



**K60x Wireless Communication System
User Guide**

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K60x User Guide



K60x User Guide

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You can determine whether your equipment is causing interference by turning it on and off. If the interference stops, it was probably caused by the equipment. If the equipment causes interference to radio or television equipment, try to correct the interference by using one or more of the following measures:

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- Increase separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from which the receiver is connected.
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1 Preface

1.1 Preface overview

Thank you for choosing the K60x system from Kwikbit. This guide introduces you to system concepts, system architecture and commonly used terms.

This preface describes:

- Audience for this guide
- Additional documentation
- Where to go for more help

1.2 About this guide

This guide provides an overview of the K60x system, its components, its network architecture, and how it is configured and deployed.

This guide is intended for network and system administrators who must install, configure, and manage K60x distribution networks. This guide is meant to provide an overview of the system. This guide does not provide detailed information on network configuration.

It is assumed readers of this guide are familiar with:

- Basic networking concepts
- Layer 2 (link layer) of OSI model
- Layer 3 (network layer) of OSI model
- Routing and switching in networks
- Radio frequency (RF) systems engineering
- Virtual local area network (VLAN) technology

1.3 Additional documentation

- Information about network management is available in the Kwikbit Edge Controller User Manual

1.4 Additional help

Kwikbit is committed to providing our customers with high quality technical support via the following methods:

Web	support.kwikbit.com
E-mail	support@kwikbit.com
Phone	+1 (952) 657-5628

2 Kwikbit K60x System Overview

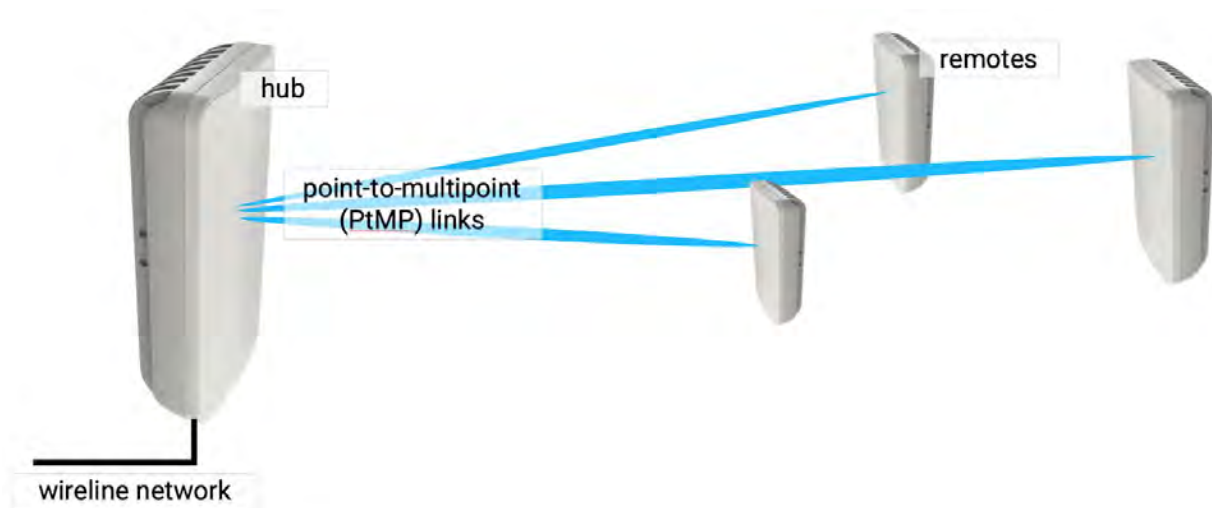


Figure 1: K60x System in a Point-to-Multipoint (PtMP) Wireless Communication Application

Kwikbit is a leader in gigabit wireless distribution solutions that intelligently adapt to challenging environments to maximize performance and reliability.

The K60x system operates in the 60 GHz unlicensed frequency band and is designed primarily for line-of-sight (LoS) operation. Non-line-of-sight (NLoS) operation is possible within short range and in the presence of reflective surfaces. By utilizing advanced beamforming techniques, the K60x system automatically adapts in Point-to-Multipoint (PtMP) communication configuration and is adaptable to changes in the operating environment. The beam forming capability also makes system installation simple for

non-technical staff as precise mechanical alignment, as required by previous generation 60 GHz systems, is not required.

The K60x system is designed for use in multiple applications including gigabit access, IoT backhaul (sensors, security cameras, etc.), optical fiber extension, and corporate and enterprise data backhaul services by providing 1 Gbps of symmetric throughput.

The K60x system operates in unlicensed Time Division Multiplexing (TDD) band 57.05 – 64.00 GHz in both Point-to-Point (PtP) and Point-to-Multipoint (PtMP) configurations. Some of the main product characteristics are shown in Table 1.

