# Milesight Field Tester

## FT101

User Guide

## Safety Precautions

Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

- The device must not be disassembled or remodeled in any way.
- Do not remove the battery of the device.
- Do not place the device and its accessories where the temperature or humidity is below/above the operating range.
- **Do not place the device close to objects with naked flames, otherwise it will explode.**
- The device must never be subjected to drops, shocks or impacts.
- Do not pull the antenna, detach them by holding the connectors.

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## Revision History

| Date | Doc Version | Description |
|---|---|---|
| July 19, 2024 | V 1.0 | Initial version |
| Jan. 20, 2025 | V 1.1 | 1. Add noise scan, pingpong and signal strength evaluation features<br>2. Update real-time testing feature<br>3. Add upgrade feature<br>4. Add real-time testing report packet |

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# 1. Product Introduction

## 1.1 Overview

Milesight Field Tester is a portable LoRaWAN® network testing device. With different kinds of antennas, it can support global LoRaWAN® frequencies to record the signal status and packet loss rate to monitor the network status from the field and verify the coverage of different LoRaWAN® gateways, to optimize the best places to deploy LoRaWAN®devices.

Equipped with a 5.72-inch touchscreen display, users are able to operate the signal test procedure and monitor the real-time network status friendly. With a built-in battery and type-C port, it can work for 8 hours and supports type-C power bank charge to bring the device everywhere easily.

## 1.2 Features

- Octa-core processor with Android system and big memory for flexible integration
- Built-in one-channel SX1262 LoRaWAN® module for signal test
- Support global LoRaWAN® frequencies with different antennas
- Compatible with any standard LoRaWAN® gateways and global mainstream network servers
- Compatible Milesight ToolBox App to configure Milesight sensors via NFC or Bluetooth
- Support noise scan to optimize the locations and configurations of gateways
- Support signal evaluation to optimize the locations and configurations of devices
- Support to simulate the parameters of Milesight devices for accurate results
- Support to get RSSI and SNR of the gateway and statistics of packet loss rate between gateway and devices
- Support GNSS positioning to record the location of the test field
- Straightforward user interfaces presented on a 5.72-inch touchable LCD screen
- With a built-in rechargeable lithium battery that works for 8 hours
- Support real-time data backup and charge through a USB type-C port

# 2. Hardware Introduction

## 2.1 Packing List

1 ×
FT101 Device

1 ×
1 x LoRaWAN®
Stubby Antenna

1 ×
Type-C Cable (1 m)
& Power Adapter

1 ×
Card Ejector Tool

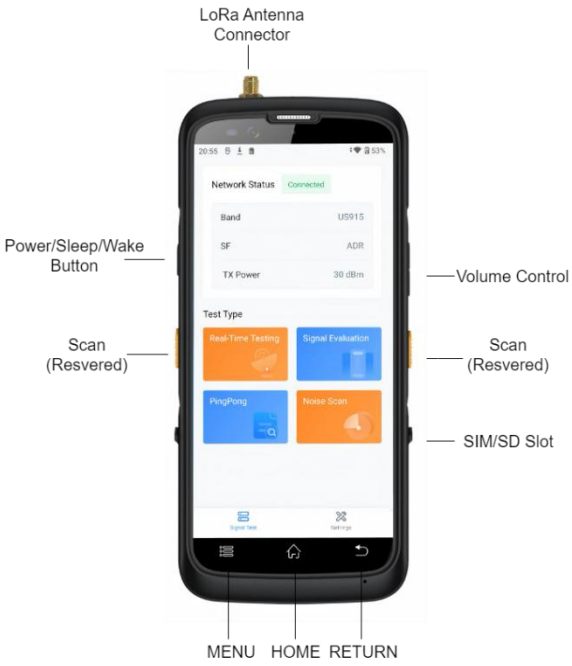
1 × Screen
Protector

1 × Lanyard

1 × Warranty Card

**If any of the above items is missing or damaged, please contact your sales representative.**

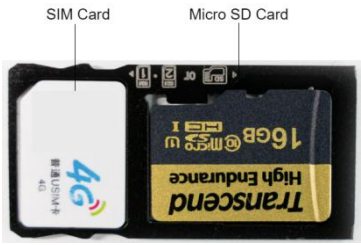
## 2.2 Hardware Overview



## 2.3 Dimensions (mm)

## 3. SIM/SD Card Installation (Optional)

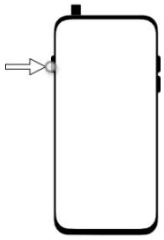
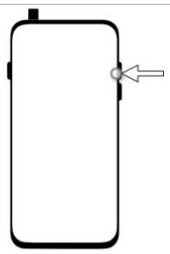
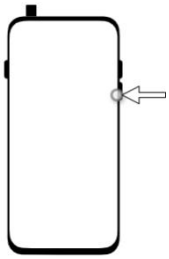
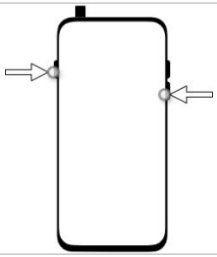
1. Remove the rubber plug of the slot, and use an ejector tool to push the contact point to pop up the card slot.
2. Insert the nano SIM card (4FF) or micro SD card, then turn the slot over and restore it back to the device.
3. Restore the rubber plug of the slot.



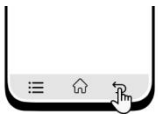
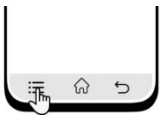
# 4. Operation Guide

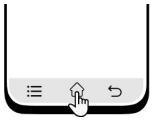
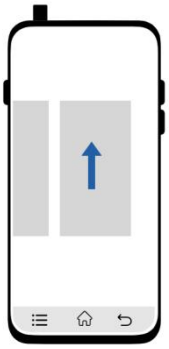
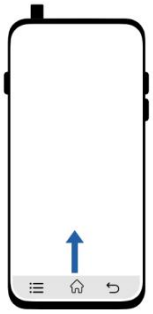
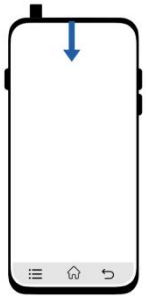
## 4.1 Basic Gestures and Shortcuts

### Button Shortcuts

| Item | Description |
|---|---|
|  | **Power On**: press and hold on the Power button for 3s until the screen lights. |
| | **Power Off or Restart**: press and hold on the Power button for 3s until the phone displays the Power off and Restart menu. |
|  | **Turn up the volume**: press the Volume up button. |
|  | **Turn down the volume**: press the Volume down button. |
|  | **Take a screenshot**: press the Volume down and Power buttons simultaneously. |

### Basic Gestures

| Item | Description |
|---|---|
| | **Back to home screen**: tap the Home button once. |
|  | **Return to the previous screen**: tap Return button once. |
|  | **Access home screen edit mode**: tap Menu button once. |

| | |
|---|---|
|  | **Recent tasks**: press and hold on Home button for a while to view recent tasks. |
|  | **Close an app**: When viewing recent tasks, swipe up on an app preview to close the app. |
|  | **Open Settings menu**: Swipe up from the bottom of home screen. |
|  | **Display notification and shortcut switches panel**: swipe down from the upper edge of the screen. |

## 4.2 Signal Test

Milesight field tester is equipped with a dedicated Field Tester App for LoRaWAN® signal testing. Please launch the Field Tester App and select below features according to the testing conditions on the spot:

