

FREEWAVE



FUSION SATELLITE Quickstart Guide



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The FreeWave Fusion Satellite is designed to create a low-cost global connection for your IoT needs.

This guide will walk you through the first-time setup and configuration of the Fusion Satellite. Provisioning the device with the data portal, setting up the antennas, sending a test message, and introducing some of the basic features of the device. Once the setup is complete, review the other FreeWave quickstart guides to set up data forwarding and protocol conversion for Modbus or the protocol converter installed on your device.

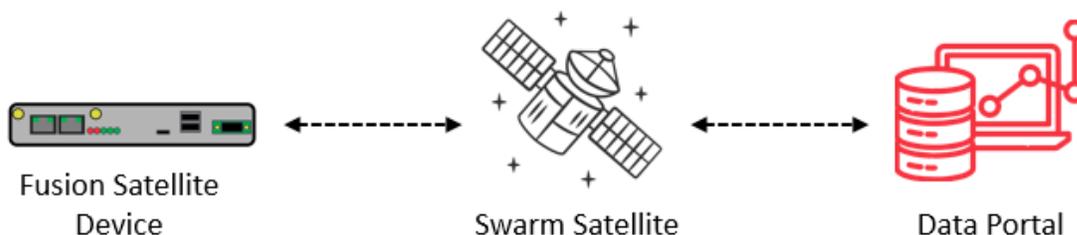


YOU WILL NEED

1. A computer running Windows with an available USB port
2. A USB-C cable or available Ethernet port on your computer

KIT CONTENTS

1. Fusion Satellite Module
2. GPS Antenna
3. Satellite Antenna
4. Jack adapter for Satellite Antenna
5. Coax Cable for Satellite Antenna
6. Fusion power supply, terminated
7. Claim Token Card



Adding your gateway to your account

Before deploying the Gateway, you need to claim it, name it, and make it your own. To do this you need to register and log on to your account in the FreeWave Data Portal at portal.modusense.com or within the ModuSense® Mobile App (Apple and Android). Once logged in, you can use the 'Claim a Device' function to adopt the Gateway.

To do this you will need the unique, one-time Claim Token – found on the card included in the box. Once successfully claimed, the Gateway will appear in the Devices > OEM menu. From this device configuration screen you can edit the device details and view the messages sent from the device to the satellite connection.



Setting up your gateway

To configure your Fusion Satellite hardware, you'll need a computer running Windows and a USB-C cable to connect to the device.

Connect the antennas and power

The Fusion Satellite device requires two antennas for operation: a GPS antenna and a satellite antenna. The ideal mounting situation of both antennas is outdoors, and a minimum of 5 feet away from any other RF noise source (other electronics, active power cables, etc.). It is also preferable that the satellite antenna be mounted perpendicular to a **ground plane**, meaning the mounting point is a conductive surface, ideally connected to an electrical **ground**. A mounting point such as a metal enclosure box or antenna mount is sufficient.

Please note: If your installation cannot provide this ground plane, or if your Fusion Satellite is installed in a high-RF-noise environment such as an urban environment, you may require a more powerful antenna. Please contact your Sales representative or FreeWave support through <https://support.freewave.com/> to procure such an antenna, or to obtain help with your installation.



¼ Wave Satellite Antenna (left) and GPS Antenna (right)

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Follow these steps to connect the antennas:

1. Screw the connector of the GPS antenna into the SMA connector labeled "ANT 2" on the faceplate of the Fusion Satellite device
2. If it isn't already, connect the SMA adapter to the end of the satellite antenna
3. Screw one end of the coax cable into the SMA connector labeled "ANT 1" on the faceplate of the Fusion Satellite device.



SMA Jack Adapter

6. Finally, connect the green connector from the power supply to the Fusion device. If using a wall adapter, plug the adapter into wall power. If using a pigtail connector, apply 6-30VDC to the bare leads of the pigtail (V+ Red, GND Black).
7. The unit will now boot up and run a self-test. The boot time is about one minute. The faceplate LEDs may flash in sequence for a few minutes after boot is complete.



