adaptiveRF

expertise in wireless design

IMPL-10
Wireless IP Bridge
User Guide

June 2008

Contents

Disclaimer

This User Guide is intended as an aid the user and as such the content is for information only. adaptiveRF Ltd assumes no liability for any errors or inaccuracies it may contain. This document is subject to change without prior notice.

Package Contents

The following items are included in the kit:

- IPML-10 OFDM Wireless IP Bridge (IP MODEM)
- Vertical Stand
- Universal Power Adaptor
- Right Angle 2dBi Diplole Antenna
- Ethernet Cable
- User Guide

Introduction

The adaptiveRF IPML-10 introduces new capabilities for simple and effective wireless data transmission and streaming applications.

Although aimed at professional wireless streaming applications, the IPML-10 provides all the normal networking features usually associated with a wired LAN.

Key features of the IPML-10 are:

- Units are completely portable and provide good throughput data rates close to range limit.
- All units are identical… each unit auto-configures to perform Master, Client and Repeater roles
- Plug and Play… units communicate on power-on. Simple configuration tool configures all networked units at once for security purposes.

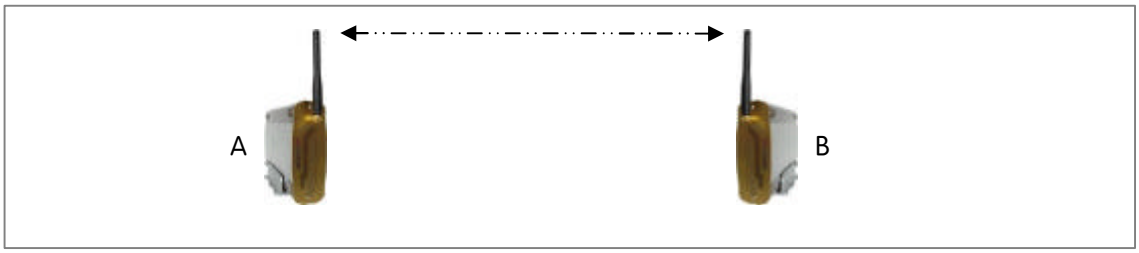
adaptiveRF Ltd can adapt the radio to provide customer specified frequencies and bandwidths.

Topologies Supported

Three types of network topologies are supported without need for any administration from the user.

