Skyus-E™ IoT Appliance

Quick Start Guide

Quick Start

Preface

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Open Source Software

This product contains software distributed under a number of open source licenses. See the Skyus-E User Manual or contact your Feeney representative for complete license information.

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Contents

Overview

The *Skyus-E IoT Appliance* simplifies the effort of implementing wireless connectivity in "Internet of Things" (IoT) networks. Built on FW's proven Skyus cellular modem technology, the Skyus-E provides a standard Ethernet interface for easy connection to customer devices.

The Skyus-E's rugged, compact aluminum body and its ease of installation make it perfect for deployment in a wide variety of IoT applications, including kiosks, digital signage, ATMs, and many others. Powered by FW's own Linux implementation, Axiom, the Skyus-E is capable of supporting nearly any FW Skyus module. With Axiom you get rapid connections, integrated connection management, and robust watchdog logic. Skyus-E features include:

- Operation on all major US carrier networks
- 4G LTE support on all major US carriers
- Modular design allows you to swap between Skyus carrier radio modules
- Skyus DS model allows you to switch carriers without switching hardware
- Standard Ethernet connection (LAN) to customer devices
- LED status indicators for power, activity, and signal strength
- GPS ready (Skyus DS models only)
- Skyus-E Administration Interface for system configuration and monitoring
- Integration with Crossroads IoT application framework
- Powered by the Axiom field data processing framework
- Future functionality and features in firmware updates

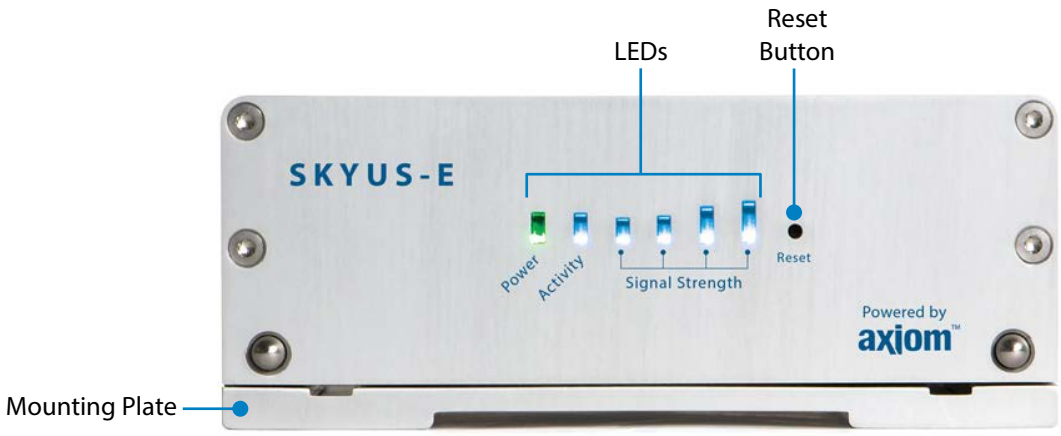


Figure 1: Skyus-E Front Panel

Intended Audience

This document is intended for users responsible for the configuration and management of the Skyus-E and assumes the user possesses a basic working knowledge of computer networking, wireless routing, and network administration.

Scope

This manual provides quick installation and configuration information. See the Skyus-E User Manual for in-depth information about Skyus-E installation, configuration, and management.