Table 1: Main K60x Characteristics

Duplex Mode	Time Division Multiplexing (TDD)
Physical Layer / Antenna System	128 patch beamforming antenna
Operation Configuration	PtP and PtMP
Capacity	1.86 Gbps goodput aggregate
Symmetry	Dynamic downlink (DL) and uplink (UP) based on offered load
Frequency of Operation	57.05 – 64.00 GHz
Channel Bandwidth	2.16 GHz
Network Interface	2 x 2.5 gigabit Ethernet 1x 1 gigabit Ethernet
Form Factor	7.75 x 4 x 2.5" with integrated antenna

The K60x system consists of the following components:

- **Hub Unit:** control communication to one or more Remote Units
- **Remote Unit:** scan for available Hub Units and connect to the Hub configured or assigned via the Edge Controller

- **Edge Controller:** Optional appliance computer that provides WebUI tools for deployment planning, commissioning, network configuration, management, monitoring and fault isolation. Edge controller is highly recommended for networks of medium and large scale.

The K60x Hub and Remote Units are identical from a hardware perspective, only differing in software configuration. The K60x has a small form factor that can be easily and unobtrusively deployed in many different outdoor environments.

3 K60x System Description

Kwikbit's K60x wireless outdoor backhaul solution is designed to meet the requirements of network planners where rapid and flexible deployment, high reliability, multi-gigabit capacity and excellent latency performance are needed. Applications for the system include IoT gateway aggregation, Wi-Fi access point backhaul, video camera connectivity and other gigabit IP based applications. The system can function either as a Point-to-Point (PtP) or Point-to-Multipoint (PtMP) wireless Ethernet bridge.

Some of the main characteristics of the system include:

- **Time Division Duplex (TDD):** The K60x solution features TDD access mode with variable frame length.
- **Adaptive Modulation with Link Adaptation:** The K60x system supports BPSK, QPSK on both the downlink and uplink path to achieve high capacity in the channel bandwidth (1.86 Gbps Ethernet layer throughput for combined downlink and uplink traffic).
- **Beamforming:** Use of the 60 GHz band allows extremely fast communication, but also presents the challenge of limited propagation. Signals in the 60 GHz band are also more susceptible to disruption from physical barriers than at lower frequencies. The K60x system includes adaptive beamforming, a technique that enables robust multi-gigabit communications at greater distances. Kwikbit's beamforming feature uses directional antennas to reduce interference and automatically focus a signal between two devices into a concentrated beam. During the beamforming process, devices establish communication and then fine-tune their antenna settings to improve the quality of directional communication until there is enough capacity for the desired data transmission.

One key benefit of Kwikbit's beamforming is that if an obstacle blocks the line of sight between two devices, for example, if someone walks between them, the devices can quickly establish a new communications pathway. Another benefit of the K60x beamforming is that non-technical personnel can quickly and easily install the

system. Precise physical alignment of the radios, as required with previous 60 GHz products, is not required with the Kwikbit system. The beamforming feature also enables the PtMP communication capability of the system.

- **Power Management:** The K60x system utilizes the scheduled access mode to reduce power consumption. Devices connected with each other via a directional link schedule the periods during which they communicate and, in between those periods, they can sleep to save power. This capability allows devices to more precisely tailor their power management to their actual traffic workload, reduces potential co-channel interference and enables efficient spectrum utilization.
- **Advanced Security:** The K60x system utilizes strong security mechanisms, including Galois/Counter Mode, a highly-efficient mode of encryption that is designed to support higher communication speeds. Encryption is based on the government-grade Advanced Encryption Standard (AES) and is implemented in hardware for performance and efficiency.
- **Integrated Antennas:** The K60x units integrate a specially-designed, 128 element antenna module that enables a maximum EIRP of 40 dBm with a 90° azimuthal and 40° vertical beam sweep range.
- **PtMP with Dynamic Bandwidth Allocation:** The K60x system can operate in PtP or PtMP configurations with up to seven Remotes. The capacity allocated to each Remote is variable according to the requirements of connected devices.
- **Compact Form Factor:** The K60x transceiver units are highly integrated, compact, and lightweight, so they can be easily mounted on poles, pipes and walls.
- **Connectivity:** K60x backhaul devices include two standard RJ45 2.5 Gigabit Ethernet ports, and one standard RJ45 1 Gigabit Ethernet port. One 2.5 Gigabit port is a PoE In port. Second 2.5 Gigabit port is 30W PoE Out port and the 1 Gigabit port is 15W PoE Out port. The two PoE Out ports can provide power to connected Wi-Fi access points, IoT gateways, surveillance cameras and other payload communication devices.

The Kwikbit K60x system provides these network management features:

- Each K60x unit incorporates a WebUI. This WebUI enables configuration, fault management, and administration of the unit, as well as provides system state and performance information.
- A command-line interface (CLI) is also available. It provides features similar to those of the WebUI.