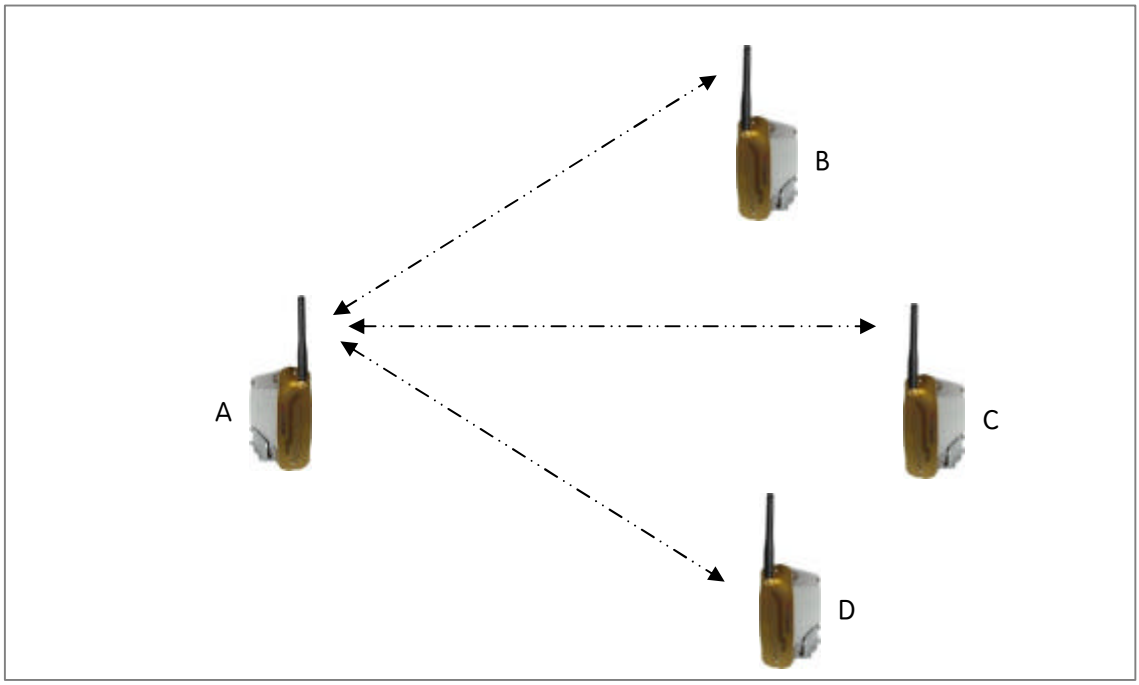
1. Point to Point

Typical application: Relay bidirectional Ethernet traffic between points 'A' and Point 'B'.



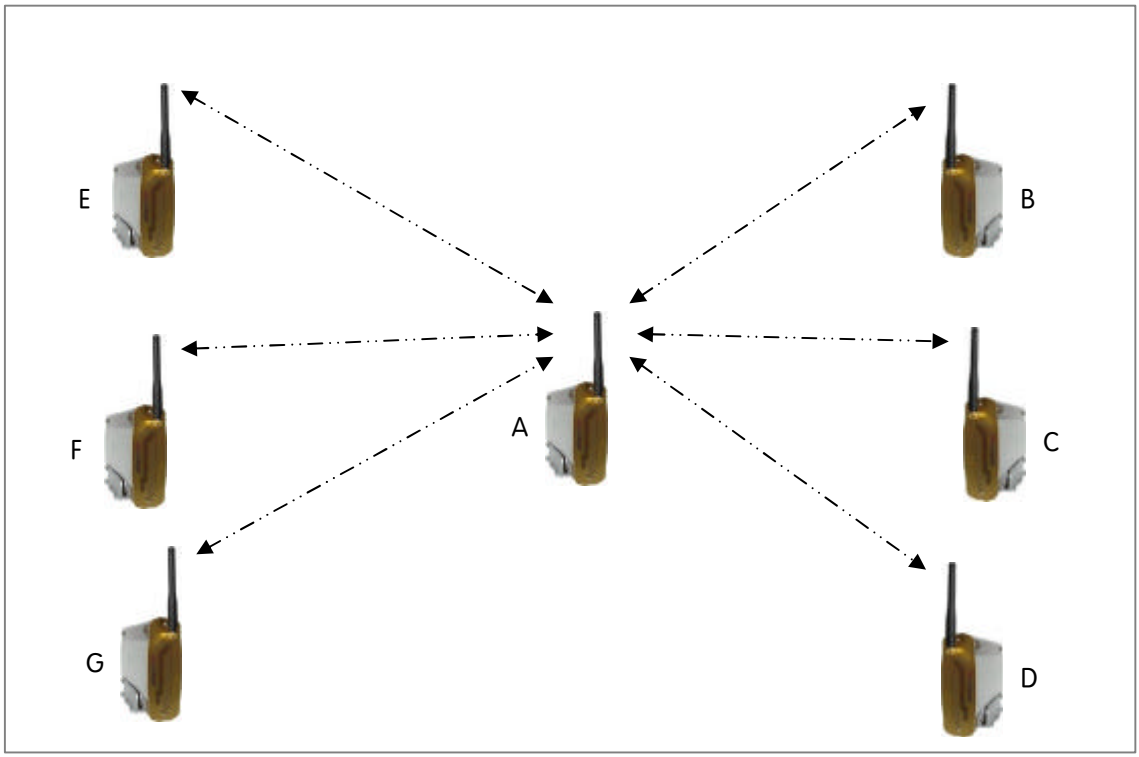
2. Point to Multi-point

Typical application: Unit A set as a fixed Master and connected to the wired network. Units B, C and D at remote sites have PZT IP cameras attached.



3. Repeater

Units E, F and G are out of wireless range with Units B, C and D. Unit A acts as a repeater to complete the wireless network.