Specifications

Hardware	
Input Voltage	• 9-36V DC, AC/DC adapter
Power Consumption	• Typical*: 12V @ 0.32A (3.84W) • Max: 12V @ 1.56A (18.75W) • Low Power: 8V @ 0.02A (0.16W) (* 3G module running Skyus-E Interface with Internet activity)
Environmental	• Operating Temperature: -20°C to 60°C (-4°F to 140°F) • Storage Temperature: -40°C to 85°C (-40°F to 185°F)
Construction	Rugged aluminum housing
Dimensions	5" (W) x 2" (H) x 5" (D) - Approximate, includes mounting plate
Weight	• Skyus-E: 0.554 kg (1.20 lbs) • Mounting Plate: 0.249 kg (0.55 lbs)
Mounting	Tool-free mounting of Skyus-E to mounting plate (sold separately)
Data Interface	One 10/100 Ethernet, RJ-45 (Ethernet switch recommended for expansion, if needed)
Antenna Connections	• Primary Cellular: 50 Ohm SMA (SubMiniature version A) female • MIMO if 4G LTE, Receive Diversity if 3G – 50 Ohm SMA female • GPS: 50 Ohm SMA female
LEDs	Power x1, Activity x1, Signal Strength x4. Signal LED color shows cellular connection type: Blue– 4G, Green–3G, Amber–2G, No lights–No Connection.
Upgrade Kit	Skyus-E upgrade kit for easy installation of existing Skyus modules.
Cellular	
Technologies	LTE with fallback to HSPA+, HSPA, UMTS, EDGE, GPRS, EVDO, 1xRTT (depending on the Skyus module used)
Carriers	Sprint, Verizon, AT&T, T-Mobile
Bands	See the Skyus Specification Sheet or the Skyus DS Specification Sheet for modem-specific information. (Skyus Global not supported.)
Multi-Carrier Support	Skyus 4G LTE embedded modem kit (Verizon, T-Mobile, AT&T) uses software-switchable radio technology for multi-carrier support.
Standards/Approvals	FCC Part 15, Class B
GPS (Skyus DS Models Only)	
Satellite Channels	16
Protocol	NMEA 0183 Version 3.0
Acquisition Time	• Hot Start: 1 second • Warm Start: 29 seconds • Cold Start: 32 seconds
Accuracy	• Horizontal: < 5m (90%) • Altitude: < 8m (90%) • Velocity: < 0.2 m/s
Sensitivity	• Tracking: –161 dBm • Acquisition (Assisted, non-LTE): –158 dBm

	• Acquisition (Assisted, LTE): –153 dBm • Acquisition (Standalone): –145 dBm
Operational Limits	• Altitude < 600m, or • Velocity < 100 m/s Either limit may be exceeded, but not both.
Software	
Operating System	AXIOM integrated connection management – FW embedded Linux image enables rapid addition of functions, features, and carrier support.
Security	Integrated onboard routing, Network Address Translation (NAT), and firewall module
Protocols	TCP/IP, UDP/IP, DHCP, HTTP

Installation

The following sections describe the installation and initialization of the Skyus-E. Whether your Skyus-E is shipped with a Skyus cellular modem installed or you are installing an existing Skyus modem in the Skyus-E appliance, these instructions assume that the Skyus modem is already activated and provisioned.

Installation Summary

- Inspect the package contents and compare against the packing list.
- (Optional) Install your existing Skyus modem in the unit if necessary.
- Install the Skyus-E mounting plate and mount the unit to the plate.
- Connect the antennas.
- Connect the Skyus-E to the LAN or desired device using the an Ethernet cable.
- Connect power.
- Verify the WAN connection.
- Verify the LAN connection.
- **Recommended:** Change the default password.

Package Contents

Package contents depend on the configuration ordered. Compare the contents with the packing list. If any items are missing or damaged, contact FW support.

Item	Type	Description
Skyus-E	Included	Skyus-E IoT Appliance
Power Supply	Included	Power supply options include: AC/DC, DC/DC (bare wire or auto accessory plug), commercial or industrial temperature
Mounting Plate	Accessory	Skyus-E mounting plate
Antenna(s)	Accessory	FW offers several antennas that meet the Skyus-E antenna specifications
Ethernet	Accessory	5' Ethernet cable, RJ-45 to RJ-45
Skyus Module	Accessory	Skyus Cellular Modem (included in many Skyus-E configurations); see the Skyus Specification Sheet or the Skyus DS Specification Sheet for models

Hardware Installation

Perform the hardware installation steps described in the following sections. These instructions assume that your Skyus-E was shipped with a Skyus modem pre-installed.

- If you already have a Skyus modem and want to upgrade to the Skyus-E, contact FW Sales for the Skyus-E Retrofit kit. Complete the steps described in the Skyus-E Retrofit Assembly Instructions before proceeding with the installation.

