anti-Spoof 4 - Packet Normalization Mode : 0 - Disable (Block) 1 - Enable (Allow)	AT&W	
AT+MFDMZ	Get/Set firewall DMZ configuration	AT+MFDMZ[<DMZ Source>[,<DMZ Mode>[,<DMZ Server IP>,<Exception Port>]]] Parameters: DMZ Source : 0 - WAN DMZ Mode : 0 - Disable 1 - Enable DMZ Server IP : Valid IP address Exception Port : 0 - 65535	AT&W	
AT+MFPORTFWD	Get/Set firewall Port Forwarding rule	AT+MFPORTFWD[=<Name>[,<Operation>[,<Source>,<Internal IP>,<Internal Port>,<Protocol>,<External Port>,<SNAT>]]] Parameters: Name : Name of Port Forwarding rule, 1 - 64 characters Operation : ADD - Add a rule EDIT - Edit a rule DEL - Delete a rule Source : 0 - WAN 1 - USB Internal IP : Valid IP address Internal Port : Valid port number, 1 - 65535 Protocol : 0 - TCP 1 - UDP 2 - TCPUDP External Port : Valid port number, 1 - 65535 Source NAT : 0 - No; 1 - Yes Usage: AT+MFPORTFWD AT+MFPORTFWD=<Name> AT+MFPORTFWD=<Name>,DEL AT+MFPORTFWD=<Name>,ADD,<Source>,<Internal IP>,<Internal Port>,<Protocol>,<External Port>,<SNAT> AT+MFPORTFWD=<Name>,EDIT,<Source>,<Internal IP>,<Internal Port>,<Protocol>,<External Port>,<SNAT>	AT&W	
AT+MFMAC	Get/Set firewall MAC list	AT+MFMAC[=<Name>[,<Operation>[,<Action>,<Mac Address>]]] Parameters: Name : Name of firewall MAC list name, 1 - 64 characters Operation : ADD - Add a firewall MAC list EDIT - Edit a firewall MAC list DEL - Delete a firewall MAC list Action : 0 - Accept 1 - Drop 2 - Reject MAC Address : Valid MAC address Usage: AT+MFMAC AT+MFMAC=<Name> AT+MFMAC=<Name>,DEL AT+MFMAC=<Name>,ADD,<Action>,<Mac Address> AT+MFMAC=<Name>,EDIT,<Action>,<Mac Address>	AT&W	
AT+MFIP	Get/SET firewall IP list	AT+MFIP[=<Name>[,<Operation>[,<Action>,<Source>,<IP Address>[,<Prefix>]]]] Parameters: Name : Name of firewall IP list name, 1 - 64 characters Operation : ADD - Add a firewall IP list EDIT - Edit a firewall IP list DEL - Delete a firewall IP list Action : 0 - Accept 1 - Drop 2 - Reject Source : 0 - LAN 1 - Independent LAN 2 - WAN 3 - USB Source IP : Valid IP address Prefix : 0 ~ 32. 32 (default) - single IP address Usage: AT+MFIP AT+MFIP=<Name> AT+MFIP=<Name>,DEL AT+MFIP=<Name>,ADD,<Action>,<Source>,<IP Address>[,<Prefix>] AT+MFIP=<Name>,EDIT,<Action>,<Source>,<IP Address>[,<Prefix>]	AT&W	



5.0 AT Command Line Interface

Firewall AT Commands (Continued)			
AT Command	Description	Syntax	Effect
AT+MFRULE	Get/Set firewall rule	AT+MFRULE[=<Name>[,<Operation>[,<Action>,<Source>,<Src IP Format>,<Src IP From/Subnet>,<Src IP To/Prefix>,<Destination>,<Dest IP Format>,<Dest IP From/Subnet>,<Dest IP To/Prefix>,<Dest Port>,<Protocol>]]] Parameters: Name : Name of firewall rule name, 1 - 64 characters Operation : ADD - Add a firewall rule EDIT - Edit a firewall rule DEL - Delete a firewall rule Action : 0 - Accept 1 - Drop 2 - Reject Source : 0 - LAN 1 - Independent LAN 2 - WAN 3 - USB 4 - None IP Format : 0 - IP Range 1 - Subnet / Prefix IP From/Subnet: Valid IP address. 0 - Set to blank IP To/Prefix : Valid IP address. 0 - Set to blank; or 0 ~ 32 for Prefix Destination : 0 - LAN 1 - Independent LAN 2 - WAN 3 - USB 4 - None IP Format : 0 - IP Range 1 - Subnet / Prefix IP From/Subnet: Valid IP address. 0 - Set to blank IP To/Prefix : Valid IP address. 0 - Set to blank; or 0 ~ 32 for Prefix Port/Range : Port 0 ~ 65535 or Port range specified as 100:200 format Protocol : 0 - TCP 1 - UDP 2 - TCPUDP 3 - ICMP	AT&W
AT+MFRST	Reset to default firewall	AT+MFRST <enter>	Immediate
Network AT Commands			
AT Command	Description	Syntax	Effect
AT+MNLAN	Show/Add/Edit/Delete the network LAN interface	AT+MNLAN AT+MNLAN=<LAN Name> AT+MNLAN=<LAN Name>,DEL AT+MNLAN=<LAN Name>,ADD/EDIT,<Protocol>[,<IP>,<Netmask>[,<Gateway>]] Where <Protocol>=0 AT+MNLAN=<LAN Name>,ADD/EDIT,<Protocol> Where <Protocol>=1 or 3 AT+MNLAN=<LAN Name>,EDIT,<Protocol>[,<IP>,<Netmask>] Where <Protocol>=2 and <LAN Name>="lan" Parameters: LAN Name : Name of Network LAN interface. System built-in one is "lan" Operation : ADD - Add a new LAN interface EDIT - Edit an existing LAN interface DEL - Delete an existing LAN interface Protocol : 0 - Static IP 1 - DHCP with LAN alias disabled 2 - DHCP with LAN alias enabled, only for "lan" 3 - None. Not for "lan" IP Address : Valid IP address Netmask : Valid netmask Gateway : Valid IP address. 0 - Reset	AT&W
AT+MNLANDHCP	Get/Set LAN DHCP server on LAN interface	AT+MNLANDHCP=<LAN Name>[,<Mode>[,<Start IP>,<Limit>,<Lease Time>[,<Alt. Gateway>,<Pre. DNS>,<Alt. DNS>,<WINS/NBNS Servers>,<WINS/NBT Node>]]] Parameters: LAN Name : Name of Network LAN interface Mode : 0 - Disable DHCP Server 1 - Enable DHCP Server Start IP : The starting address DHCP assignable IP Addresses Limit : The maximum number of IP addresses. min=1 max=16777214 Lease Time : The DHCP lease time in minutes. 2~2147483647 minutes. 0 means'infinity' Alt. Gateway : Alternate Gateway for DHCP assigned devices if the default gateway is not to be used Pre. DNS : Preferred DNS server address to be assigned to DHCP devices Alt. DNS : Alternate DNS server address to be assigned to DHCP devices WINS/NBNS Server : WINS/NBNS Servers WINS/NBT Node : WINS/NBT Node Type 0 - none 1 - b-node 2 - p-node 3 - m-node 4 - h-node	AT&W