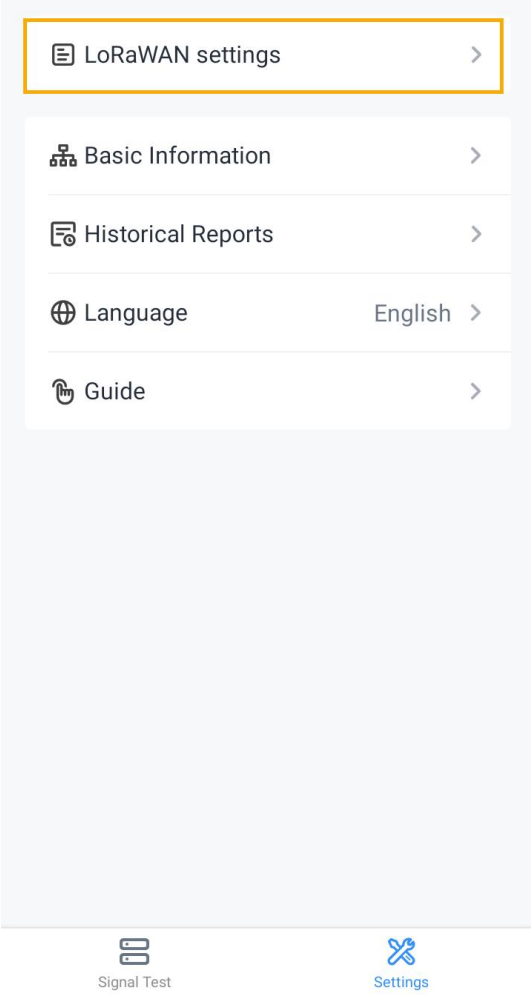
| Feature | Description |
|---|---|
| **No LoRaWAN® gateway on the spot** | |
| Noise Scan | Scan the noise of every frequency channel and provide a diagram for users to analyze the environmental interference condition, and select best installation locations and channel configuration for LoRaWAN® gateways. |
| PingPong Test | Simulate the uplink and downlink communication between end devices and the LoRaWAN® gateway. This requires at least 2 field tester devices. |

| Has LoRaWAN® gateway on the spot | |
|---|---|
| Signal Evaluation | Simulate the end device to evaluate the signal strength quality of every spreading factor (datarate) by sending packets to the LoRaWAN® gateway. This is suitable for the situation which users do not know which spreading factor is the best option for end devices. |
| Real-time Testing | Simulate the end device to evaluate the signal strength quality by sending packets to the LoRaWAN® gateway. This is suitable for the situation which users already know which spreading factor or ADR will be used for end devices. |

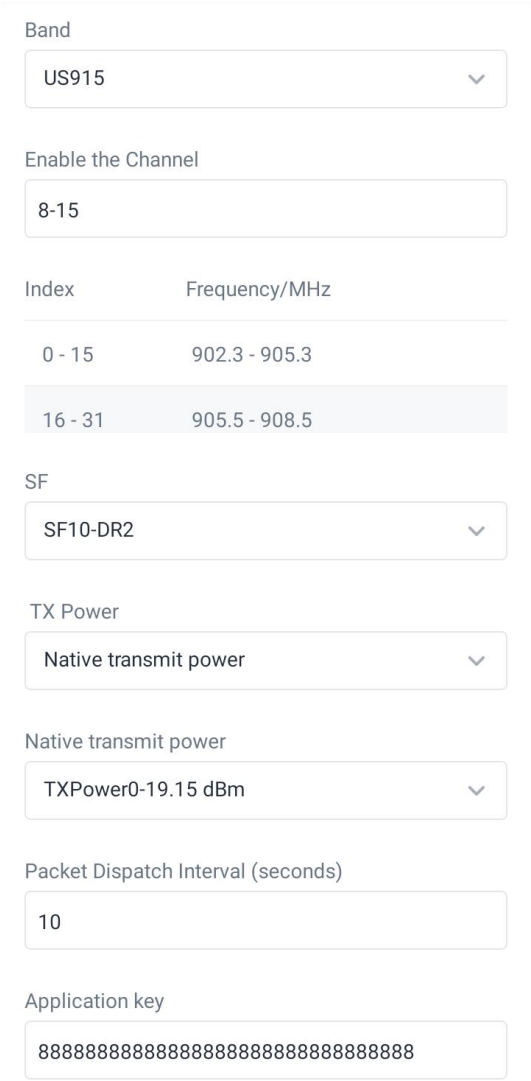
### 4.2.1 LoRaWAN Setting

Before starting all tests, it is necessary to launch the Field Tester App to configure the LoRaWAN® settings.

**Note:** after changing any parameters, the device will rejoin the network.




Ensure that the frequency channels match the testing gateway and configure the related parameters as required.




| Parameters | Description |
|---|---|
| Band | Select the frequency plan to send packets. If the band is one of CN470/AU915/US915, enter the index of the channel to enable in the input box, making them separated by commas.<br>**Examples:**<br>1, 40: Enabling Channel 1 and Channel 40<br>1-40: Enabling Channel 1 to Channel 40<br>1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60<br>All: Enabling all channels<br>Null: Indicate that all channels are disabled |
| SF (Spreading Factor) | Select a fixed spreading factor or select ADR to allow network server to adjust the spreading factor. This is used on Real-time Testing feature. |
| Tx Power | Select the transmit power mode of the device. This is used on Signal Evaluation and Real-time Testing features. |

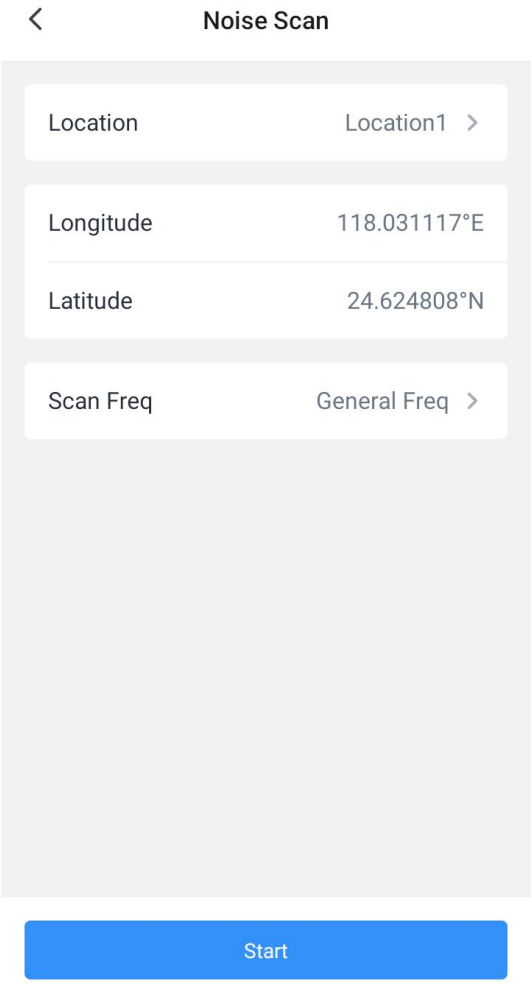
| | |
|---|---|
| | **Native transmit power:** select the Tx power directly.<br>**Mock sensor:** select the Milesight LoRaWAN device model. The tester will simulate the capability of this model to send packets. |
| Packet Dispatch Interval | Set the interval to report the packets. This is also the timeout when not receiving replies from LoRaWAN® gateway. Range: 6-60s, default: 10s. |
| Application Key | Set the Appkey for OTAA mode as required, the default value is 88888888888888888888888888888888. |

### 4.2.2 Noise Scan

The field tester supports to simulate the gateway to scan the noise of specific LoRaWAN frequencies and give a diagram for users to analyze the environmental interference condition and select best frequencies.

