M4-2000
User Guide

Release 2.0 – November, 2017

Table of Contents

1 Introduction

This document describes the installation, configuration and management of the Kwikbit M4-2000 point-to-point Non-Line-of-Site (NLoS) wireless bridge.

It is intended for wireless system planners, installers and managers.

2 Abbreviations

ATPC	Automatic Transmit Power Control
BH	Backhaul
CINR	Carrier to interference and noise ratio
CLI	Command Line Interface
LAN	Local area network
LoS	Line-of-sight
MAC	Media Access Control
MIMO	Multiple in multiple out
MSL	Mobile Street Link (trailered test endpoint)
NLoS	Non-line-of-sight
nLoS	Near-line-of-sight
PtP	Point-to-point
PoE	Power over Ethernet
PSU	Power supply unit
RAN	Radio access network
SNR	Signal to noise ratio
SoC	System on a chip
TDD	Time division duplexing
XPIC	Cross-polariztion interference cancellation

3 Regulatory Information

Caution

Do Not disassemble the product. There are no user serviceable parts inside. Contact Customer Service if the equipment needs servicing.

Changes or modifications not expressly approved by Kwikbit could void the user's authority to operate this equipment.

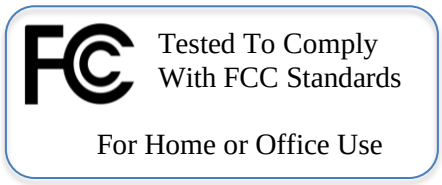
Declaration of Conformity for RF Exposure

This point-to-point wireless backhaul product has been found to be in compliance with the requirements detailed in the Code of Federal Regulations (CFR) Title 47 Section 1.1307 addressing RF Exposure from radio frequency devices as described in OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields. To maintain compliance, the minimum separation distance between the device and the general public is 20 inches (51 cm).

Professional Installation

Installation and servicing of Kwikbit products shall be completed by Professional Installation Personnel.

Manufacturers Federal Communication Commission Declaration of Conformity Statement



Manufacturer:

Kwikbit, Inc.
7801 E Bush Lake Rd STE 300
Minneapolis, MN 55439
USA

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.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

4 M4-2000 point to point system description

This chapter provides description of the Kwikbit M4-2000 system. This includes the system components, their functions and typical deployment.

4.1 System purpose and key features

The Kwikbit M4-2000 system provides for Ethernet bridge connectivity over a point-to-point wireless link utilizing Sub 6 GHz spectrum. The system operates as an OSI layer 2 (Data Link) transparent Ethernet switch, connecting the Ethernet ports between a pair of units with a wireless data link.

The key features of the system are:

- Operation in NLoS, nLoS and LoS conditions
- High-performance, utilizing advanced Single Carrier FDMA transmission techniques with adaptive modulation and coding
- Carrier aggregation supporting two radio modules
- Radio options for both licensed and unlicensed frequencies
- Interference management
- Low latency TDD operation: 1ms frame duration
- Dynamic uplink to downlink ratio
- High spectral efficiency
- Ethernet and IP header compression for throughput enhancement
- Out of band management capability through a dedicated Ethernet port
- Compact, weatherproof unit with integrated antenna
- Simple installation, configuration and management with embedded web, SNMPv3, CLI and syslog

4.2 System components

The M4-2000 consists of a main board and two radio boards. The main board contains an Ethernet switch device along with the Qualcomm DAN3200 network processor. Each radio employs a MIMO antenna system with separate horizontal and vertical polarizations. The dual radio system operates with radio 1 initially connecting and synchronizing link timing before establishing the radio 2 link.

Once connected, bearer plane data from the data ports is distributed evenly between the dual radio links.

4.3 Product Specifications

4.3.1 Network Specifications

Aggregate capacity	Up to 900 Mbit/sec
Ethernet frame size	Up to 2,048 bytes
Ethernet frame type	Transparent bridging of all Ethernet types
In-sequence delivery	Guaranteed

Latency	Sub 1 ms TDD
L2 switching	Layer 2 switching with MAC learning, tagged frames supported
QoS	Classification via IPv4 or IPv6 DSCP field or 802.1p Ethernet tag priority field
Timing	GPS and internal independent timing
Header compression	Proprietary algorithm, Ethernet and IP header

4.3.2 RF Specifications

Frequencies	5 GHz radio module: 5.15 - 5.250 GHz and 5.725 - 5.850 GHz
Bandwidth	10, 20 and 40 MHz channel bandwidths
Output power (maximum)	5 GHz: up to 27 dBm, depending on local regulations
Antenna System	Dual, integrated, 2x2 MIMO antennas (16dBi @ 5GHz)
Duplex	TDD: manually configured, or dynamic based on uplink/downlink utilization TDD ratio in 1% increments from 30% to 70% F-TDD: in 5 GHz band system automatically selects different channels on each side of link to avoid interference
Modulation	SC-FDMA with per antenna adaptive modulation and coding: QPSK (1/4, 1/2, 3/4), 16QAM (1/2, 3/4), 64QAM (4/6, 5/6), and 256QAM (6/8, 7/8)
ATPC	Transmit power set automatically per antenna
TDD Timing	Internal, GPS (built-in)
Maximum Range	Auto ranging up to 20 km

4.3.3 Physical Specifications

Configuration	Single-piece outdoor unit with 2 internal radio modules
Ethernet Ports	2 data ports 1 management port
Power	Power over Ethernet via management port or first data port
Dimensions (H x W x D)	292 x 292 x 65 mm 11.5 x 11.5 x 2.5 inches
Weight	3.6 kg / 8 lbs

Operating temperature	Full sun (solar shield optional) -30 to +55C. Power output reduction is allowed over +45C ambient
Humidity	10-90% condensing
Ingress protection	IP-67 with connectors mated or IP-66 and NEMA4X compliant with corrosion resistance of 720hr salt fog per ASTM B117
Vibration	Swept: 5G, 20-500 Hz, one octave per minute, 30 minutes each orientation. Random: 0.008G2 for 10 Hz to 300 Hz and 0.0012G2 for 300 Hz to 500 Hz, 30 minutes per orientation
ESD	IEC EN 61000-4-2
EMC	IEC EN 61000-4-3

4.3.4 Unlicensed Radio Performance

The following table provides the maximum transmit power, per polarization, and nominal receive sensitivity of the hardware, with 10, 20 and 40 MHz channel bandwidths.

Modulation Format	MCS level	Max Transmit Power (dBm)	Receiving Sensitivity (dBm) 10 MHz	Receiving Sensitivity (dBm) 20 MHz	Receiving Sensitivity (dBm) 40 MHz
QPSK 1/4	0	24	-97.0	-94.0	-91.0
QPSK 1/2	1	24	-89.5	-86.6	-83.7
QPSK 3/4	2	24	-87.1	-84.5	-81.5
16QAM 1/2	3	24	-85.0	-82.1	-79.5
16QAM 3/4	4	24	-82.0	-78.8	-76.0
64QAM 4/6	5	24	-77.6	-75.1	-72.8
64QAM 5/6	6	24	-72.6	-69.5	-66.2
256QAM 6/8	7	24	-69.8	-66.7	-63.5
256QAM 7/8	8	24	-67.1	-64.0	-60.7

Table 3.2.4 – 5 GHz Radio Performance

4.4 Typical system deployment

The M4-2000 system consists of two units, primary and secondary. The two units are identical hardware and software and differ only by configuration. Configure the units to 10MHz, 20MHz or 40MHz channel bandwidth. The units operate in TDD mode with the primary unit controlling the link. A typical system deployment would be to provide connectivity between two segments of Ethernet LAN. These scenarios include:

- Backhaul connectivity to RAN base stations including 3G, 4G LTE and WiFi
- Enterprise LAN connectivity between buildings
- Fiber network extensions

Figure 3.3 – Typical Deployment with Street Furniture Mounted Small Cells

4.5 The M4-2000 Unit

The M4-2000 unit is an integrated unit containing an internal antenna, radio, modem and Ethernet switch powered by Power over Ethernet (PoE). The external interfaces to the unit are illustrated below in Figures 3.4.1 and 3.4.2 and listed in Table 3.4.3.

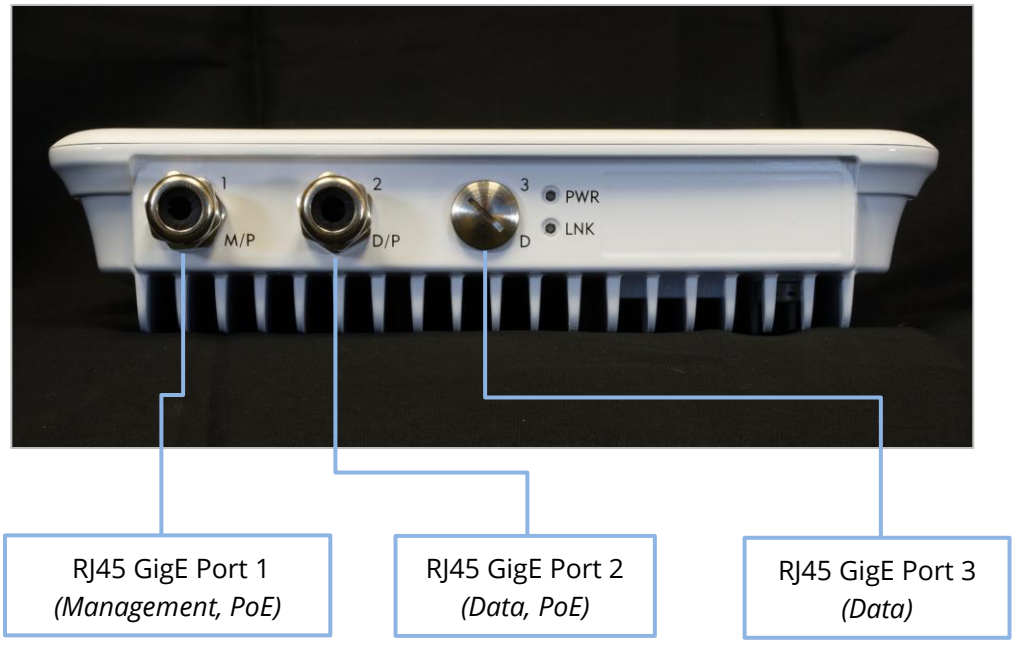


Figure 3.4.1 – M4-2000 interfaces

Figure 3.4.2 – M4-2000 ground stud

Interface	Description
Port 1	RJ45 Ethernet out-of-band management connector, to be connected to the Management network. This port may also be used for PoE
Port 2	RJ45 Gigabit Ethernet data plane connector. This port may also be used for PoE
Port 3	RJ45 Gigabit Ethernet data plane connector
Ground stud	Connected to ground for lightning protection (located on upper left of back side of unit in Figure 3.4.2)

Table 3.4.3 – M4-2000 Interfaces

4.5.1 Network connections

The M4-2000 unit features two GigE RJ45 connectors for data plane connectivity and one GigE RJ45 connector for out-of-band management.

4.5.2 Power connection

The M4-2000 unit is powered by IEEE 802.3at Power over Ethernet (PoE) via port one (management) or port two (data plane). The following table details power requirements by M4-2000 radio configuration.

M4-2000 Configuration	Avg. Power	Max. Power	PoE Requirement
Dual 5 GHz radios	34.0	46.0	PoE+ Type 2 Four Pair

4.5.3 GPS

The M4-2000 unit is equipped with an internal GPS receiver and antenna as an option for TDD timing of the airlink.

4.5.4 Mounting bracket

Figure 3.4.4 – M4-2000 Mounting Bracket

4.5.5 LED Status Indicators

The M4-2000 unit has two external indicator lights adjacent to GigE port three that will be illuminated in various patterns to show the internal operating state of the device. The Power (PWR) indicator light is green in color and when illuminated indicates that the unit is receiving power. The Link (LNK) indicator light will illuminate in either green or red per the following table:

	State	PWR LED Green	LNK LED Green/ Red
1	Power On	o	o
2	Boot sequence in progress	o	o
3	Boot sequence complete, cores are started, system is running	o	-
4	Primary: broadcasting Secondary: seek mode (i.e. scanning)	o	*
5	RF and data link established	o	o
8	Fault	o	*

- = LED off * = Blinking LED o = LED continuously lit

Table 3.4.5 – M4-2000 LED Status Indicators

4.6 Wireless Operation

The M4-2000 point-to-point wireless communication system consists of a primary unit and a secondary unit. They operate in a master / slave relationship, with the primary unit responsible for establishing Time Division Duplex (TDD) link timing while the secondary unit locks onto the downlink in order to synchronize the uplink properly.

The TDD frame duration is 1 ms, divided into separate uplink and downlink subframes. When the link starts, the ratio between uplink and and downlink is 50-50; once communication is established the ratio will change to either a configured fixed setting or else dynamically adapt to optimize for the throughput observed in each direction.

The TDD ratio ranges from 30% downlink to 70% downlink, in increments of 1%. The overall 1 ms TDD frame size results in low data transfer latency.

The system can operate over channel bandwidths of 10, 20 or 40MHz.

4.6.1 Carrier Aggregation

The M4-2000 system features carrier aggregation where two radios combine seamlessly into a single, large data pipe. The radios can operate in the same or different bands, licensed or unlicensed, but are required to use the same channel bandwidth and TDD ratio.

Each radio has separately configured transmit and receive frequencies. Normal configuration is a single frequency for radio 1, and a separate frequency for radio 2.

However, each radio can split the channel into separate downlink and uplink frequencies. This hybrid mode maintains the TDD channel turn-around alternating between uplink and downlink, but also alternates the transmit frequency between uplink and downlink.

