OTDR

High Performance
Optical Time Domain Reflectometer

User Manual

PREFACE

Thank you very much for purchasing and using this series optical time domain reflector meters (OTDR). This manual mainly contains information on common operation safety instructions, basic operations and specifications of the instrument, as well as common troubleshooting guides. For your convenience, before operating this instrument, please read this manual carefully and follow the instructions in the book correctly.

This manual is only for use with this instrument. Without the authorization of the company, any unit or individual shall not tamper, copy and disseminate the contents of this manual for commercial purposes.

The contents of this manual are subject to change without notice. If you have any questions, please call the supplier and we will be happy to provide you with the best service!

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1. Summary

1.1 Unpacking inspection

This instrument is packaged and transported strictly in accordance with GB/T 9174-2008 "General Technical Conditions for General Cargo Transport Packaging". When you receive the instrument, please carefully check the appearance of the product according to the packing list, and if timely find out any possible damage for the product during the shipping process, please notify the shipping company immediately while keeping the original packaging materials, and contact the supplier of this product for a solution.

1.2 Product Overview

This instrument is a new generation of 7-inch capacitive touch screen comprehensive tester with rich functions, sturdy and durable structure, and beautiful and novel appearance. Using excellent intelligent hardware and software design, it is used to measure parameters such as the length, loss and connection quality of optical fibers and optical cables. It integrates rich ethernet testing functions to provide convenient testing methods for ethernet fault diagnosis. Provides the highest performance solution in the construction and installation of fiber optic networks and subsequent fast and efficient maintenance and troubleshooting tests. The battery capacity is 7.4V 5200mAh, which is suitable for long-term outdoor use.

The instrument comes with standard OTDR, light source, optical power meter, red light, event map, optical loss test, ethernet test and ethernet remote functions.

1.3 Safety tips

⚠ **External power supply**

The power adapter input meets the following requirements：100V～240V, 50/60Hz.

The power adapter output meets the following requirements：DC：12V-19V ≥1.5A.

Please use the adapter provided with the instrument and use the external power supply strictly in accordance with the specifications, otherwise the equipment may be damaged.

⚠ **Internal battery**

The inside of instrument is special lithium battery, which can only be used for this instrument and cannot be removed. For safe use, the internal charging circuit of instrument has set multiple protection measures for battery voltage, charging current, charging temperature and so on. The battery charging temperature range is -5℃～40℃. When the ambient temperature is too high, the charging will be terminated automatically. When the instrument is not used for a long time, please charge the battery regularly. It is recommended to charge the battery every 2 to 3 months to ensure the best performance of the battery. Please do not let the battery close to fire or strong heat environment; the temperature range for long-term storage of the battery is: -20℃～45℃.

If the battery leaks or explodes, the electrolyte will damage clothing or skin it has come in contact with. Electrolyte may cause blindness. If accidentally gets into the eyes, please wash the eyes thoroughly with clean water and seek medical attention immediately.

⚠ Laser Safety

When using this instrument, please avoid looking directly at the laser output port, and do not look directly at the end of the optical fiber during testing; when the instrument is used, please cover the light output port dust cap.

LCD Screen: The display of this series of optical time domain reflector meters is a 7-inch color LCD screen with a touch screen, In order to maintain good viewing effect, please keep the LCD screen clean and clean. When cleaning, the LCD screen can be cleaned by wiping with soft fabric.

Tip: Do not press the LCD screen with sharp objects or wipe the LCD screen with organic solvents, otherwise the LCD screen may be damaged.

During the use of the instrument, it is strictly forbidden for the user to disassemble the machine without permission, otherwise the warranty will be lost!

Except for the 1625nm/1650nm wavelength, other wavelengths cannot be tested with light (on-line test). Forcible use will burn out the internal components of the instrument and cause the instrument to malfunction (the malfunction caused by this operation will not covered by the warranty)!

1.4 Instrument Maintenance

The whole machine is guaranteed for 18 months, and the battery, adapter, and consumable parts of the optical interface are guaranteed for 6 months. The items provided with the product are not within the scope of this warranty. For specific warranty terms, please refer to the warranty description "After-sale Service Warranty Card".

If you need to return the product due to product calibration or other reasons, please contact your supplier in advance, and briefly explain the reason for the return of the product, so as to provide you with more timely and effective services.

When the product returns, please note that:

- Wrap the instrument with a soft, thin pad such as polyethylene to protect the integrity of the instrument case;
- Please use a hard packing box and ensure that there is at least 3 cm of soft stuffing around the instrument;
- Fill in the product after-sales service warranty card correctly, including company name, address, contact person, phone number, problem description and other information, reliable shipping to the agent who supplies you.

2. Basic Knowledge of OTDR

Optical Time Domain Reflectometer (OTDR) is a precision optical fiber measurement instrument made by using the principle of back-scattering generated by Rayleigh scattering and Fresnel reflection when laser light is transmitted in optical fiber. It measures the transit time of a light pulse back and forth, use the formula $L=c \times t/(2n)$ to calculate the distance L, the unit of L is m, c is the propagation speed of light in vacuum 2.99792×108m/s, t is return light pulse (the unit is s), where n is the refractive index, specified by the fiber manufacturer, and divided by 2 in the formula because the round-trip time is measured.

When light is transmitted in an optical fiber, due to the in-homogeneity of the optical fiber doping composition or the defects of the optical fiber link itself, the optical pulse propagating in the optical fiber undergoes Rayleigh scattering, and part of the optical signal will be scattered in the opposite direction of the pulse incidence. Back, it is called back Rayleigh scattering. By regularly observing the changes of Rayleigh back-scattered light signal intensity, the loss distribution and connection quality of optical fibers and cables can be accurately measured.

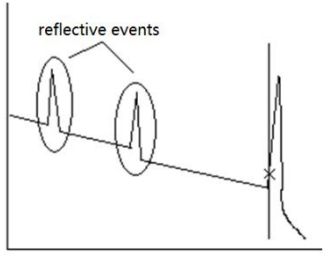
According to the light transmission theory, when light encounters the boundary of two transmission media with different refractive indices (such as a flexible connector, a break or an optical fiber termination) during the propagation process, the Fresnel reflection phenomenon will occur. Timed reception of the nel-reflected signal enables accurate location of discontinuities along the length of the fiber. The magnitude of the reflection depends on the refractive index difference and the flatness of the boundary surface.