5.0 AT Command Line Interface

Network AT Commands (Continued)			
AT Command	Description	Syntax	Effect
AT+MNLANSTP	Get/Set the network LAN interface: Spanning Tree (STP)	AT+MNLANSTP=<LAN Name>[,<STP>] Parameters: LAN Name : Name of Network LAN interface Spanning Tree : 0 - Off 1 - On	AT&W
AT+MNLANIGMP	Get/Set the network LAN interface: IGMP Snooping	AT+MNLANIGMP=<LAN Name>[,<IGMP Snooping>] Parameters: LAN Name : Name of Network LAN interface IGMP Snooping : 0 - Off 1 - On	AT&W
AT+MNLANDR	Get/Set the network LAN interface: Default Route	AT+MNLANDR=<LAN Name>[,<Default Route>] Parameters: LAN Name : Name of Network LAN interface Default Route : 0 - No 1 - Yes	AT&W
AT+MNLANDNS	Get/Set the network LAN interface: DNS	AT+MNLANDNS=<LAN Name>[,<Mode>[,<Primary DNS>,<Secondary DNS>]] Usage: AT+MNLANDNS=<LAN Name> AT+MNLANDNS=<LAN Name>,<Mode> Where <Mode>=0 AT+MNLANDNS=<LAN Name>,<Mode>[,<Primary DNS>,<Secondary DNS>] Where <Mode>=1 Parameters: LAN Name : Name of Network LAN interface Mode : 0 - Auto 1 - Manual Primary DNS : Valid IP Address or 0 (Reset) Secondary DNS : Valid IP address or 0 (Reset)	AT&W
AT+MNWAN	Get/Set the network WAN interface	AT+MNWAN[=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]]] Usage: AT+MNWAN AT+MNWAN=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]] Where <Mode>=0 and <Protocol>=0 AT+MNWAN=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]] Where <Mode>=2 and <Protocol>=0 AT+MNWAN=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]] Where <Mode>=0/2 and <Protocol>=1 AT+MNWAN=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]] Where <Mode>=2 and <Protocol>=2 AT+MNWAN=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]] Where <Mode>=1 Parameters: Mode : 0 - Independent WAN 1 - Bridge with LAN Port 2 - Independent LAN Protocol: 0 - Static IP 1 - DHCP 2 - None IP : Valid IP address Netmask : Valid netmask Gateway : Valid IP address. 0 - Reset	AT&W
AT+MNWANDR	Get/Set the network WAN interface: Default Route	AT+MNWANDR[=<Default Route>] Parameters: Default Route : 0 - No 1 - Yes	AT&W
AT+MNWANDNS	Get/Set DNS Server when WAN port works as Independent WAN	AT+MNWANDNS[=<Mode>[,<Primary DNS>,<Secondary DNS>]] Usage: AT+MNWANDNS AT+MNWANDNS=<Mode> Where <Mode>=0 AT+MNWANDNS=<Mode>[,<Primary DNS>,<Secondary DNS>] Where <Mode>=1 Parameters: Mode : 0 - Auto 1 - Manual Primary DNS : Valid IP Address or 0 (Reset) Secondary DNS : Valid IP address or 0 (Reset)	AT&W
AT+MNWANLANDDHCP	Get/Set LAN DHCP server when the WAN port is set as Independent LAN	AT+MNWANLANDDHCP[=<Mode>[,<Start IP>,<Limit>,<Lease Time>[,<Alt.Gateway>,<Pre.DNS>,<Alt.DNS>]]] Usage: AT+MNWANLANDDHCP AT+MNWANLANDDHCP=<Mode> Where <Mode>=0 AT+MNWANLANDDHCP=<Mode>[,<Start IP>,<Limit>,<Lease Time>[,<Alt.Gateway>,<Pre.DNS>,<Alt.DNS>]] Where <Mode>=1 Parameters: Mode : 0 - Disable DHCP Server 1 - Enable DHCP Server Start IP : The starting address DHCP assignable IP Addresses Limit : The maximum number of IP addresses. min=1 max=16777214 Lease Time : The DHCP lease time in minutes, 2~2147483647 minutes. 0 means 'infinity' Alt. Gateway : Alternate Gateway for DHCP assigned devices if the default gateway is not to be used Pre. DNS : Preferred DNS server address to be assigned to DHCP devices Alt. DNS : Alternate DNS server address to be assigned to DHCP devices	AT&W



5.0 AT Command Line Interface

Network AT Commands (Continued)

AT Command	Description	Syntax	Effect
AT+MNIPMAC	Show/Add/Delete/Release/ReleaseAll the MAC-IP address binding	AT+MNIPMAC[=<Operation>[,<Name>[,<IP Address>,<MAC Address>]]] Usage: AT+MNIPMAC AT+MNIPMAC=SHOW,<Name> AT+MNIPMAC=ADD,<Name>,<IP Address>,<MAC Address> AT+MNIPMAC=DEL,<NAME> AT+MNIPMAC=RELEASE,<NAME> AT+MNIPMAC=RELEASEALL Parameters: Operation : SHOW - Show the details of the MAC-IP address binding ADD - Add a new MAC-IP address binding DEL - Delete an existing MAC-IP address binding RELEASE - Release the active DHCP lease RELEASEALL - Release all active DHCP leases Name : Name of the MAC-IP binding, 1-64 characters IP Address : Valid IP address MAC Address: The physical MAC address of the device or interface	AT&W
AT+MNEMAC	Get the MAC address of the local Ethernet interface	AT+MNEMAC <enter> Sample Output: +MNEMAC: "00:0F:92:02:F9:0F" OK	Immediate
AT+MNPORT	Get/Set the Ethernet port configuration	AT+MNPORT[=<Ethernet Port>[,<Mode>[,<Auto Negotiation>,<Speed>,<Duplex>]]] Parameters: Ethernet Port : 0 - WAN 1 - LAN Mode : 0 - Auto 1 - Manual Auto-Negotiation : 0 - Off 1 - On Speed : 0 - 10 Mbit/s 1 - 100 Mbit/s Duplex : 0 - Full 1 - Half	AT&W
AT+MNSTATUS	Get the network status	AT+MNSTATUS <enter> Sample Output: LAN Port Status General Status IP Address : 192.168.168.1 Connection Type : static Subnet Mask : 255.255.255.0 MAC Address : 00:0F:92:02:F9:0F Traffic Status Receive bytes : 262.633KB Receive packets : 3345 Transmit bytes : 168.370KB Transmit packets : 2229 WAN Port Status General Status IP Address : N/A Connection Type : dhcp Subnet Mask : N/A MAC Address : 00:0F:92:03:F9:0F Traffic Status Receive bytes : 0B Receive packets : 0 Transmit bytes : 0B Transmit packets : 0 Default Gateway : 192.168.168.1 DNS Server(s) : None Kernel IP routing table Destination Gateway Subnet Mask Flags Metric Ref Use Iface 0.0.0.0 192.168.168.1 0.0.0.0 UG 0 0 0 br-lan 192.168.168.0 0.0.0.0 255.255.255.0 U 0 0 0 br-lan	Immediate