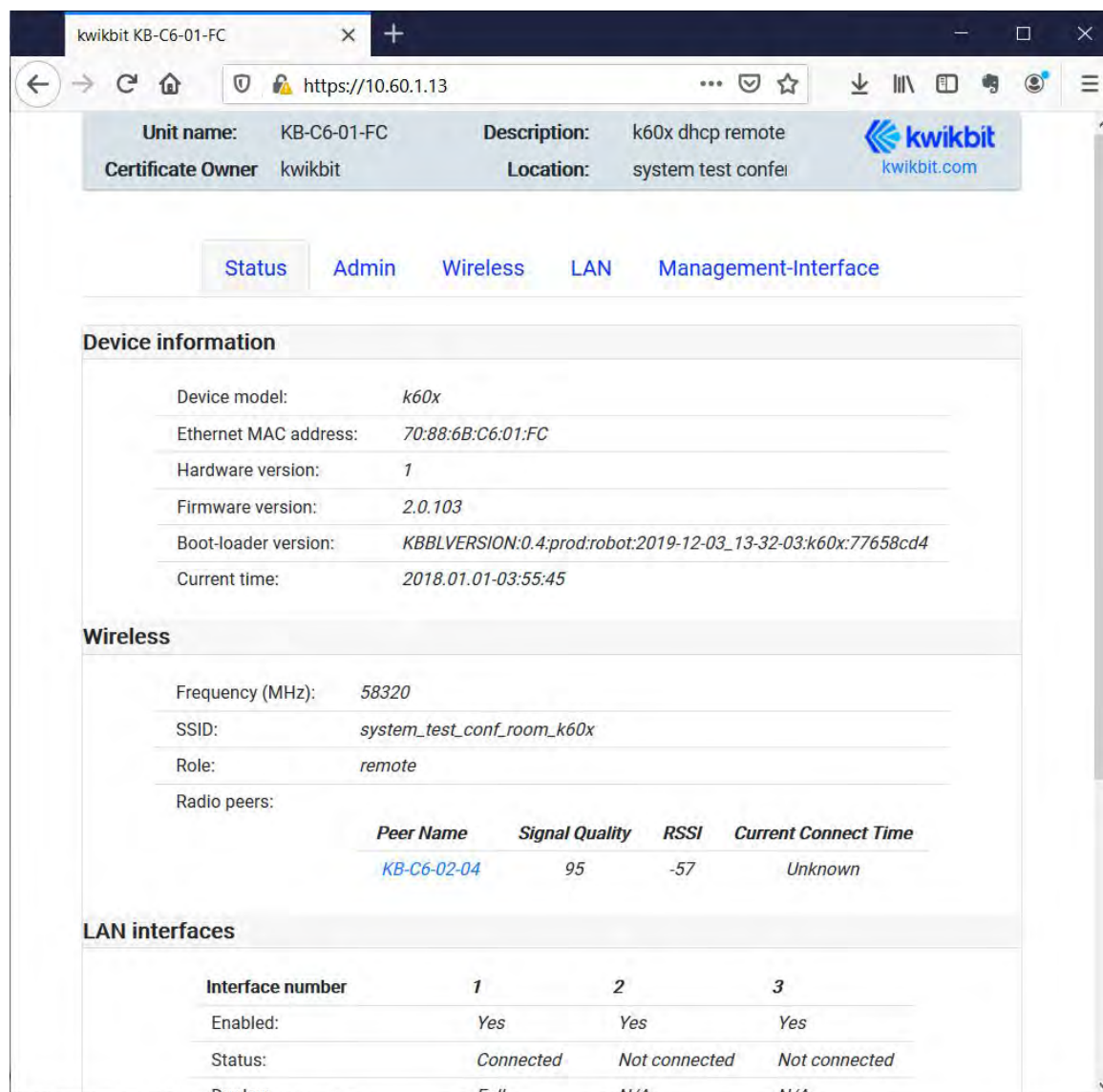


Figure 2: K60x Hub and Remote WebUI interface page

- The Kwikbit Edge Controller is a very powerful part of the Kwikbit solution. The Edge Controller connects through an Ethernet connection to the root K60x unit and enables non-technical personnel to physically install an entire network without K60x units being configured on the bench in advance. A local or remote IT resource can design, commission and manage the network using the Edge Controller's WebUI. The Edge Controller can be connected to the cloud for remote management of multiple locations.

4 Technical Specifications

4.1 System Specifications

Aggregate capacity	Up to 1.8 Gbit/sec (Layer 2/ Ethernet)
Ethernet frame type	Transparent bridging of all Ethernet types including VLAN and VLAN stacking
Latency	250 microseconds average
L2 switching	Complete Layer 2 switching with VLAN support
Security	AES 128 with automatic secure key distribution
Network Attributes	Ethernet bridge, 802.1Q, DSCP/ToS/802.1p (IPv4/v6) and 802.1ad/ QinQ tagging
Network Interfaces	2 x 2.5 GbE RJ-45 (one port with PoE in and one port with up to 30W PoE output) 1 x GbE RJ-45 (with up to 15W PoE output)
Other Interfaces	LED indicator for power, link condition, signal strength, and unit location
Provisioning	Zero-touch deployment and commissioning with Edge Controller web application
Management	Web GUI, CLI, REST API and Edge Controller (optional)