First-Time Connection

Once the device is powered, the next step is to navigate to the configuration page hosted on the device itself. To do this, connect a USB-C cable to the USB-C connector on the device, and connect the other end to your computer. Once this is complete, open a browser and in the URL bar, and navigate to **192.168.137.2**. If this is your first time connecting to the device, continue to the next section. If not, feel free to skip the next section.

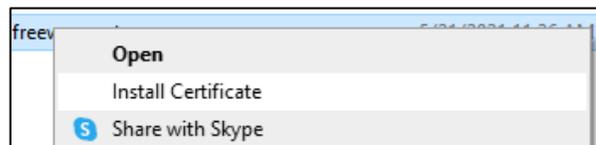
Certificate Installation

Because the Fusion configuration site uses the secure <https://> URL, one must first install the Fusion security certificate. This is located on the device and can be downloaded directly in a browser:

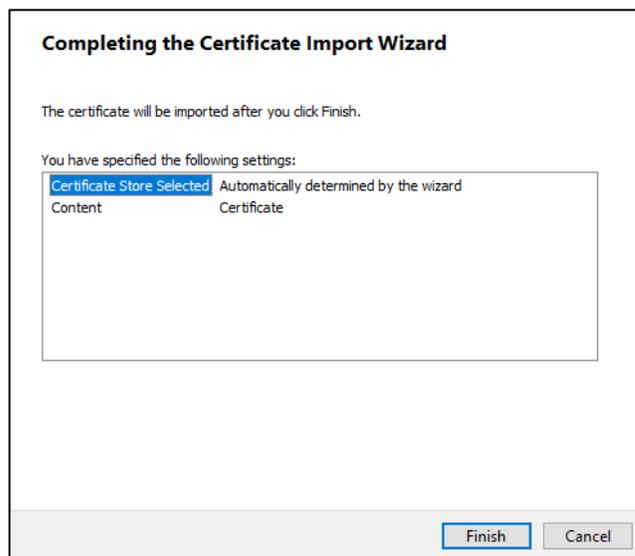
1. Navigate to <https://192.168.137.2/freewave.crt>
2. The browser should automatically begin downloading the certificate from the Fusion device



3. Once the certificate has downloaded, open the Downloads folder, right click on the freewave.crt file, and select "Install Certificate"



4. The certificate will now be installed, click through the install wizard with the default selections on each screen, then click "Finish". The certificate is now installed and your browser will now recognize the Fusion device.

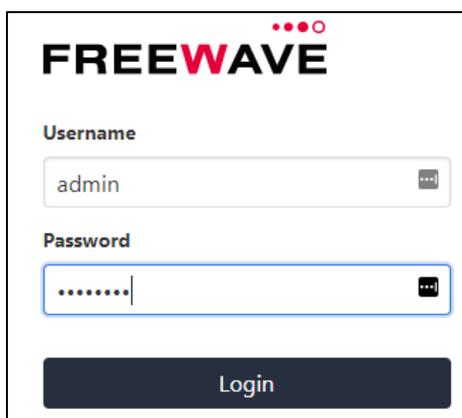


Device Configuration and First-Time Test

Now we'll verify the antenna connection and send a test message to the FreeWave data portal. With your device still connected to your computer. Open a browser (Chrome or Firefox) and navigate to the IP **192.168.137.2** This is the default IP of the Fusion device

You should now be at the Login screen. Login with the credentials:

username: **admin** and password: **password**



FREEWAVE

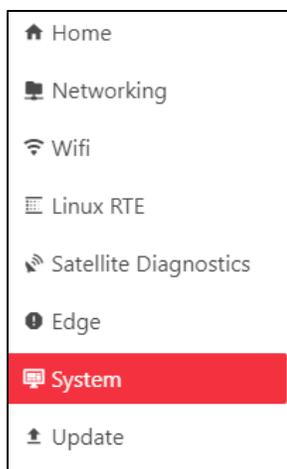
Username
admin

Password
password

Login

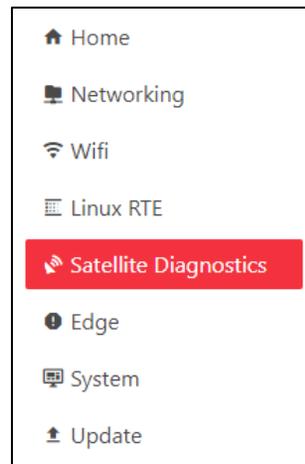
Change username and password

When signing in for the first time, we recommend that you change the credentials to something only known to you (note, this is optional, but recommended if the system will be used in non-test conditions). To change your credentials now, navigate to the System tab and update your credentials there.



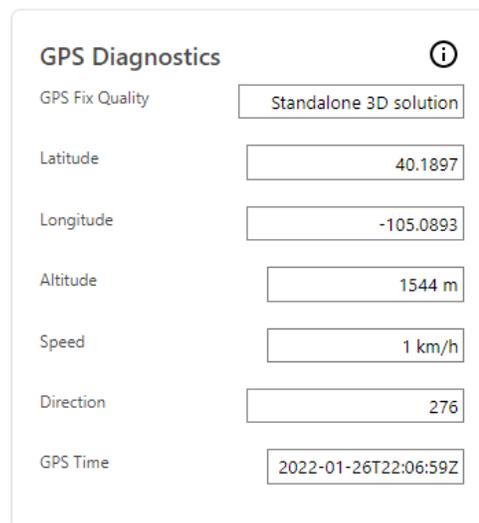
Configuration Page

Next, navigate to the Satellite Diagnostics page by clicking the tab on the left side of the screen:



The Satellite Diagnostics page contains information about your satellite modem and strength of your GPS and satellite connections. It can be refreshed manually by clicking the "Refresh Diagnostics Info" button at the bottom of the page, or it can be set to refresh at regular intervals by setting the "Auto Refresh Diagnostics Info" toggle.

The first thing to verify is your GPS connection. If you have a GPS lock, your current latitude, longitude, and altitude should appear in the GPS section. **Please note:** a GPS lock is required to send and receive satellite messages.



The second then to verify is your Satellite connection. On the top left of the configuration screen is the “Satellite Signal Floor” reading. This value should be, at maximum, -90dBm, and ideally be below -97dBm to obtain a usable satellite connection when a constellation is within range. If you are having trouble obtaining this level of signal strength in your setup or environment, please contact FreeWave Support through <https://support.freewave.com/> to procure a stronger antenna, or to obtain help with your installation.

Send a Test Message

Once the antenna connections are verified, we can now test the data path of the satellite connection by sending a test message. To do this, we will use the REST API tool hosted on the device.

To start navigate to <https://192.168.137.2/api/> in your browser.

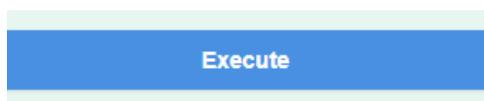


This screen displays all the API calls available on the Fusion Satellite device. Using these API calls, one may test all the major functions of the satellite modem.

To start scroll down to the section labeled “tty-v2”. Under that section, click on the request labeled

`/tty/v2/transmitdata/ascii`

This is the API call used to transmit data to the Swarm satellite constellation. To use it to test your device, click the button labeled “Try It Out” on the right-hand side. This will display an example JSON transmit packet. The text following the “data:” label is the plain-text data to be sent. By default, this data is “hello world”, but change it to any test data you prefer, up to 192 characters. Next, click the button labeled “Execute”.

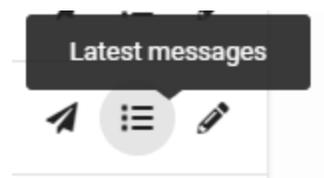


Viewing Next Satellite Pass

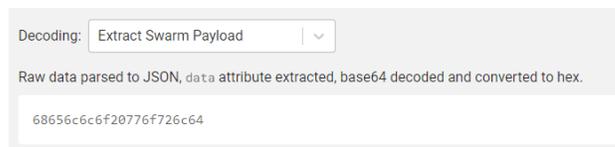
All messages in the message queue are sent as soon as the Swarm satellite constellation comes within view of the device. To find when the next constellation pass will occur in your location, visit <https://kube.tools.swarm.space/pass-checker/> and enter your location in the search box. On the next satellite pass, your test message should disappear from the message queue and be sent to the satellite.