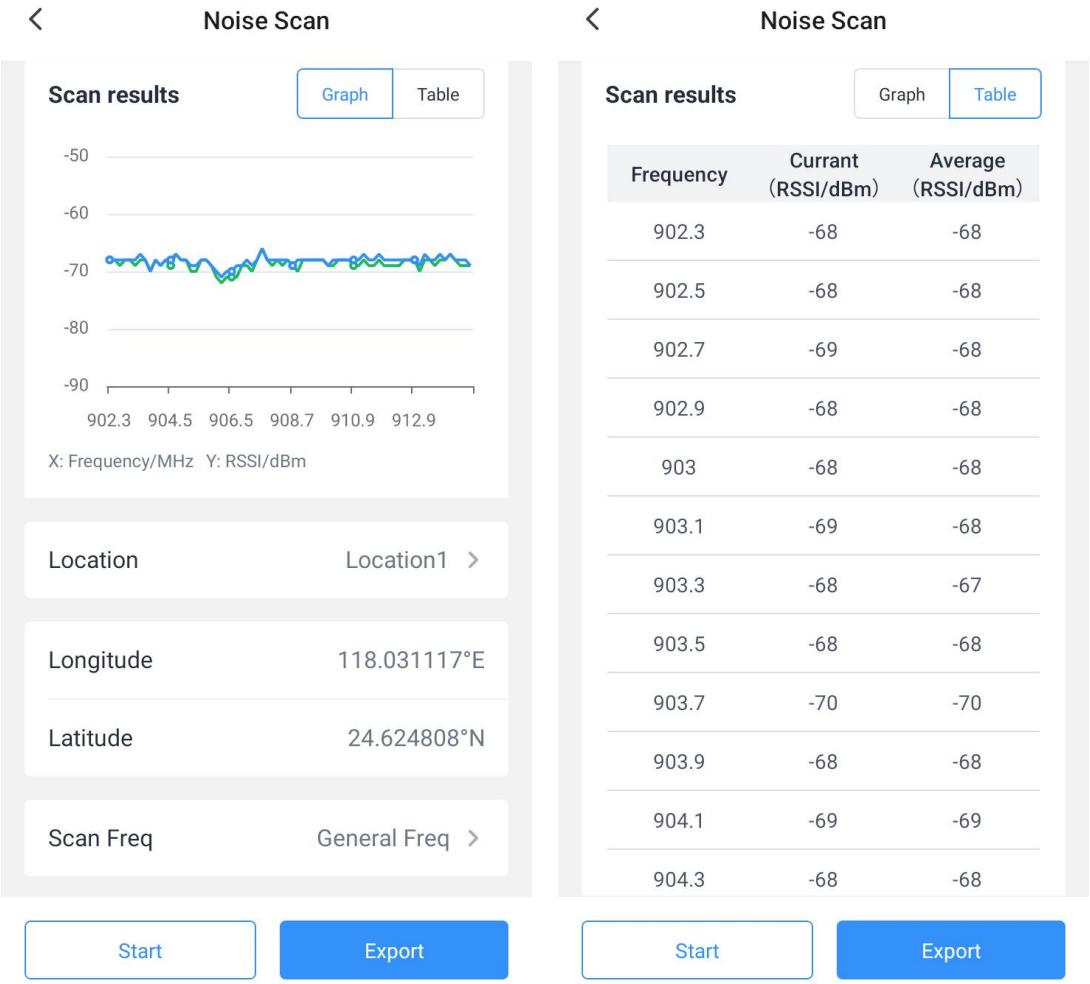
1. Ensure the frequency plan of LoRaWAN settings is selected.
2. Place the field tester to the target location of LoRaWAN gateway.
3. Select **Noise Scan** button to configure related parameters, then click **Start** to scan.

**Note:** it is suggested to scan at least 1 hour for accurate results.



| Parameters | Description |
|---|---|
| Location | Customize a name to indicate the test location. |
| Longitude<br>Latitude | Show the coordinates of devices. It only works when placed outdoors.<br>**Note:**<br>1) Ensure the Location is turned on in the Settings page of this device.<br>2) Download and launch App **GPS Test** if still not getting the coordinates. |
| Scan Freq | Set the frequency to scan the noise.<br>**General Freq:** use the channels enabled in LoRaWAN Settings. If the band is one of CN470/AU915/US915, the device will scan all channels.<br>**Custom Freq:** set the start and end frequency of a range, and the frequency interval. |

4. Click **Stop** to stop the scanning. The tester will display the RSSI result as graph or table. RSSI indicates the sensitivity for every frequency channel. The lower the RSSI value, the better the signal.




5. Click **Export** to save the test results as a CSV log file to the tester. You can also click **Start** to

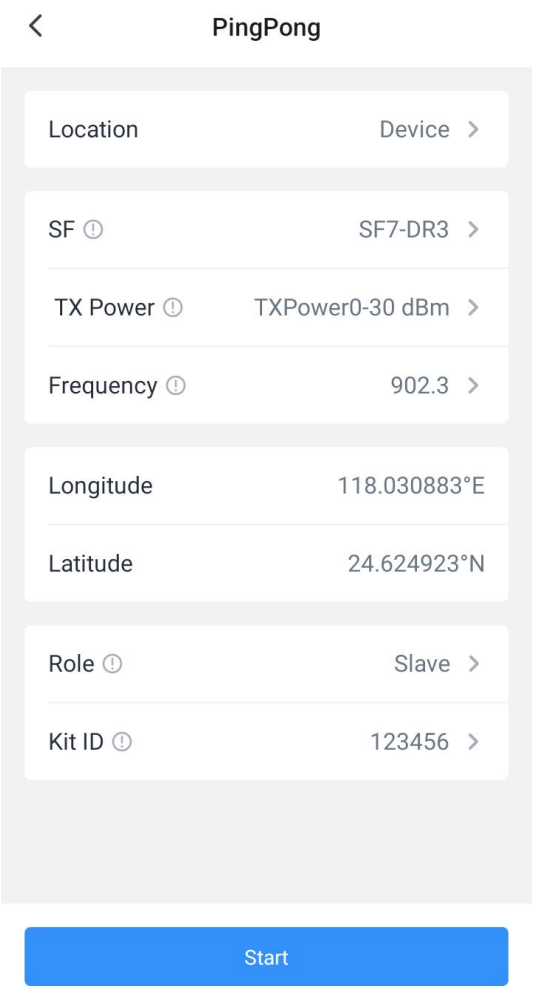
start a new scanning.

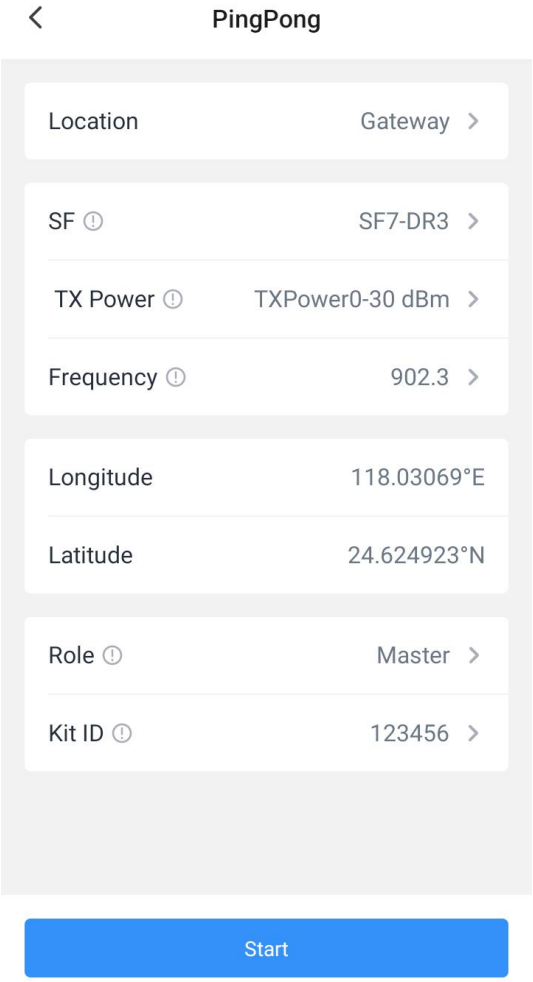
| Frequency | Current Scan (dBm) | Weighted Average Scan (dBm) | Location | Longitude | Latitude |
|---|---|---|---|---|---|
| 902.3 | -65 | -66 | Location1 | 118.03069° E | 24.624923° N |
| 902.5 | -67 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 902.7 | -68 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 902.9 | -67 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 903.1 | -68 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 903.3 | -66 | -66 | Location1 | 118.03069° E | 24.624923° N |
| 903.5 | -67 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 903.7 | -67 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 903.9 | -68 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 904.1 | -67 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 904.3 | -67 | -67 | Location1 | 118.03069° E | 24.624923° N |
| 904.5 | -67 | -66 | Location1 | 118.03069° E | 24.624923° N |

### 4.2.3 PingPong Test

Two field testers support PingPong test feature to simulate the communication between end devices and gateway if there is not gateway on the spot.