An OTDR tested event is an anomalous point that causes a sudden change in loss or reflected power. Including various connection points, fusion points and bending, cracking or breaking positions in the optical fiber link that lead

to the loss of transmission signals, mainly divided into reflection events and non-reflection events.

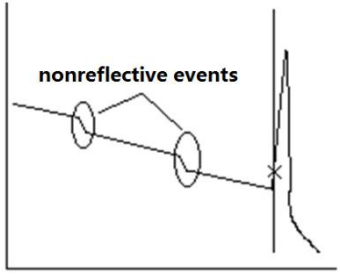
（1）Reflective event

When the laser pulse sent by the OTDR is transmitted along the fiber under test, if it encounters an active connection point or the end of the fiber, reflection will occur due to the sudden change of the refractive index, and part of the optical signal will return to the instrument along the fiber under test. The instrument will detect this reflection event by accepting this reflection signal. On the OTDR test curve, it appears as an upward spike signal with a certain width. The width and amplitude of the spike are mainly determined by the pulse width used for the test and the reflection intensity that occurs.



（2）Non-reflective event

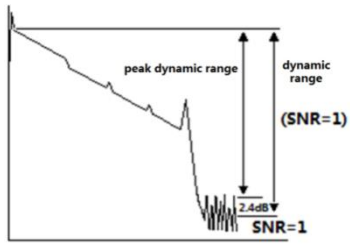
When the laser pulse emitted by the OTDR is transmitted along the fiber under test, if it encounters a position where the energy is partially lost, such as a fusion point or bending, the reflection phenomenon will not occur because there is no sudden change in the refractive index. , or can be ignored.



The OTDR detects the energy change difference entering the OTDR receiver through backscattering, and can detect the non-reflection event parameters at this point. A non-reflection event appears as a signal with a drop in energy on the OTDR curve, and the magnitude of the drop indicates power loss.

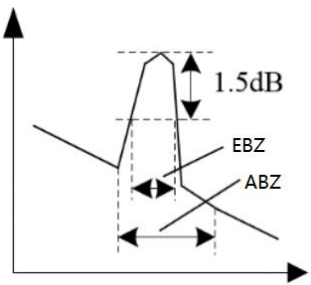
（3）Dynamic Range

Dynamic range is an important parameter of optical time domain reflectometry, measured in dB. This parameter is expressed as the maximum optical loss that the OTDR can analyze from the back-scatter level at the output port of the instrument down to a specific noise level. In actual use, this parameter is usually measured by the farthest distance that the OTDR can test under the condition of the maximum test pulse width provided by the instrument. Therefore, under the same link conditions, the larger the dynamic range, the longer the distance of the fiber optic link that the instrument can test. The maximum test distance of an OTDR is different in different applications, and connectors, fusion splices, and optical splitters are also factors that reduce the test length of an OTDR.



（4）Event Blind Zone and Attenuation Blind Zone

There are places in the link that cannot be measured due to tie points or connectors. The OTDR blind area is divided into event blind area and attenuation blind area, which is generated by Fresnel reflection and expressed in distance (meters) that varies with the reflected power.



Event Blind Zone: The shortest distance between the detection of Fresnel reflection signal and the recognition of the next Fresnel reflection signal by OTDR is defined by the pulse width less than 1.5dB of the peak value.

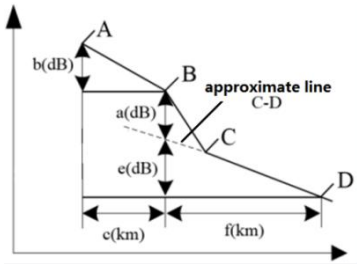
Attenuation Blind Zone: The shortest distance that OTDR goes through from detecting Fresnel reflection signal to

normal testing backward Rayleigh scattering signal, that is, the phase cannot measure fusion loss due to adjacent large reflection.

（5）Splice Loss

The OTDR tests the distance and loss between specified points. This series OTDR mainly use the 4-point marking method:

Measurement start point A, splice loss start point B, splice loss end point C, and measurement end point D. The splice loss is calculated by the level difference between the approximate line between B-A and the approximate line between C-D where the marker B is located. Please place marker B at the exact position. The splice loss value depends heavily on the position of B, the measured loss value between marks depends on the specified approximation method.



(6)Return Loss (RL)

RL is the ratio of reflected light Pr to incident light Pi in dB. Using the formula RL=-10log (Pr/Pi), the greater the echo loss, the smaller the reflected light energy, indicating that the better the measured light path.

3.Features of this series of OTDR products

3.1Main function

（1）**OTDR：** Support transmitting fiber, receiving fiber setting, Pass/Fail threshold determination, test report generation and other functions.

（2）**Event Map：** Splitter test and fiber optical link test.

（3）**Laser Source：** Generate CW、270Hz、1kHz、2kHz laser source.

（4）**Optical Power Meter（OPM）：** -70dBm~+6dBm and -50dBm~+26dBm（defaulted） multi-wavelength power detection range, support the identification of laser source modulation frequency.

（5）**Visual Fault Location function（VFL）：** Continuous、1Hz、2Hz visible red light, visually locate fiber faults.

（6）**Optical Insertion Loss Test：** Support laser source and optical power meter to be turned on at the same time, Insertion loss for testing devices and links.

（7）**Fiber Inspection：** Visual fiber end-face inspection. (**Note: this function is an optional function**）

（8）**Ethernet Tools：** Network test functions include PING, PPPOE, IP scan； the link test function includes link speed measurement

（9）**Remote Test：** Remotely connect the instrument via Ethernet to realize remote control of the OTDR function.

3.2 Other function

Mobile APP wireless operation(optional): The mobile APP is connected to the instrument through a wireless interface such as Bluetooth or wifi to realize basic control testing and file acquisition.

User-defined power-on password: Flexible power-on password settings ensure instrument management and test data security.