Each of the dual radios is capable of hybrid TDD operation, with independently configured Transmit and Receive frequencies for each radio.

Bearer plane data is always distributed evenly between the two radios.

4.6.2 MIMO / XPIC operation

Each radio in the M4-2000 system operates in Cross Polarization Interference Canceling (XPIC) mode with dual data streams doubling the channel capacity.

4.6.3 Adaptive modulation and coding

Each M4-2000 unit adapts its modulation and coding level to maximize data throughput based on received signal quality.

Each receiver evaluates signal quality by measuring signal strength, signal to noise ratio, and the rate of corrected bit errors. The receiver feeds this information back over the air to its peer transmitter to optimize the modulation level used. The MCS level is continually adjusted on 1ms frame boundaries.

The system automatically switches between nine modulation and coding modes, indicated by number as shown

Level	Modulation / Coding scheme
0	QPSK 1/4
1	QPSK 1/2
2	QPSK 3/4
3	16QAM 1/2
4	16QAM 3/4
5	64QAM 4/6
6	64QAM 5/6
7	256QAM 6/8
8	256QAM 7/8

The most robust is MCS level 1, while the highest performance is level 8. The following tables illustrate maximum achievable data rates for a 5GHz M4-2000 system with different packet sizes and modulation and coding levels. These values include the additional throughput gained via header compression (see section 4.6.4).

M4-2000 Layer 2 Capacity: 5 GHz radios, 2 x 10 MHz

Packet Size	MCS 4 16QAM 3/4	MCS 5 64 QAM 2/3	MCS 6 64 QAM 5/6	MCS 7 256 QAM 3/4	MCS 8 256 QAM 7/8
64 byte	148.1	202.6	253.6	307.5	359.9
128	102.8	139.5	176.5	213.3	250.3
256	88.1	119.5	150.8	182.0	213.3
512	82.3	111.5	140.7	169.9	199.1
1024	79.6	107.9	136.2	164.5	192.7
1280	79.1	107.2	135.3	163.3	191.4
1518	78.8	106.8	134.7	162.7	190.7

Table 3.5.3a –M4-2000 throughput in Mbps running 2 x 5GHz radios with 10 MHz channels

M4-2000 Layer 2 Capacity: 5 GHz radios, 2 x 20 MHz

Packet Size	MCS 4 16QAM 3/4	MCS 5 64 QAM 2/3	MCS 6 64 QAM 5/6	MCS 7 256 QAM 3/4	MCS 8 256 QAM 7/8
64 byte	339.9	360.5	373.0	384.3	384.5
128	230.5	310.1	389.6	470.0	547.0
256	197.2	265.1	332.8	400.2	466.4
512	184.1	247.4	310.5	373.2	436.4
1024	178.2	238.6	300.7	361.6	422.8
1280	177.0	237.8	297.9	358.1	418.2
1518	176.2	235.9	297.4	358.1	418.4

Table 3.5.3a –M4-2000 throughput in Mbps running 2 x 5GHz radios with 20 MHz channels

M4-2000 Layer 2 Capacity: 5 GHz radios, 2 x 40 MHz

Packet Size	MCS 3 16QAM 1/2	MCS 4 16QAM 3/4	MCS 5 64 QAM 2/3	MCS 6 64 QAM 5/6	MCS 7 256 QAM 3/4
64 byte	365.3	387.1	401.5	397.2	353.3
128	301.1	459.6	608.1	673.1	730.4
256	257.7	392.1	527.3	660.5	795.0
512	240.1	366.4	492.4	616.7	742.0
1024	232.7	354.4	476.8	596.9	718.1
1280	231.2	351.2	473.5	593.2	713.5
1518	230.3	351.1	471.7	590.8	710.5

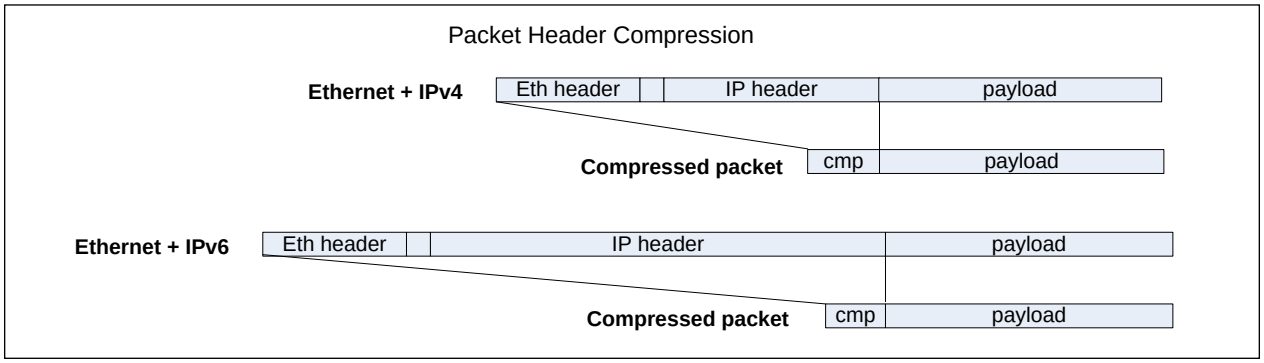
Table 3.5.3b –M4-2000 throughput in Mbps – 2 x 5GHz radios, 40 MHz channel bandwidth

4.6.4 Header compression

Header compression improves data throughput by reducing the number of bytes sent over the air. M4-2000's header compressor examines ingress packet flows and removes Ethernet and IP header bytes from continuous flows. The header de-compressor at the receiver then restores headers using previously cached values.

The header compression feature provides the following link enhancements:

- Ingress packet classification determines compression *profile* (example: IPV4, IPV6)
- Within each profile, flows are assigned a compression *context*. A new context is automatically established and runs as long as the flow is present. The context is discarded when the flow ends
- Up to 1024 contexts are supported
- Compression efficiency will vary. Best case:
  - IPV4: 34 bytes of Ethernet and IP header → 4 bytes compressed header
  - IPv6: 54 bytes of Ethernet and IP header → 2 bytes compressed header



The following table shows expected throughput enhancement, in percentage increased, for different size of Ethernet packets with IP payload:

Packet size in bytes	IPv4	IPv6
64	46.9%	78.1%
128	23.4	39.1
256	11.7	19.5
384	7.81	13.0
512	5.86	9.77
768	3.91	6.51
1024	2.93	4.88
1518	1.98	3.29

Table 3.5.4 – M4-2000 header compression enhancement by packet size

4.6.5 Configuration of Radio 1 Frequencies

Proper configuration of Radio 1 hailing channel is required in order for the nodes to connect.

Configure radio 1 (on both primary and secondary nodes) with DL (downlink) and UL (uplink) frequency.

On the primary node, the term “Downlink” refers to the radio transmitter, whereas on the secondary node the “Downlink” configuration applies to the radio receiver.

Use of the terms “Downlink” and “Uplink” (instead of “transmit” and “receive”) means both nodes share the same frequency configuration making it easier to compare configurations or switch roles.

Both primary and secondary nodes must have the same configuration for Radio 1 DL and UL frequencies in order for the link to connect. Radio 1 frequency configuration is referred to as the “hailing channel”, and serves as the starting point whenever either node restarts, or the link fails for any reason. If Dynamic Channel Selection is enabled (DCS described in a subsequent section) radio 1 will potentially move to alternate frequencies after its started. However the link will always start with radio 1 on the hailing channel. If DCS is disabled, then of course Radio 1 will remain on the hailing channel.

Unless you are working around a specific known interference issue at one location, its reasonable to use a single frequency for both DL and UL.

The frequency configuration is visible on the Web UI via

Configure → Radio Link → Radio 1 → L Frequency, UL Frequency

The corresponding SNMP configuration variables are in the first row of the `cfg58RadioTable`, the variables are

`cfg58RadioDLFrequency.1` and `cfg58RadioULFrequency.1`

The frequency value is entered as kHz with a resolution of 100 kHz.

The allowed range for radio 1 is show in the following table:

channel bandwidth	U-NII-1 band	U-NII-3 band
10 MHz	5160000 : 5245000	5735000 : 5845000
20 MHz	5160000 : 5240000	5735000 : 5840000
40 MHz	5190000 : 5230000	5755000 : 5830000

The radio frequency as configured will take effect *when the link is started.* After changing the frequency, you must manually restart the link in order to trigger the new configuration setting to take effect. For radio 1, the frequency must be configured on both the primary and secondary nodes. Once changed, both nodes thus require an administrative restart in order for the new configuration to take effect. Take special care to restart the remote end of the link first, before resetting the local end, in order to maintain connection over-the-air to the remote end.

Note that a loss of the link, due to RF path obstruction for example, and subsequent recovery will not trigger a configuration refresh; it is triggered only via administrative link toggle.

Link Toggle

Administrative toggle of the link (that is, turn it off, then on again) is required for various changes of configuration. Link toggle is automatic when changing frequencies via the Web UI. When the "submit" button is pressed, the link will automatically be stopped, then started.

Make sure to modify the remote end prior to changing the local end; that is, to change the hailing channel set it first on the secondary node at the remote end of the link and hit "submit". At this point, the changes will take effect and the link will go down (since the frequencies on the secondary node no longer match the primary node). Then change the local primary node and hit "submit". When the changes take effect, the link will be re-established.

Using an SNMP management station, the link toggle is accomplished via setting the following:

```
m4gNlosPtpControlAirlink.0 = restart
```

Other Radio 1 configuration

In addition to radio 1 frequencies, both primary and secondary nodes must be properly configured for Radio 1 Antenna Mode and Channel Bandwidth.

Antenna mode configuration is visible on the Web UI via:

Configure → Radio Link → Radio 1 → Antenna Configuration

Channel Bandwidth is found under

Configure → Radio Link → Link Features → Radio Channel Bandwidth

The corresponding SNMP variables are:

`cfg58RadioAntennaMode.1`

`m4gNlosPtpCfgGenChannelBandwidth.0`

Configured vs active frequencies

If the DL and UL frequencies are changed when the link is already running, then the currently running frequencies will not match the pending active configuration.

To observe note the Web GUI top panel always shows the currently running set of frequencies, whereas

the panel

Configure → Radio Link → Radio 1 → DL Frequency, UL Frequency

shows the configured values.

The SNMP status values for the currently operating frequencies are found in the `m4gNlosPtpDevStatusRadioLinkTable`, the variables are

`rltDLFrequency.1` and `rltULFrequency.1`

Frequency configuration errors

If a radio 1 frequency configuration error is discovered when the link is started, the status of radio 1 will show "0" as the operating frequency, and the link will not start.

For example, suppose the channel bandwidth is 10 MHz and the DL Frequency is 5170000.

If the channel bandwidth is subsequently changed to 40 MHz, the DL Frequency setting will become out-of-bounds, since the lowest center frequency of a 40 MHz channel bandwidth is 5190000.

The SNMP status in `m4gNlosPtpDevStatusRadioLinkTable`,

`rltDLFrequency.1`

will show a value of "0", which indicates the error.

Likewise, the top banner of the Web UI will show the Radio1 Tx frequency "0.000", also indicating an unacceptable value.

To correct, set the frequency to a valid value, say 5200000, restart the link and the DevStatusRadioLinkTable value will show the corrected value, likewise the top banner of the Web UI will show the corrected value and the link connected.

4.6.6 Configuration of Radio 2 Frequencies

The M4-2000 is a dual radio system whereby radio 1 always performs initial link establishment, and then initiates a second link using Radio 2. The primary node always uses the initial Radio 1 connection to communicate the frequencies to be used by Radio 2.

To configure the starting frequencies for Radio 2, it is only necessary to configure the DL and UL Frequency values on the primary node. Once the Radio 1 link is established, the Radio 2 configuration is interpreted by the primary node and used to set up radio 2 link.

If the configuration is invalid for any reason (out of range or overlapping the first radio for example), the primary node will automatically adjust to an appropriate frequency. If this occurs, you may note that the current operating frequency for Radio 2 differs from its configuration.

Configure the Radio 2 frequency on the primary node via the Web UI:

Configure → Radio Link → Radio 2 → DL Frequency, UL Frequency

Note on the remote node these fields are greyed out. Values that may appear are not relevant.

The corresponding SNMP configuration variables are in the second row of the `cfg58RadioTable`, the variables are

`cfg58RadioDLFrequency.2` and `cfg58RadioULFrequency.2`

Likewise, on the secondary node these variables exist but they are ignored as long as the node is configured as a secondary node; the radio 2 frequencies are always controlled by the primary node.

4.6.7 Dynamic Channel Selection

The M4-2000 system features an advanced interference avoidance feature.

Known as Dynamic Channel Selection (DCS), this feature automatically hops the radio away from a degraded frequency and selects the best available alternate frequency. Switching frequencies is quick with very little or no packet loss over the link.

In the background, the system periodically scans across the channel plan to measure the signal level at each plan center frequency. The resultant accumulation of frequency observation data insures selection of the optimal frequency when a channel hop is necessary.

The system can select different channels for uplink and downlink (i.e., F-TDD) to avoid localized intereference on either side of the link.

To enable DCS, on the primary node Web UI select

Configure → Radio Link → Link Features → DCS Mode → enabled

The corresponding SNMP variable is

`m4gNlosPtpCfgPriEnableDCS.0`

Changes to the EnableDCS parameter will take place immediately.

The operational details of DCS follow.

Channel Plan

The channel plan file contains a list of channel numbers and center frequencies that partition the 5.8 GHz band into a set of operational center frequencies.