Features

- Plug and Use Setup
- Long Range — >> 1km Line of sight (using suitable antennas)
- OFDM Modulation with real data throughput up to 20 Mbps (10MHz bandwidth)
- Powerful error correction provides maximum robustness in any environment
- IEE 802.3 10/100BASE-T Ethernet
- Integrated 802.1D Ethernet Bridge for Repeater coverage extension
- 4 pre-programmed channel Frequencies (others on request)
- Programmable channel bandwidths (on request)
- Security using Network Name, Encryption Key - Hardware 168-bit 3DES Encryption
- Unit and Packet Prioritisation — 802.1p, ToS
- Connected Link and Status LEDs
- Built-in Rechargeable Battery and charger for truly portable operation
- Auxiliary power output for external IP camera, router, or other equipment

Description

The IPML-10 is an IP-based Wireless Bridge which provides a compact and portable solution to reliable wireless networking. The IPML-10 is primarily designed for use with IP-based surveillance cameras but can easily function to complement and complete IP networks.

The integrated rechargeable battery allows the IPML-10 to provide up to 2hrs of fully-portable usage. Charge control is also integrated into the unit and the battery will automatically charge when the AC power adapter is connected to the unit.

Using industry-recognised OFDM modulation the IPML-10 is ideal for operation in near and non-line-of-sight environments.

The IPML-10 can be used in various size system configurations and is scalable from simple point to point operation, to up to 31 units distributing data across multiple virtual networks.

Each unit is identical and upon power-up a Master unit is automatically assigned (Auto Master). If desired a Fixed Master controller can also be manually assigned.

Power Management

A rechargeable nickel metal hydride (NiMh) battery is integrated into the unit. Charging and power management is microprocessor controlled to ensure maximum battery life and efficient operation.

The battery charges If necessary when 12V dc is applied to the dc in connector. The current drawn by the internal circuitry from the 12V supply is limited to 2A. This means that the battery will charge fastest when the IPML-10 is switched off. Typical recharge time is 3 hours.

The battery warning LED begins to flash when the battery needs recharging. If the battery becomes fully discharged the unit switches off to prevent further discharge and damage to the battery. Re-connecting the power resumes normal operation and allows the battery to recharge. The battery warning LED will remain on until the battery recovers to a sufficient level.

The charge LED will flash when the battery is being charged. The flash rate is proportional to the charging current. Intelligent charge termination ensures the battery is safely charged at the maximum appropriate rate. Once fully-charged the battery is kept in a top-off state. If the battery capacity is between 80 and 100% the charge LED will be on.

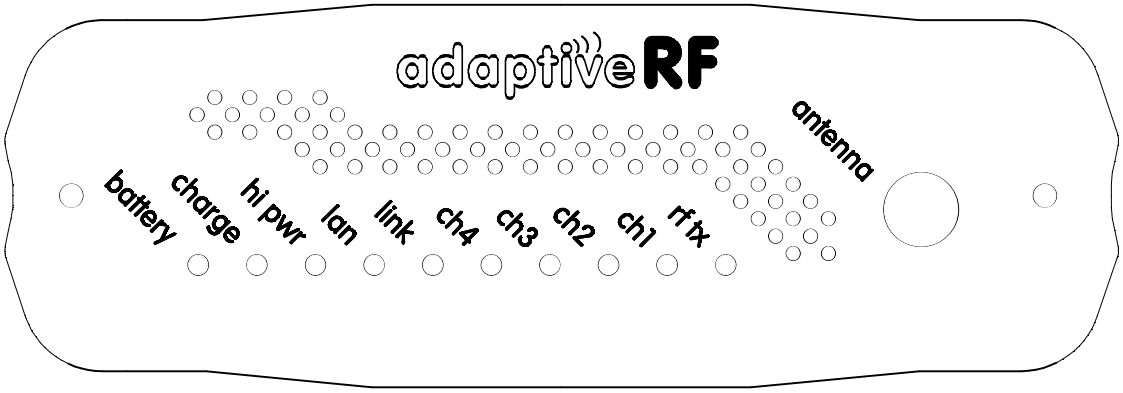
Physical

The IPM-10 is a compact unit which can be mounted both horizontally and vertically. A stand is provided for mounting the unit vertically.