If you want to replace the existing Skyus modem in your Skyus-E, follow the instructions in "Appendix B: Swapping Modems

Installing the Mounting Plate

The Skyus-E attaches easily to the mounting plate (sold separately). The figure below shows the dimensions and mounting hole locations of the plate. The mounting hardware you use will depend on the requirements of your enclosure. Countersunk bolts or screws may be used. Appendix A "Mounting Plate Template" provides a full-scale template you can print and use to mark the screw hole positions.

> **Note:** The plate mounting plate hole spacing supports mounting to a monitor or TV using VESA standard 75 mm hole spacing if the appropriate screws are used.

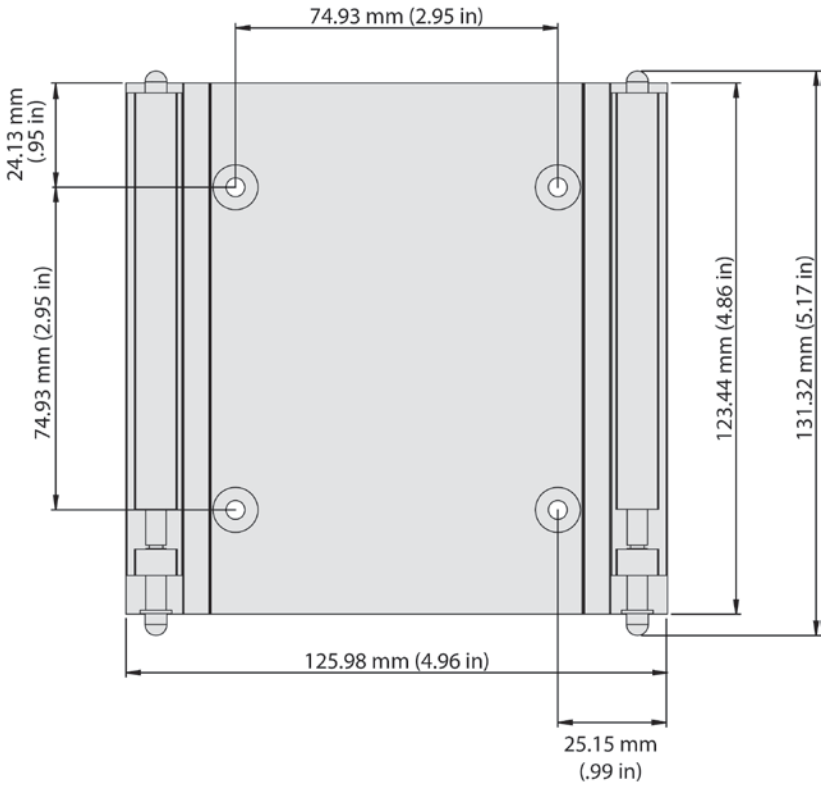


Figure 2: Mounting Plate Dimensions (Not to scale.)

The Skyus-E is mounted to the plate by placing the front or back edge of the Skyus-E over the spring-loaded pins, pulling to compress the pins, and dropping the opposite edge down over the fixed pins, as shown below. A how-to video on attaching the Skyus-E to the mounting plate is available on the Skyus-E Product Page on the FW website.

Figure 3: Attaching the Skyus-E to the Mounting Plate

Connecting Antennas

If you have questions about the appropriate cellular antennas for your Skyus-E, contact your FW representative. Antennas should be located at least 20 mm from any person. When using multiple separate antennas for MIMO or Receive Diversity, they should optimally be separated from each other by at least 20 mm.

Connect the primary cellular antenna to the SMA connector on the back panel labeled **Primary**. A second antenna can be attached to the SMA connector labeled **Diversity/AUX**. This connector is used for Receive Diversity for 3G connections or multiple-input and multiple-output (MIMO) for 4G LTE connections. Connect the GPS antenna to the SMA connector labeled **GPS**.

All SMA connectors should be tightened to 8 in-lbs. using a torque wrench with a 5/16 bit.