5.0 AT Command Line Interface

Network AT Commands (Continued)			
AT Command	Description	Syntax	Effect
AT+MNUSB	Show/Edit the network USB Interface	AT+MNUSB[=<Mode>[,<Protocol>[,<IP>,<Netmask>[,<Gateway>]]]] Usage: AT+MNUSB AT+MNUSB=<Mode>,<Protocol>,<IP>,<Netmask>[,<Gateway>] Where <Mode>=0 and <Protocol>=0 AT+MNUSB=<Mode>,<Protocol> Where <Mode>=0 and <Protocol>=1 AT+MNUSB=<Mode> Where <Mode>=1/2 Parameters: Mode : 0 - Independent LAN 1 - Bridge with LAN Port 2 - Bridge with WAN Port Protocol: 0 - Static IP 1 - DHCP IP : Valid IP address Netmask : Valid netmask Gateway : Valid IP address. 0 - Reset	AT&W
AT+MNUSBDHCP	Get/Set USB DHCP server on USB interface	AT+MNUSBDHCP[=<Mode>[,<Start IP>,<Limit>,<Lease Time>[,<Alt. Gateway>,<Pre. DNS>,<Alt. DNS>]]] Parameters: Mode : 0 - Disable DHCP Server 1 - Enable DHCP Server Start IP : The starting address DHCP assignable IP Addresses Limit : The maximum number of IP addresses Lease Time : The DHCP lease time in minutes. 2~2147483647 minutes. 0 means 'infinity' Alt. Gateway : Alternate Gateway for DHCP assigned devices if the default gateway is not to be used Pre. DNS : Preferred DNS server address to be assigned to DHCP devices Alt. DNS : Alternate DNS server address to be assigned to DHCP devices	AT&W
AT+MNUSBDR	Get/Set the network USB interface: Default Route	AT+MNUSBDR[=<Default Route>] Parameters: Default Route : 0 - No 1 - Yes	AT&W
AT+MNUSBDNS	Get/Set the network USB interface: DNS	AT+MNUSBDNS[=<Mode>[,<Primary DNS>,<Secondary DNS>]] Usage: AT+MNUSBDNS AT+MNUSBDNS=<Mode> Where <Mode>=0 AT+MNUSBDNS=<Mode>[,<Primary DNS>,<Secondary DNS>] Where <Mode>=1 Parameters: Mode : 0 - Auto 1 - Manual Primary DNS : Valid IP Address or 0 (Reset) Secondary DNS : Valid IP address or 0 (Reset)	AT&W

5.0 AT Command Line Interface

System AT Commands			
AT Command	Description	Syntax	Effect
AT+MSCNTO	Get/Set the console timeout	AT+MSCNTO=<Timeout_s> Parameter: <Timeout_s> : 30 to 65535 in seconds, 0-Disable	AT&W
AT+MSPWD	Set password	AT+MSPWD=<New Password>,<Confirm Password> Parameters: <New Password> : 5-64 characters except space <Confirm Password> : Same as <New Password>	AT&W
AT+MSGMI	Get manufacturers identification	AT+MSGMI <enter> Sample Output: +MSGMI: 2014-2016 Microhard.	Immediate
AT+MSSYSI	Get system summary information	AT+MSSYSI <enter> Sample Output: +MSSYSI: Ethernet Port: MAC : 00:0F:92:02:AB:22 IP : 192.168.168.1 MASK : 255.255.255.0 System: Device : UserDevice Product : pMDL Image : PWii Hardware : Rev A Software : v1.4.0 build 1005 Copyright : 2014-2016 Microhard. System Time : Tue Jul 19 14:14:32 2017	Immediate
AT+MSGMR	Get modem Record information	AT+MSGMR <enter> Sample Output: +MSGMR: Hardware Version : Rev A Software Version : v1.4.0 build 1005 Copyright : 2014-2016 Microhard. System Time : Tue Nov 29 14:15:02 2016	Immediate
AT+MSIMG	Get the image status for both active and inactive images	AT+MSIMG <enter> Active Version : v1.4.0-1008 Active Build Time : 2017-11-02 08:58:58 Inactive Version : v1.4.0-1005 Inactive Build Time : 2017-07-04 11:31:18	Immediate
AT+MSMNAME	Get/Set modem Name setting	AT+MSMNAME=<Modem_Name> Parameter: <Modem_Name> : 1 - 64 characters. Must be alphanumeric or dots(.), or dashes(-) or underscores(_)	AT&W
AT+MSRTF	Reset the modem to the factory default settings from non-volatile (NV) memory	AT+MSRTF=<Action> Parameter: <Action>: 0 - Pre-set action 1 - Confirm action	AT&W
AT+MSREB	Reboot the modem	AT+MSREB <enter> Sample Output: Rebooting...	Immediate
AT+MSNTP	Get/Set NTP server	AT+MSNTP[=<Mode>[,<Server>,<Port>,<Client Interval>]] Parameters: <Mode> : 0 - Local Time; 1 - NTP <Server> : Valid IP Address or Name <Port> : 1 to 65535. Default is 123 <Client Interval> : 15 to 65535 in seconds, 0-Disable	AT&W
AT+MSSYSLOG	Get/Set Syslog server settings	AT+MSSYSLOG[<Server>[,<Port>]] Parameters: <Server> : Valid IP Address or Name, 0.0.0.0 - Disable. 1 to 256 characters <Port> : 1 to 65535. Default is 514	AT&W
AT+MSSERVICE	Get/Set service status and port	AT+MSSERVICE[=<Service>[,<Mode>[,<Port>]]] Parameters: <Service> : 0 - FTP 1 - Telnet 2 - SSH <Mode> : 0 - Disable 1 - Enable <Port> : 0 to 65535. For Telnet (23 by default) and SSH (22 by default) only	AT&W
AT+MSWEBUI	Get/Set Web UI protocol and port	AT+MSWEBUI[=<Mode>[,<HTTP Port>[,<HTTPS Port>]]] Parameters: <Mode> : 0 - HTTP/HTTPS 1 - HTTP 2 - HTTPS 3 - Disable <HTTP Port> : 2 to 65534. 80 by default <HTTPS Port> : 2 to 65534. 443 by default	AT&W
AT+MSTR	Get Traffic status on interfaces	AT+MSTR[=<Interfaces>] <Interfaces> : 0 - WiFi 1 - Serial COM 2 - WAN 3 - LAN AT+MSTR=0 <enter> WiFi RX packets: 408 RX bytes : 57.301KB TX packets: 0 TX bytes : 0B	Immediate