Quick screenshot: A convenient drop-down window provides a quick screen capture function to record the status of the instrument at any time.

Quick and easy help: A quick drop-down window provides customized help services to ensure hassle-free operation with the instrument.

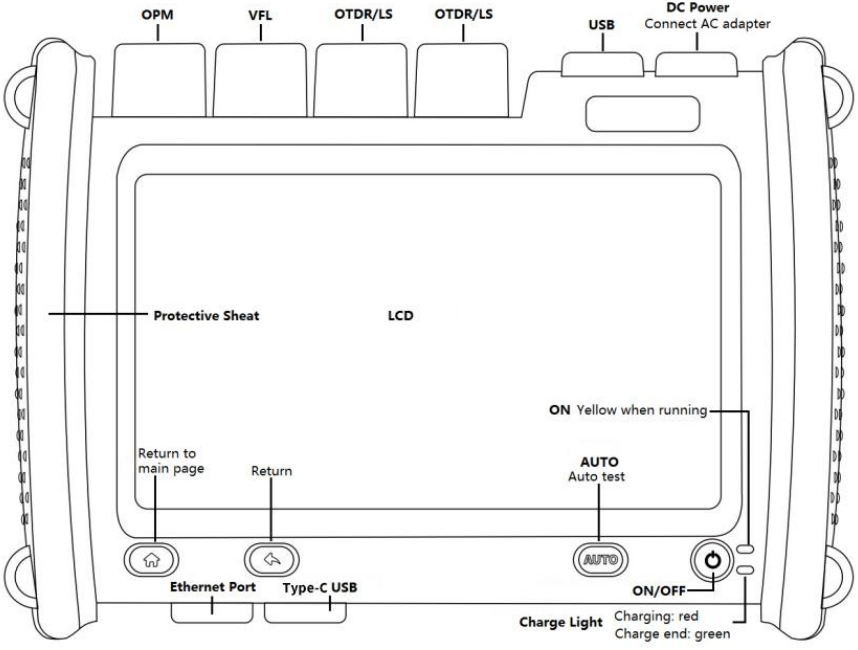
Large-capacity battery, long battery life: Built-in7.4V、5200mAh rechargeable lithium-ion battery, with long battery life, worry-free outdoor testing.

Note: The typical battery life is about 8 hours (OTDR real-time test, backlight brightness 50%)

One-key automatic test: The excellent automatic test function provides you with a convenient one-key automatic test.

4. Basic operation and usage of OTDR products of this instrument

4.1 Instrument panel



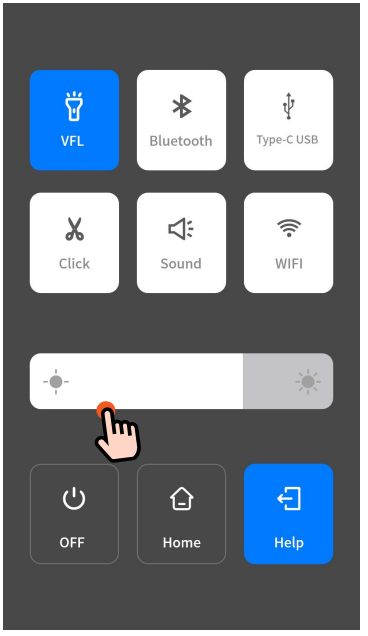
4.2 ON/OFF

- Power-on operation: In the power-off state, press the power-on button for >2s when the instrument is turned on, and the power-on indicator lights up.
- Soft shutdown operation:

(1) Press the on/off button for > 2s, a shutdown prompt box will pop up, select "Yes", and the instrument will shut down.

(2) Pull down the status bar to pop up the shortcut operation menu, click Shut down a shutdown prompt box will pop up, select OFF.

- Forced shutdown operation: in the power-on state, after pressing the power button for >8s, the power indicator turns off and the instrument shuts down.



4.3 Charge and Discharge

Charge： The instrument is charged via the DC interface， support 12V-19V，adapters with current≥1.5A， The red indicator light is on when charging, and the charging icon is displayed in the status bar. After fast charging end ,the green light will turn on.

Note： When the power display is 100% and the light is red, it is in trickle charge.

4.4 Connect Optical Cable

⚠ **Warning**

- **The light is emitted from the light source port of instrument, please do not unplug the connected optical cable, the light can damage the eyes.**
- **If there is no optical cable connected to the light source port, close the cover of the light source port. When using an instrument with more than 2 light source ports, it may cause eye damage if it reflects in the eyes.**

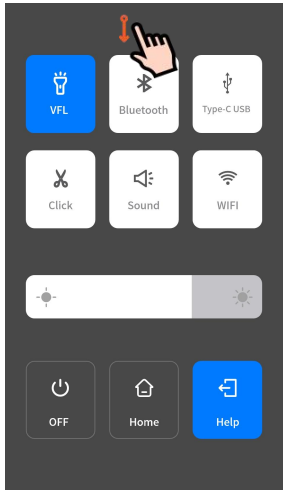
Attention：

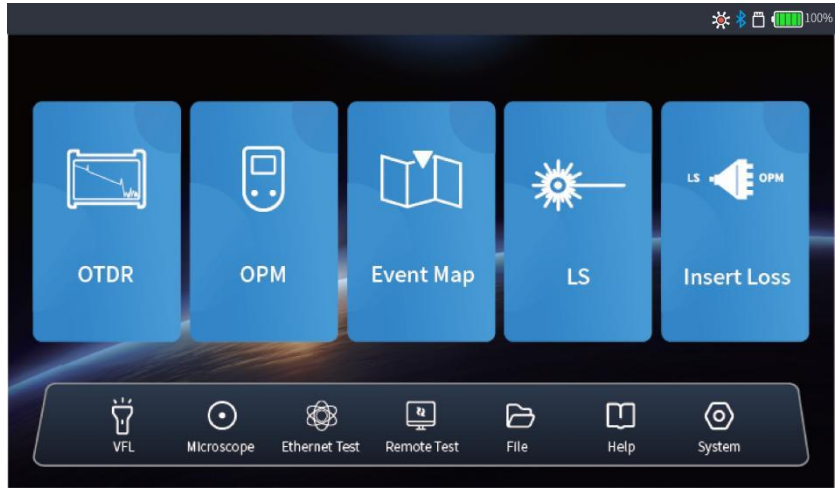
- Before connecting the optical cable connector, please confirm whether the connector type matches and whether the connector is clean. The wrong connector type or contaminated connector will not only lead to inaccurate measurements, but may even damage the optical interface of the instrument. The correct way to clean the end face is: before inserting the optical fiber connector (jumper), use anhydrous alcohol to clean the jumper, especially the end face, and connect it to the instrument after the alcohol evaporates.
- When connecting the optical cable connector, it should be inserted into the optical port vertically and slowly. If it is turned to the left, right or too much force, the optical connector or the optical port will be damaged.
- If there is no optical cable connected to the port, immediately put on the dust cover to prevent dust or other dirt from adhering to the optical output port of the instrument.