DCS operation depends on the channel plan in order to make background RSSI measurements on plan frequencies. These measurements are the basis by which the system selects an optimal frequency.

Configure the channel plan filename via Web UI:

Configure → Radio Link → Dynamic Channel Selection → Available Channel Plans

The corresponding SNMP configuration variable is

`cfg58RadioChannelFileName.0`

Channel Plan filenames must end with ".cpx" extension.
The search path for Channel Plan files is:

/etc/m4g/58_cfg/
/etc/m4g/58_cfg_local/

By default, the filename is

`default_plan.cpx`.

If you want to create a custom channel plan file, use the default as a template. Rename the file (keeping the cpx extension) and copy your custom channel plan into the directory 58_cfg_local in order to prevent subsequent software updates from disturbing your custom plan file.

Channels defined in a plan must have non-overlapping frequencies. There are separate sections in the plan file for channel bandwidths of 10, 20 and 40 MHz.

The primary and secondary nodes must be configured with the same channel plan file.

The system reads and processes the channel plan file only at system boot. Therefore, after a change to the channel plan file, reboot the system for the new plan to take effect.

When DCS mode is enabled, the sytem is restricted to operation on plan frequencies because background monitoring of interference occurs only on plan frequencies. However, the Radio 1 hailing channel configuration is not restricted to plan frequencies.

Therefore, after the link initially comes up on the hailing channel, and prior to full DCS operation, the system will hop from the configured hailing channel to the nearest plan frequency.

Radio 2 configuration likewise is affected by DCS operation. If Radio 2 is configured to a non-plan frequency, when DCS is enabled the system will automaticically start Radio 2 on the nearest plan frequency.

Runtime change to EnableDCS

If EnableDCS is changed from disable → enable at run time, when the airlink is up, the system will immediately hop radio 1 to the nearest plan frequency, then hop radio 2 to the nearest plan frequency, and then begin DCS operation.

If EnableDCS is subsequency changed back from enable → disable, the system will simply cease DCS operations, it will not revert the currently operating frequencies back to their previous values.

Of course, if the airlink is stopped then started it will always start on the hailing frequency.

DCS Operation

Dynamic Channel Selection involves the following elements

- background measurement over plan frequencies of received signals
- monitoring the current airlink for signal quality
- hopping away from a degraded channel onto an alternate channel when required

Background measurements are displayed via the Web UI via

Monitor → Spectrum → Background Noise

The graph shows a relative signal level of noise and/or interference.

DCS Operation: background measurements

The background monitor operates by iterating over the channel plan and collecting a signal measurement for each frequency.

The background monitor very briefly tunes the radios to the target frequency, listens just long enough to collect a measurement, and then resumes operation on the current frequency. These ongoing measurements create small gaps in the bearer plane which effectively consume a small percentage of the airlink, reducing available bandwidth and slightly increasing maximum latency.

The background monitor operates at a rate controlled via the parameter

```
m4gNlosPtpCfgPriBandRefresh.0
```

BandRefresh can be set to low, medium, or high. Select the rate that provides the optimal trade-off between the amount of gap time introduced (and the resultant loss of airlink capacity) and the time required to refresh the measurements over the entire channel plan.

A setting of "low" consumes approximately 1% of the airlink and will refresh the entire channel plan in about 20 seconds; a setting of "high" will consume approximately 4% of the bandwidth while refreshing the channel plan in about 5 seconds.

Normally "low" should be sufficient, the high band refresh is intended to address highly varying interference environments where more rapid measurement accumulation may provide improved channel selection when hopping around.

DCS Operation: airlink quality optimization

Whenever DCS is enabled the airlink quality is continually monitored. If the link degrades sufficiently, (triggered by a drop in MCS level to below 2,) the system will quickly hop to an alternate channel.

A channel hop may also be triggered when some alternate channel remains sufficiently better (approximately 9 db lower background RSSI measurement value) over some period (approximately 5 measurement periods) compared to the current channel.

4.7 Ethernet operation

The M4-2000 system utilizes Gbit Ethernet interfaces for customer data network(s) and the management data network. On each M4-2000 unit there are two RJ45 connectors for customer data and one RJ45 connector for the management LAN. The unit operates with an internal, managed layer 2 switch where the management interface is preprogrammed to connect to the internal IP stack of the device itself. This connection is used for operation, configuration and management of the device.

4.7.1 Customer Data Network

The Ethernet traffic of the three data interfaces is switched over the airlink to the remote unit based on configured internal switch options. Following are highlighted features of the integrated switch capabilities:

- 2,048 byte jumbo frame support
- 8K MAC addresses
- QoS
    - 4 queues per port
    - 802.1p, port, TOS/DS, IPv6, TC, MAC
    - Programmable QoS Weighting

- VLAN
  - 4096 802.1q VLANs
  - Port based VLANs
  - Double tagging (Q in Q)

4.7.2 Management Network

The M4-2000 unit's management agent operates on one of the SoC cores running a Linux operating system. This management agent is IP addressable with in-band and out-of-band interfaces. The default IP address is 192.168.0.51. If the programmed IP address is lost, it can be reprogrammed using the serial interface by an authorized service technician. The management interface can be configured to transmit and receive either VLAN tagged, untagged, or unmodified Ethernet frames.

The management agent can be connected with standard network management protocols including SNMPv3, web http, web https, CLI, ssh, and syslog. The SNMPv3 MIB defines the canonical management information database. The proprietary M4-2000 MIB contains device configuration, status and statistics information. It also defines device notification alarms.

4.7.2.1 Web-Based Management

The M4-2000 unit's management system includes a web server. This provides a convenient way to configure and operate the equipment from a locally connected device (Ethernet or Wi-Fi) or a management station on the management network. Management traffic to remote units is bridged over the air, which provides an easy and secure method to manage both sides of the link. The web agent provides status, configuration, statistics and security functions that are organized into the following sections:

- Main/Home: summary of unit status, performance and configuration information
- Monitor: short and longterm statistics graphs for the unit throughput, RSSI, CINR, packet rate, header compression and temperature
- Configure: separate pages for general unit configuration, radio link configuration, IP configuration, L2 switch configuration (including, ports, VLAN and QoS), and time source configuration
- Fault Isolation: SNMP alarms and syslog view
- Security: user security settings for management access
- Administration: configuration backup and upload, as well as unit software upgrade features

5 M4-2000 Installation and Configuration

This chapter describes installation, alignment and configuration of M4-2000 units for wireless bridge operation.

NOTE: This device must be professionally installed.

5.1 Unit installation

Before field installation, it is recommended that the units be preconfigured at a staging area. Following are the pre-installation configuration procedures.

5.1.1 Configuring a PC for Management of M4-2000 Units

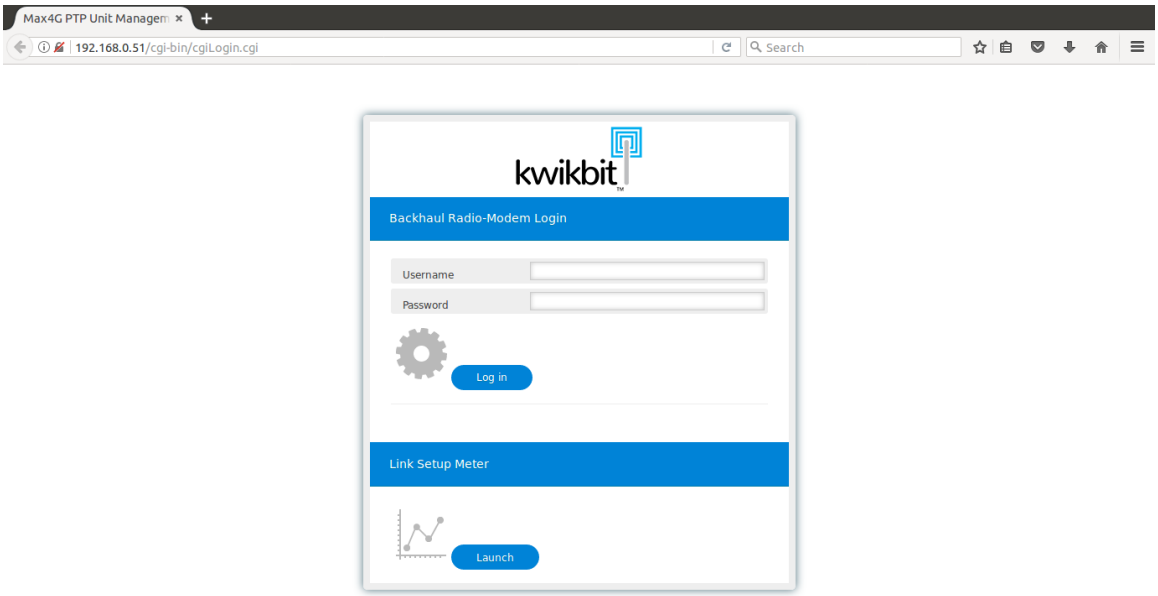
Follow these steps to configure a management PC for communication with a M4-2000 unit:

1. On a Windows PC, select Control Panel > Network and Internet > Network and Sharing Center > Local Area Connection. For other operating systems, simply go to network and TCP/IP settings
2. Select Properties > Internet Protocol Version 4 (TCP/IPv4) > Properties
3. Configure the management IP address
4. Set IP address to 192.168.0.x where x is any host number except 51 (the default M4-2000 factory preprogrammed IP host address)
5. Set Subnet mask to 255.255.255.0
6. Leave the Default Gateway blank
7. Click OK to save configuration

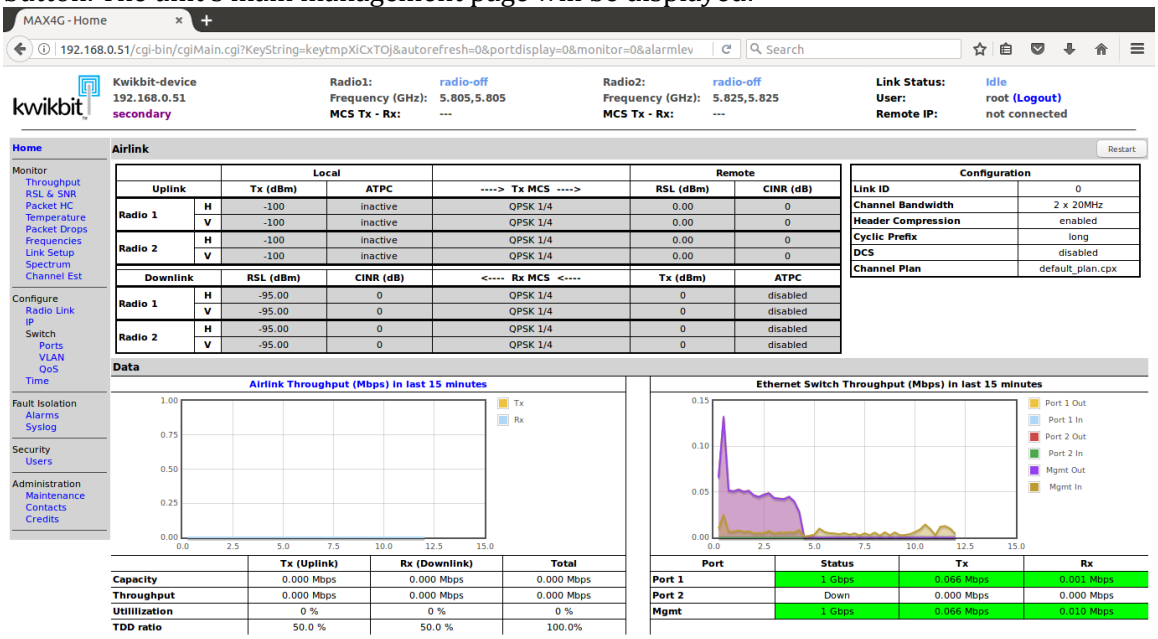
5.1.2 Connecting a Management PC to a M4-2000 unit

Follow these steps to connect the management PC to the M4-2000 unit:

1. Connect the Management PC's Ethernet port to the M4-2000 unit Management port (the left most Ethernet port when facing the unit) using a standard Ethernet cable
2. Apply PoE power to the M4-2000 unit
3. Allow approximately 60 seconds for the unit to boot
4. Start the web browser on the Management PC
5. Type the default M4-2000 IP address 192.168.0.51 into URL address field. The unit's Login page is displayed:



6. Type “root” in the Name field and “m4g_root” in the Password field. Click on the Login button. The unit’s main management page will be displayed:



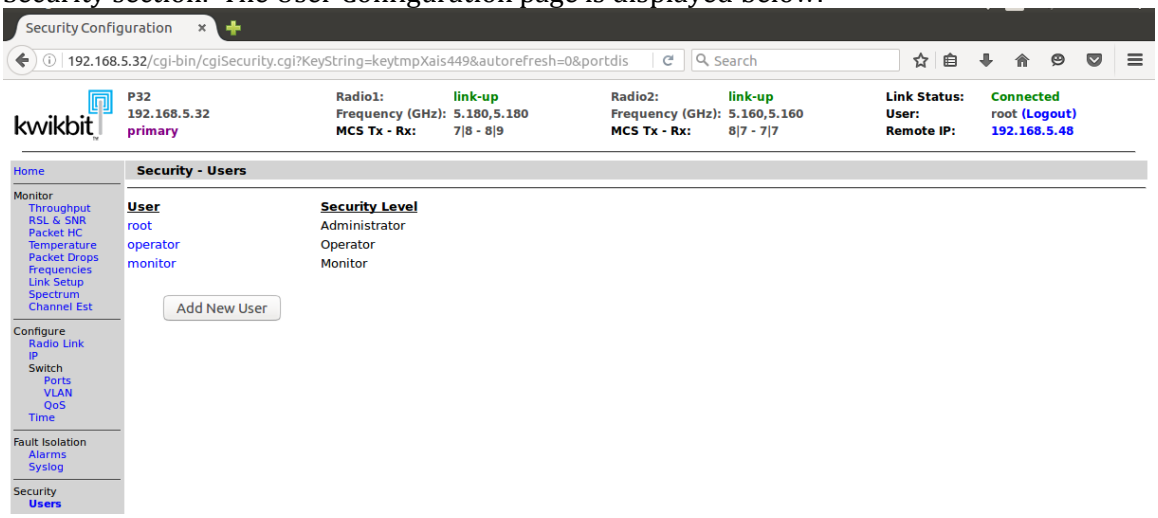
5.1.3 Pre-Configuring the M4-2000

Summary of minimum configuration prior to field installation of a M4-2000:

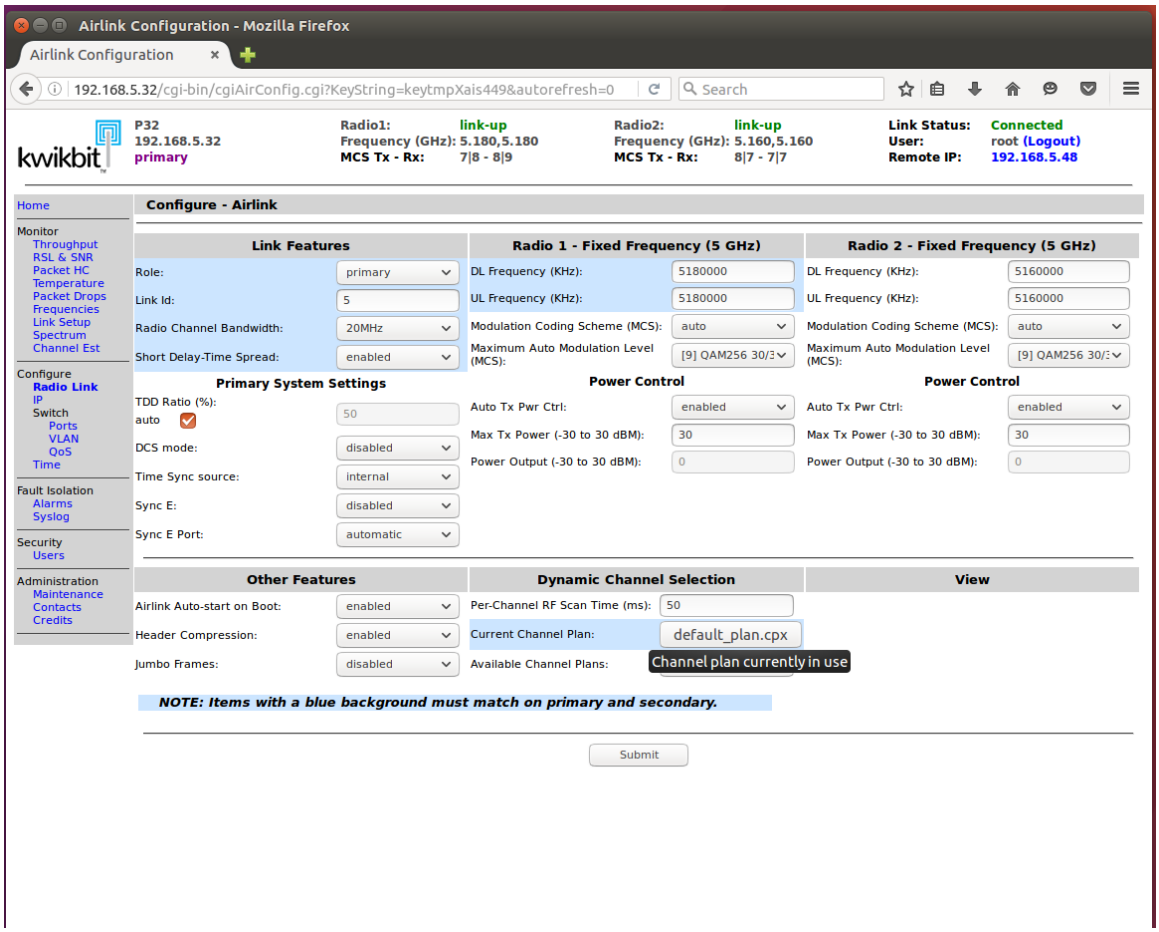
- change root password from default
- configure IP address
- Role (primary or secondary)
- Enable airlink auto-start on boot (Primary device only)
- Enable DCS Mode
- The following must match on primary and secondary:
    - Link ID
    - Starting frequency for Radio 1 (UL and DL)
    - Channel Bandwidth
    - channel plan

These configuration items are set via the following detailed instructions:

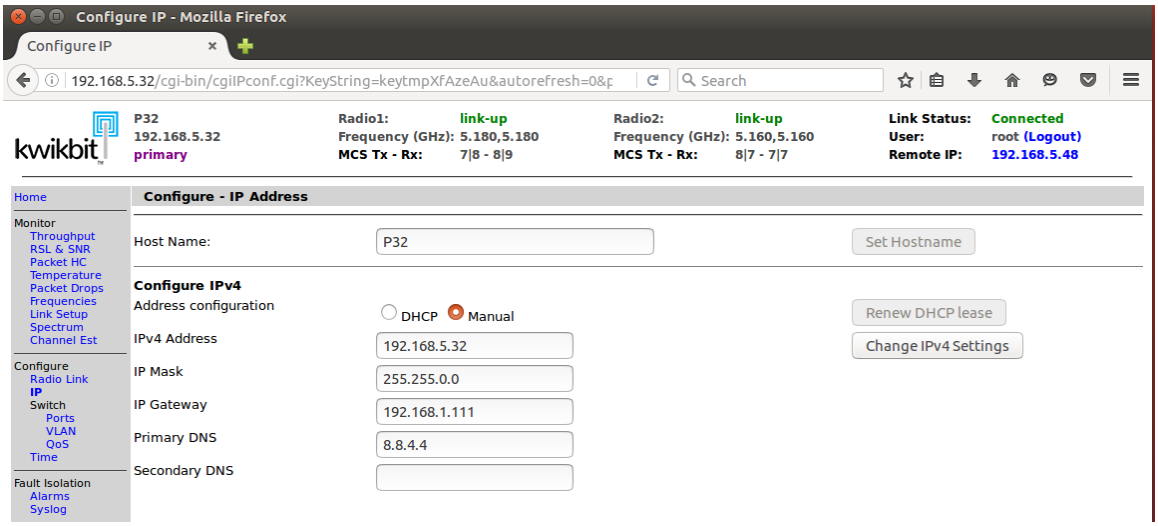
1. From the M4-2000's web management menu, select *Users* on the left navigation under the Security section. The User Configuration page is displayed below:



2. Click on the *root* user and the Edit User window will open up
3. Set a new password for root by entering a password and confirming in the appropriate fields. Click on *Submit*
4. If desired at this stage, an additional user can be added. Select *Add New User* and follow the instructions in the Edit User window
5. From the navigation menu on the left, under the Configuration section, select *Radio Link*. The Radio Link Configuration page will be displayed:



6. Under *Link Features*, Select *Role*. In each installed link, one unit is defined as primary and one is secondary. Configure the remote unit as the secondary
7. Enter a *Link ID* in a range of 0 - 15. The Link ID on the primary and the secondary units of the same radio link must match to operate properly
8. Select the appropriate *Radio Channel Bandwidth*
9. On the primary node, enable *DCS Mode*
10. On the primary node, choose the *Time Sync Source* (internal or GPS) for TDD timing of the airlink
11. Enter the desired center frequency for the link's *Radio Channel* for radio 1.
12. On the primary, set the desired center frequency for radio 2
13. Under *Other Features*, Select *Enabled* for *Airlink Auto-start on Boot* setting. This setting causes the airlink to begin operating automatically when the unit is powered up
14. Click on *Submit* at the bottom of the page
15. From the left navigation menu, select *IP* in the Configuration section. The IP Configuration screen displayed:

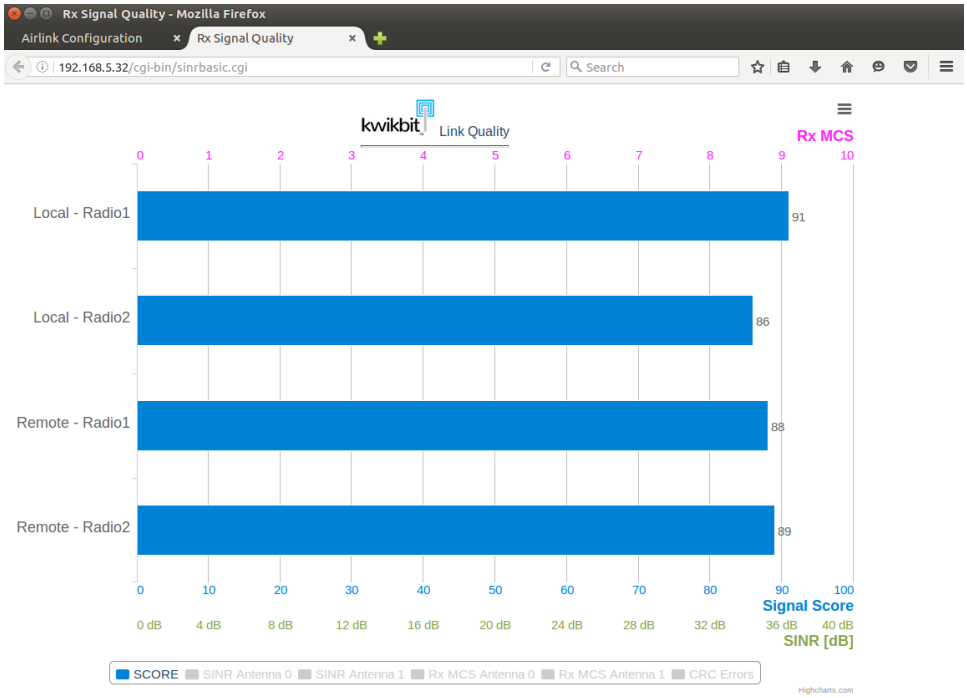


16. Configure the desired IP settings
17. Click on *Submit*
18. In order to retain the ability to manage the remote unit over the airlink following physical installation, it is necessary to configure the L2 switch VLAN tagging and forwarding on the local unit so that the management traffic can be forwarded over the radio port to the remote unit. Configure the L2 switch VLAN tagging and forwarding on the remote unit so that the management traffic received over the radio port is forwarded to the management internal port of the unit
19. Reboot the unit

Further configuration can be performed following unit installation by web via the management VLAN, SNMP, or by downloading/uploading the preset configuration file. For instructions on configuring other unit operating parameters, please refer to the General Configuration section.

5.1.4 Installer Link Setup Tool

In addition to the full management console, each M4-2000 unit hosts a Link Setup Meter page optimized for mobile devices.



The simplified interface, showing the real-time link score for each radio, enables installers to align links rapidly. The link score aggegates RSSI, SINR, and CRC error rate into a link quality metric that ranges from 0 to 100. The objective of link alignment is simply to position the device to maximize the score: higher score is better.

Advanced users can view SINR, MCS and CRC errors.

In order to use the Link Setup Meter, connect to the management port and point your browser at the unit. On the initial page, simply select “launch” of the link setup meter on the bottom of the page, no login is required.

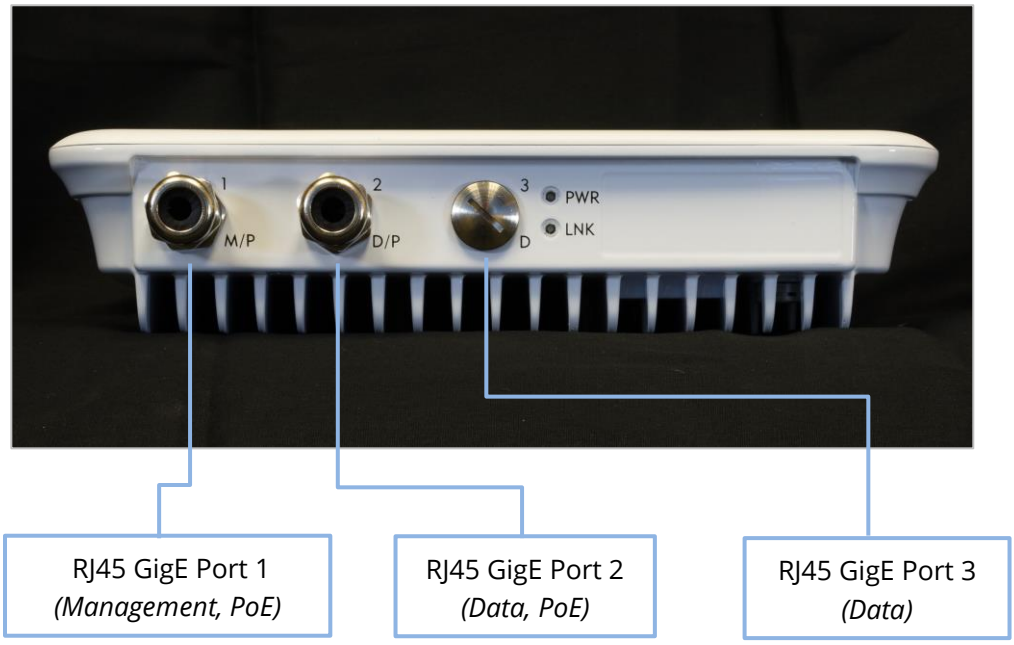
5.1.5 M4-2000 Physical Installation

Select a mounting location for the M4-2000 unit that permits easy adjustment of its vertical and horizontal orientation and, at the same time, allows for cable connectivity and management.