4.2 Radio Specifications

Access Technology	Single carrier beamforming physical layer
Duplex	Time Division Multiplexing (TDD)

Modulation	BPSK, QPSK; 8 levels of adaptive modulation and coding schemes
Frequencies	57.05 - 64.00 GHz
Channel Bandwidth	2.16 GHz
Antenna System	128 patch beamforming antenna with 90° horizontal and 40° vertical scan range
Output power (maximum)	40 dBm EIRP
Typical Range	400 meters

4.3 Mechanical, Power and Environmental Specifications

Configuration	Single-piece indoor unit with integrated antenna
Dimensions (H x W x D)	197 x 100 x 60 mm 7.75 x 4 x 2.5 inches
Weight	508g / 18 ounces
Power Input	802.3at, 802.3at+, or 802.3bt PoE
Power Consumption	K60x only: 20 watts idle, 24 watts maximum K60x + fully loaded PoE: 70 watts maximum
Power Output	PoE available on 2 ports (with 65W PoE input): 802.3at (30 watts) on second RJ45 2.5 GbE port and 802.3af (15 watts) on the RJ45 1 GbE port
Operating temperature	-30 °C to +55 °C
Humidity	Up to 95% non-condensing
ESD	IEC EN 61000-4-2

EMC	IEC EN 61000-4-3
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4.4 System Enclosure

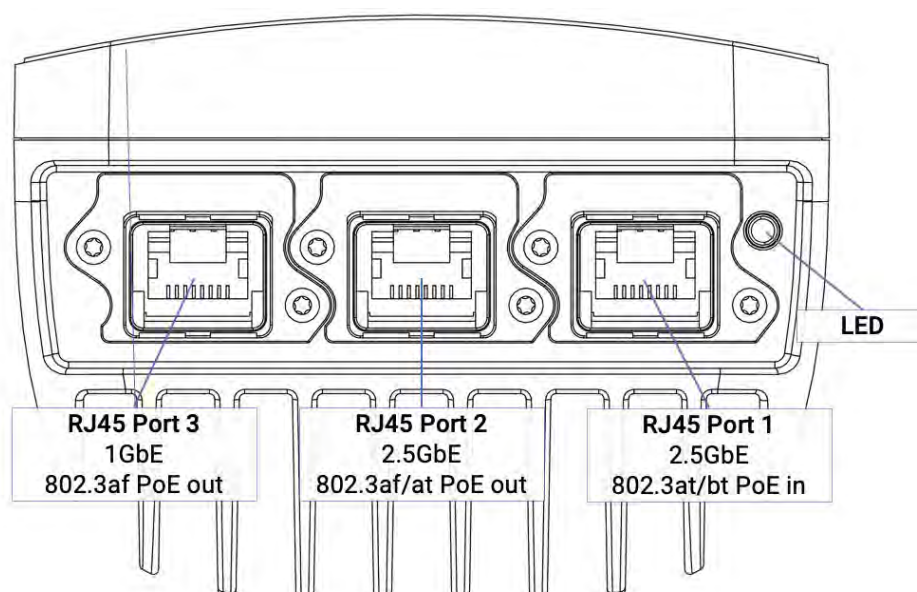


Figure 3: Ports on K60x (Hub and Remote)

The K60x enclosure is a rugged casing that is supplied with a combination pole and wall mounting bracket. The mounting bracket allows for a range of orientation flexibility to enable mounting in challenging locations. Units installed at the same location can be interconnected for medium and large network deployments.

The mechanical enclosure for the transceiver Module has three RJ45 connectors. Port one is for 2.5 Gigabit Ethernet network connectivity and PoE power input (802.3at, 802.3at+, or 802.3bt). Port two is for 2.5 Gigabit Ethernet network connectivity and provides PoE power output (up to 30W/802.3at). The third port provides 1 Gigabit Ethernet network connectivity

and up to 15W 802.3af PoE power output. 70W PoE input power would be required to satisfy the maximum 24W power consumption of the K60x plus support the maximum delivered PoE output power with two connected devices (802.3af/15W delivered on port three plus 802.3at/30W delivered on port two).

5 System Throughput

The K60x system uses time division duplexing (TDD) access mode, employing a single frequency for both transmit and receive paths. The throughput for the downlink and uplink depends on a downlink-to-uplink frame bandwidth ratio. The ratio is automatically adjusted based on the offered load in each direction, taking into account all Remotes connected to a Hub in PtMP. Furthermore, the system's throughput depends on the Modulation and Coding Rate (MCS) which varies according to link and signal conditions. The following table details Ethernet uplink and downlink combined throughput for a K60x link.