4.5 Homepage and status bar

Status bar: Indicates red light,Bluetooth,U disk,charging status, and power in turn.

Pull down the status bar to pop up the shortcut interface click other areas to close the shortcut interface.



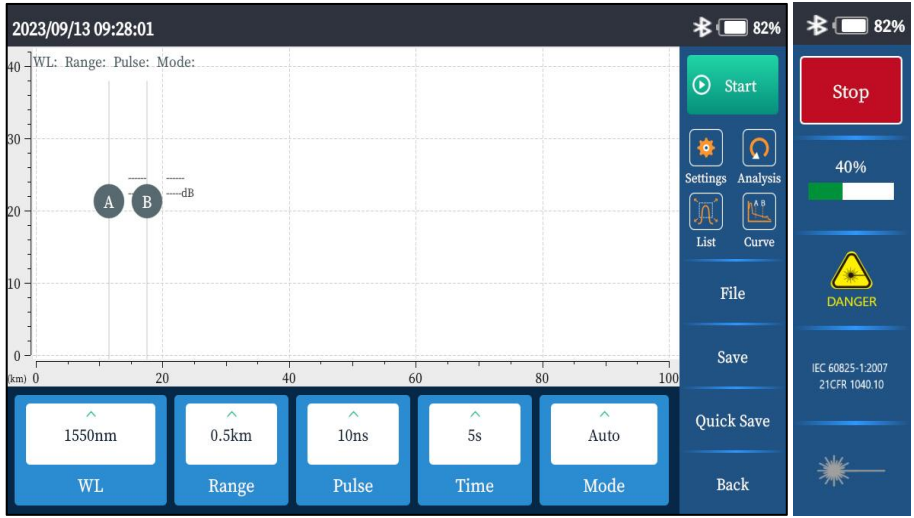


The quick operation interface controls the Bluetooth switch, Type-C USB (data transfer) switch, red light switch, quick screenshot, main sound switch, and brightness adjustment, and can also perform shortcut operations of shutting down and returning to the homepage.

Click screenshot, save the screen display in real time.

4.6 OTDR

（1）Settings



The setting interface is the first interface of the OTDR function: select test range, pulse width, time, wavelength, mode. Different ranges correspond to different optional pulse widths. and the selected test time is the average mode.

Settings:OTDR analysis, threshold and other parameter settings;

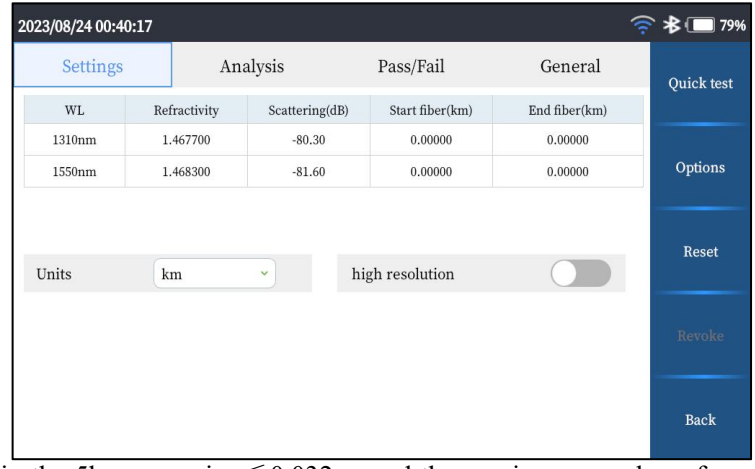
Analysis： reanalyze the curves that have been tested or opened;

List: Switch the display mode of event lists and curves.

Curve: Click on the curve operation to enter the waveform analysis interface, which supports waveform calculations such as LSA and 4-point method.

Note: During test, the test parameters can be modified in real time (except for automatic test and multi-wavelength real-time test), and the output port cannot be directly viewed.

（2） Settings (Click)



- Options: Click “Options”/set title to switch the setting content;
- Restore default: The current interface setting parameters are restored to the factory settings.

① Measurement settings:

Set the refractive index, backscatter coefficient, transmitting fiber, receiving fiber, measurement unit;

High-resolution mode: After turning on the high-resolution mode, the minimum point spacing within the 5km range is ⩽0.032m, and the maximum number of sampling points above the 260km range is ⩾256k.When the start fiber and end fiber are set to 5km, the test is shown on the right.

② Analysis settings

Set the reflection threshold, non-reflection threshold, and end threshold required for event analysis.