5.0 AT Command Line Interface

Serial USB - AT Commands			
AT Command	Description	Syntax	Effect
AT+MUSBPS	Get/Set Serial USB Port Status *Only available when valid USB to Serial Adapter is connected*	AT+MUSBPS[=<USB Serial>[,<Mode>]] Parameters: USB Serial : 0 - GS0 Mode : 0 - Idle 1 - Data	AT&W
AT+MUSBBR	Get/Set Serial USB port baud rate *Only available when valid USB to Serial Adapter is connected*	AT+MUSBR[=<USB Serial>[,<Baud Rate>]] Parameters: USB Serial: 0 - GS0 Baud Rate : 0 - 300 1 - 600 2 - 1200 3 - 2400 4 - 3600 5 - 4800 6 - 7200 7 - 9600 8 - 14400 9 - 19200 10 - 28800 11 - 38400 12 - 57600 13 - 115200 14 - 230400 15 - 460800 16 - 921600	AT&W
AT+MUSBDF	Get/Set Serial USB data format *Only available when valid USB to Serial Adapter is connected*	AT+MUSBDF[=<USB Serial>[,<Data Format>]] Parameters: USB Serial: 0 - GS0 Data Format: 0 - 8N1 1 - 8E1 2 - 8O1	AT&W
AT+MUSBFC	Get/Set Serial USB port flow control	AT+MUSBFC[=<USB Serial>[,<Flow Control>]] Parameters: USB Serial: 0 - GS0 Flow Control: 0 - none 1 - RTS/CTS	AT&W
AT+MUSBDM	Get/Set Serial USB port data mode	AT+MUSBDM[=<USB Serial>[,<Data Mode>]] Parameters: USB Serial: 0 - GS0 Data Mode: 0 - Seamless 1 - Transparent	AT&W
AT+MUSBCT	Get/Set USB port character timeout	AT+MUSBCT[=<USB Serial>[,<Timeout>]] Parameters: USB Serial: 0 - GS0 Timeout: 1 to 65535 in seconds	AT&W
AT+MUSBMPS	Get/Set Serial USB port maximum packet size	AT+MUSBMPS[=<USB Serial>[,<Maximum Packet Size>]] Parameters: USB Serial : 0 - GS0 Maximum Packet Size : 1 to 2048	AT&W
AT+MUSBNCDI	Get/Set Serial USB port no-connection data intake	AT+MUSBNCDI[=<USB Serial>[,<No-Connection Data>]] Parameters: USB Serial: 0 - GS0 No-Connection Data: 0 - Disable 1 - Enable	AT&W
AT+MUSBMTC	Get/Set Serial USB port modbus tcp configuration	AT+MUSBMTC[=<USB Serial>[,<Modbus Status>]] Parameters: USB Serial: 0 - GS0 Modbus Status: 0 - Disable 1 - Enable	AT&W
AT+MUSBIPM	Get/Set Serial USB port IP protocol mode	AT+MUSBIPM[=<USB Serial>[,<IP Protocol Config>]] Parameters: USB Serial : 0 - GS0 IP Protocol Config : 0 - TCP Client 1 - TCP Server 2 - TCP Client/Server 3 - UDP Point to Point 4 - UDP Point to Multipoint(P) 5 - UDP Point to Multipoint(MP)	AT&W



5.0 AT Command Line Interface

Serial USB - AT Commands			
AT Command	Description	Syntax	Effect
AT+MUSBTC	Get/Set Serial USB port tcp client configuration when IP protocol mode is TCP Client	AT+MUSBTC[=<USB Serial>[,<Remote Server IP>,<Remote Server Port>,<Outgoing timeout>[,<Fast Recovery>]]] Parameters: USB Serial : 0 - GS0 Remote Server IP : valid IP address Remote Server Port : 1 to 65535 Outgoing timeout : 1 to 65535 in seconds Fast Recovery : 0 - Disable; 1 - Enable	AT&W
AT+MUSBTS	Get/Set Serial USB port tcp server configuration when IP protocol mode is TCP Server	AT+MUSBTS[=<USB Serial>[,<Server Mode>,<Polling Timeout>,<Local Listening Port>,<Connection timeout>[,<Fast Recovery>]]] Parameters: USB Serial : 0 - GS0 Server Mode : 0 - Monitor; 1 - Polling Polling timeout : 1 to 65535 in seconds Local Listening Port : 1 to 65535 Connection timeout : 1 to 65535 in seconds Fast Recovery : 0 - Disable; 1 - Enable	AT&W
AT+MUSBTCS	Get/Set Serial USB port tcp client/server configuration when IP protocol mode is TCP Client/ Server	AT+MUSBTCS[=<USB Serial>[,<Remote Server IP>,<Remote Server Port>,<Outgoing timeout>,<Server Mode>,<Polling Timeout>,<Local Listener Port>,<Incoming timeout>[,<Fast Recovery>]]] Parameters: USB Serial : 0 - GS0 Remote Server IP : valid IP address Remote Server Port : 1 to 65535 Outgoing timeout : 1 to 65535 in seconds Server Mode : 0 - Monitor; 1 - Polling Polling timeout : 1 to 65535 in seconds Local Listening Port : 1 to 65535 Incoming timeout : 1 to 65535 in seconds Fast Recovery : 0 - Disable; 1 - Enable	AT&W
AT+MUSBUPP	Get/Set Serial USB port UDP point to point configuration when IP protocol mode is UDP point to point	AT+MUSBUPP[=<USB Serial>[,<Remote IP>,<Remote Port>,<Listening Port>,<UDP Timeout>]] Parameters: USB Serial : 0 - GS0 Remote IP : valid IP address Remote Port : 1 to 65535 Listening Port : 1 to 65535 UDP Timeout : 1 to 65535 in seconds	AT&W
AT+MUSBUPMP	Get/Set Serial USB port UDP point to multipoint as point configuration when IP protocol mode be set to UDP point to multipoint (P)	AT+MUSBUPMP[=<USB Serial>[,<Multicast IP>,<Multicast Port>,<Listening Port>,<Time To Live>,<Multicast Interface>]] Parameters: USB Serial: 0 - GS0 Multicast IP: valid IP address Multicast Port: 1 to 65535 Listening Port: 1 to 65535 Time To Live: 1 to 255 in seconds Multicast Interface: 0 - default 1 - LAN	AT&W
AT+MUSBUPMM	Get/Set Serial USB port UDP point to multipoint as MP configuration when IP protocol mode be set to UDP point to multipoint (MP)	AT+MUSBUPMM[=<USB Serial>[,<Remote IP>,<Remote Port>,<Multicast IP>,<Multicast Port>,<Multicast Interface>]] Parameters: USB Serial: 0 - GS0 Remote IP: valid IP address Remote Port: 1 to 65535 Multicast IP: valid IP address Multicast Port: 1 to 65535 Multicast Interface: 0 - default 1 - LAN	AT&W