Dimensions L 209 x H 122 X W 43mm excluding SMA connector

Front Panel

The front panel provides status indication LEDs and an SMA RF Jack Socket for antenna connection.



Front Panel LED Functions

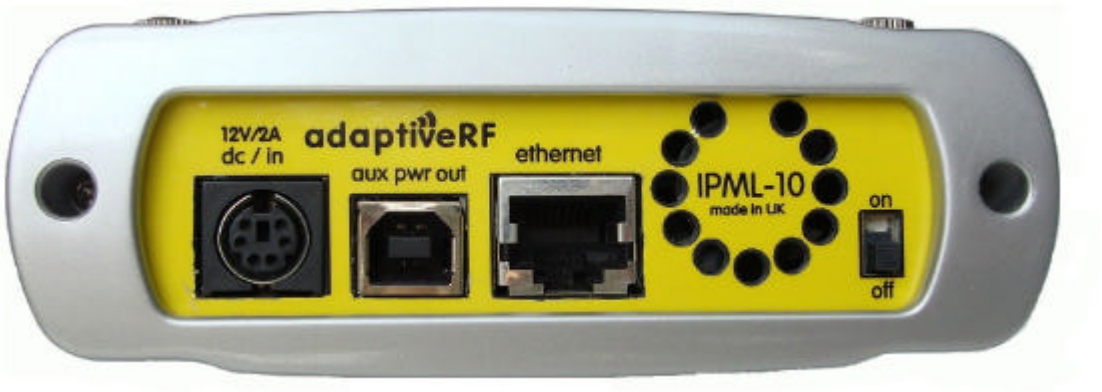
Name	Function	Description
battery	Battery Low	Flashing on = shutdown imminent… re-charge now Solid on = shutdown… re-connect the power supply to recharge
charge	Charge State	Solid on = 80 — 100% charged state Flashing = charging (flash rate is proportional to charge rate)
hi pwr	Transmit Power	Indicates transmit high power (normal) mode
lan	LAN Connected	10/100 ethernet connected. Flashes to indicate data
link	Link State	Radio link established (in full communication with other unit(s))
ch4	Selected Channel	Solid on = ch4 selected
ch3	Selected Channel	Solid on = ch3 selected
ch2	Selected Channel	Solid on = ch2 selected
ch1	Selected Channel	Solid on = ch1 selected
rf tx	TX On/SYNC	RF transmitter "on". Strobing indicates synchronisation to the network

Flashing indicates radio fault

AC Adapter

The IPML-10 is supplied with a universal AC power adapter suitable for supplying power for the unit and charging the battery. An IEC type connector allows a country specific mains lead to be used.

Rear Panel



Rear Panel Connections

Connector	Description
dc / in	12Vdc (2A Max)
aux pwr out	+5v dc @1A (max) for external camera etc
ethernet	10/100 Ethernet port
on/off	on/off power switch

Power Switch

Off + AC Adapter connected:
The IPML-10 is switched off. The battery will charge if necessary.

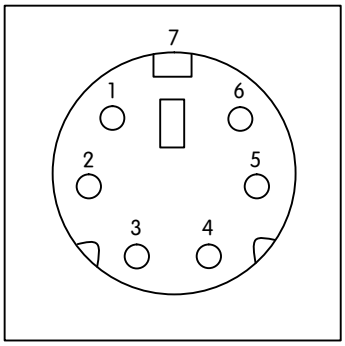
Off + AC Adapter not connected:
The IPML-10 is switched off.

On + AC Adapter connected:
The IPML-10 is switched on, regardless of the battery condition. The battery will charge if necessary.

On + AC Adapter not connected:
The IPML-10 is switched on if the battery is sufficiently charged.

DC / In

The DC in connector is a Din 6 way type socket. The pinouts are shown below:



Pinouts Viewed From Rear

Pin 1	**N/C**
Pin 2	**N/C**
Pin 3	**+12V in**
Pin 4	**+12V in**
Pin 5	**GND**
Pin 6	**GND**
Pin 7	**GND**

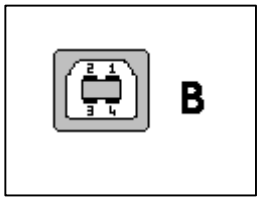
Aux Pwr Out

An auxiliary power output is available for powering such things as IP cameras, hubs and routers. This output provides +5V dc at up to 800mA. The output is via a USB type 'B' connector.