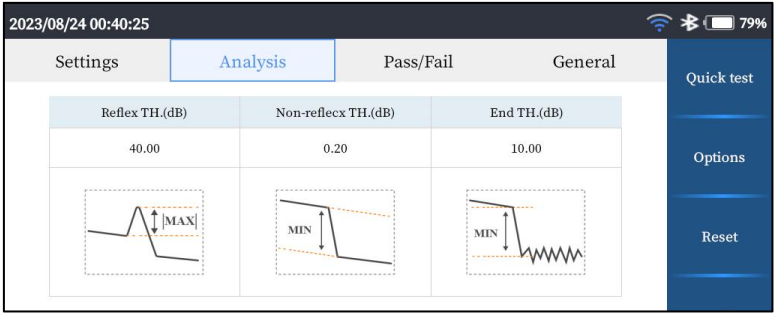
③ Pass/Fail

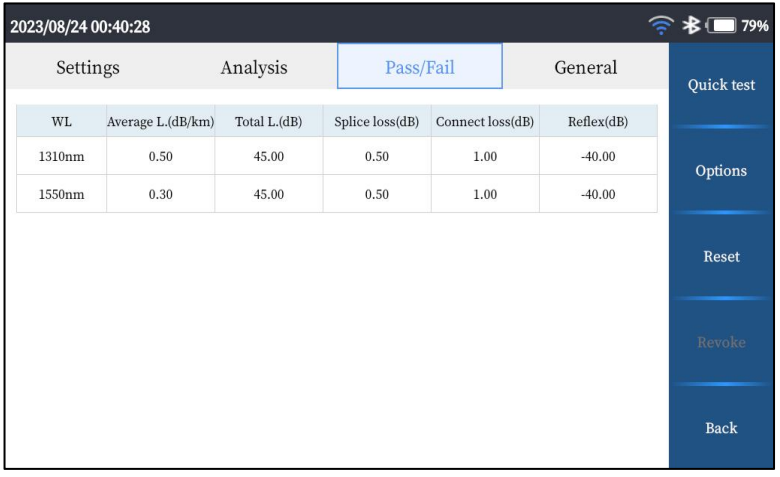
Pass/Fail is used to set the Pass/Fail function parameters, and can set the average loss of different wavelengths, total link loss, splice loss, connection loss and reflectivity judgment threshold, exceeded, they will be marked in the event list.

Step 1: Touch the "Pass/Fail Threshold" switch to enable the Pass/Fail function;

Step 2: Click the number area to pop up the key-board to modify the parameters;

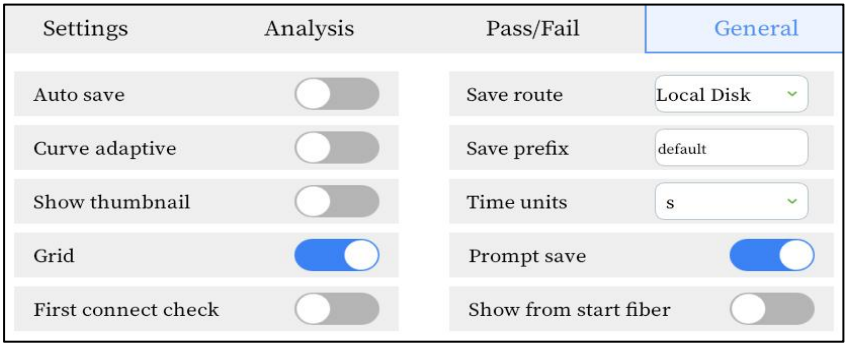
Step 3: Test: after the pass/fail threshold function





is enabled, the event list display effect is as shown in the right figure.

④ General settings



Auto save: After opening, save the OTDR curve after testing according to the default naming format;

Prompt save: prompt the user whether to save the test curve when testing again after opening;

Grid: After opening, the background of the OTDR curve will display the grid;

The event list is displayed by section: After it is turned on, the event list will be displayed according to the section;

Save name prefix: user-defined automatic naming, quick naming prefix, the name is incremented by numbers;

Save route: select the storage path;

Show from start fiber: After it is turned on, the display starts from the set launch fiber position;

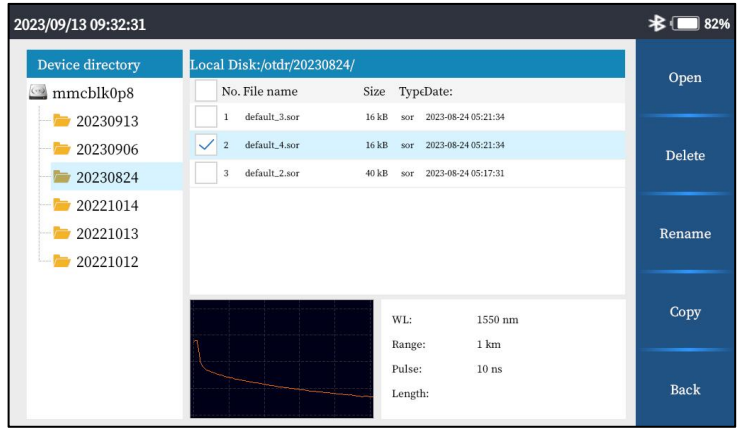
Show Thumbnail: When turned on, the curve thumbnails are displayed in the upper right corner of the test interface.

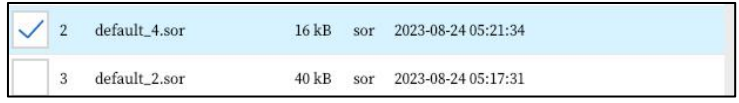
（3）File (Click)

"File" in the OTDR can operate the SOR file saved by the OTDR test and the generated test report PDF file, SOR files are saved in date-named folders.

" √ " means selected, and operations such as opening, deleting, renaming, and copying the selected file can be performed.

"Change color" indicates the current cursor position, and you can view the thumbnail of the SOR file curve at the cursor position.





（4）Curve operation

- Save：Save the current curve and generate a test report by SOR;
- Settings：Click return to the setting interface and set the test parameters;
- Curve: Perform operations such as zooming in, moving the cursor, and comparing curves to the test curve;
- Quick store: Quickly save the currently displayed test curve (Automatically named according to the common setting name prefix).