Follow these steps to install the M4-2000 unit:

1. Attach the unit bracket strap to the pole
2. Attach the unit with the pre-fit mounting bracket to the bracket strap. Keep the screws loose so that the unit position can be adjusted on the pole

3. Connect a grounding cable between the ground stud on the backside of the unit and the supporting structure's grounding point
4. If out of band management option is desired, connect the management network cable to the management RJ45 connector port as illustrated below:



5. Connect up to two Ethernet cables to RJ 45 ports 1 (management) and 2 (data)
6. Power can be provided to the unit through ports 1 (management) or 2 (data plane). A PoE injector needs to be installed in-line with the Management or Data network cables connected to one of these ports as shown. Make sure that the length of the Ethernet cable between the unit and the injection point does not exceed 30 meters.

5.1.6 Aligning Link Antenna

Before performing the units' antenna alignment for optimal link performance, make sure you have completed the physical installation procedure for the units on both sides of the link. If the pre-configuration tasks were not performed prior to physical installation of the units, perform the pre-configuration tasks before proceeding with the alignment procedure.

1. Power up the units on both sides of the link. The PWR indicator light on both units should be illuminated green. The primary unit will begin broadcasting signal and the secondary unit will enter receiving mode, attempting to obtain signal. The main page on the web management interface will reflect this state and the LNK indicator light on the unit will start blinking green. Once the radio link and data connection is established, the LNK light becomes continuously lit. Observe the LEDs to determine initial connectivity between the units when performing next steps. Table 3.4.5 details the states indicated by LED activity.
2. At each side of the link adjust the units to point towards the unit at the other side of the link. Use a compass or other tool to perform this task

3. Without moving the Primary unit, adjust the azimuth and elevation angle of the Secondary unit for maximum link quality. Link quality is to be monitored via a unit's Link Setup Meter as described in the previous section
4. Without moving the Secondary unit adjust the azimuth and elevation angle of the Primary unit for maximum link score
5. Repeat steps 3 and 4 to fine tune the alignment. Note: If the installation is in a complete NLoS situation, repeat the alignment process by pointing the Primary antenna in different directions for maximum CINR reading on the Secondary unit.
6. Once the alignment process is complete and the best signal quality is achieved, secure the Primary and Secondary units by tightening the mounting screws

5.2 System configuration

After the Primary and the Secondary units are preconfigured and installed, connect to both units from a Management PC on the Management network. The Management PC needs to have an IP address on the Management network to be able to communicate through the pre-configured Management IP gateway. To verify connectivity from a terminal window, issue the ping command as follows:

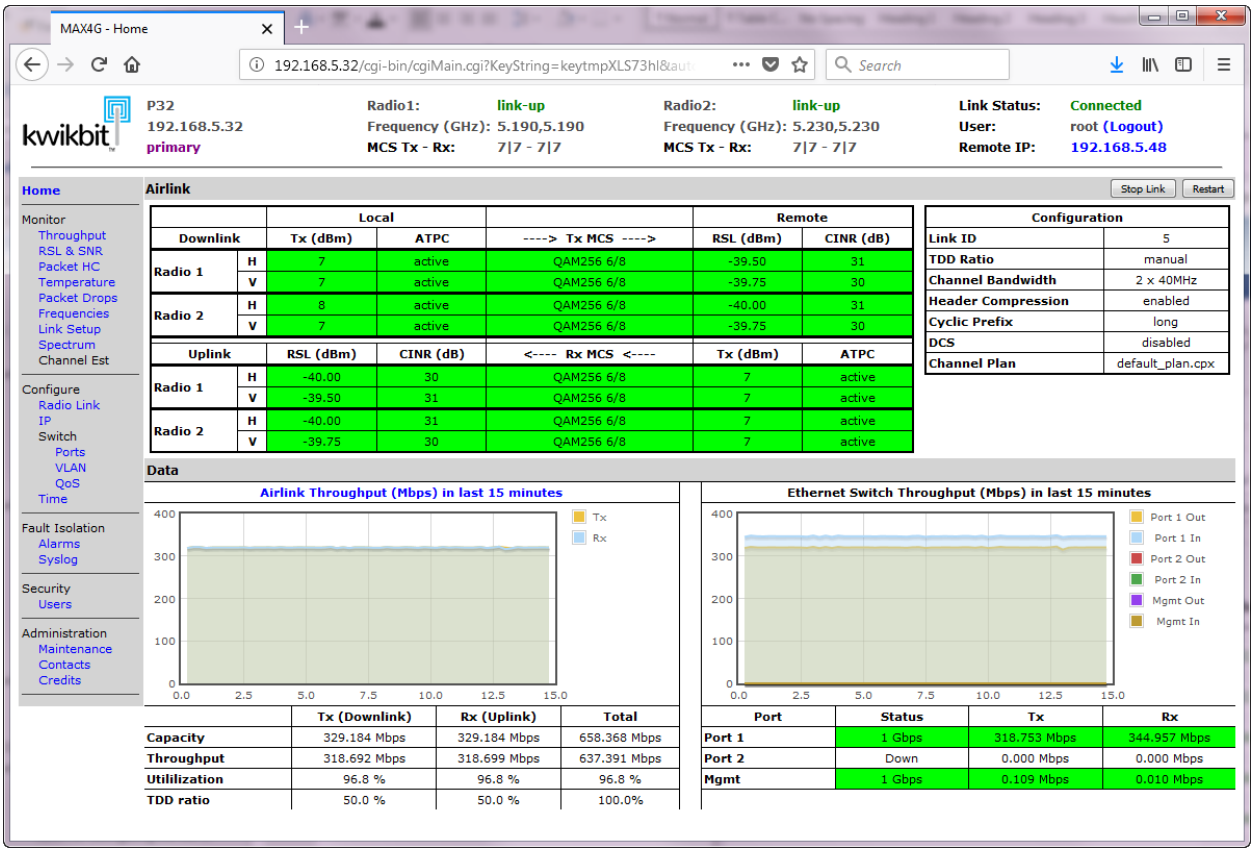
- ping [M4-2000 unit's assigned IP address]

Once connectivity is established, open a browser window on the Management PC and enter the target unit's IP address in the URL field. On the Login page enter the pre-configured Name and Password. The Main management page will open, which provides a summary of unit status, state and configuration information. To further configure the unit, follow the configuration pages from the main menu on the left side of the Main page. Please see Section 6 for configuration options.

Following configuration of the Primary unit, connect to the Secondary (remote) unit by entering its IP address in the URL address field. Note that in order to be able to connect to the remote unit management over the airlink, pre-configuration step 17 in section 4.1.3 must have been performed. Repeat the configuration steps of the Primary on Secondary unit.

5.3 Verifying link performance

After the system has been installed and configured, check its performance to verify that it is achieving predicted levels. Open a browser window, connect and login to one of the units of a link. The Main page provides summary of performance status of radio 1 and radio 2 as illustrated below:



Verify that Radio 1 and Radio 2 are in a “link-up” state and that the Link Status displays “Connected”.

For both Uplink and Downlink, note the MCS levels, horizontal (H) and vertical (V), for each radio. Based on these MCS levels, the maximum achievable data rate in each direction is listed in the throughput section at the bottom of the page.

If the header compression feature is enabled, the throughput can be higher than the capacity and the utilization can exceed 100%. Refer to tables in section 3.5.4 for expected throughput enhancement due to header compression based on different average packet sizes.

Verify that RSL and CINR values on both local and remote units are at the optimal levels for achieving the highest possible MCS level.

6 M4-2000 operation and management

The M4-2000 units can be managed using a combination of 3 methods: web, CLI and SNMP. This section describes the main management procedures and commands. It also includes a logical overview of the M4-2000 SNMP MIB. The MIB can be compiled into an SNMP management station to manage the units.

6.1 Web based management

When the system is properly configured, and the link is operational, a computer that has connectivity to the Management network of the M4-2000 links can connect to either Primary or Secondary unit of the link by typing the corresponding IP address in a browser window. On the Login page enter the User Name and Password and click Login. The main management page will open.

All the pages of the M4-2000 unit web management system include

- ⇒ The navigation menu on the left side of the page
- ⇒ The header with the unit's main status information

The menu provides for easy navigation between the Monitor, Configure, Fault Isolation Security and Administration sections.

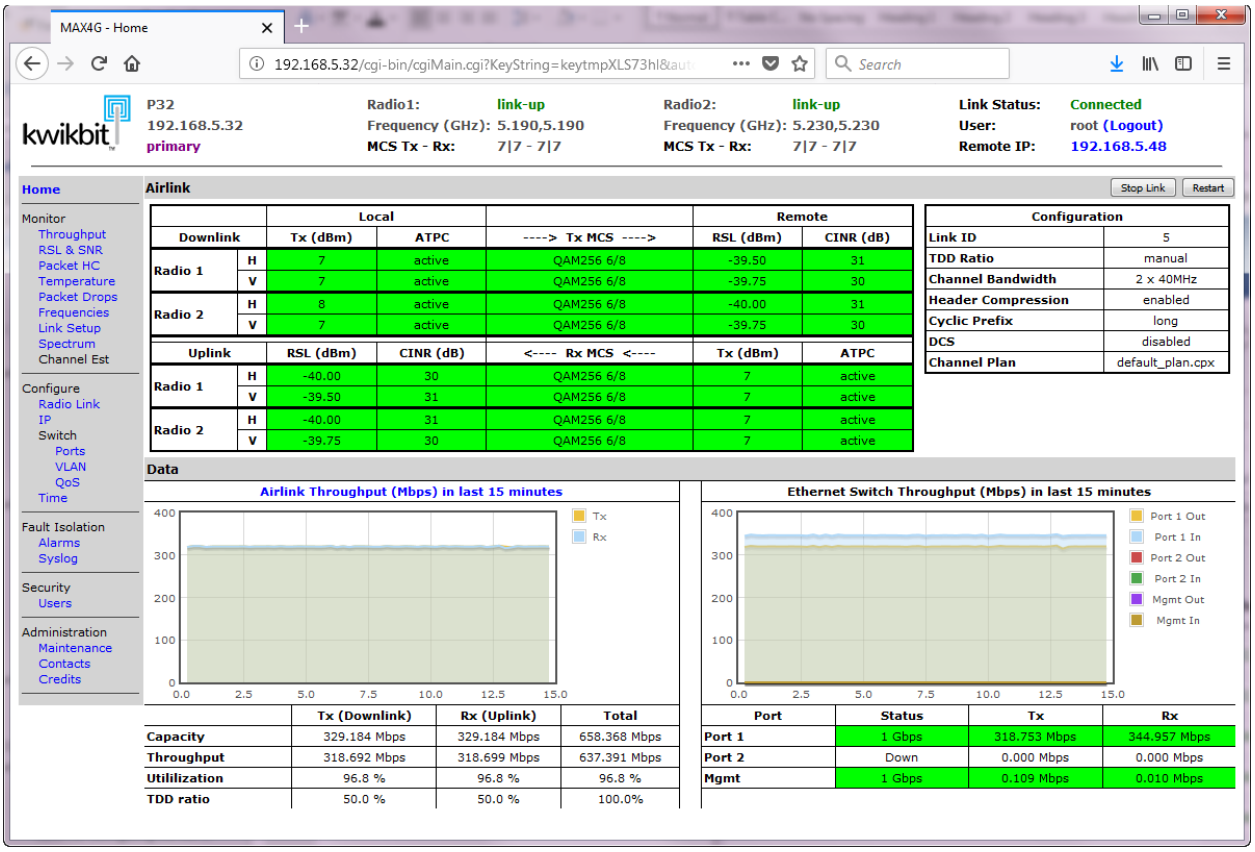
The header includes the unit identification, and operational status information. The header is continually refreshed approximately every 2 seconds.

The header also shows the user login information and provides for Logout.

The following is a description of information and procedures available within each menu option.

6.1.1 Management Home

After login, users arrive at the Management Home Page. To return to the *Home* from any other page, click on either the *Home* link in the left navigation bar or the Kwikbit logo in the upper left corner of the page.



The main page displays airlink status and configuration information, as well as Ethernet and airlink throughput. The airlink can be started, stopped and restarted using the buttons in the upper right of the main page.

The airlink status table shows Downlink and Uplink status for each radio and from the perspective of both the local and remote. This display is continually updated approximately every 2 seconds.

- ⇒ TX power – displays transmit power into antenna ports, horizontal (H) and vertical (V), for local and remote units for all radios
- ⇒ ATPC – Automatic Transmit Power Control status, active or disabled, for all local and remote antenna ports
- ⇒ RSL – Received Signal Level in dBm on antenna inputs of local and remote units
- ⇒ CINR – Carrier to Interference plus Noise Ratio in dB on all local and remote antennas. This is a very good indication of the received signal quality
- ⇒ Tx MCS – Modulation and Coding Scheme of transmitted signal from horizontal and vertical antennas of local unit to remote unit. The MCS can be configured manually, but will more likely be adjusted automatically by the system when configured for Adaptive MCS
- ⇒ Rx MCS – Modulation and Coding Scheme of received signal from horizontal and vertical antennas of local unit

- ⇒ Airlink Throughput graph – throughput over the airlink value over last 15 minutes. Note this graph displays data collected every 2 minutes (approximately) so it will not immediately show instantaneous bursts of throughput.
- ⇒ Ethernet Switch Throughput – statistics over past 15 minutes for data and management ports. This graph also displays data collected about every 2 minutes and so will not immediately show instantaneous bursts of throughput.