Table 8: Throughput Performance for Cyclic Prefix of 1/8

MCS Index	Modulation	NCBPS	Repetitions	Code Rate	Data Rate (Mbit/s)
1	$\pi/2$ BPSK	1	2	1/2	310
2	$\pi/2$ BPSK	1	1	1/2	620
3	$\pi/2$ BPSK	1	1	5/8	775
4	$\pi/2$ BPSK	1	1	3/4	930
5	$\pi/2$ BPSK	1	1	13/16	1007
6	$\pi/2$ QPSK	2	1	1/2	1240
7	$\pi/2$ QPSK	2	1	5/8	1550
8	$\pi/2$ QPSK	2	1	3/4	1860

6 Element and Network Management

The K60x system supports the following network management interfaces:

- K60x Web Interface (WebUI). Accessible via HTTPS, the K60x WebUI provides an interactive visual toolset that allows an operator to modify the full configuration of the K60x system as well as view state, fault, and performance indicator.
- K60x Command Line Interface (CLI) provides a set of commands that allows the operator to manage, maintain and troubleshoot the system.
- The Edge Controller WebUI application provides complete access to configuration, state, performance and fault information for all K60x units in a network system.

The WebUI network management interface on the K60x system is accessible via HTTPS. Power the unit with a PoE power source. Connect to the K60x system with your browser utilizing one of the following methods:

- **Local Name:** Connect a K60x transceiver unit directly to your computer by plugging an Ethernet cable into any of the K60x's RJ45 connectors. In the URL field on your computer's browser type **https://KB-XX-XX-XX.local** where **KB-XX-XX-XX** is the Host name of the unit that appears on the label on the side of the unit. For example, if the unit Host name is **KB-C5-6B-78**, then the URL address of the unit is **https://KB-C5-6B-78.local**. Your browser will display a warning stating that the connection is not secure. You may ignore the warning and proceed connecting to the unit. To avoid the warning, please go to the Kwikbit support website, download the Kwikbit security certificate, and install it on your browser.
- **Management IP Address:** Connect using the IPv4 IP address. The factory-assigned IP address appears on a temporary label on the unit. Be sure to use https:// rather than http.

The Command Line Interface network interface on the K60x system is accessible via Secure Shell (SSH). Power the unit with a PoE power source. Connect to the K60x system with your terminal application utilizing one of the following methods:

- **Local Name:** Connect a K60x transceiver unit directly to your computer by plugging an Ethernet cable into any of the K60x's RJ45 connectors. In a terminal application window on your Linux, Unix or MAC computer type **ssh kwikbit@KB-XX-XX-XX.local** where **KB-XX-XX-XX** is the Host name of the unit that appears on the label on the side of the unit. For example, if the unit Host name is **KB-C5-6B-78**, then the command line is **ssh kwikbit@KB-C5-6B-78.local**. For the password prompt enter **kwikbit**.
- **Management IP Address:** Connect using the IPv4 IP address. The factory-assigned IP address appears on a temporary label on the unit.

The optional Kwikbit Edge Controller's management application automatically discovers all connected K60x devices on the network and establishes a secure connection to each one utilizing a security certificate provided by Kwikbit and customized by the customer. For more information on the Kwikbit Edge Controller device and associated applications, please refer to the Kwikbit Edge Controller User Manual.

The K60x system provides the following network management functions:

1. Device configuration information and status is displayed on the WebUI page interface as shown above in Figure 2. When the mouse cursor is hovered over an Ethernet Port or wireless connections icon, detailed information is displayed. In the Wireless section, the list of wirelessly connected devices is displayed. The list of LAN connected devices is displayed in the LAN Peers section. The WebUI of a connected device is established by clicking on the device's name.
2. Configuration Management. The system configuration section covers several functional areas:
 - Device
 - Device location
 - Device description
 - Wired Network
 - Device IP address assignment
 - Static address
 - DHCP – requires DHCP server
 - Automatic Zero Configuration address assignment
 - Management VLAN
 - Ethernet ports
 - Enable / Disable
 - PoE Enable / Disable (port 2 and 3)
 - Wireless Network
 - Device role
 - SSID
 - Airlink passcode
 - Channel frequency
 - Preferred Hub (if device configured as Remote)
3. Administration Operations:
 - Flash LEDs of the device – used to identify location of physically installed device
 - Change administrator password of the device
 - Upgrade device software
 - Reboot the device

To reset the device to factory defaults:

- Insert the Reset Dongle (provided separately) into Ethernet Port 3 (the 1Gbps port)
- Cycle the power
- During power-up, observe the LED.
- Remove the Reset Dongle when the LED pattern indicates that the reset has been triggered (refer to the LED Indicator Codes section of this document)
- The device is now operating at factory default settings
- The login password is “kwikbit”

7 Ethernet Bridge Support

Designed to seamlessly integrate into existing Ethernet backhaul or general-purpose networks, the K60x system is built for Ethernet connectivity services and provides network functionality as a standard Layer 2 (L2) Transparent Bridge (IEEE 802.1d), whereby the K60x cluster (a cluster being one Hub with its group of up to seven Remotes) is the bridge, and the Ethernet ports on the Hub and associated Remotes are the ports of the bridge.