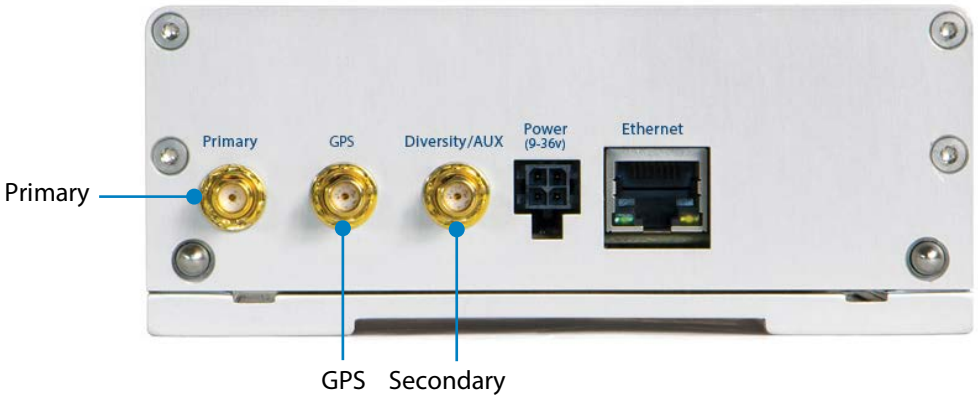


Figure 4: Antenna Connections

Connecting to the LAN

Connect a standard RJ-45 Ethernet cable into the connector labeled **Ethernet** on the back of the Skyus-E. Connect the other end of the cable to your host computer, switch, or separate router.

Connecting Power

Attach an AC/DC or DC/DC power supply to the connector labeled **Power (9-36v)** (mating connector: Molex 43025-0400) on the back of the Skyus-E. Plug the other end of the adapter into the power source. Contact FW for available power supply options. The pin assignments of the power connector are shown below. Refer to the power specifications for operating and maximum allowed voltage ranges.

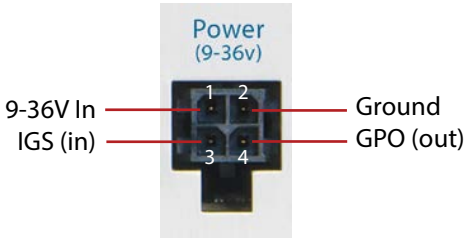


Figure 5: Power Connector Pin Assignments

Power LED

When power is applied, the **Power** LED on the front panel will flash green slowly until the boot process is complete. During normal operation, the **Power** LED will flash green quickly. The following table describes the **Power** LED modes.

LED Mode	Color	Description
Slow flashing	Green	System is booting
Quick flashing	Green	Power is applied, boot process is complete, normal operation
Solid	Red	System is in a non-recoverable unhealthy state
Flashing	Red	Over/under voltage or temperature condition

Verifying the Connections

Connection to the carrier should occur approximately 90-150 seconds after applying power. Connection time will vary according to carrier network and signal strength. The **Activity** LED lights up with activity. The **Signal Strength** LED array indicates the strength of the signal being received. The color of the LEDs depends on the connection type.

You can connect to the Skyus-E Interface via a Web browser to obtain more information about the connection status. From a computer connected to the Internet, open a browser and enter the Skyus-E IP address in the address bar. The login page of the utility displays the state, type, and up time of the connection, among other information. (See "Skyus-E Default Settings.")

See "Skyus-E Administration Interface" for information on monitoring, configuring, and managing your Skyus-E.

Activity LED

The **Activity** LED indicates both network activity and data usage. The following table describes the **Activity** LED modes. Note that indication of monthly data plan used is dependent upon configuring your data usage thresholds in the Skyus-E configuration. If this is not configured, the **Activity** LED will default to blue.

LED Mode	Color	Description
Intermittent flashing	Green	Skyus-E transferring data
Solid	Blue	0-50% of the monthly data plan is used
Solid	Green	51-85% of the monthly data plan is used
Solid	Yellow	86-99% of the monthly data plan is used
Solid	Red	100% of the monthly data plan is used

Signal Strength LEDs

The **Signal Strength** LED array indicates both the strength of the cellular signal and the type of connection. The array follows the standard 1-4 bar signal strength scheme, with four bars indicating a strong signal. The following table describes the **Signal Strength** LED modes.