Verifying Message Receipt

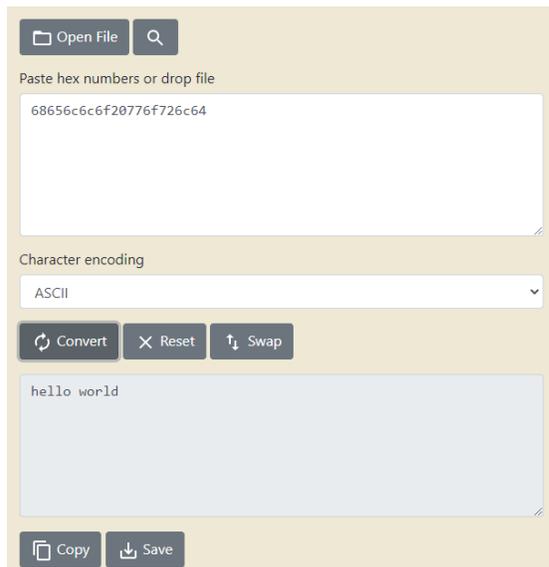
Once a message has been sent from the Fusion device to the satellite, it will be relayed to the cloud and appear under your account in the data portal. To view it, login to the portal, find your device under “Devices->OEM” and click the “Latest Messages” icon on the right-hand side.



On the “Latest Messages” screen, click on the message to view it. There is a dropdown menu that allows the message to be viewed in multiple formats. Choose the option “Extract Swarm Payload”. This will display your ASCII message in hexadecimal format. Use an online hex-to-ascii converter to convert this to ASCII and read your message in plain-text.



Data Portal



Hex-to-ASCII Converter

Exploring More Features

The best way to become an expert with the Fusion Satellite is to explore the API page. The API for the Fusion Satellite product exposes all the features of the Swarm satellite modem as well as the features of Fusion platform itself. Each feature has a description of its function and its use as well as a built-in tool to test the function right in a browser. The example code in the API can be utilized in programs running on the Fusion runtime environment.

Accessing the Runtime Environment

The Fusion utilizes a Debian Linux runtime environment to host user programs. To access the RTE, connect through secure shell when connected to the device via USB-C or Ethernet. Simply open a shell or command prompt on your host computer and run:

```
ssh devuser@192.186.137.2
```

Password: devuser

Exploring the Data Portal

The cloud data portal also includes a full API for accessing and re-routing data sent from Fusion Satellite devices. This API can be used to create custom dashboards and automate data processing. To explore the data portal's API functions, visit the API docs page:

<https://support.modusense.com/hc/en-us/articles/440522753817-ModuSense-API-Documentation>

Configuring SCADA Devices

Now that the device is tested and configured with the Satellite and Data Portal connectivity, the Fusion can be configured to communicate natively with SCADA systems. See our other quickstart documents at

<https://www.freewave.com/products/freewave-fusion-satellite/>

to learn how to quickly and easily configure the Fusion for your system.

Thanks!

This is just the beginning of what is capable with FreeWave Fusion devices. With the multi-radio configurability of Fusion, users will be able to create complex networks build with a mixed variety of radio and network types according to their need.

For the latest on FreeWave Fusion, please visit

<https://www.freewave.com/products/fusion/>

To purchase, or to find out how FreeWave can solve your network challenges, please visit

<https://www.freewave.com/how-to-buy/>

For questions and support with the Fusion device, please visit <https://support.freewave.com/>

FCC Supplier's Declaration of Conformity

FreeWave Technologies, Inc.
5395 Pearl Parkway, Boulder, CO 80301
Phone Number: 303.381.9200
Website: www.freewave.com

FreeWave Technologies declare under our sole responsibility that the product Models: FUSION-SAT complies with Part 15 of 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. The content of this guide covers FreeWave Technologies, Inc. models sold under FCC ID: 2AVE9-TILE01.