The embedded bridge functionality performs Media Access Control (MAC) address learning (up to 4096 MAC addresses). This function allows the Hub to perform an optimal allocation of radio resources by sending traffic to the Remote behind which the destination of that traffic is located.

The K60x system allows network management traffic to be encapsulated in a dedicated management VLAN and can transport standard Ethernet frames (up to 1518 bytes).

8 Installation Planning

When unpacking K60x backhaul units during install, be sure to do the following for each unit:

- Locate the label on the unit casing that lists the Serial Number (SN) and Host name of the unit
- Record the SN on your registration card for future reference
- Record the Host name for future reference when provisioning the system

After installation of the K60x backhaul units, perform the tasks described in Chapter 12 “System Provisioning”.

9 LED Indicator Codes

K60x is equipped with a single double color (red and green) LED indicator. The following are the LED indication modes. The sequences indicate the LED state during each 150ms time slot

- during boot up: solid red
- normal operation:
 - no wireless link: repeat the sequence: green, off, off, green, off, off ...
 - established wireless link:
 - Hub: solid green
 - Remote: signal quality from 1 blink for weakest to 5 blinks for the strongest between pauses. Example: for link quality of 3 the repeat sequence is: pause green green green
- error condition:
 - repeat the sequence: red, off, red, off, red, off, off, off
- identify the unit
 - repeat the sequence: red, green
- signal for reset to factory defaults:
 - repeat the sequence: green, red, green, red, green, red, off, off
- restore factory defaults is in progress:
 - repeat the sequence: red, off, red, off, off, off, green, off, green, off, off, off

10 Using the K60x Web User Interface (UI)

10.1 Requirements

The K60x embedded WebUI allows for direct configuration of both Hub and Remote units. It is a standard web application that runs directly on the K60x unit and is accessible through the default port for HTTPS (443) at URL <https://<Host name of the unit>>. Your browser will display a warning stating that the connection is not secure. You may ignore the warning and proceed connecting to the unit. To avoid the warning, go to the Kwikbit support website, download the Kwikbit security certificate, and install it on your browser.

The recommended browsers for the K60x WebUI are:

- Google Chrome
- Safari

Operating System (OS) support for K60x WebUI:

- Windows

- Mac OS X
- Unix
- Linux

Note: With the exception of IE9, the K60x WebUI supports the most recent web browser and OS versions.

Required basic K60x unit configuration tasks can be performed using the units WebUI; however, the Kwikbit Edge Controller can be used to quickly and efficiently plan, commission, configure and monitor small to large K60x networks. See the K60x Edge Controller User Guide for details.

10.2 K60x Web UI Page

The K60x WebUI is a single page that provides device status as well as configuration options.