The auxiliary supply is by default internally generated and actively controlled with the on / off switch. In this case the supply is also active when running from the internal battery.

The supply can optionally be through fed from the supplied external power adapter by repositioning an internal link. In this case the supply is only available when the external adapter is plugged in, but an increased output current of 2A is available.

Auxiliary Power Connector – viewed from rear of IPML-10



Pin-Outs

Pin 1	**+5V**
Pin 2	**N/C**
Pin 3	**N/C**
Pin 4	**GND**

Pin-out for the Aux power pins is the same as a standard USB B type connector.

A suitable mating connector is the Assmann A-USBPB-R available from Digikey (AF1078-ND)

Ethernet

The RJ45 Ethernet connection provides 10/100 Ethernet Port for data transport and administration purposes. Although 10Mbit Ethernet connections are also supported, connections of this type will limit the maximum data throughput.

Configuration

IPML-10 units set in the delivery state are Plug and play: i.e. on power-up they can communicate with each other. The only required user settings are for security purposes:

- To prevent reconfiguration of the units by assigning an Admin Password
- To isolate different networks from each other using a Network Name
- To encrypt the data in each network using an Encryption Key

Only units with same Network Name and Encryption Key can communicate with each other.

Delivery Settings

The following are the delivery settings for the IPML-10:

Setting	Value	Comment
Password	adaptiveRF	Configuration password
Network Name	adaptiveRF	Case Sensitive should be set for security
Encryption	off/no key	Should be set for security purposes
Unit Priority	2	All units have equal priority
Packet Prioritisation	none	All services have equal priority

IPML-10s are configured using the provided Windows™ configuration utility. This provides a means of setting up the Network Name, Encryption Key and Priority Settings.

The units may be configured individually or together when in the same network. Once a network of devices has been created, new IPML-10s can only be added to an existing network by running the tool locally via the on the units' wired Ethernet port, or resetting the whole network to its delivery state, then re-configuring the network.

Set-up Procedure

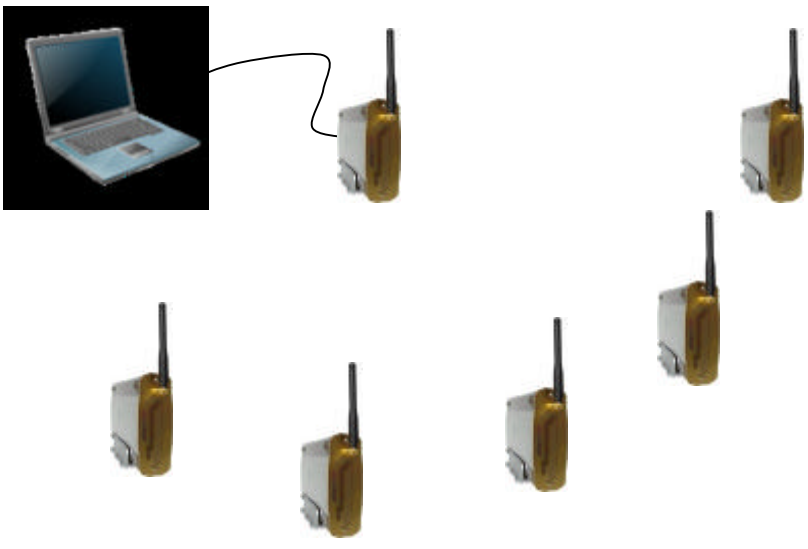
Each IPML-10 must have the same Network Name if it is to communicate on the same network. IPML-10s with different network IDs can not communicate with each other. Co-located units on the same RF channel will lock to each other for synchronisation purposes, but will not communicate although their bandwidths will be shared.

It is suggested to follow the following procedure in order to prepare the units for first use:

- Unpack and check all contents present.
- Connect antenna or 50 Ohm load to antenna port.
- Ensure unit under test on/off switch is in the 'off' position.
- Connect mains adapter. (Unit may start to charge).
- Connect Ethernet cable between unit under test and P.C / router / hub.
- Install the configuration tool and WinPcap.
- Switch on the IPML-10 units to be configured in the same network.
- Run the configuration tool to set the parameters for the IMPL-10 network.
- Verify operation.
- Use the configuration tool to modify priority settings if required.
- Verify operation.