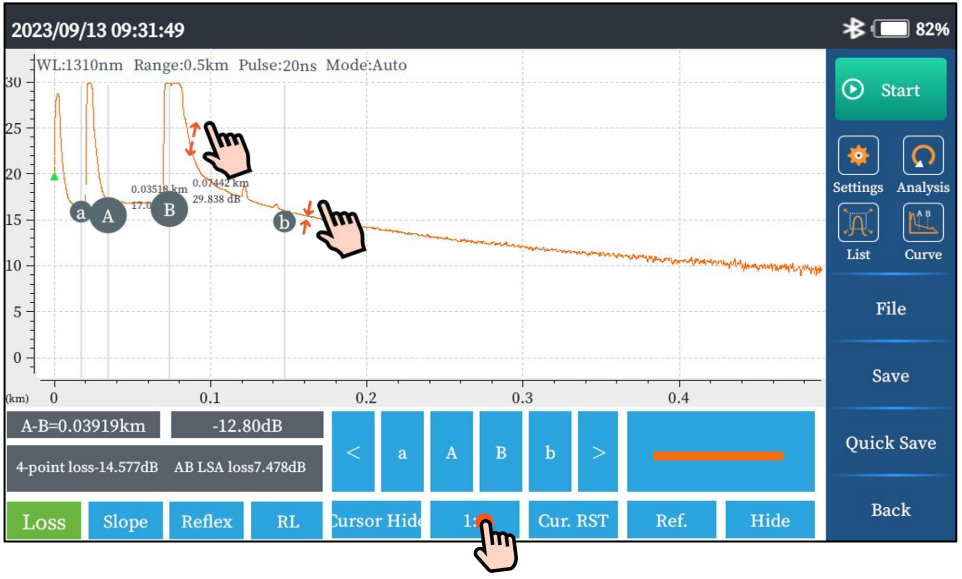
Event list:

After the test is completed and analyzed, it will automatically jump to the event list interface. Click the event list icon again to switch the display content.

Waveform Analysis：

Waveform zoom and move operations

- Waveform zoom: Full touch screen gestures expand outward to zoom in the zoom center area;
- Waveform zoom out: The full touch screen gesture shrinks inward in the zoom center area to zoom out;
- Waveform reset: Click the "1:1" button or double-click the screen to reset the waveform;



- Waveform movement: Click and hold the curve and drag.

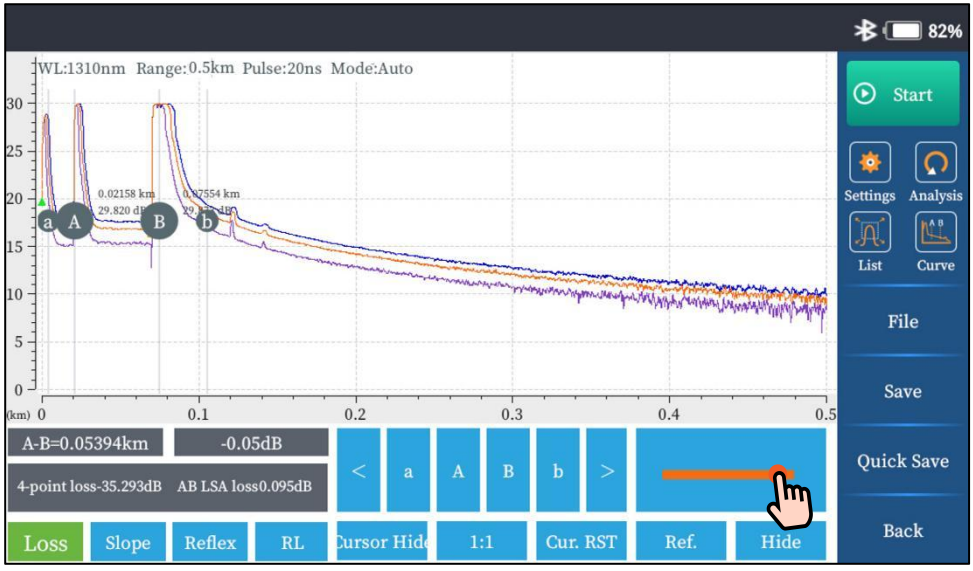
Cursor operation：

- Cursor movement: click and hold the cursor symbol and drag or select the cursor in the key area and click the direction of movement；
- Cursor Hide: All cursors can be hidden, and the cursor centering resets all cursors to the center of the screen.

Open multiple curves：

File -> Target SOR File -> Open

Support to open 3 SOR files at the same time for curve analysis and comparison operations.



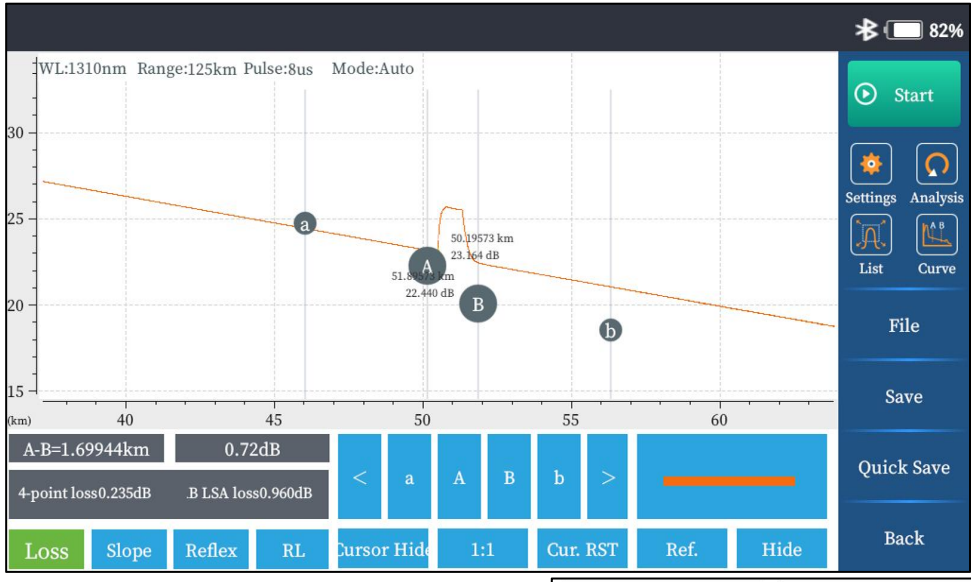
—: The currently selected curve, click to switch;

Hide: Hide the currently selected curve;

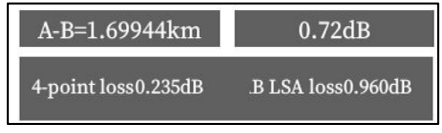
Reference: Select a curve as a reference, then test, the test curve can be compared and analyzed with the reference curve.