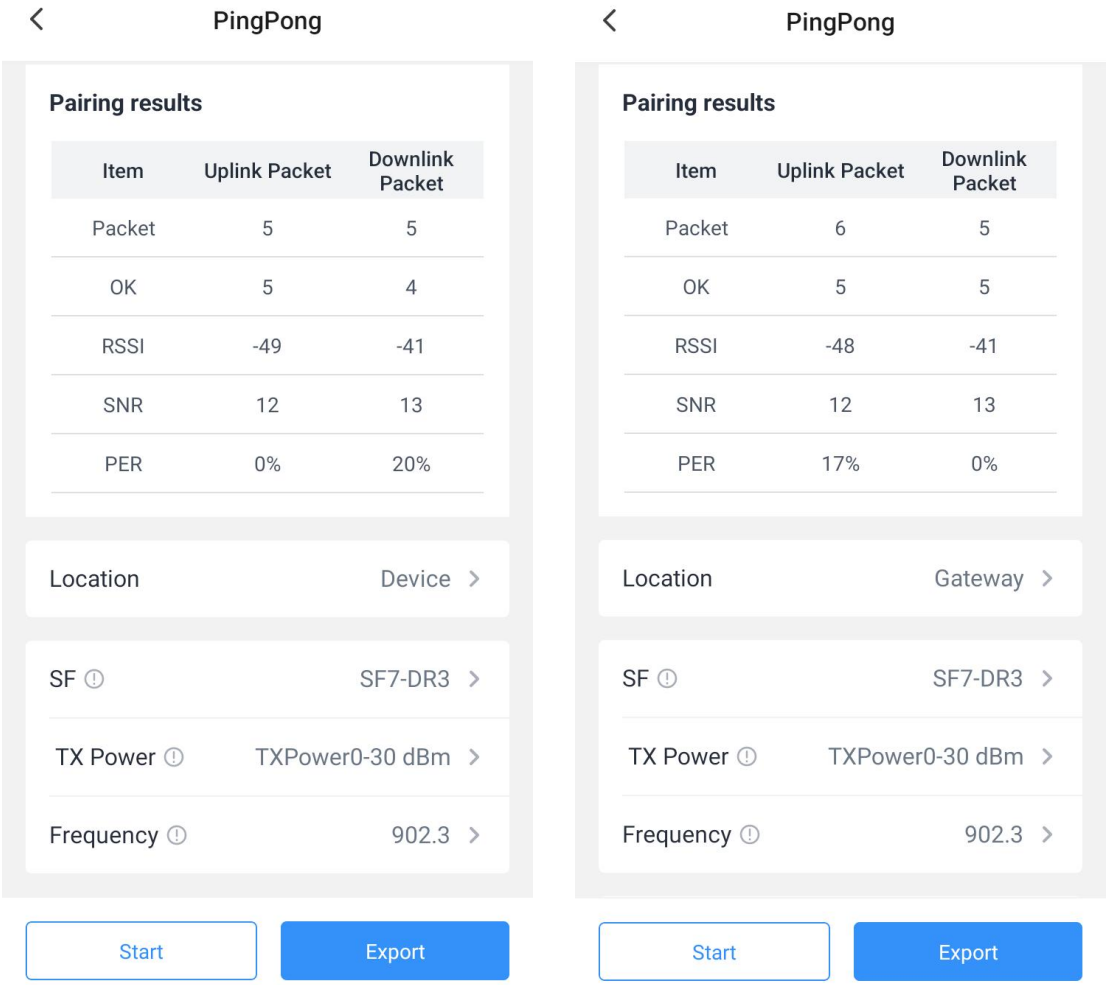
1. Ensure the frequency plan of LoRaWAN Settings of both testers are the same.
2. Place one tester to the target location of end device, and the other to the target location of LoRaWAN gateway.
3. Select **PingPong** button of both testers to configure related parameters, then click **Start** of both devices.




| Parameters | Description |
|---|---|
| Location | Customize a name to indicate the test locations. |
| SF | Select the spread factor to send packets. This parameter of both devices must be the same. |
| Tx Power | Select the transmit power of both devices. This parameter of both devices must be the same. |
| Frequency | Set the frequency to send packets. This parameter of both devices must be the same. |
| Longitude | Show the coordinates of devices. It only works when placed outdoors.<br>**Note:**<br>1) Ensure the Location is turned on in the Settings page of this device.<br>2) Download and launch App **GPS Test** if still not getting the coordinates. |
| Latitude | |
| Role | Set one device as Slave and the other one as Master. |
| Kit ID | Only the devices with the same kit ID can communicate with each other. |

4. Click **Stop** to stop the scanning. The tester will display the result including uplink/downlink sending/receiving amounts, average RSSI/SNR, and packet loss rate.




5. Click **Export** to save the test results as CSV log files to both testers. You can also click **Start** to start a new testing.

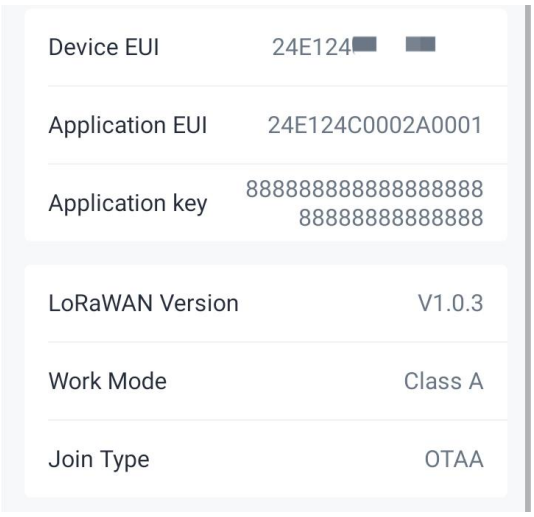
| Time | Tx Power (dBm) | SF | Total Packets (Master) | Successful Packets ( | RSSI (dBm, Master) | SNR (dB, Master) | Packet Loss Rate | Longitude | Latitude (Mas |
|---|---|---|---|---|---|---|---|---|---|
| 2024/12/30 17:54 | TXPower0-30 dB | SF7-DR3 | 5 | 5 | -49 | 12 | 0 | 118.03069° | 24.624923° N |

## 4.2.4 Signal Evaluation

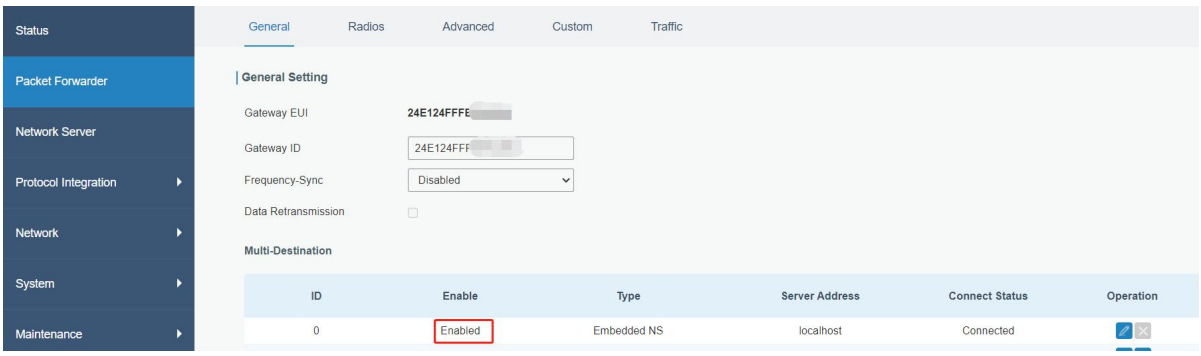
The field tester supports to evaluate the signal strength quality of every spreading factor (datarate) by sending packets to gateway. This guide will take the Milesight UG65 gateway as an example to operate the signal strength evaluation. Users can also connect this device to any standard LoRaWAN® network server.