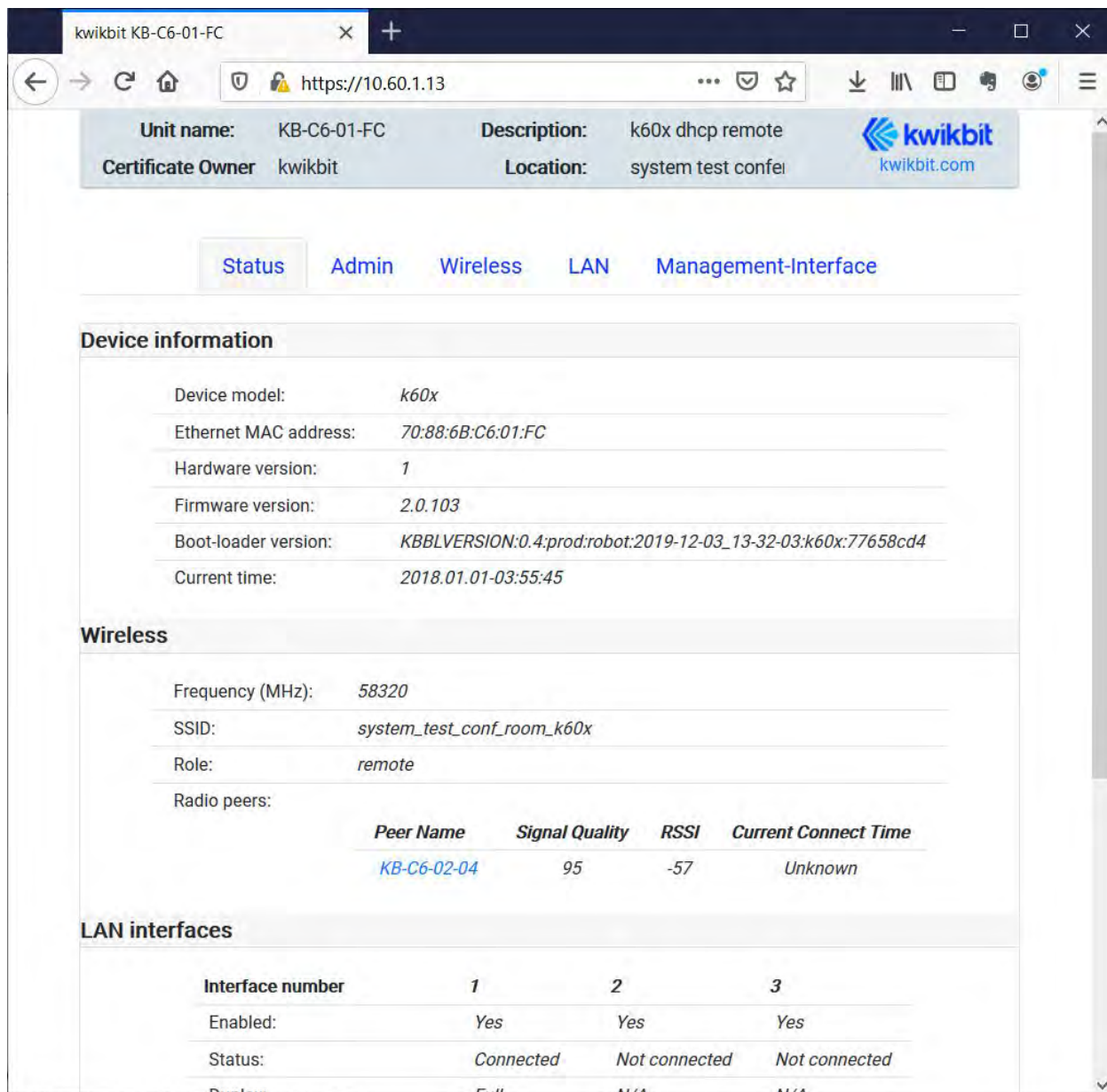
10.2.1 Logging In

Use your browser to connect to K60x device's WebUI as described above. It is not necessary to login to the system in order to view the WebUI page. You will then be prompted to login once you click on any one of the configuration tabs if you do not have a security certificate installed on your computer. The security certificate based authentication option is available when utilizing an Edge Controller to manage the network.

The default username and password is as follows:

User Name: kwikbit
Password: kwikbit

The page remains read-only if you do not login to the system and only gives general system information.



The screenshot shows the Kwikbit K60x WebUI interface in a browser window. The address bar shows the URL `https://10.60.1.13`. The page header displays the unit name `KB-C6-01-FC`, description `k60x dhcp remote`, certificate owner `kwikbit`, and location `system test confel`. The Kwikbit logo and website URL `kwikbit.com` are also present.

The main content area has a navigation bar with tabs: **Status**, **Admin**, **Wireless**, **LAN**, and **Management-Interface**. The **Status** tab is selected.

Device information

Device model:	<i>k60x</i>
Ethernet MAC address:	<i>70:88:6B:C6:01:FC</i>
Hardware version:	<i>1</i>
Firmware version:	<i>2.0.103</i>
Boot-loader version:	<i>KBBLVERSION:0.4;prod:robot:2019-12-03_13-32-03:k60x:77658cd4</i>
Current time:	<i>2018.01.01-03:55:45</i>

Wireless

Frequency (MHz):	<i>58320</i>
SSID:	<i>system_test_conf_room_k60x</i>
Role:	<i>remote</i>
Radio peers:	

Peer Name	Signal Quality	RSSI	Current Connect Time
KB-C6-02-04	95	-57	Unknown

LAN interfaces

Interface number	1	2	3
Enabled:	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Status:	<i>Connected</i>	<i>Not connected</i>	<i>Not connected</i>
Duplex:	<i>Full</i>	<i>N/A</i>	<i>N/A</i>

At the top of the WebUI screen, general node information including unit name, description, and location is displayed. There are two network sections on the page, Wireless and LAN.

The **Wireless** section displays the connection SSID, the unit role (Hub or Remote) and all current wireless connections. If the unit is a Hub, all currently linked Remotes will be displayed under connections. If the unit is a Remote, only one connection to a Hub can be listed. Each connection displays the connected unit name as well as graphical representation of the signal quality of the connection. By clicking on the connected device's

name, a browser page of that device is opened. By hovering over the signal quality graphic, detailed signal level information is displayed. You can change SSID and unit Role configuration by clicking on the tool icon in the section banner, assuming you are an authorized user.

The **LAN** section displays the unit's assigned IP address and the status of the three Gigabit Ethernet ports. By hovering over the Ethernet port icons, detailed port status information is displayed. The unit's IP configuration can be changed by clicking on the tool icon in the section banner. Clicking on the Ethernet port icons allows a user to enable and disable ports as well as turn PoE output on or off for ports one and two.

The **Device** section displays and provides configuration capability for **Device Location** and **Device Description**.

The **LAN Peers** section displays the names of all K60x units that are connected to the current unit over a LAN connection. In most cases, these would be collocated units that provide additional wireless connectivity from that location.