Loss Analysis:

Loss analysis: When calculating the loss of "Event 1" in the figure, the cursor sequence position is shown in on the right.



The 2-point method displays the distance and loss of the A-B cursor in real time; as shown on the left below.

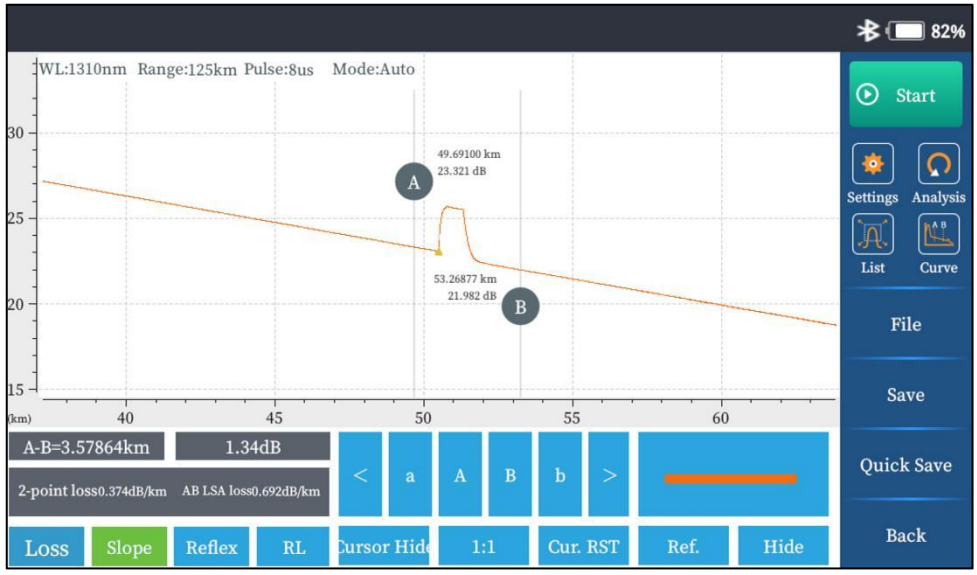


The 4-point method calculates the event loss in real time, and the LSA method calculates the A-B cursor loss in real time, as shown on the right below.

Slope Analysis:

When calculating the decay of event 1 in the figure, the cursor order position is shown on the right.

The 2-point method calculates the attenuation of the A-B cursor area in real time, and the LSA method calculates the attenuation of the A-B area in real time as shown on the right below.

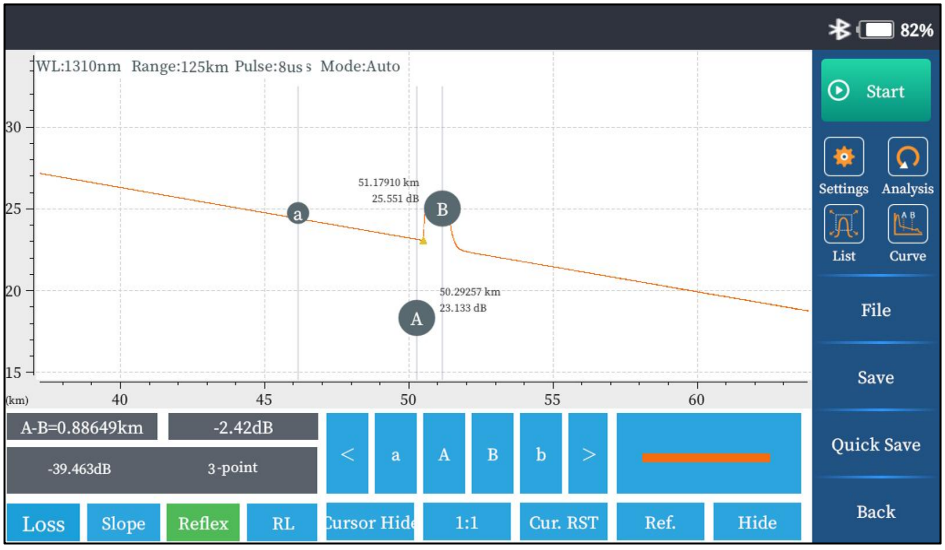


Reflectivity Analysis:

When calculating the reflectivity of event 1 in the figure, the cursor sequence position is shown on the right.

The distance and loss of the A-B cursor in real time using the 2-point method as shown on the left below.

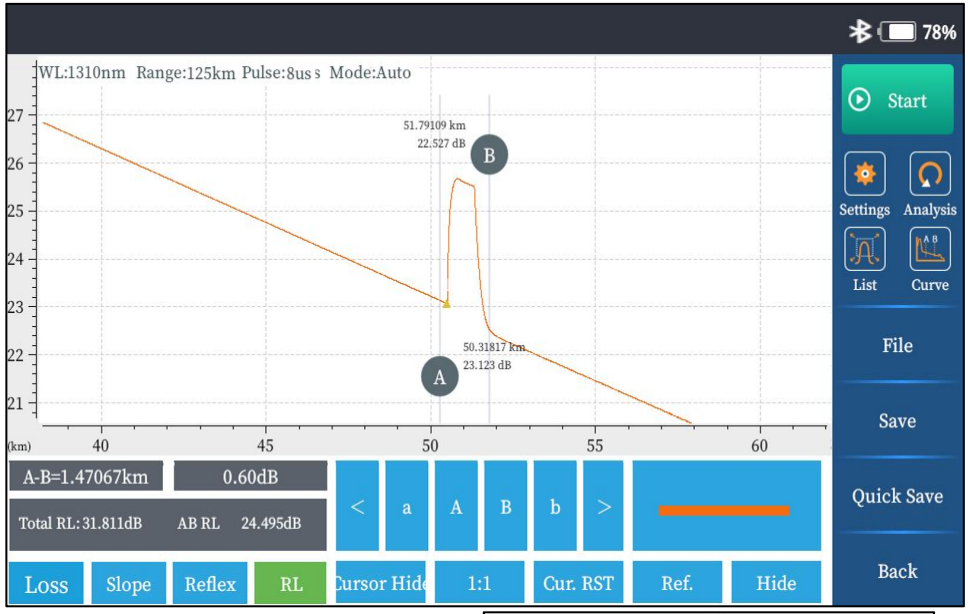
The 3-point method calculates the reflectivity of the measured event in real time, as shown on the right below.