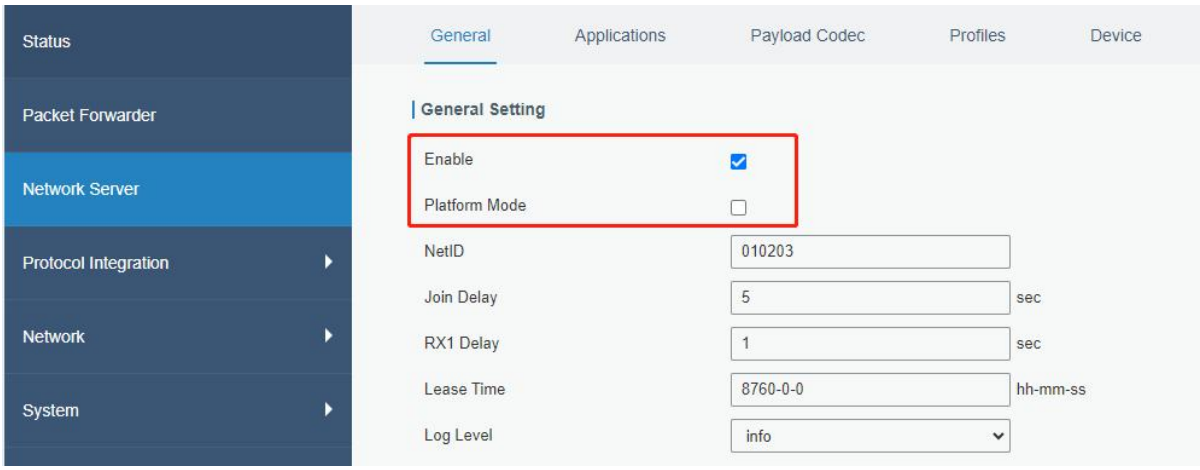
1. Launch the Field Tester App, and find the device EUI and application key information.

**Note:** the app EUI (join EUI) is fixed as 24E124C0002A0001.

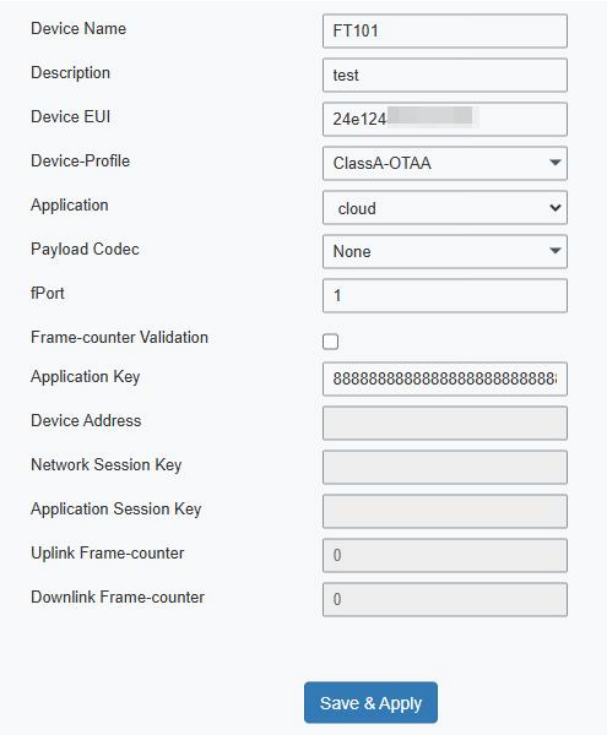



2. Configure the LoRaWAN® settings of this field tester, and ensure the frequency band matches the settings of gateway.
3. Navigate to the web GUI of Milesight gateway to enable embedded NS mode.



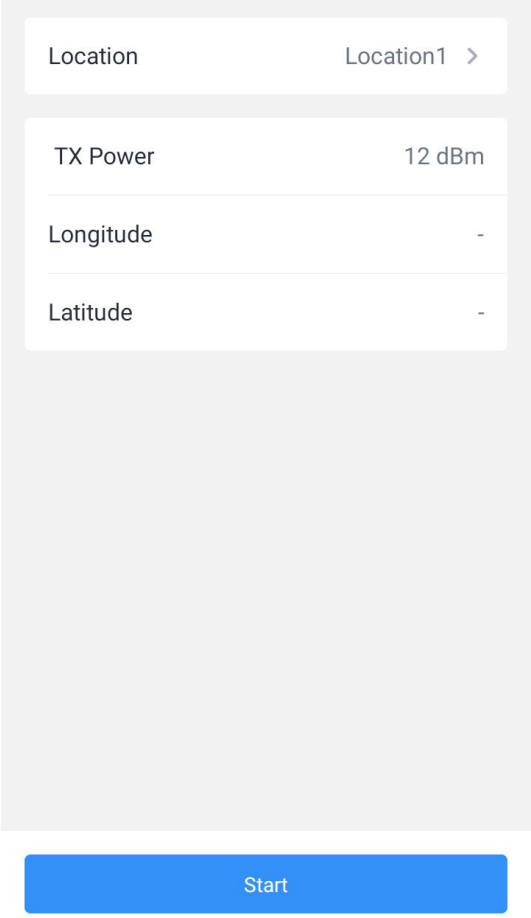

4. Navigate to **Network Server > Device** page to add the field tester to the gateway. The device profile type should be set as **OTAA-Class A**.




After adding, the field tester will show network status is connected.

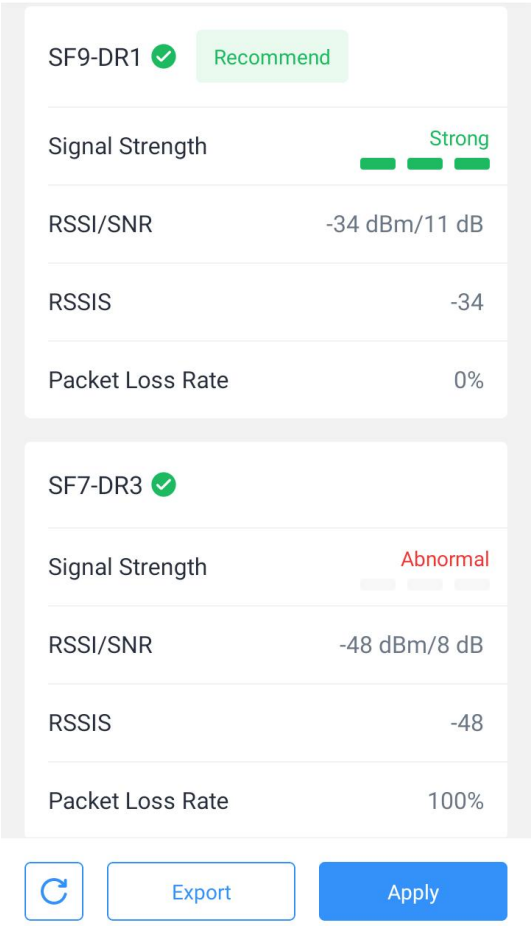
5. Place the field tester to the target location of end devices.
6. Select **Signal Evaluation** button, customize a name to record the detection location and click **Start** to test.