5.0 AT Command Line Interface

Wireless (Radio) AT Commands			
AT Command	Description	Syntax	Effect
AT+MWRFREQ	Get/Set radio frequency	AT+MWRFREQ[=<Frequency>] <Frequency> 0 - Off 1 - On	AT&W
AT+MWVPOWER	Get/Set radio Tx power	AT+MWVPOWER[=<Tx Power>] <Tx Power> 7 - 7 dbm 8 - 8 dbm 9 - 9 dbm 10 - 10 dbm 11 - 11 dbm 12 - 12 dbm 13 - 13 dbm 14 - 14 dbm 15 - 15 dbm 16 - 16 dbm 17 - 17 dbm 18 - 18 dbm 19 - 19 dbm 20 - 20 dbm 21 - 21 dbm 22 - 22 dbm 23 - 23 dbm 24 - 24 dbm 25 - 25 dbm 26 - 26 dbm 27 - 27 dbm 28 - 28 dbm 29 - 29 dbm 30 - 30 dbm	AT&W
AT+MWBAND	Get/Set radio channel bandwidth	AT+MWBAND[=<Channel Bandwidth>[,<Symbol Rate>]] Available radio channel bandwidth for pMDD mode 0 - 8 MHz 1 - 4 MHz	AT&W
AT+MWFREQ2400	Get/Set radio channel-frequency (Options vary by channel bandwidth)	AT+MWFREQ2400[=<MHz Channel Frequency>] <Channel Frequency> : 4 - 2405 MHz . . . 78- 2479 MHz	AT&W
AT+MWMIMO	Get/Set radio MIMO	AT+MWMIMO[=<MIMO>] <MIMO> : 0 - Off 1 - On	AT&W
AT+MWMCASTRT	Get/Set radio Multicast Rate	AT+MWMCASTRT[=<Multicast Rate>] <Multicast Rate> : 0 - QPSK FEC 1/2 1 - QPSK FEC 3/4 2 - 16-QAM FEC 1/2 3 - 16-QAM FEC 3/4 4 - 64-QAM FEC 2/3	AT&W
AT+MWVMODE	Get/Set radio mode	AT+MWVMODE[=<Virtual Interface Mode>] <Virtual Interface Mode> : 0 - Master 1 - Slave 2 - Repeater	AT&W
AT+MWVRATE	Get/Set radio TX Rate	AT+MWVRATE[=<Virtual Interface TX Rate>] <Virtual Interface TX Rate> : 0 - auto (Recommended) 1 - 64-QAM 5/6 FEC 2 - 64-QAM 3/4 FEC 3 - 64-QAM 2/3 FEC 4 - 16-QAM 3/4 FEC 5 - 16-QAM 1/2 FEC 6 - QPSK FEC 3/4 7 - QPSK FEC 1/2	AT&W



5.0 AT Command Line Interface

Wireless (Radio) AT Commands (Continued)			
AT Command	Description	Syntax	Effect
AT+MWEXTADDR	Get/Set radio extended addressing	AT+MWEXTADDR[=<Extended Addressing>] <Extended Addressing> : 0 - Off 1 - On	AT&W
AT+MWNWNETWORKID	Get/Set radio Network ID	AT+MWNWNETWORKID[=<Network ID>] <Network ID> Radio Virtual Interface Network ID: 1-64 characters	AT&W
AT+MWVENCRYPT	Get/Set radio Encryption Type & Key	AT+MWVENCRYPT[=<Encryption Type>[,<Key>]] <Encryption Type> Radio Virtual Interface Encryption Type: 0 - Disabled 1 - AES-128 <Key>: Min 8 characters, Max 64 characters	AT&W
AT+MWRESYNC	RF Re-Sync from the slave side	AT+MWRESYNC <enter>	Immediate
AT+MWSTATUS	Get the status of RF	AT+MWSTATUS <enter> Sample Output: General Status MAC Address : 00:0F:92:FA:38:30 Operation Mode : Master Network ID : pMDDL Bandwidth : 4 MHz Frequency : 2441 Tx Power : 20 dBm Encryption Type : AES-128 Traffic Status Receive Bytes : 0B Receive Packets : 0 Transmit Bytes : 89.076KB Transmit Packets : 550 OK Connection Info MAC Address : 00:0F:92:FA:59:F9 Tx Mod : 64-QAM FEC 5/6 Rx Mod : 64-QAM FEC 2/3 SNR (dB) : 75 RSSI (dBm) : -24	Immediate
AT+MWSNR	Get the value of SNR (Slave)	AT+MWSNR <enter> Sample Output: 43 OK	Immediate
AT+MWNOISEFLOOR	Get the value of Noise Floor (Slave)	AT+MWNOISEFLOOR <enter> Sample Output: -99 OK	Immediate
AT+MWSQTHRESH	Get/Set Squelch threshold	AT+MWSQTHRESH[=<Squelch Threshold>] Squelch Threshold : -1 to -128 (-1 = Turn off the threshold)	AT&W
AT+MWRSSI	Get radio RSSI	AT+MWRSSI <enter> Sample Output: 00:0F:92:FA:59:F9 -74 dBm	Immediate

6.0 Installation

The are a number of factors to consider when preparing to deploy a radio network, several of which have been touched-upon or detailed elsewhere within this manual. Following is a listing of a number of factors, in no particular order:



**The installation,
removal, or
maintenance of any
antenna system
components must be
undertaken only by
qualified and
experienced
personnel.**

Network Topology

The pMDDL currently supports Master and Slave modes which can create either Point to Multipoint or Point to Point network topologies.

Throughput

The pMDDL is capable of up to 25 Mbps throughput. The network topology has an effect on how this available throughput is ‘shared’ between all nodes on the network.

Distance

The physical distance between the modems dictates such things as required antenna performance and heights. When contemplating antenna types, keep in mind the directivity (omnidirectional or directional) of the antennas being used.