Please note that in addition to a maximum wireless range, that there is also a minimum distance allowed between each unit, which is dependent upon antenna types used. This is only likely to be an issue during configuration, or when the units are in close proximity (<10M). If operating the units in close proximity then it is advised to fit 20dB attenuators in-line with the antenna.

Set-up for configuring IPML-10 Units

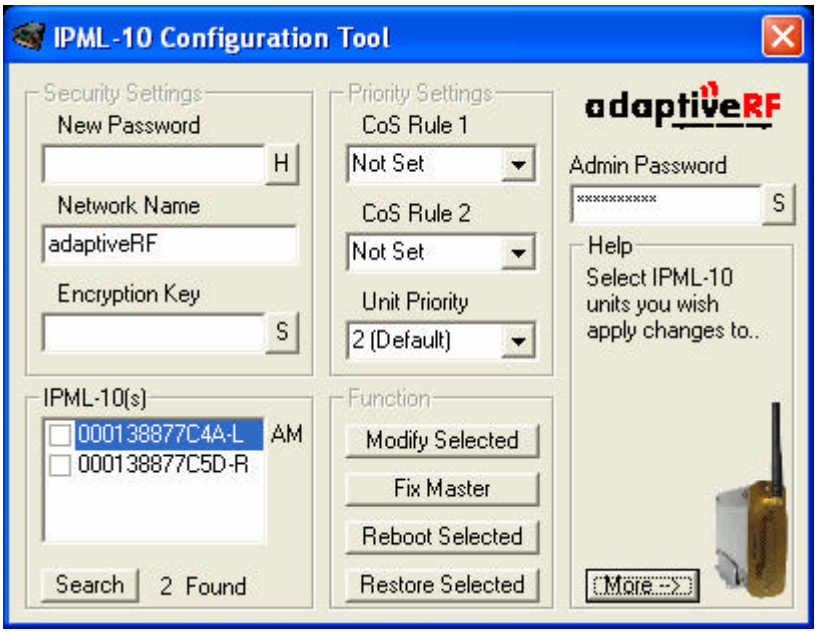


Installation of the configuration tool

Insert the IPML-10 CD into one of the CD-ROM drives on the computer connected to your router. The CD should start automatically. If the installation menu doe s not appear, or you are installing from another location, browse the installation folder and run the autorun.exe file

Install the IPML-10 Configurator and WinPcap from the launcher.

Run the IPML-10 Configuration Tool. The tool should look similar to this;



Configuration Procedure

Although in their default configuration the IPML-10 units are 'plug and use', it is advisable to change the default security settings.

Ensure that all IPML-10s to be configured are switched on and that the blue link LEDs are on.

Click on the "Locate IPML-10s" button to find the IPML-10 units in your network. Enter the Admin Password for the local IPML-10 when requested. The delivery Admin Password has been set to "adaptiveRF"

Please note the following important rules:

1. The MAC addresses of all units which are in wireless range of the local (L) IPML-10 will be found.
2. Modifications can only be made to those units which share the same Network Name and Encryption Key.
3. Block modifications can only be made to units which share the same Admin Password.
4. If the same modifications are being made to units individually, then modify the Local (-L) listed unit last, otherwise certain modifications to the local unit can cause the connection to fail.
5. Units with identical network names but different encryption keys will indicate link connected, but will not be able to communicate.
6. If you forget the Admin Password, the unit will need to be returned for re-programming.

Providing the units are in the delivery state, they will communicate with each other and can be block modified.

Security Settings

Admin Password

The Admin Password prevents unauthorised changes to be made to each IMPL-10. Setting a common Admin Password for each network allows block functions to be used. Change the Admin Password as follows:

- Select all the IPML-10 units to which the modifications should be applied.
- Enter the new Admin Password into the "New Password" text box.
- Click the "Modify Selected" button to make the action the change, or wait until all desired changes have been made.