**Note:** **Signal Evaluation** button only displays when the device joins the network.




| Parameters | Description |
|---|---|
| Location | Customize a name to indicate the test locations. |
| Tx Power | Show the tx power used in this evaluation. This can be set in LoRaWAN Settings. |
| Longitude | Show the coordinates of devices. It only works when placed outdoors.<br>**Note:**<br>1) Ensure the Location is turned on in the Settings page of this device.<br>2) Download and launch App **GPS Test** if still not getting the coordinates. |
| Latitude | |

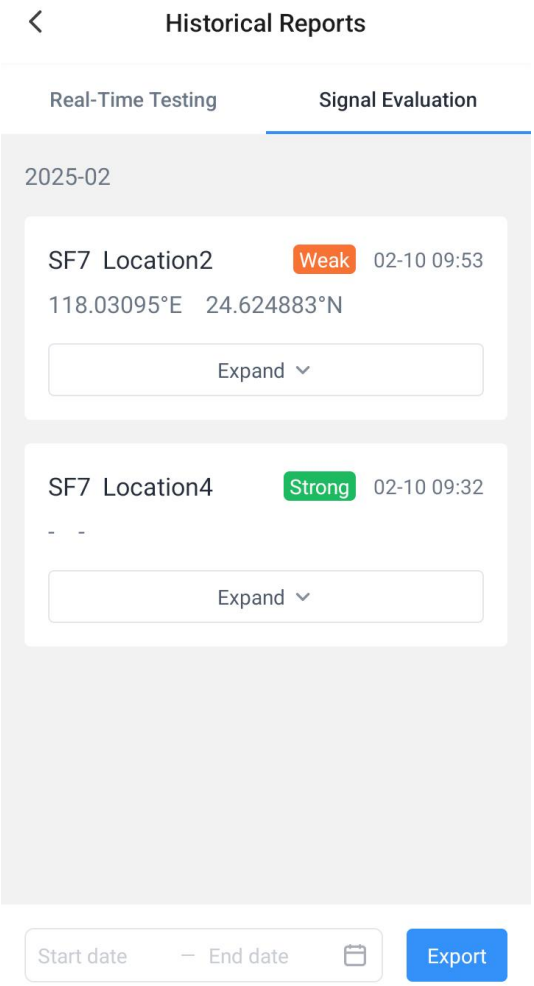
7. After 1 minute, the tester will display the results and suggest the most recommended spreading factor (datarate). After evaluation, click **Apply** to change the SF of LoRaWAN setting to the most recommended value if required.




8. Click **Export** to save the test results as a CSV log file to the tester.

| Time | RSSI (dBm) | RSSIS (dBm | SNR (dB) | Signal | Packet Loss (%) | Longitude | Latitude | Location | SF | TX Power |
|---|---|---|---|---|---|---|---|---|---|---|
| 2024/12/31 11:32 | -43 | -43 | 11 | Strong | 0 | 118.03076° E | 24.625017° N | 2 | SF9-DR1 | AM102 |
| 2024/12/30 20:43 | -34 | -34 | 11 | Strong | 0 | 118.03076° E | 24.625017° N | Location4 | SF9-DR1 | 12 dBm |

Users can also click the button at the top right corner of testing result or go to **Settings > Historical Reports** to check and export the test results.

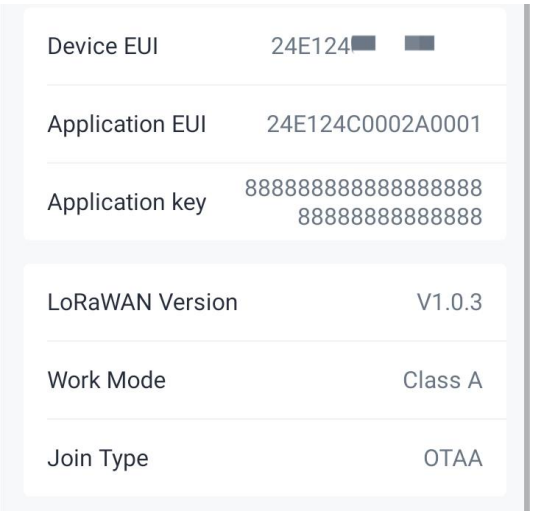



## 4.2.5 Real-time Testing

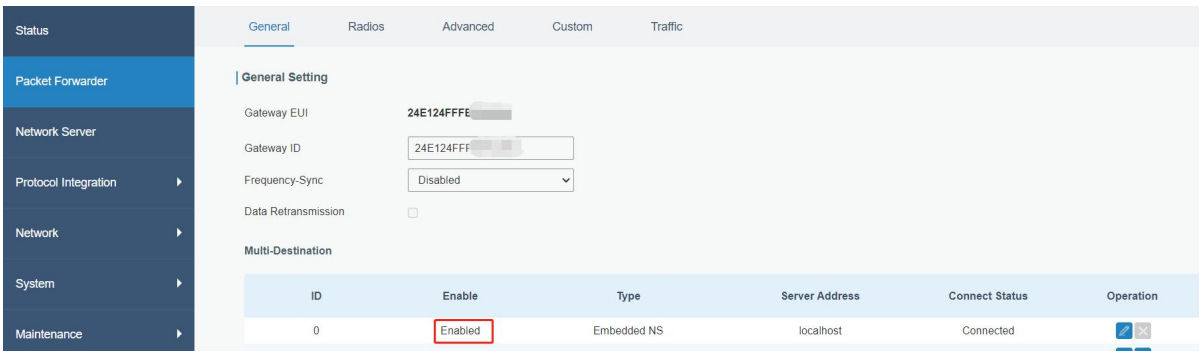
This guide will take the Milesight UG65 gateway as an example to operate the real-time signal testing. Users can also connect this device to any standard LoRaWAN® network server.

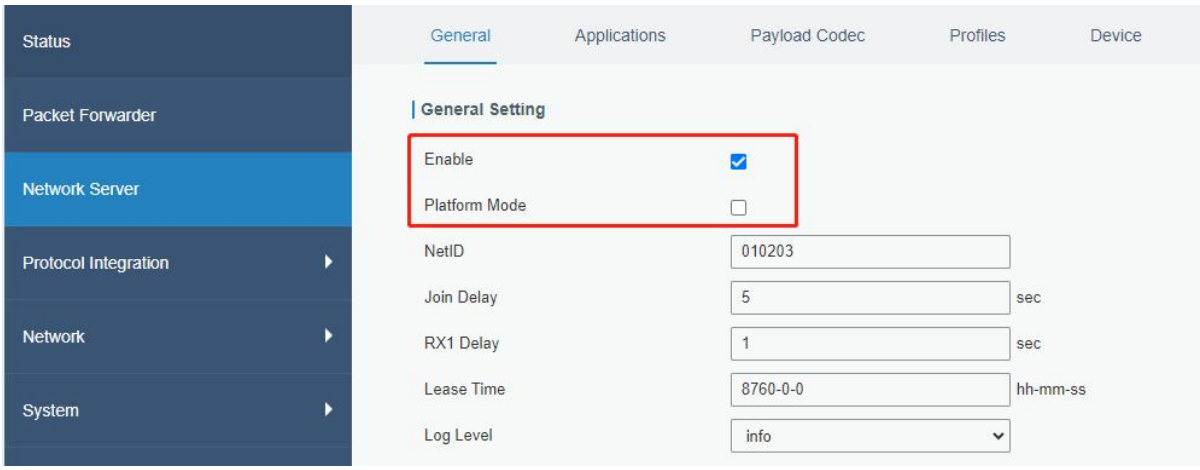
1. Launch the Field Tester App, and go to **Settings > Basic Information** menu to find the device EUI and application key information.

**Note:** the app EUI (join EUI) is fixed as 24E124C0002A0001.

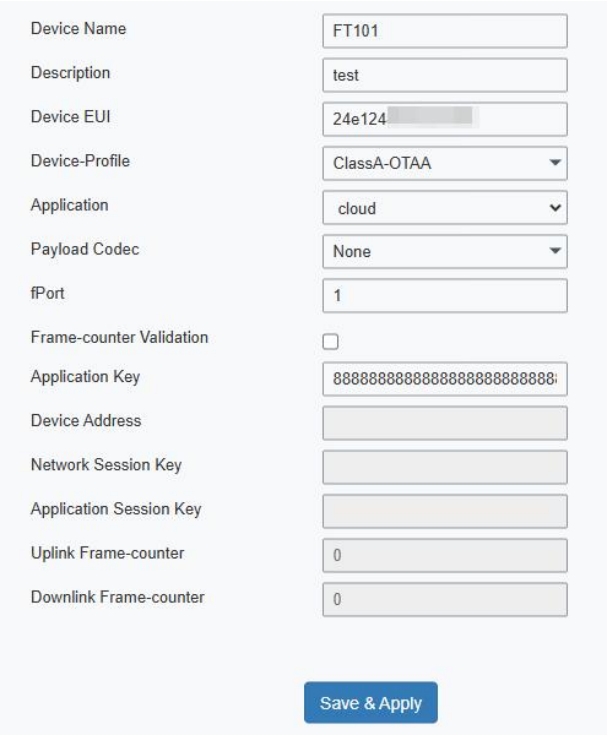



2. Configure the LoRaWAN® settings of this field tester.
3. Navigate to the web GUI of Milesight gateway to enable embedded NS mode.