Terrain

Along with distance, the terrain is a very important consideration with respect to antenna height requirements. The term 'line-of-sight' (LOS) refers to being able to 'see' one location from another - a minimum requirement for a radio signal path. In addition to LOS, adequate clearance must also be provided to satisfy 'Fresnel Zone' requirements - an obstruction-free area much greater than the physical LOS, i.e. LOS is not enough to completely satisfy RF path requirements for a robust communications link.

Transmit Power

Having read thus far through the factors to be considered, it should be clear that they are all interrelated. Transmit power should be set for the minimum required to establish a reliable communications path with adequate fade margin. Required transmit power is dictated primarily by distance, antenna type (specifically the 'gain' of the antennas being used), and the receive sensitivity of the distant modem. Cable and connector losses (the physical path from the modem's 'antenna connector' to the antenna's connector) must also be taken into account.

Receive Sensitivity

The Pico Series has exceptional receive sensitivity, which can produce a number of benefits, such as: added fade margin for a given link, being able to use less expensive coaxial cable or antenna types, being able to operate at greater distances for a given distant transmitter power (perhaps negating the requirement for a Repeater site!). Distance, antenna gain, transmit power, and receive sensitivity are critical ‘numbers’ for radio path calculations. Fortunately, the Pico Series features the maximum available transmit power combined with exceptional receive sensitivity - two ‘numbers’ which will produce the most favorable path calculation results.



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6.0 Installation

Fade Margin

When all radio path numbers are being considered and hardware assumptions are being made, another factor to consider is the 'fade margin' of the overall system. The fade margin is the difference between the anticipated receive signal level and the minimum acceptable receive level (receive sensitivity). Being that the Pico Series performs to exacting specifications, the overall deployment should be such that the modems may be utilized to their full potential to provide a reliable and robust communications link. A typical desired fade margin is in the order of 20dB, however oftentimes a 10dB fade margin is acceptable.

Frequency

The 2.4 GHz frequency range is not effected by rain to any significant degree, and is also able to penetrate through foliage and 'around obstacles' to a certain degree. This being the case, some may choose to scrimp on the physical deployment, particularly when it comes to antenna (tower) heights. Path calculations provide results which specify 'required' antenna heights. For cost savings and in taking advantage of the characteristics of the frequency range, sometimes the height requirements are not adhered to: this may result in unreliable communications.

Power Requirements

The Pico Series may be integrated into a system (Development Board, or custom) which accepts a range of DC input voltages (supply current requirements must also be met). In some deployments, power consumption is critical. A number of features related to minimizing power consumption are available with the pMDDL such the ability to operate at lower transmit power given the receive sensitivity of the distant modem.

Interference

The channel selection of the pMDDL often allows it to work well in an environment within which there may be sources of in-band interference. Cavity filters are also available if required: contact Microhard Systems Inc. for further information.

6.0 Installation

6.1 Path Calculation



FCC regulations allow for up to 36dB_i effective isotropic radiated power (EIRP). The sum (in dBm) of the transmitted power, the cabling loss, and the antenna gain cannot exceed 36dB_i.

Assuming adequate antenna heights, a basic formula to determine if an adequate radio signal path exists (i.e. there is a reasonable fade margin to ensure reliability) is:

Fade Margin = System Gain - Path Loss

where all values are expressed in dB.

As discussed on the previous page, a desired fade margin is 20dB.

System gain is calculated as follows:

System Gain = Transmitter Power + (Transmitter Antenna Gain - Transmitter Cable and Connector Losses) + (Receiver Antenna Gain - Receiver Cable and Connector Losses) + | Receiver Sensitivity |.

where all values are expressed in dB, dBi, or dBm, as applicable.

Assuming a path loss of 113dB for this example, the fade margin = 143-113 = 30dB.

30dB exceeds the desired fade margin of 20dB, therefore this radio communications link would be very reliable and robust.

On the following page are examples of actual path loss measurements taken in an open rural environment; the path loss numbers do not apply to urban or non-LOS environments.

Example:

Tx power = 30dBm
Tx antenna gain = 6dBi
Tx cable/connector loss = 2dB
Rx antenna gain = 3dBi
Rx cable/connector loss = 2dB
Rx sensitivity = -108dBm

$$\begin{aligned}\text{System Gain} &= [30+(6-2)+(3-2)+108]\text{dB} \\ &= [30+4+1+108]\text{dB} \\ &= 143\text{dB.}\end{aligned}$$



6.0 Installation



To satisfy FCC radio frequency (RF) exposure requirements for mobile transmitting devices, a separation distance of 23cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at less than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.



Never work on an antenna system when there is lightning in the area.

Distance (km)	Master Height (m)	Remote Height (m)	Path Loss (dB)
5	15	2.5	116.5
5	30	2.5	110.9
8	15	2.5	124.1
8	15	5	117.7
8	15	10	105
16	15	2.5	135.3
16	15	5	128.9
16	15	10	116.2
16	30	10	109.6
16	30	5	122.4
16	30	2.5	128.8

Table 6-1: Path Loss

6.2 Installation of Antenna System Components

The installation, removal, or maintenance of any antenna system components must be undertaken only by qualified and experienced personnel.

6.2.1 Antennas

The two most common types of antenna are the omnidirectional ('omni') and directional (Yagi).

An **omni** typically has 3-6dBi gain and spreads its energy in all directions (hence the name 'omnidirectional'). The 'pattern' of the energy field is in the shape of a donut, with the antenna mounted vertically at the centre. This vertical-mounted antenna produces a signal which is vertically 'polarized'.

A **Yagi** has a more focused antenna pattern, which results in greater gain: commonly, 6-12dBi. The pattern of a Yagi is in the shape of a large raindrop in the direction in which the antenna is pointed. If the elements of the Yagi are perpendicular to the ground (most common orientation) the radiated signal will be vertically polarized; if parallel to the ground, the polarization is horizontal.

The network topology, application, and path calculation are all taken into consideration when selecting the various antenna types to be used in a radio network deployment.

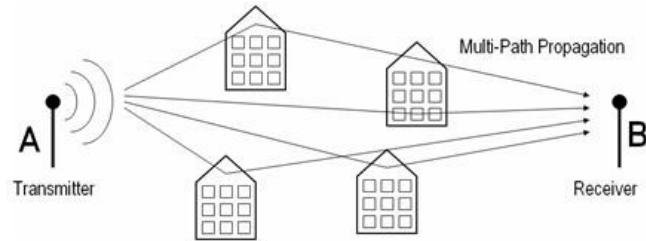
6.0 Installation

6.2.2 2X2 MIMO Antenna Selection, Placement & Orientation

For optimal performance of the pMDDL modems one must consider and plan for the specific application and environment where the pMDDL modules will be used. Described below are some of the considerations that must be taken into account while using pMDDL modems.