The **Administration** section displays the software and the hardware versions of the device and includes controls to change user password, upgrade device software, flash device LEDs for device identification, and to reboot the device.

11 Using the K60x Command Line Interface (CLI)

11.1 Requirements

The K60x CLI allows for direct configuration of both Hub and Remote units. To connect using Command Line Interface from a Linux, Unix or MAC computer terminal window type **ssh kwikbit@KB-XX-XX-XX.local** where **KB-XX-XX-XX** is the Host name of the unit that appears on the label on the side of the unit. For example, if the unit Host name is **KB-C5-6B-78**, then the command line is **ssh kwikbit@KB-C5-6B-78.local**. For the password prompt enter **kwikbit**. You should receive a command prompt

11.2 K60x CLI commands

The K60x CLI provides device status as well as configuration options commands.

At the prompt type "?" for the list of commands and their operation.

12 System Provisioning

Network planning, installation procedure and commissioning are most efficiently performed using the Kwikbit Edge Controller. In addition, the Edge Controller enables

centralized network operation view and management. Please see the Kwikbit Edge Controller User Guide for detailed information.

If it is desired to provision a K60x network without the use of edge controller, the following tasks associated with preparing a K60x system must be followed:

1. Initial system setup and IP configurations
2. Setting units' roles
3. Setting SSID and airlink connectivity passcode
4. Setting communication channel frequency

12.1 Initial System Setup and IP Configurations

All new K60x units shipped from the factory are identical with a default software configuration loaded. You must connect to the management interface in order to configure the following system management parameters:

1. Connect your computer directly to the unit with an Ethernet cable. Once connected, open a browser on the computer and enter the IP address found on the unit's label.
2. After successfully opening the WebUI page, the unit's IP address can be changed by clicking on the **Wired Network** section tool icon:
 - When prompted for username, enter **kwikbit** for the username and **kwikbit** for password.
 - Select the desired address assignment protocol. If static address is selected, enter the network mask and default gateway.
 - Click Submit and the unit will reboot with the new address assignment. Your browser will automatically reconnect and display the page.
3. Click on the Wireless section tool icon to configure wireless communication parameters:
 - Select the role of the unit. When configuring a PtP or PtMP communication system, only one of the wirelessly connected devices may be configured with a Hub role. The units connecting to the Hub wirelessly must be configured as Remotes.
 - Configure SSID, airlink passcode and channel frequency (not required on remote). These parameters must match between the Hub and all wirelessly connected Remotes in order to establish wireless communication.
 - If a configured Remote can connect to multiple Hubs, you may want to set the optimal Hub in the Preferred Hub field.
 - There needs to be a Hub node configured with Network Root = enable. Alternatively, each remote needs to be configured with "Preferred Hub".

Lacking both of these will result in Remote nodes periodically scanning attempting to locate the Root node.

- Click **Submit** to save changes.
4. Click on the tool icon in the Device section to configure the **Location** at which the device will be physically installed and the description of the device. Click **Submit**.
 5. In the Admin section, click on the second icon to change the management interface password.

The unit is now configured and ready to be installed.

13 Appendices

13.1 Glossary

DHCP	Dynamic Host Configuration Protocol
DL	Downlink
DNS	Domain Name System
FCC	Federal Communications Commission
FTP	File Transfer Protocol
Gbps	Gigabits per second
GHz	Gigahertz
HU	Hub Unit
IEEE	Institute of Electrical and Electronics Engineers
ISED	Innovation, Science, and Economic Development Canada
L2	Layer 2
LAN	Local Area Network
LED	Light Emitting Diode
LoS	Line-of-Sight
MAC	Media Access Control
Mbps	Megabits per second
MCS	Modulation and Coding Scheme
MHz	Megahertz
NLoS	Non-Line-of-Sight

NMS	Network Management System
PC	Personal Computer
PtMP	Point-to-Multipoint
PtP	Point-to-Point
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RU	Remote Unit
SSID	Service Set Identifier
TDD	Time Division Duplexing
UL	Uplink
VLAN	Virtual Local Area Network
VDC	Volts Direct Current

13.2 FCC Regulatory Statement

Any changes or modifications not expressly approved by Kwikbit Inc. could void the user's authority to operate the equipment.

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.

13.3 FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. A minimum of 30 centimeters (12 inches) of separation between the K60x and all persons shall be maintained.

13.4 ISED Industry Canada Regulatory Statement

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'encompromettre le fonctionnement.

13.5 ISED Industry Canada Radiation Exposure Statement

NOTE: IC Radiation Exposure Statement: This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. A minimum of 30 centimeters of separation between the K60x and all persons shall be maintained.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Un minimum de 30 centimètres de séparation entre le K60x et toutes les personnes doit être maintenu.

13.6 Operation on Aircraft

USA: This device is not to be operated on aircraft except for the conditions listed in FCC CFR §15.255 (b).

Canada: This device is not to be operated on aircraft except for the conditions listed in ISED RSS-210 Annex J.1.