LED Mode	Color	Description
1-4 bars lit	Blue	4G connection
1-4 bars lit	Green	3G connection
1-4 bars lit	Yellow	2G connection
0 bars lit	—	No connection

Resetting the Skyus-E

The **Reset** button on the Skyus-E front panel performs two different reset functions. The type of reset performed depends on how long the button is held down. When the button is pressed and held down, the signal strength LEDs will flash specific colors three times to indicate the type of reset that will be performed when the button is released.

CAUTION: Do not remove power to the Skyus-E or disconnect interface cables during a reset. Wait until the device is fully reset and the connection has been reestablished. Failure to wait might compromise the device.

NOTE: The reset button is functional only when the **Activity** LED is lit. Pressing the reset button will have no effect when the **Activity** LED is not lit.

To press the button, use a narrow tool such as a precision screwdriver or the end of a paperclip.

Reset Type	Button Press*	LED Flash Color	Description
Soft	5 seconds	Green	Resets the system using the current settings. This is similar to removing and reapplying power to the Skyus-E.
Factory Default	10 seconds	Red	Resets the system to the as-shipped settings.†

** Approximate duration of press.*
† Does not reset firmware to factory settings. Any after-purchase firmware upgrades will remain intact.

After a reset, restart your browser to reload the Skyus-E Interface and ensure that the latest settings are displayed.

Skyus-E Administration Interface

The Skyus-E Administration Interface is an all-purpose administrative tool that provides an intuitive Web interface for monitoring, configuring, and managing the Skyus-E. From the interface you can check the status of your connections to the WAN and LAN, view the status of the Skyus-E hardware, configure network and security settings, add users , set permission levels, and create and view system logs, among other activities.

Supported browsers are Chrome, Opera, and Firefox. Use of Internet Explorer 10 or newer may result in less than optimal interface performance; earlier versions of Internet Explorer have not been tested.

Skyus-E Default Settings

The following table provides the default system settings you will need to access the Skyus-E Interface.

Parameter	Default Setting
Skyus-E Local URL	http://192.168.66.1
Username	admin
Password	fw*xxxxxx* where *xxxxxx* is the last six digits of the MAC address not including dashes or colons (shown on the utility log on page)
Local Port	80
Remote Port	8080

Logging In

To log in to the Skyus-E Interface, open a browser on a computer connected to the Internet, and type the Skyus-E IP address into the address bar. The interface login page displays, as shown below. A summary of the current status of the Skyus-E appears on this page for quick reference.