Network Name

The Network Name isolates different groups of IMPL-10 from one another. Units with different network names cannot communicate with each other, but may share the same bandwidth and act as repeaters for other networks on the same RF channel. Change the Network Name as follows:

- Select all the IPML-10 units to which the modifications should be applied.
- Enter the new Network Name into the "Network Name" text box. (Max 20 Alpha-Numeric characters)
- Click the "Modify Selected" button to make the action the change, or wait until all desired changes have been made.

Encryption Key

The Encryption Key together with the Network Name is used for the hardware based 3DES encryption engine. When an Encryption Key is set, all wireless payload data is 3DES encrypted. Only IPLM-10 units using the same Encryption Key are able to decrypt the data. This makes for a very secure link. (3DES data encryption is defined in ANSI X9.5). Set the Encryption Key as follows:

- Select all the IPML-10 units to which the modifications should be applied.
- Enter the new encryption key into the "Encryption Key" text box. (Max 24 Alpha-Numeric characters)
- Click the "Modify Selected" button to make the action the change, or wait until all desired changes have been made.

Note: A Blank Encryption entry disables Encryption. Try to choose encryption keys which are difficult to guess and longer than 6 characters.

Priority Settings

Class of Service (CoS) Rules

This allows the selection of 2 rules for classification of different traffic types. Currently it is possible to prioritise traffic based on UDP, TCP and 802.1p. Rule 0 has a higher priority than Rule 1. If neither of the rules is matched, then the value set in the Unit Priority field will be used. The CoS Rules are set as follows:

- Select the IPML-10 units to which the modifications should be applied.
- Use the "CoS Rule n" drop-down control to set the desired traffic classification.
- Click the "Modify Selected" button to make the action the change, or wait until all desired changes have been made.

Unit Priority

Unit Priority allows 7 different priorities (0 to 6) to be set for traffic transmitted by each IPML-10 unit over the wireless link. Units with a numerically lower Unit Priority setting have a higher priority for transmission than units with a numerically higher setting. The Unit Priority value can be changed as follows:

- Select all the IPML-10 units to which the modifications should be applied.
- Use the "Unit Priority" drop-down control to set the desired Unit Priority.
- Click the "Modify Selected" button to make the action the change, or wait until all desired changes have been made.

Specifications

Ethernet Port
Connector: RJ-45 X 1
Standards supported: IEEE 802.3, IEEE 802.3u
10/100 BaseT Auto-sense and MDI/MDX support

Radio
OFDM, 512 Carriers (10MHz B/W)
Flexible frequency configuration
Throughput with TCPIP data: up to 20Mbps

Security
Configuration Password
Network Name
Mixed DES/3DES Encryption

Supported Protocols
IEE 802.1D Spanning Tree Protocol (STP)
802.1Q VLAN
Quality of Service (QoS)

Environmental
Operating temperature 10 ~ 40 degrees Celsius
Relative humidity 0 ~ 90% (non-condensing)

Note: Specifications are subject to change without notice.

Parameter	MIN	TYP	MAX	UNITS	NOTES
RF operating frequency range	1200		1400	MHz	see default freq table
Modulation b/w		10		MHz	
TX o/p power		250		mW	
Rx Sensitivity		-82		dBm	to maintain sync
LOS range		1km			with dipole antennas
Operating Voltage	10	12	14	Volts (dc)	
Operating Current		1000	1900	mA	current limited depends on charge state
Aux power output current @5V			1000	mA	
Spurious Emissions RF Port			-57	dBm	
Frequency Stability		+/-2.5		ppm	(-10 to +40°C)
Operating Temperature	+10		+40	°C	
Weight		1.5		Kg	with rechargeable batteries
Dimensions	W = 44	L = 208	H =122	mm	excluding length of SMA connectors

Approvals

Approval pending to ETSI EN 300 440-1

Channel Selection

The units are shipped with a 1394MHz Dipole antenna which is suitable for use on channel 1.
It is also possible to select an additional 3 pre-programmed channels. If operation on channels 2, 3 or 4 is required an alternative antenna must be used.

Please contact adaptiveRF Ltd with your frequency requirements and for further information.

Note:	Any 4 channel frequencies in the 1200-1400MHz range can be programmed on request.