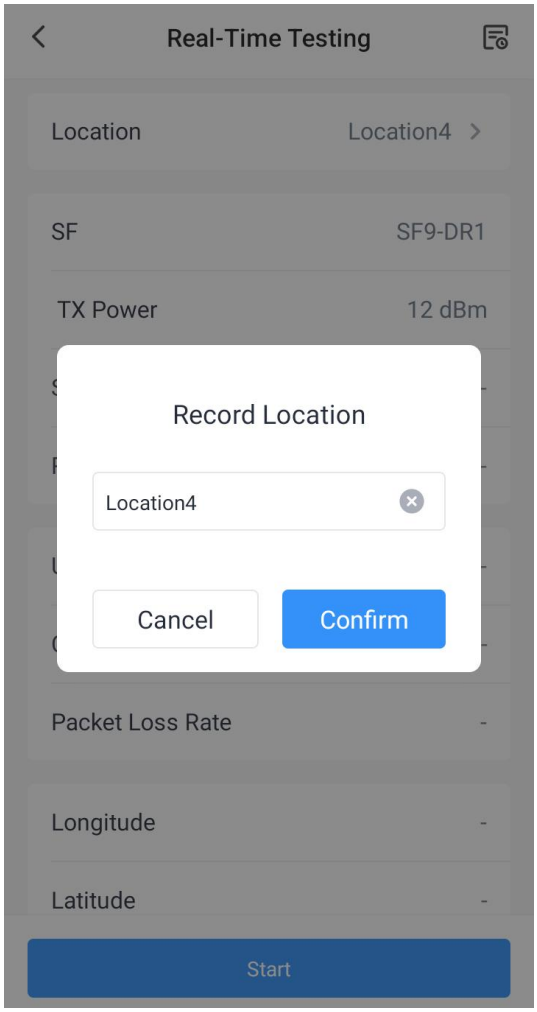

4. Navigate to **Network Server > Device** page to add the field tester to the gateway. The device profile type should be set as **OTAA-Class A**.



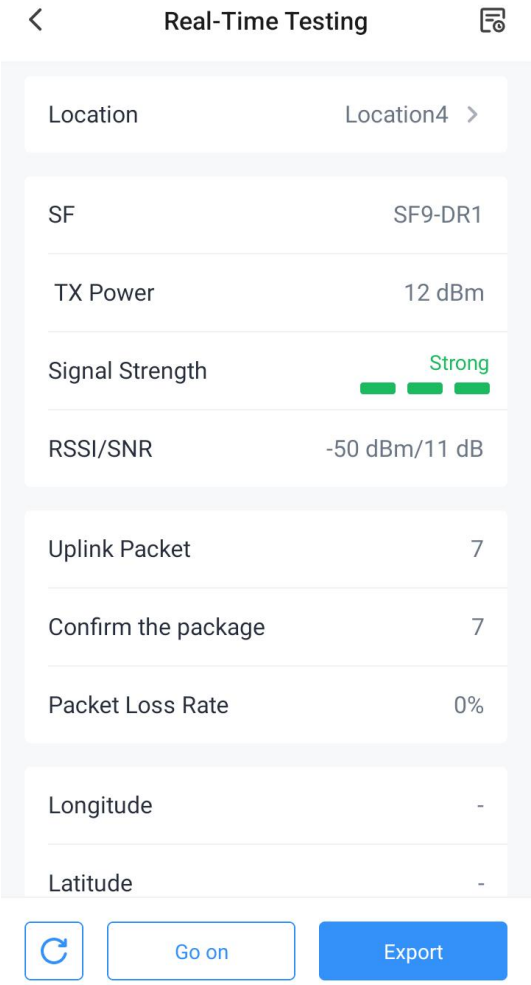

After adding, the field tester will show network status is connected.

5. Place the field tester to the target location of end devices.
6. Select **Real-time Testing** button, customize a name to record the detection location and click **Start** to start the test, then the device will send the confirmed packets to the network server and record the testing results.

**Note:** **Real-time Testing** button only displays when the device joins to the network.



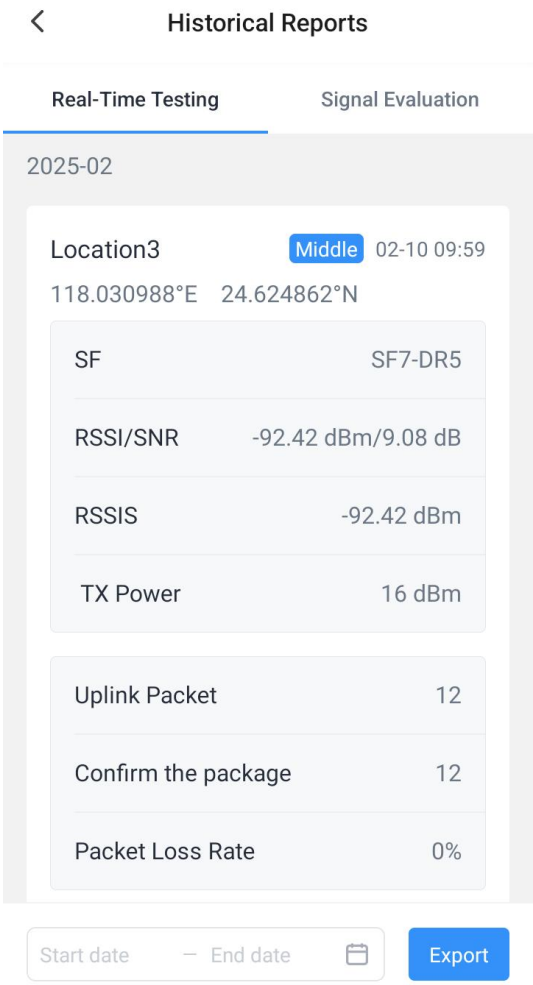

7. Click **Stop** to stop the test. The tester will display the signal test results and details.
**Note:** only after 1 minute the test can be stopped.




8. Click **Export** to save the test results as a CSV log file to the tester.

| Tx Cnt | Time | RSSI (dBm) | RSSIS (dBm | SNR (dB) | Signal | UPlink Packet | Confirm Packet | Packet Loss (%) | Longitude | Latitude | Location | SF | TX Power |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2024/12/31 13:31 | -94 | -94 | 9 | Middle | 1 | 1 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 2 | 2024/12/31 13:31 | -88 | -88 | 10 | Middle | 2 | 2 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 3 | 2024/12/31 13:31 | -90 | -90 | 9 | Middle | 3 | 3 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 4 | 2024/12/31 13:32 | -94 | -94 | 8 | Middle | 4 | 4 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 5 | 2024/12/31 13:32 | -94 | -94 | 9 | Middle | 5 | 5 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 6 | 2024/12/31 13:32 | -92 | -92 | 9 | Middle | 6 | 6 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 7 | 2024/12/31 13:32 | -85 | -85 | 10 | Middle | 7 | 7 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |
| 8 | 2024/12/31 13:32 | -84 | -84 | 11 | Middle | 8 | 8 | 0 | 118.03076° | 24.625017° | Location4 | SF9-DR1 | 12 dBm |

Users can also click the button at the top right corner of testing result or go to **Settings > Historical Reports** to check and export the test results.