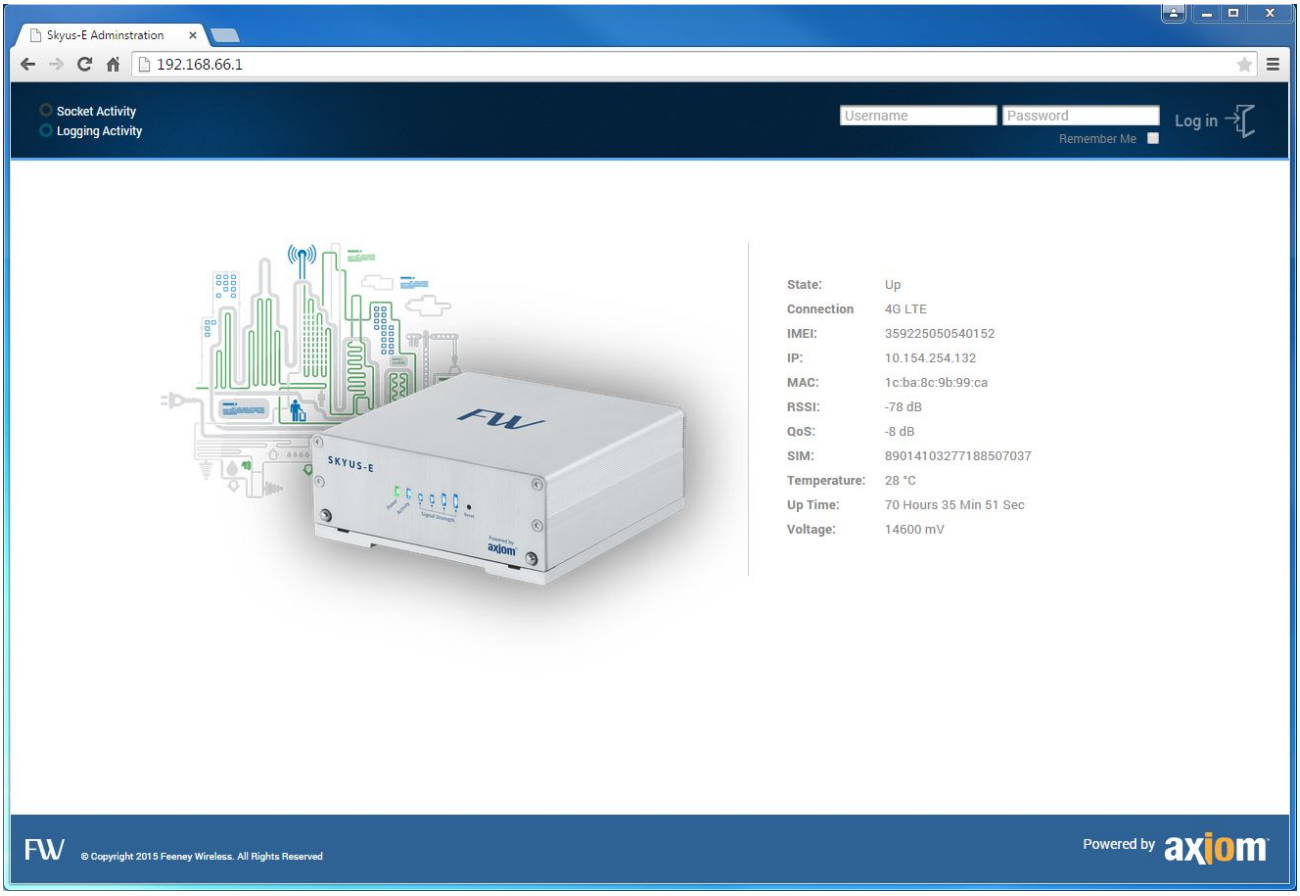


Figure 6: Skyus-E Utility Login Screen

Enter the default username and password and click the **Log in** icon. The default username and password are:

Username: admin
Password: fw*xxxxxx*

Where *xxxxxx* is the last six characters of the MAC address (excluding separators). It is recommended that you change the default password. The password can be changed on the Administration > User tab.

To log out, click the **Log out** icon on any page. The Skyus-E Interface will automatically log out after about 10 minutes of inactivity.

See the "Skyus-E User Manual" in the FW Literature Library for complete information on monitoring, configuring, and managing your Skyus-E.

Remote Access to the Skyus-E Interface

The Skyus-E Interface can also be accessed remotely if your Skyus has been assigned a publicly routable IP address from your cellular carrier. To access the Skyus-E remotely, the default port is 8080. Access the Skyus-E using the following URL:

http://<IP assigned from your carrier>:8080

Contacting FW

For help with installing, operating, maintaining, and troubleshooting this product, refer to this document and any other documentation provided. See the Skyus-E User Manual in the FW Literature Library for troubleshooting tips

If you still have questions, contact us during business hours:

Monday through Friday, excluding holidays, between 8 a.m. and 5 p.m. Pacific Time.

Contact Us	
Support E-Mail	support@feeneywireless.com
Telephone	(800) 683-4818
Website	www.feeneywireless.com
Mailing Address	P.O. Box 2549, Eugene, OR 97402

When contacting technical support, please have the following information on-hand:

- Serial number on product label
- Date that you received your device
- A brief description of the problem

Online Library

For other documentation, see our online document library at:

http://feeneywireless.com/documents

FCC Compliance

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 when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication. FW does not guarantee that interference will not occur in a particular installation.

Operation is subject to the following conditions:

a. This device may not cause harmful interference.
b. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

a. Reorient or relocate the receiving antenna.
b. Increase the distance between the equipment and the receiver.
c. Connect the equipment to outlet on a circuit different from that to which the receiver is connected.
d. Consult the dealer or an experienced radio/TV technician for help.