Multipath Environments

A multipath environment is where the signal from origin to destination may not have a direct path as seen in the illustration below:



In a multipath rich conditions is it recommended that each pMDDL end have a pair (2) of omnidirectional antennas that have at least half-wavelength distance between them. A set of (4) Omni-directional antennas is good for a pair of pMDDL radios.

The wavelength* is determined by the specific frequency being used by the pMDDL. For example the length of a wavelength @ 2.450 MHz is 122 mm, therefore the half wavelength is 61 mm. This would mean that the pair of antennas on each pMDDL system would have to be spaced at least 61 mm apart.

** Refer to a wavelength calculator or antenna manufacturer for accurate wavelength calculations*

LOS (Line of Sight) Environments

In good LOS applications, where the main LOS signal is much stronger than other components, orthogonally polarized antennas on both radios will out perform other types of antennas in terms of spatial separation. With these types of antenna systems it is recommended to space each pair of antennas at least one or more wavelengths apart on each end of the system to achieve as much spatial diversity as possible.

- Circular polarized antennas (Left Hand Circular Polarization (LHCP) and Right Hand Circular Polarization (RHCP)) will work with circular polarized antennas (LHCP and RHCP) for best match.
- Circular polarized antennas (LHCP and RHCP) will work with linear orthogonal antennas (V-POL and H-POL) at about 3 db loss. This combination results in preferable performance for UAV applications as circular polarized antennas at GCS acquire adequate signal no matter what the UAV antennas' orientation change to.
- Linear polarized antennas (V-POL and H-POL) will work with linear orthogonal antennas (V-POL and H-POL) for best match.
- OMNI directional antennas work with OMNI directional antennas due to dimension & weight limitation, two antennas are one or more wavelengths apart .



Circular Polarized Antenna



Linear Orthogonal Antenna



OMNI Directional Antenna(s)

6.0 Installation



Direct human contact with the antenna is potentially unhealthy when a pMDDL is generating RF energy.

Always ensure that the pMDDL equipment is powered down (off) during installation.

6.2.3 Coaxial Cable

The following types of coaxial cable are recommended and suitable for most applications (followed by loss at 2.4GHz, in dB, per 100 feet):

- LMR 195 (10.7)
 - LMR 400 (3.9)
 - LMR 600 (2.5)

For a typical application, LMR 400 may be suitable. Where a long cable run is required - and in particular within networks where there is not a lot of margin available - a cable with lower loss should be considered.

When installing cable, care must be taken to not physically damage it (be particularly careful with respect to not kinking it at any time) and to secure it properly. Care must also be taken to affix the connectors properly - using the proper crimping tools - and to weatherproof them.



To comply with FCC regulations, the maximum EIRP must not exceed 36dBm.

6.2.4 Surge Arrestors

The most effective protection against lightning-induced damage is to install two lightning surge arrestors: one at the antenna, the other at the interface with the equipment. The surge arrestor grounding system should be fully interconnected with the transmission tower and power grounding systems to form a single, fully integrated ground circuit. Typically, both ports on surge arrestors are N-type female.

6.2.5 External Filter

Although the Pico Series is capable of filtering-out RF noise in most environments, there are circumstances that require external filtering. Paging towers and cellular base stations in close proximity to the pMDDL's antenna can desensitize the receiver. Microhard Systems Inc.'s external cavity filter eliminates this problem. The filter has two N-female connectors and should be connected inline at the interface to the RF equipment.



**Installation, maintenance,
and removal work must be
done in accordance with
applicable codes.**

Appendix A: Serial Interface

Module (DCE)	Host (e.g. PC)	Signal (DTE)	
1	DCD	→	IN Arrows denote the direction that signals are asserted (e.g., DCD originates at the DCE, informing the DTE that a carrier is present).
2	RX	→	IN The interface conforms to standard RS-232 signals, so direct connection to a host PC (for example) is accommodated.
3	← TX		OUT
4	← DTR		OUT
5	SG		
6	DSR	→	IN
7	← RTS		OUT The signals in the asynchronous serial interface are described below:
8	CTS	→	IN

DCD *Data Carrier Detect* - Output from Module - When asserted (TTL low), DCD informs the DTE that a communications link has been established with another device.

RX *Receive Data - Output from Module - Signals transferred from the pMDDL are received by the DTE via RX.*

TX *Transmit Data* - Input to Module - Signals are transmitted from the DTE via TX to the pMDDL.

DTR *Data Terminal Ready - Input to Module - Asserted (TTL low) by the DTE to inform the module that it is alive and ready for communications.*

SG *Signal Ground* - Provides a ground reference for all signals transmitted by both DTE and DCE.

DSR *Data Set Ready - Output from Module - Asserted (TTL low) by the DCE to inform the DTE that it is alive and ready for communications. DSR is the module's equivalent of the DTR signal.*

RTS Request to Send - Input to Module - A “handshaking” signal which is asserted by the DTE (TTL low) when it is ready. When hardware handshaking is used, the RTS signal indicates to the DCE that the host can receive data.

CTS *Clear to Send - Output from Module - A “handshaking” signal which is asserted by the DCE (TTL low) when it has enabled communications and transmission from the DTE can commence. When hardware handshaking is used, the CTS signal indicates to the host that the DCE can receive data.*

Notes: It is typical to refer to RX and TX from the perspective of the DTE. This should be kept in mind when looking at signals relative to the module (DCE); the module transmits data on the RX line, and receives on TX.

“DCE” and “module” are often synonymous since a module is typically a DCE device. “DTE” is, in most applications, a device such as a host PC.

Appendix B: Firmware Recovery Procedure

In event that your unit becomes unresponsive it may be required to perform a firmware recovery procedure outlined below:

1. Download and save firmware file in a local folder, for example C:\;
 2. Separate the PC from the network and set IP to static:

192.168.1.1
255.255.255.0

3. Connect PC Ethernet port to the Ethernet port of the modem to be recovered
 4. Start a ping on the PC

```
C:\>ping 192.168.1.39 -t  
Pinging 192.168.1.39 with 32 bytes of data:  
Request timed out.  
Request timed out.
```

5. Power cycle modem while pressing and holding CFG (Config) button;
 6. Release the CFG button when ping responded:

```
C:\>ping 192.168.1.39 -t  
Pinging 192.168.1.39 with 32 bytes of data:  
Request timed out.  
Request timed out.  
Request timed out.  
Reply from 192.168.1.39: bytes=32 time<1ms TTL=128  
Reply from 192.168.1.39: bytes=32 time<1ms TTL=128  
Reply from 192.168.1.39: bytes=32 time<1ms TTL=128  
Reply from 192.168.1.39: bytes=32 time<1ms TTL=128
```

Note, If ping responds as shown above, then you can probably recover the unit, please proceed. Otherwise, send the unit back for RMA.