The background shading of the presented figures in this table indicates the link status. When the link is in connected and operational state, the background color is green. Any other color indicates some other link status, which is detailed in the top page section.

Configuration table attributes:

- ⇒ Link ID
- ⇒ TDD Ratio
- ⇒ Channel Bandwidth
- ⇒ Header Compression State
- ⇒ Cyclic Prefix

6.1.2 Monitor Section

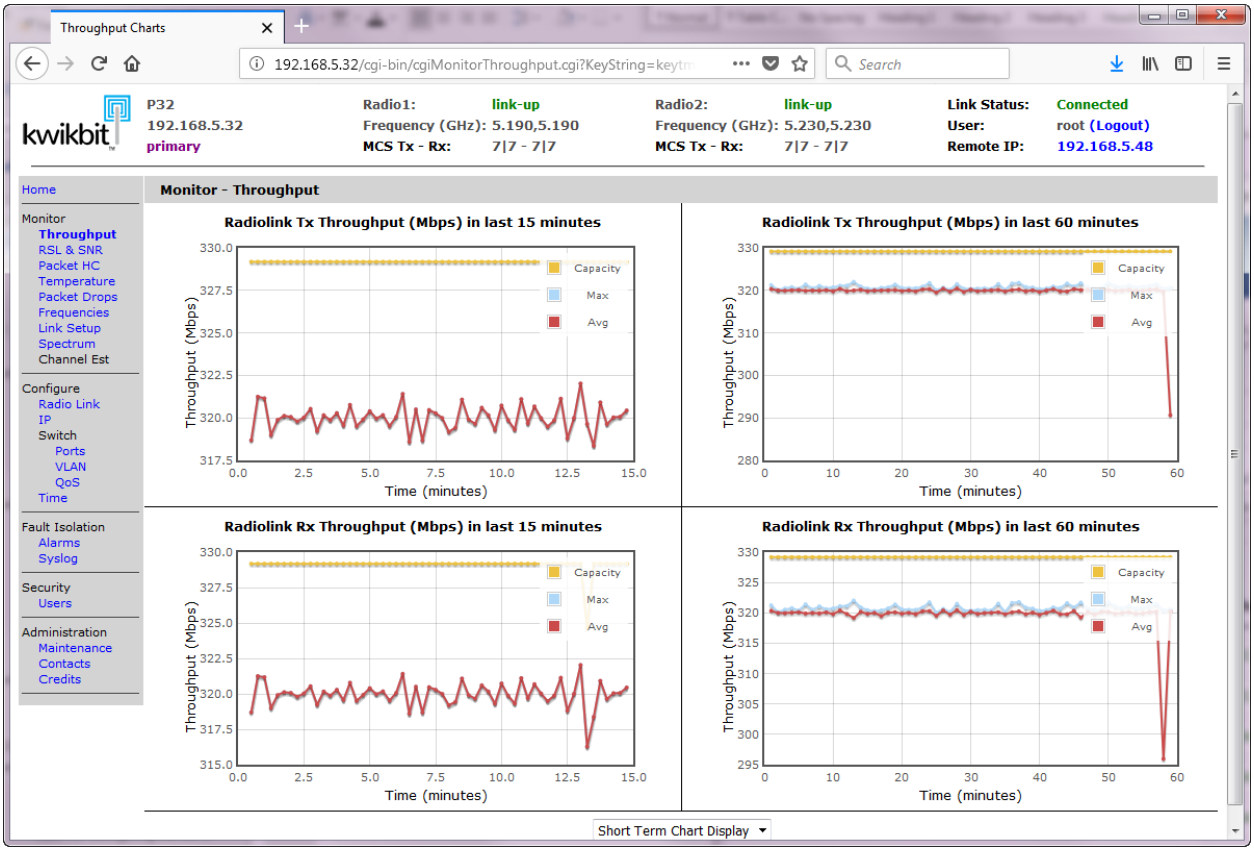
The seven pages in the Monitor section provide various performance statistics charts. The charts are drawn from the Round Robin Database (RRD) tool that runs on the Linux core and accumulates unit performance statistics. All statistics can be presented in Short Term Chart Display mode, providing a view of the last 15 and 60 minutes of operation, and in Long Term Chart Display mode, providing statistics a view of the last 24 hours and 7 days of operation. Change between the modes by using pull down menu on the bottom of each page. All pages automatically refresh every 2 seconds.

6.1.2.1 Throughput

The *Througput* page displays the following Tx and Rx statistics at various time intervals:

- ⇒ Capacity – airlink capacity in Mbps
- ⇒ Max – maximum throughput rate achieved in Mbps, during sampling time interval, as measured at the Ethernet port(s)
- ⇒ Average – average throughput rate in Mbps, over sampling time interval, as measured at the Ethernet port(s)

By toggling *Long Term Chart Display* at the bottom of this page, the same statistics will be displayed for durations of 24 hours and 7 days. Note that when Header Compression is enabled, the Maximum and the Average data rates may exceed the airlink channel Capacity, as the throughput measured at the Ethernet port includes the Ethernet and the IP headers.



6.1.2.2 RSL and SNR

In the RSL & SNR section, radio statistics are presented on four charts for each radio installed:

⇒ RSL for last 15 minutes – Received Signal Level measured at horizontal and vertical antennas for each radio installed
⇒ RSL for last 60 minutes
⇒ SNR for last 15 minutes – Signal to Noise Ratio measured at horizontal and vertical atennas for each radio installed
⇒ SNR for last 60 minutes

By toggling *Long Term Chart Display* at the bottom of this page, the same statistics will be displayed for durations of 24 hours and 7 days.

6.1.2.3 Header Compression and Throughput

Header Compression and packet throughput on four graphs:

⇒ Header compression gain over past 15 minutes – percentage of header compression gain achieved for both Tx and Rx
⇒ Header compression gain % over past 60 minutes
⇒ Packet throughput over past 15 minutes – kilo packets per second for both Tx and Rx
⇒ Packet throughput over past 60 minutes

By toggling *Long Term Chart Display* at the bottom of this page, the same statistics will be displayed for durations of 24 hours and 7 days. Note that the Header Compression gain is a function of average packet size and number of flows that go through the system.

6.1.2.4 Link Setup

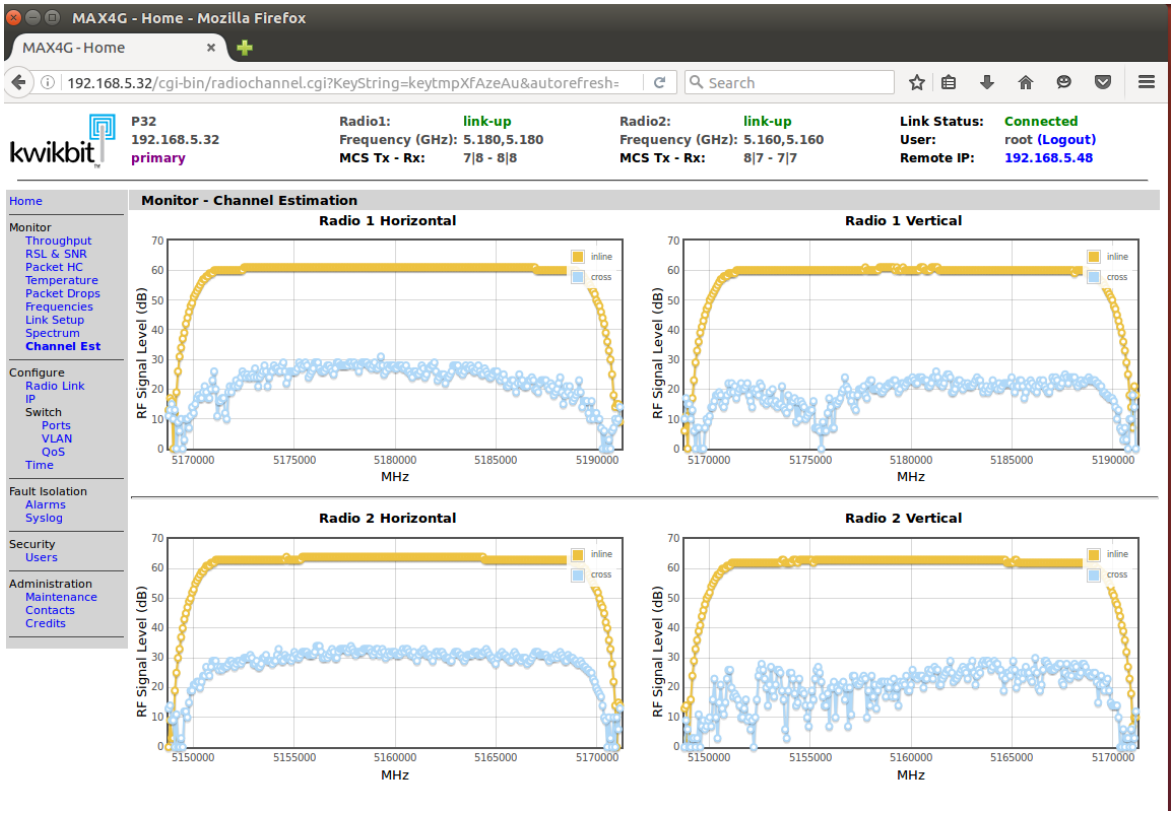
By clicking on *Link Setup* in the left navigation bar, a user can view the link aligment tool, a webpage optimized for mobile devices. See section 5.1.4 for additional information on using this tool.

6.1.2.5 Spectrum

For unlicensed bands, a user can determine current RF conditions using this page. Clicking the *RSSI Scan* button will scan available channels in the configured channel plan and update two charts:

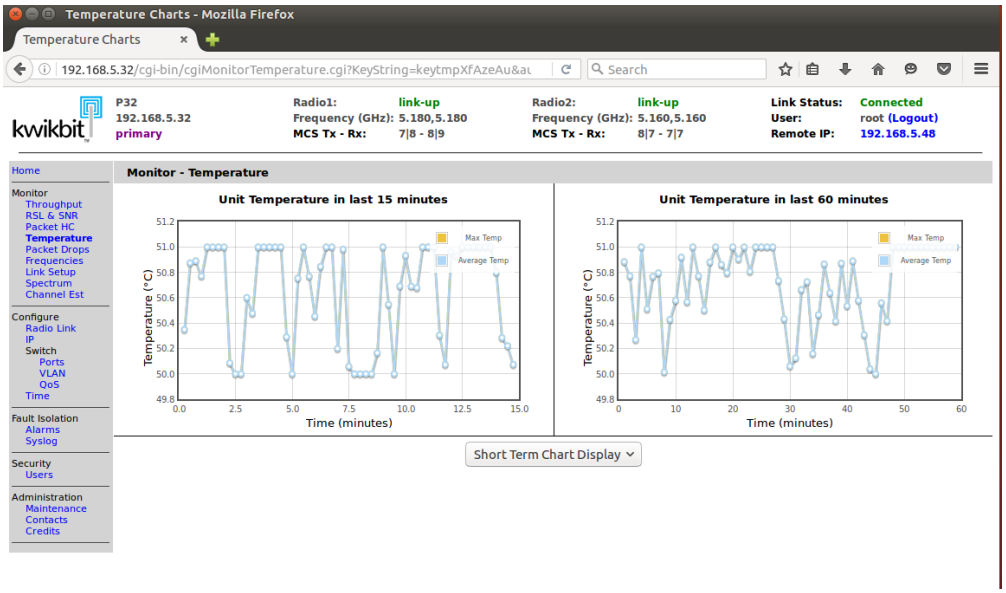
⇒ Background noise (dBm above noise floor)
⇒ Best channel score

6.1.2.6 Channel Estimator



6.1.2.7 Temperature

The temperature graph presents the internal unit temperature statistics for the last 15 and 60 minutes. Toggle *Long Term Chart Display* at the bottom of this page to display the same statistics for durations of 24 hours and 7 days.

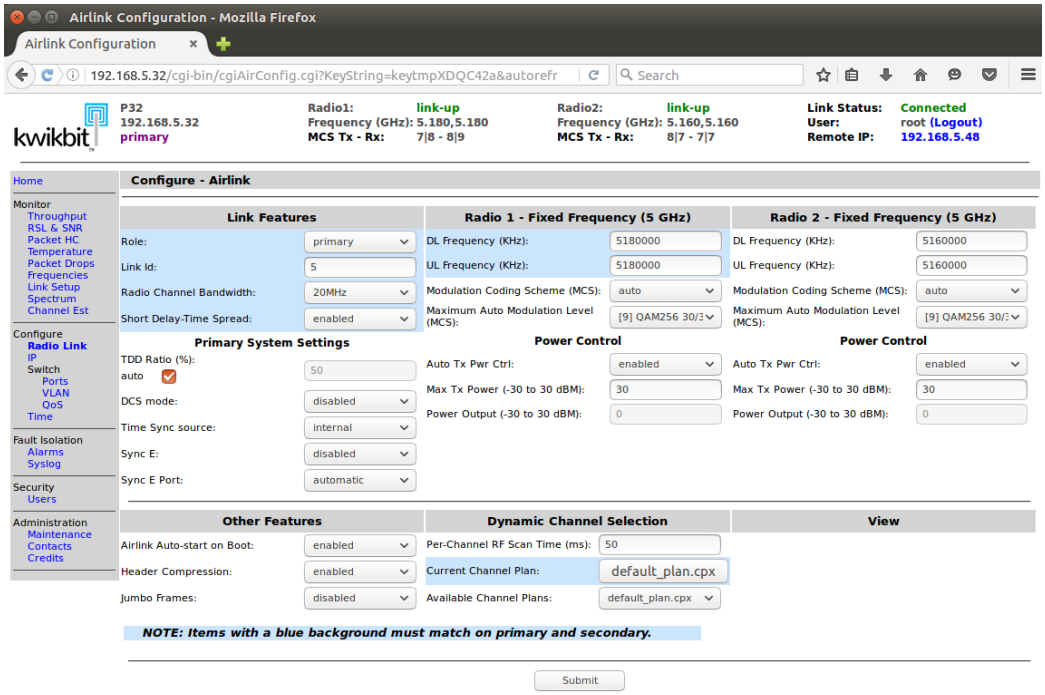


6.1.3 Configure Section

The Configuration section of web management provides for unit operational configuration parameters. When accessed, the pages show current operating parameters. These parameters can also be accessed and manipulated using Command Line Interface (CLI) and SNMP interface from a network management station. Alternatively, configuration parameters can be uploaded in the form of a file or saved to a management station in the form of a file. Note that some configured parameters take effect immediately, while others will require the unit to reboot.