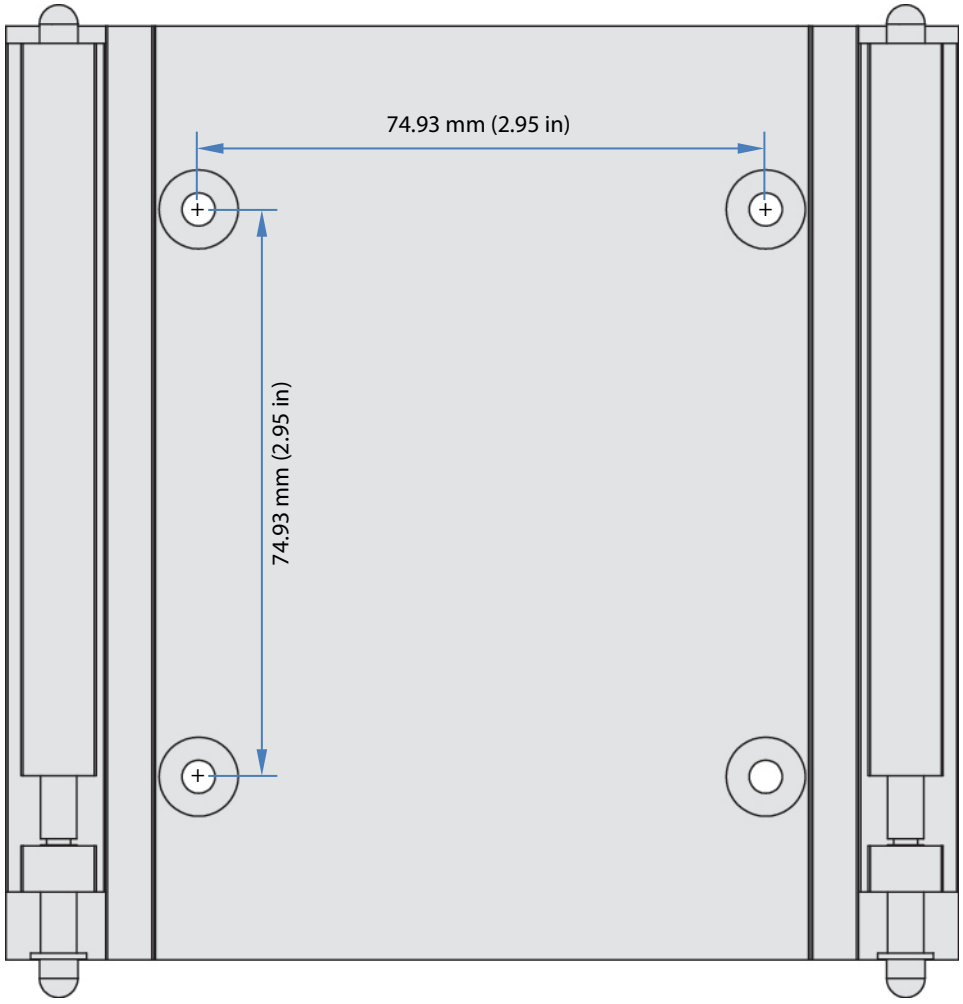
Exposure to RF radiation – To comply with FCC RF exposure compliance requirements, for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. Do not collocate or operate this device in conjunction with any other antenna or transmitter.

The TX module FCC ID depends on the Skyus module installed. See the Skyus Specification Sheet or the Skyus DS Specification Sheet.

Appendix A: Mounting Plate Template

Printed at full-size, the illustration below can be used to mark the center points of the four screw holes for installing the mounting plate. After printing the template, measure the distance between the holes to make sure the size is accurate, as shown below.

NOTE: Some print drivers will provide the option to "fit to printer margins" which may cause scaling. To ensure that the size is accurate, make sure to print to actual size.



Appendix B: Swapping Modems

The following instructions describe the procedure for swapping modems in the Skyus-E enclosure. For instructions on installing a Skyus modem into the Skyus-E Retrofit kit, see the Skyus-E Retrofit Assembly Instructions.

The figure below shows how to access inside of the Skyus-E in order to swap a Skyus radio module.