7. Now use TFTP to push firmware file into the corrupted unit:

For example, on Windows 7 using following command line:

tftp -i 192.168.1.39 put pMDDL-v1_3_0-r1005.bin (use the filename saved).

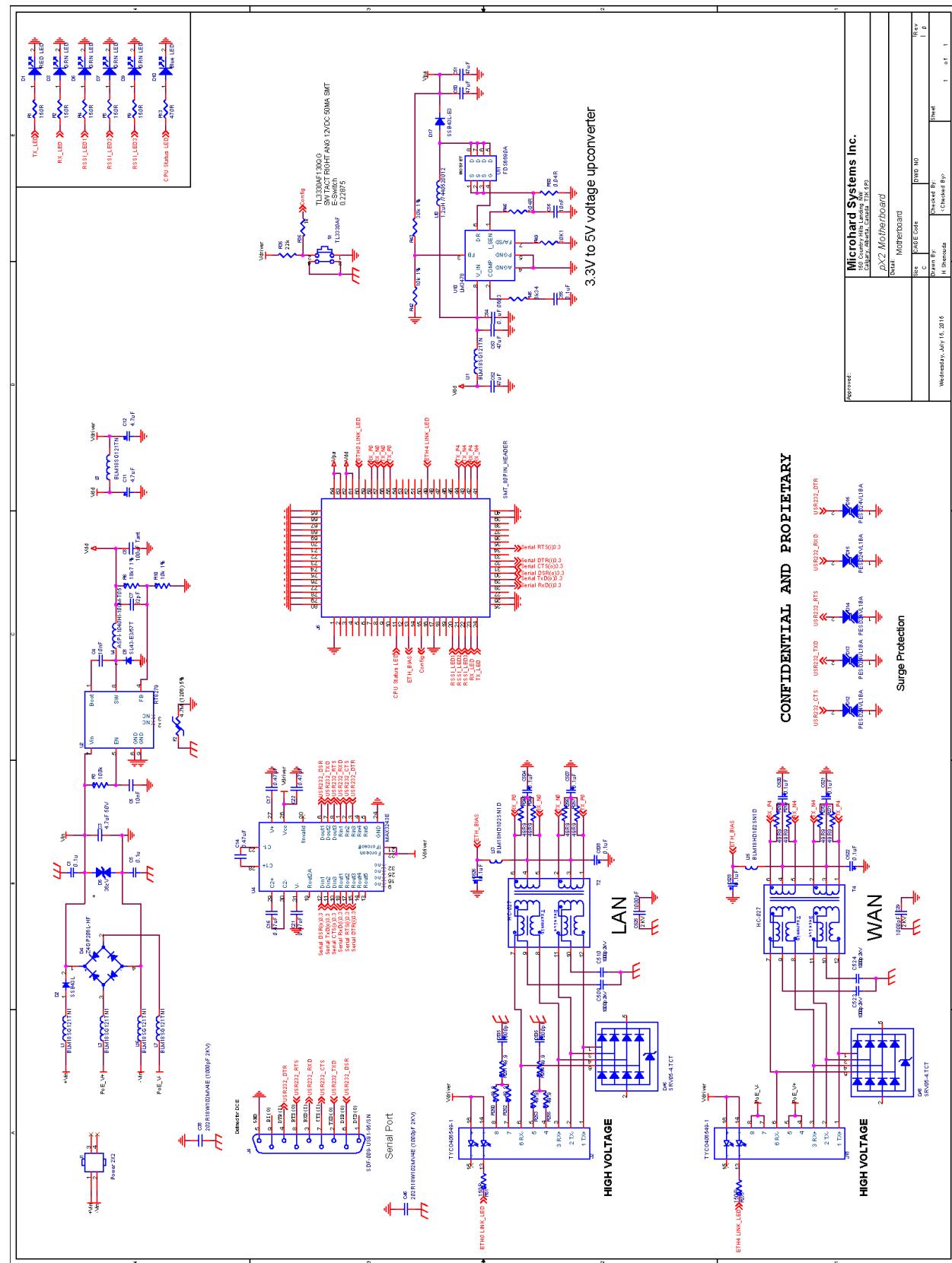
8. Wait until above command to successfully transferred the image, similar message should show

Transfer successful: xxxxxxx bytes in 5 seconds, nnnnnnn bytes/s, note the number might change for different firmware file

Note, if you see message above, the unit will re-flash itself and reboot, otherwise call for help or send back for RMA.

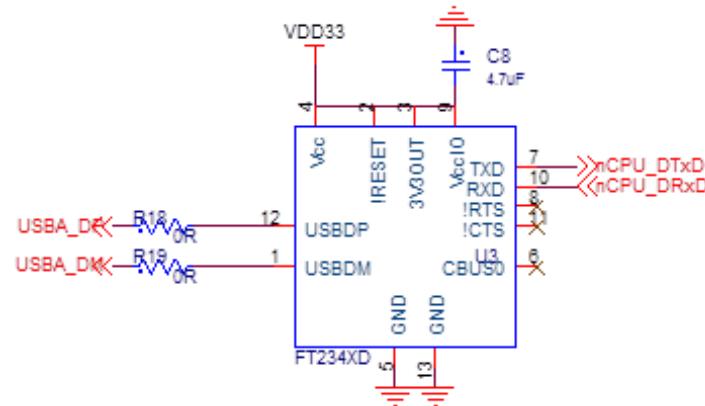
9. Wait for the unit to recover and reboot.

Appendix C: Sample Interface Schematic



Appendix D: Serial Port Extension

The pMDL can support a second serial port by utilizing a FT234XD USB to serial UART interfaced to the USB lines of the pMDL. The sample circuit below shows how this is done.



Drawing App-D: FTDI USB to Basic UART



Appendix E: Troubleshooting

Below is a number of the common support questions that are asked about the pMDDL. The purpose of the section is to provide answers and/or direction on how to solve common problems with the pMDDL.

Question: *What is the default IP Address of the pMDDL?*

Answer: The default IP address for the LAN is 192.168.168.1.

Question: *What is the default login for the pMDDL?*

Answer: The default username is **admin**, the default password is **admin**. You will be prompted to change the password as soon as you login using the default.

Question: *How do I reset my modem to factory default settings?*

Answer: If you are logged into the pMDDL navigate to the System > Maintenance Tab. If you cannot log in, power on the pMDDL and wait until the modem complete the boot up process. Press and hold the Config button for 8 seconds to reset to a factory default Master.

Question: *I connected a device to the serial port of the pMDDL and nothing happens?*

Answer: In addition to the basic serial port settings, the IP Protocol Config has to be configured. Refer to the COM0/1 Configuration pages for a description of the different options.

Additional topics will be added in future releases.



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pMDDL



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