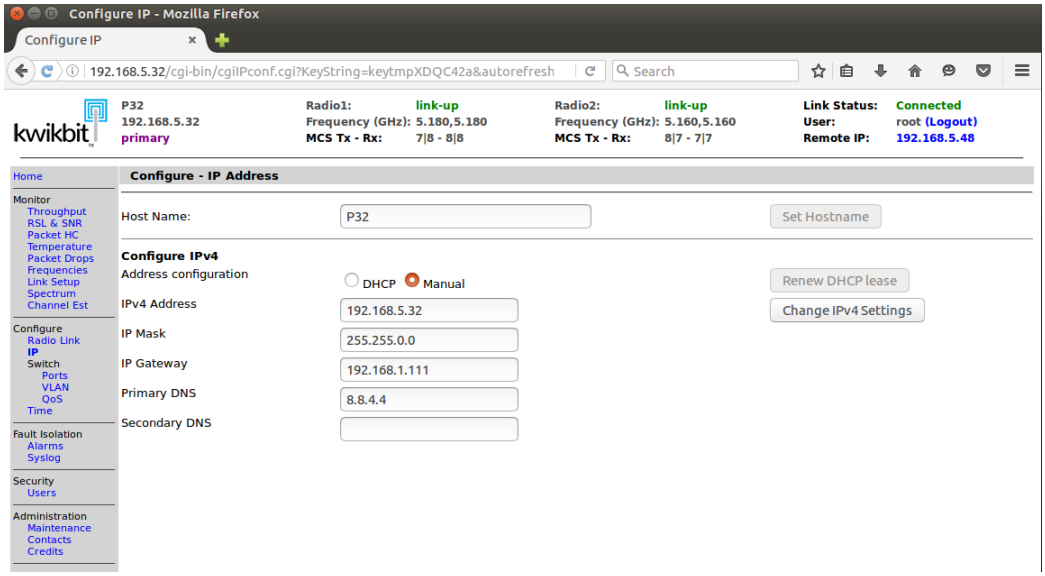
6.1.3.2 Radio Link Configuration

Radio Link configuration parameters need to match between the Primary and the secondary units of the same link. These parameters also require a unit reboot to take effect.



6.1.3.3 IP Configuration

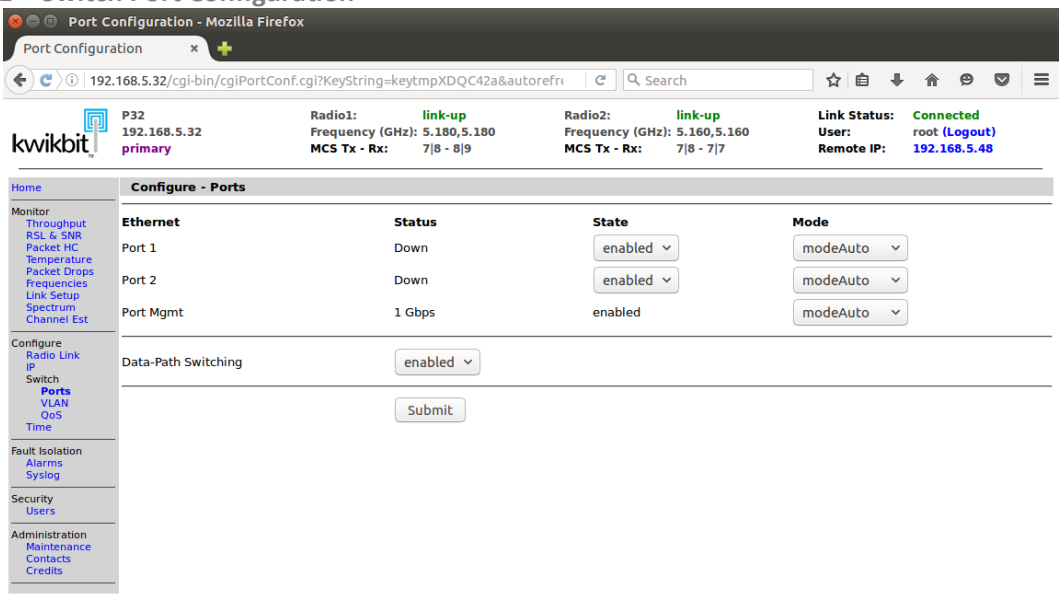
IP configuration parameters take effect immediately after clicking on *Change IPv4 Settings* button. Make sure the new parameters will provide the desired network connectivity.



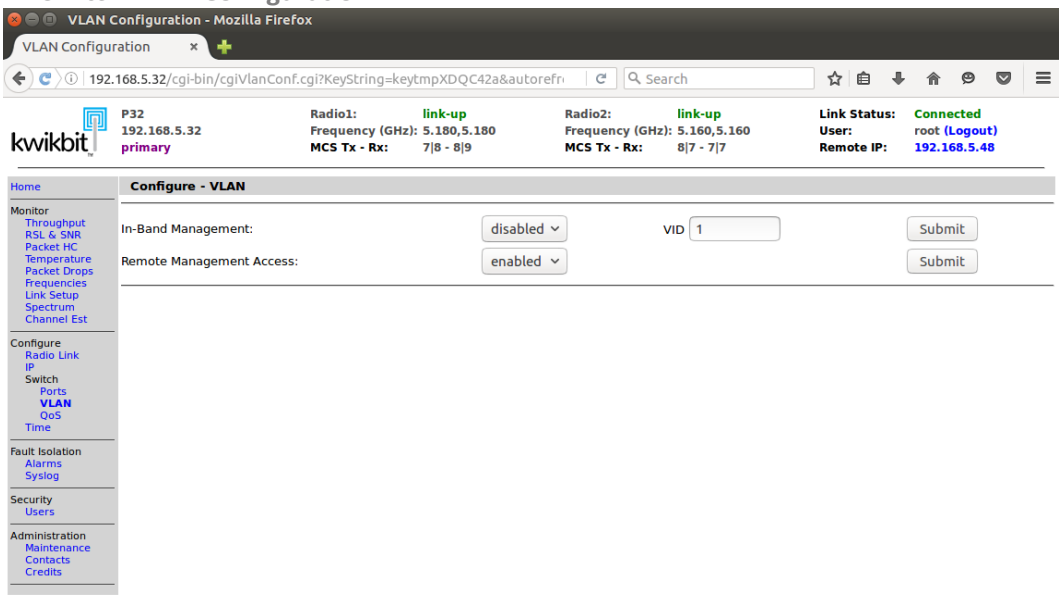
6.1.3.4 Switch Configuration Sub-Section

The configuration subsection for the M4-2000's internal switch consists of three pages for easy management of Ethernet port, VLAN and QoS settings. Switch configuration parameters take effect immediately after clicking the *Submit*.

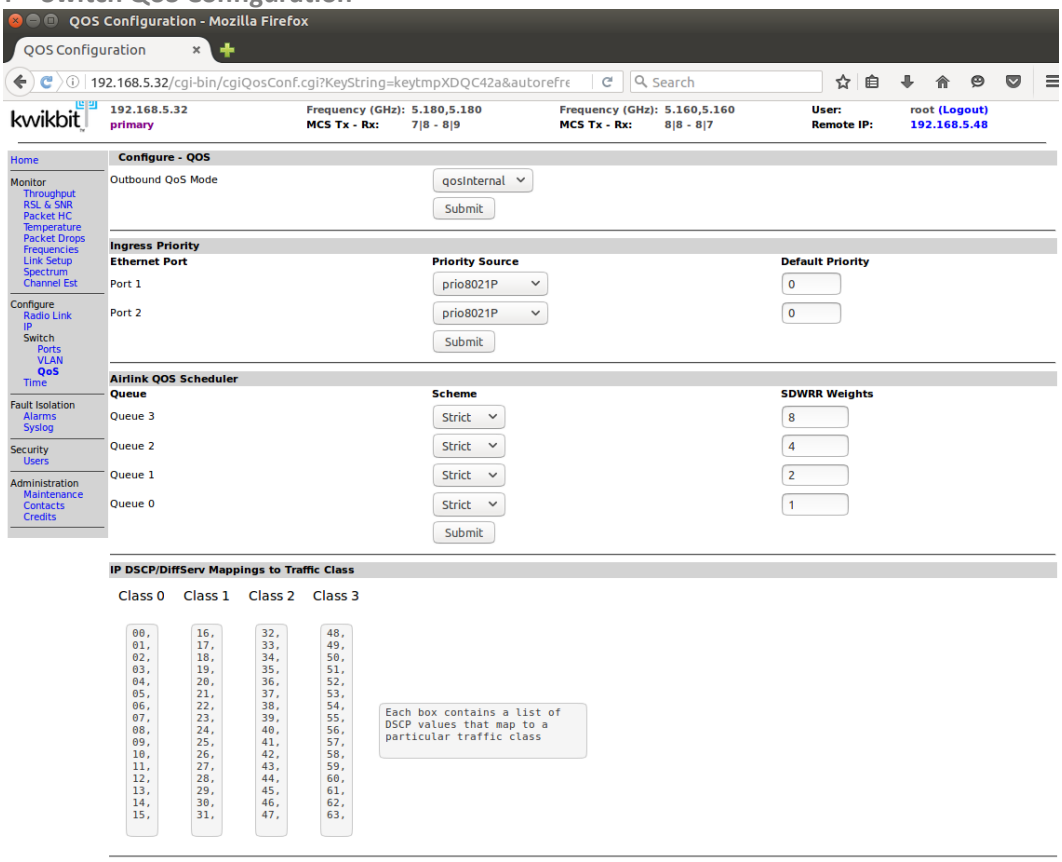
6.1.3.4.1 Switch Port Configuration



6.1.3.4.2 Switch VLAN Configuration

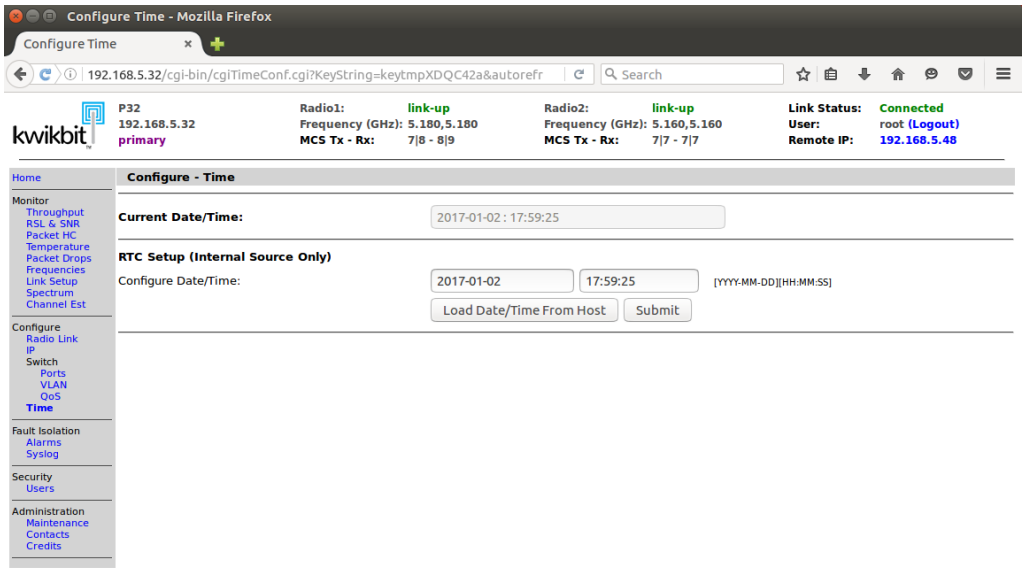


6.1.3.4.4 Switch QoS Configuration



6.1.3.5 Time Configuration

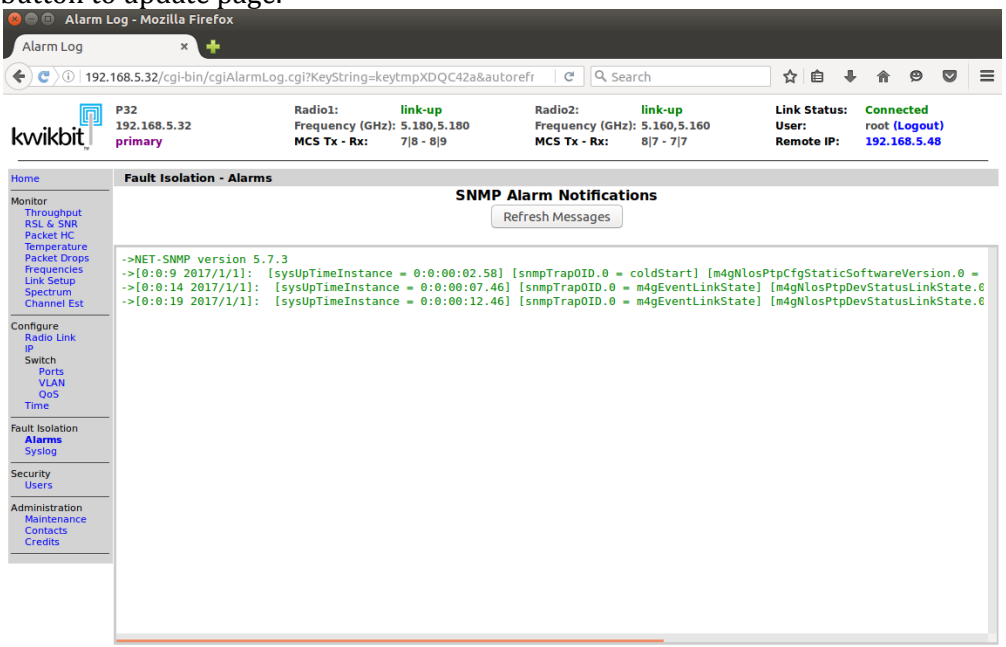
The configuration subsection for the M4-2000's time settings consists of a single management screen. Time configuration parameters take effect immediately after clicking the *Submit* button.