1. Faceplate Screws x4
2. Faceplate
3. Skyus Radio Module
4. Pull Tab
5. Antenna Cable Clip
6. USB
7. Secondary Antenna
8. Primary Antenna
9. Skyus-E Enclosure
10. Mounting Plate

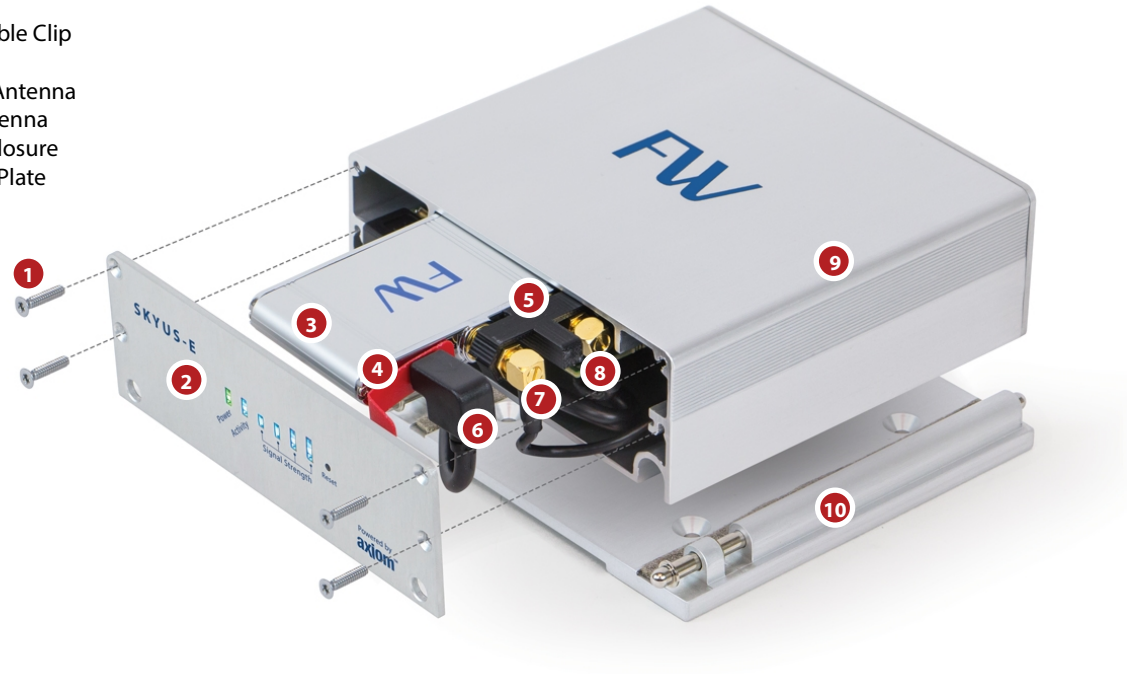


Figure 7: Skyus Modem Installation (Single SIM Modem)

1. Detach the Skyus-E from the mounting plate (10) if it is attached.
2. Access the inside of the Skyus-E by removing the four screws (1) securing the faceplate (2) using a T8 Torx driver.
3. Pull out the existing Skyus modem (3) using the red pull tab (4).
4. Remove the antenna cable clip (5).
5. Disconnect the USB (6), secondary antenna (7), and primary (8) antenna cables from the existing modem and attach them in the same order to the new modem. When plugging in the USB cable, make sure to position the pull tab over the connector for easy modem removal in the future. SMA connectors should be tightened to 8 in-lbs. using a torque wrench with a 5/16 bit.

   Note: The cable labeled **FW8163-A** is the **Primary** antenna cable and attaches to the outermost antenna connector on the Skyus module. The cable labeled **FW7837-A** is the **Secondary** antenna cable and attaches to the innermost antenna connector on the Skyus module.

6. For GPS models, connect the GPS cable to the middle SMA connector (*not shown*).
7. Snap the cable clip (5) into place over the antenna connectors.

8. Slide the Skyus module into the modem compartment, carefully tucking in the cables so that they do not extend beyond the opening of the Skyus-E enclosure and do not catch on the front edge of the PCB. The Skyus fits snugly in the compartment, so be sure to apply firm pressure.
9. Replace the faceplate.