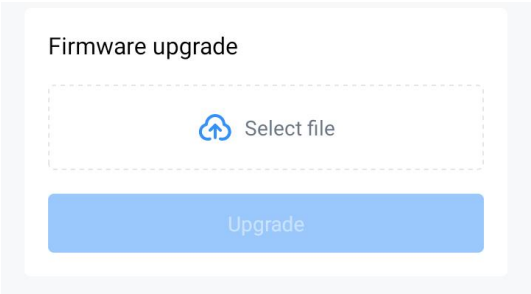



## 4.3 Upgrade

Field Tester supports to upgrade the device firmware or Field Tester App as required.

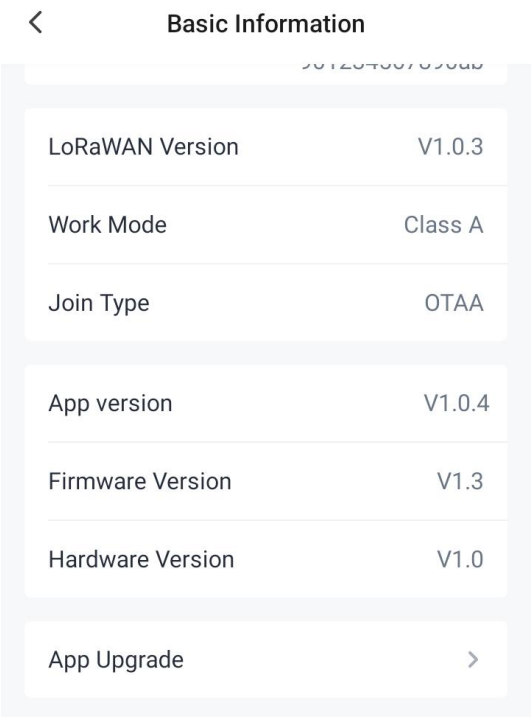
### Firmware Upgrade

1. Download FT101 device firmware from Milesight official website.
2. Connect the FT101 to the computer via type-C port.
3. Import the device firmware to the file folder of FT101 device.
4. Launch Field Test App, and navigate to **Settings > Basic Information** page.
5. Click **Select file** to select the firmware file and click **Upgrade** to upgrade the device.

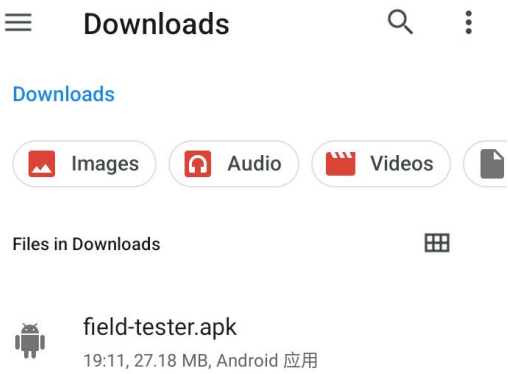


## App Upgrade

1. Ensure the FT101 device is able to access the Internet.
2. Launch Field Test App, and navigate to **Settings > Basic Information** page.
3. Click **App Upgrade** to download the latest App apk file from the Internet. You can also import the file to the device by connecting device to computer via type-C port if there is no Internet.




4. Open the apk file on the device folder to install it.




# 5. Maintenance

- Keep the device and its accessories dry. If the device sprayed the water, clean the surface with a dry soft cloth. Do not use an external heating device (such as a microwave oven) to dry it.
- Power off the device and disconnect the power adapter when cleaning the device.
- Do not clean the device and its accessories with strong chemicals, strong detergents or

solvents. To clean the device, wipe it with a soft moistened cloth. Use another soft, dry cloth to wipe dry.

- When installing a SIM card or micro SD card, keep the device clean to prevent impurities from entering the device.
- The response speed of the screen will become slow at a low temperature, which is a normal phenomenon and does not affect the performance.
- It is not suggested to charge the device when the environment temperature is over 45°C or below -10°C.
- Charge the device every 3 months if it is not used for an extended period.

## 6. Communication Protocol

The data are based on the following format (HEX), the Data field should follow little-endian:

| Channel1 | Type1 | Data1 | Channel2 | Type2 | Data2 | Channel 3 | ... |
|---|---|---|---|---|---|---|---|
| 1 Byte | 1 Byte | N Bytes | 1 Byte | 1 Byte | M Bytes | 1 Byte | ... |

For decoder examples please find files on https://github.com/Milesight-IoT/SensorDecoders.

| Item | Channel | Type | Description |
|---|---|---|---|
| Protocol Version | ff | 01 | 01=>V1 |
| Hardware Version | | 09 | 01 40 => V1.4 |
| Firmware Version | | 0a | 01 14 => V1.14 |
| Power On | | 0b | Device is on |
| Device Type | | 0f | 00: Class A, 01: Class B, 02: Class C |
| Device SN | | 16 | 16 digits |
| Coordinate | 03 | a1 | Byte 1-4: Longitude, INT32/1000000<br>Byte 5-8: Latitude, INT32/1000000 |
| Signal Strength | 04 | a2 | Byte 1-2: RSSI, INT16/10, Unit: dBm<br>Byte 3-4: SNR, INT16/10, Unit: dB |
| SF (Spreading Factor) | 05 | a3 | UINT8, range: 7-12<br>**Note:** when SF is set to ADR, the device will report this value as FF. |
| Tx Power | 06 | a4 | INT16/100, Unit: dBm |

**Examples:**

1. **Basic Information**: reports whenever it joins the network.

| ff0bff ff0101 ff166746d48016300014 ff090110 ff0a0101 | | |
|---|---|---|
| **Channel** | **Type** | **Value** |
| ff | 0b (Power On) | ff |

| | | |
|---|---|---|
| ff | 01(Protocol Version) | 01=V1 |
| ff | 16 (Device SN) | 6746d48016300014 |
| ff | 09 (Hardware Version) | 0100=>V1.0 |
| ff | 0a (Firmware Version) | 0101=>V1.1 |

2. **Signal test packet:** reports when starting signal testing.

| |
|---|
| **ff** |

3. **Real-time Testing packet**: reports everytime Real-time Testing stops.

| **03a1a801090779bf7701 04a279fc5d00 05a309 06a4b004** | | |
|---|---|---|
| **Channel** | **Type** | **Value** |
| 03 | a1<br>(Coordinate) | Longitude: a8 01 09 07=>07 09 01<br>a8=118030760/10^6=118.030760<br>Latitude: 79 bf 77 01=>01 77 bf<br>79=24625017/10^6=24.625017 |
| 04 | a2<br>(Signal Strength) | RSSI: 79fc=>fc79= -903/10=-90.3dBm<br>SNR: 5d 00=> 00 5d=93/10=9.3dB |
| 05 | a3(Spreading Factor) | 09=SF9 |
| 06 | a4 (Tx Power) | b0 04=>04 b0=1200/100=12 dBm |

## Appendix: Signal Quality Guidelines

| Signal Quality | Packet Loss Rate | SF | RSSIS |
|---|---|---|---|
| Strong | ≤ 5% | SF7 | ≥ 60dBm |
| | | SF8 | |
| | | SF9 | |
| | | SF10 | |
| | | SF11 | |
| | | SF12 | |
| Medium | 5% < Rate ≤ 10% | SF7 | -100dBm ≤ RSSIS <60dBm |
| | | SF8 | |
| | | SF9 | |
| | | SF10 | |
| | | SF11 | |
| | | SF12 | |
| Weak | 10% < Rate < 50% | SF7 | -115dBm ≤ RSSIS < -100dBm |
| | | SF8 | -120dBm ≤ RSSIS < -100dBm |
| | | SF9 | -125dBm ≤ RSSIS < -100dBm |
| | | SF10 | -130dBm ≤ RSSIS < -100dBm |
| | | SF11 | -135dBm ≤ RSSIS < -100dBm |
| | | SF12 | -141dBm ≤ RSSIS < -100dBm |

| | | | |
|---|---|---|---|
| Abnormal | ≥ 50% | SF7 | < -110dBm |
| | | SF8 | < -120dBm |
| | | SF9 | < -125dBm |
| | | SF10 | < -130dBm |
| | | SF11 | < -135dBm |
| | | SF12 | < -141dBm |

**-END-**