6.1.4 Fault Isolation

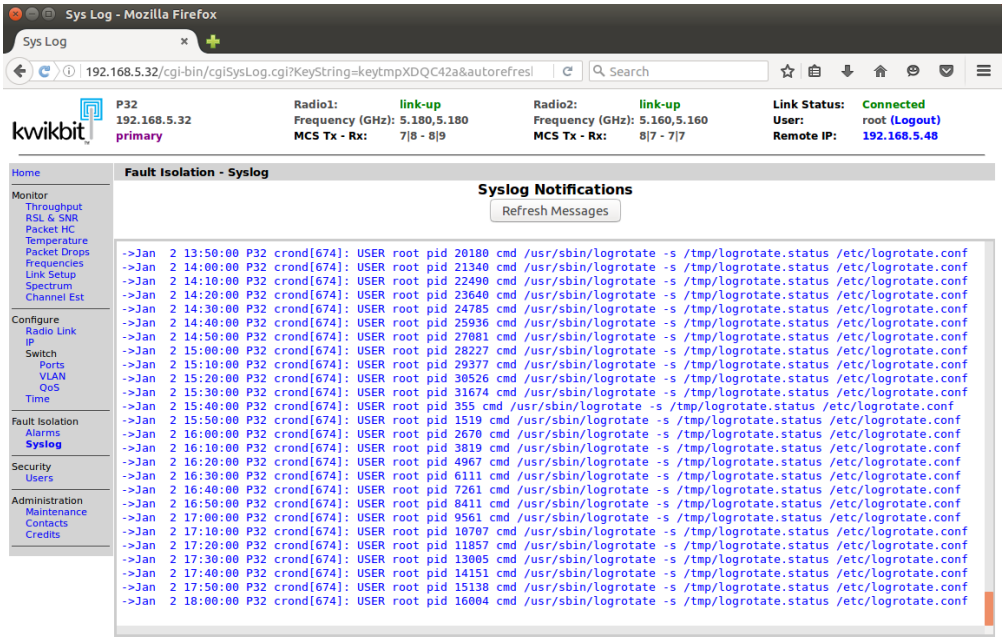
6.1.4.1 SNMP Alarms

This section provides a summary of System alarms since the last alarm reset. Click the *Refresh Messages* button to update page.



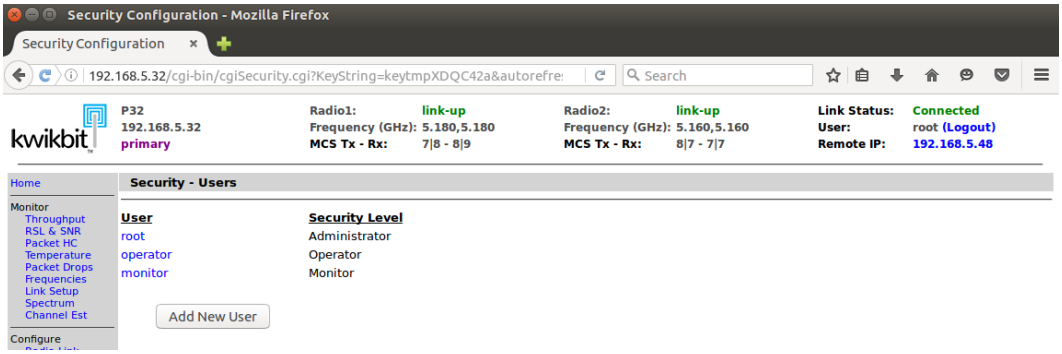
Syslog Notifications

This section provides a summary of Syslog notifications since the last reset. Click the *Refresh Messages* button to update page.



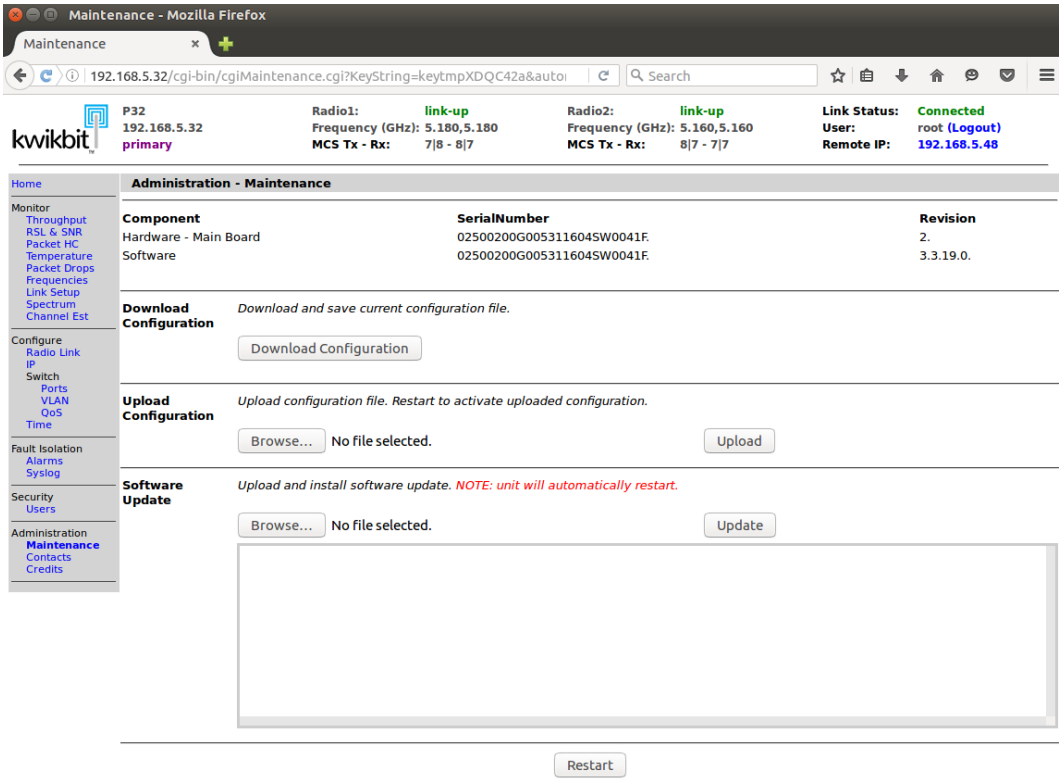
6.1.5 Security Section – Users

This section allows for user and password management for the current M4-2000 unit.



6.1.6 Administration – Maintenance

The Maintenance page of the Administration section displays serial number and software version information. From this page, a user is also able to remotely upload/download the configuration file and update software.



6.3 M4-2000 MIB – Logical Overview

The M4-2000 features an embedded SNMP agent and proprietary MIB divided into sections: Configuration, Statistics, Device Status and Control.

6.3.1 MIB Configuration Section

The Configurtion section of the MIB is organized into groups:

- ⇒ Static
- ⇒ General
- ⇒ Radio
- ⇒ Primary
- ⇒ Secondary

6.3.2 MIB Statistics Section

The MIB's Statistics section is organized into the following groups:

- ⇒ Ethernet bytes/packets in/out
- ⇒ Airlink bytes/packets in/out
- ⇒ Header compression counters
- ⇒ Connection control protocol counters

6.3.3 MIB Device Status Section

The Device Status section of the MIB consists of real-time gauges organized into the following groups:

- ⇒ Interesting local information (e.g., link state, unit temperature, encryption state)
- ⇒ Airlink status cable
  - TxMCS, RxMCS, RSSI, CINR, TxPower, etc.
  - Reported per antenna

6.3.4 MIB Control Section

The MIB's control section is divided into the following groups:

- ⇒ Link enable/disablce
- ⇒ Advance to next channel
- ⇒ Reset statistics
- ⇒ Reboot the device

6.4 Appendix

6.4.1 Default channel plan

The channel plan named “default_plan.cpx” is the factory default configuration.

10 MHz channel bandwidth

35	5175000
37	5185000
39	5195000
41	5205000
43	5215000
45	5225000
47	5235000
49	5245000
148	5740000
150	5750000
152	5760000
154	5770000
156	5780000
158	5790000
160	5800000
162	5810000
164	5820000
166	5830000

20 MHz channel bandwidth

36	5180000
40	5200000
44	5220000
48	5240000
149	5745000
153	5765000
157	5785000
161	5805000
165	5825000

40 MHz channel bandwidth

38	5190000
46	5230000
151	5755000
159	5795000

6.4.2 Default configuration

The following table itemizes the default configuration parameters controlled via SNMP.

m4gNlosPtpCfgGenRole.0	secondary
m4gNlosPtpCfgGenLinkID.0	0
m4gNlosPtpCfgGenChannelBandwidth.0	bw20MHz
m4gNlosPtpCfgGenEnableShortDelayTimeSpread.0	disabled
m4gNlosPtpCfgGenEnableAirlinkAtBoot.0	disabled
m4gNlosPtpCfgGenDCSObservationInterval.0	50
m4gNlosPtpCfgGenEnableJumboFrames.0	disabled
m4gNlosPtpCfgGenEnableHeaderCompression.0	enabled
m4gNlosPtpCfgGenEnableExternalLEDs.0	disabled
m4gNlosPtpCfgGenWebTimeout.0	900
m4gNlosPtpCfgEthMgmtVlanId.0	1
m4gNlosPtpCfgEthEnableInBandMgmt.0	disabled
m4gNlosPtpCfgEthEnableRemoteMgmt.0	enabled
m4gNlosPtpCfgEthEnableDataPathSwitching.0	enabled
m4gNlosPtpCfgQosDqScheme.0	eDqStrict
m4gNlosPtpCfgQoSEnableOutbound.0	qosInternal
cfg58RadioChannelFileName.0	default_plan.cpx
m4gNlosPtpCfgPriAirlinkTimeSource.0	internal
m4gNlosPtpCfgPriEnableDCS.0	enabled
m4gNlosPtpCfgPriBandRefresh.0	low
m4gNlosPtpCfgPriEnableAirlinkSecurity.0	disabled
m4gNlosPtpCfgPriAirlinkSecurityKeyInterval.0	0
m4gNlosPtpCfgPriEnableSyncE.0	disabled
m4gNlosPtpCfgPriSyncESourcePort.0	automatic
m4gNlosPtpCfgPri1588Transport.0	eNone
m4gNlosPtpCfgPriTddRatio.0	50
m4gNlosPtpCfgPriEnableAutoTddRatio.0	enabled
ethPortEnable.1	enabled
ethPortMode.1	modeAuto
ethPortDefaultPriority.1	0
ethPortPrioritySource.1	prio8021P
ethPortEnable.2	enabled
ethPortMode.2	modeAuto
ethPortDefaultPriority.2	0
ethPortPrioritySource.2	prio8021P
ethPortEnable.3	enabled
ethPortMode.3	modeAuto
ethPortDefaultPriority.3	5
ethPortPrioritySource.3	prio8021P
sqEgressWeight.1	1
sqEgressWeight.2	2
sqEgressWeight.3	4
sqEgressWeight.4	8
cfg58RadioDLFrequency.1	5805000
cfg58RadioULFrequency.1	5805000
cfg58RadioAntennaMode.1	xpic
cfg58RadioTxPower.1	-30
cfg58RadioEnableATPC.1	enabled
cfg58RadioAtpcMaxTxPower.1	30
cfg58RadioMCS.1	1
cfg58RadioEnableAdaptiveMCS.1	enabled

cfg58RadioAmcMaxMCS.1	9
cfg58RadioDLFrequency.2	5825000
cfg58RadioULFrequency.2	5825000
cfg58RadioAntennaMode.2	xpic
cfg58RadioTxPower.2	-30
cfg58RadioEnableATPC.2	enabled
cfg58RadioAtpcMaxTxPower.2	30
cfg58RadioMCS.2	1
cfg58RadioEnableAdaptiveMCS.2	enabled
cfg58RadioAmcMaxMCS.2	9

In addition, there are a few other default configurations as shown:

ip address	192.168.0.51
ip netmask	255.255.255.0
ip gateway	192.168.0.1
sysName	kwikbit-device
sysLocation	UnKnown