All models sold under the listed FCC ID(s) must be installed professionally and are only approved for use when installed in devices produced by FreeWave Technologies or third party OEMs with the express written approval of FreeWave Technologies, Inc. Changes or modifications should not be made to the device.

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

FCC Part 15 Class A

Note: This equipment has been tested and found to comply with the limits for a Class A 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 commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the User-Reference Manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

FCC NEMA Installation and Label

Where applicable, the models described in this guide must be installed in a NEMA enclosure. When any FreeWave Technologies, Inc. module is placed inside an enclosure, a label must be placed on the outside of the enclosure. The label must include the text: "**Contains FCC ID: 2AVE9-TILE01.**"

ISED Notifications

This device complies with Industry Canada license-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. *CAN ICES-3 (A)/NMB-3(A)*

Ce dispositif est conforme aux normes permis-exemptes du Canada RSS d'industrie. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence, et (2) ce dispositif doit accepter n'importe quelle interférence, y compris l'interférence qui peut causer le fonctionnement peu désiré du dispositif. *CAN ICES-3 (A)/NMB-3(A)*

ISED Host Installation and Label

The content of this documentation covers FreeWave Technologies, Inc. models sold under IC: 2329B-PMT0101AB. When any FreeWave Technologies, Inc. module is placed inside a Host, a label must be placed on the outside of the Host. The label must include the text "**Contains IC: 25817-TILE01.**"

Professional Installation

All models sold under the listed IC ID must be professionally installed.

Only FCC and IC approved antennas may be used.

The antenna must be professionally installed on a fixed, mounted, and permanent outdoor structure to satisfy RF exposure requirements.

Any antenna placed outdoors must be properly grounded.

Use extreme caution when installing antennas and follow all instructions included with the antenna.

UL and Safety Notification

FUSION-SAT a Listed component under UL File Number 5019876.

Standards and Editions

HazLoc Standards

UL 121201-2019

CSA C22.2 No. 213-17

Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations – Edition 3 Revision Date 2019/08/26

Ordinary Location Standards

UL 60950, 2nd Edition

CAN / CSA-C22.2 No. 60950, 2nd Edition

IEC 60950, 2nd Edition

EN 60950, 2nd Edition

Power Source

FUSION-SAT is intended to be operated from a Limited Power Source (LPS) or Class 2 power source in accordance with IEC/EN/UL 60950-1 and CAN/CSA C22.2 No. 60950-1-07.

The FUSION-SAT is approved to operate with an input voltage range of +6 to +30 VDC, 4A, Tmra of 60°C.

Hazardous Locations Installation Instructions

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D OR non-hazardous locations only.

Open type device intended to be installed in a suitable enclosure that requires the use of a tool to access.

Ambient: -40°C to +85°C

Temperature Code: T5

Input voltage rating of +6 to +30 VDC, 4A

WARNING – EXPLOSION HAZARD. DO NOT CONNECT OR DISCONNECT WHEN ENERGIZED.

AVERTISSEMENT – RISQUE D'EXPLOSION. NE PAS BRANCHER NI DÉBRANCHER SOUS TENSION.

WARNING – EXTERNAL USE OF THE ANTENNA IS NOT PERMITTED. THE ANTENNA IS TO BE TERMINATED AND MOUNTED INTERNAL TO THE FINAL INSTALLED ENCLOSURE

AVERTISSEMENT - L'UTILISATION EXTERNE DE L'ANTENNE N'EST PAS AUTORISÉE. L'ANTENNE DOIT ÊTRE TERMINÉE ET MONTÉE À L'INTÉRIEUR DU BOÎTIER FINAL INSTALLÉ

The Antenna must be a 50OHM, passive type.

NOTICES

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Security.

FreeWave products may provide security parameters that can be configured by the user based on their particular operating environment. FreeWave recommends setting and using these parameters following industry recognized security practices. Security aspects to be considered are protecting the confidentiality, integrity, and availability of information and assets. Under certain circumstances, FreeWave may make specific recommendations regarding security practices, however the implementation of these recommendations and final responsibility for the security of the product lies with the user.

Caution.

Changes or modifications to the equipment must not be made unless under the express consent of the party responsible for compliance. Any such modifications could void the user’s authority to operate the equipment and will void the manufacturer’s warranty.

All applicable federal, state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and potentially voiding the manufacturer’s warranty, only the manufacturer should perform repairs to the product. When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use approved software with FreeWave hardware products may result in injury, harm, or improper operating results. Failure to observe this information can result in injury or equipment damage.

Terms and Conditions.

Purchase and Use of this product is subject to FreeWave’s Terms and Conditions of Sale in effect at the time the order is received by FreeWave. Any different or additional terms in the Buyer’s purchase order are hereby expressly rejected.

In addition to the terms and conditions that you have entered into with FreeWave Technologies, Inc. (“FreeWave”) and LayerX Limited dba ModuSense (“ModuSense”) for their respectively owned products and services; the Customer, its Subscribers or any other third party of an approved product must comply with the terms and conditions required by the third-party data supplier, Swarm Technologies, Inc. (“Swarm”), which were previously provided, regarding use of their network. FreeWave does not own Swarm products and services and their use is subject to the rights and limitations described below to which Customer must give its consent. The Customer must pay all fees associated with Swarm Network. If the Customer does not comply with Swarm’s terms and conditions, FreeWave may be required to immediately suspend or terminate the Customer’s access to the Swarm Network for which Customer will not be entitled to correct. Termination, suspension, or unavailability of the Swarm Network or other services is at the Customer’s own risk and the Customer acknowledges and agrees that FreeWave will have no liability or duty arising out of any such termination, suspension, or unavailability. FreeWave reserves the right to cancel any Customer order without liability, if a Customer chooses not to accept these terms. FreeWave reserves the right to suspend or terminate the contract without liability in the event that the Buyer or any person or entity connected to the Buyer is determined to or becomes subject to U.S. EU or UN Sanctions, a Specially Designated National/Denied Party, or in the event that the item to be provided is subject to restrictions under U.S. or EU laws.

Warning - Export Compliance.

This document describes a product that contains encryption and is subject to the Export Administration Regulations (EAR) and Office of Foreign Assets Control (OFAC). This product may be restricted to certain countries and users. Access to this document does not guarantee or imply the product will be available for purchase to a specific end-user. Export, re-export, release or transfer of the product in violation of U.S. Export Regulations including the International in Traffic Regulations (ITAR), Export Administration Regulations (EAR) or Office of Foreign Assets Control (OFAC) is prohibited. Any party exporting, re-exporting, releasing or transferring the product is responsible for obtaining all necessary U.S. government authorizations as required to ensure compliance with these and other applicable U.S. laws. Consult with your Trade Compliance department or legal counsel for further guidance or contact compliance@freewave.com. Violations of these regulations are punishable by fine, imprisonment, or both. Diversion or use contrary to U.S. law is prohibited.

In no event shall our company be liable for any direct, indirect, punitive, incidental, special consequential damages, to property or life, whatsoever arising out of or connected with the use or misuse of our products.

Regulatory Disclosures

Model: FUSION-SAT
 Brand: FreeWave
 Manufacturer: FreeWave Technologies, Inc.
 Manufacturer address: 5395 Pearl Parkway, Boulder, CO 80301, USA.

This device contains the following component:

Satellite Data Modem

Model: TILE01
 Brand: Swarm
 Manufacturer: Swarm Technologies, Inc.
 Manufacturer address: 435 N Whisman Rd Ste 100 Mountain View, CA 94043, USA.
 FCC ID: 2AVE9-TILE01

Operating frequency range	Maximum transmission power
148.0039 - 150.0461 MHz	0.859 W



FUSION SATELLITE
Quickstart Guide



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