Return Loss Analysis:

Analyze the total return loss of the link under test and the return loss within the A-B cursor position, as shown on the right.

Calculate the total return loss of the link and the return loss within the 2- points of the A-B cursor, as shown on the right below.



（5）Save

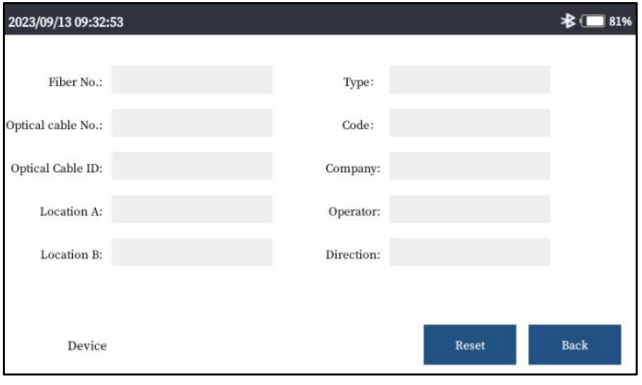
①Save File: Curve Operation -> Save -> Save File

Step 1: Set the name and save parameters, select the storage path.

Step 2: Confirm to save.

Curve Operation -> Save -> Save File -> Save Settings

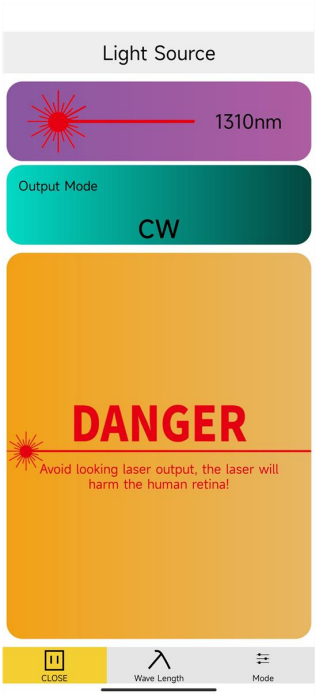
Save setting is used to set the SOR file save content such as fiber identification, cable identification, cable code, location and project type, project code, company name, operator, direction, etc.

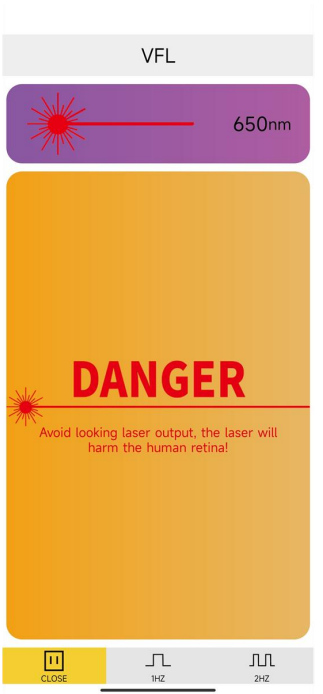


Step 2: On mobile phone APP, add a Bluetooth device, scan the corresponding MAC information, and then the connection is successful;

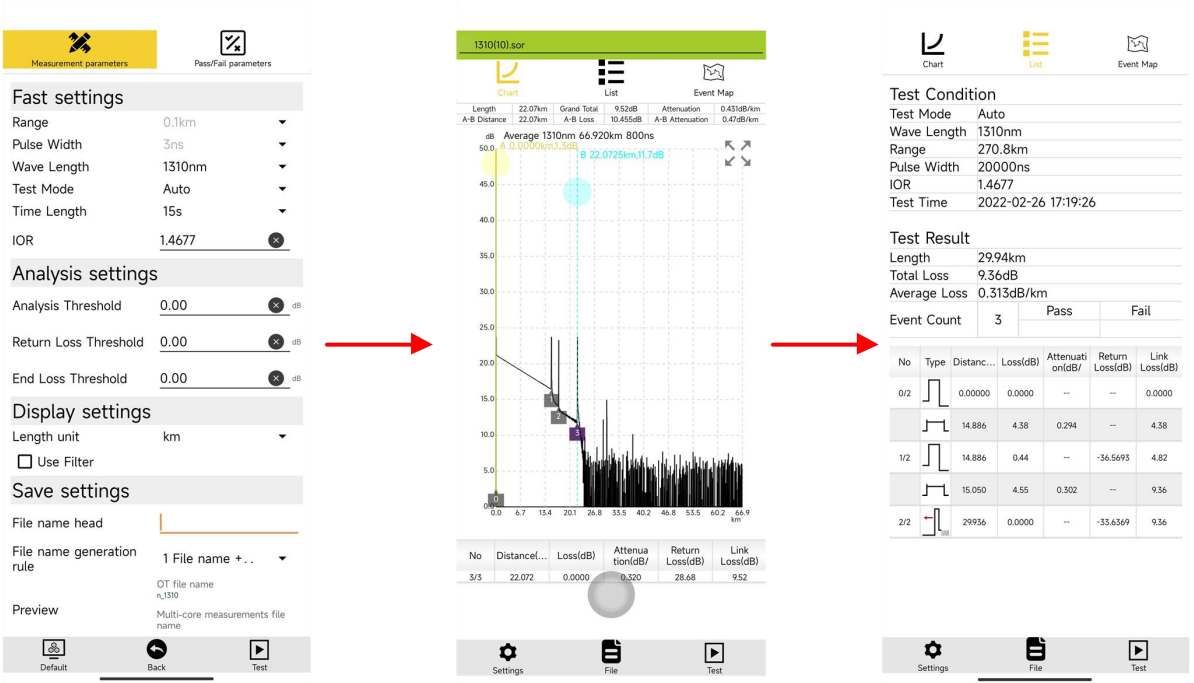
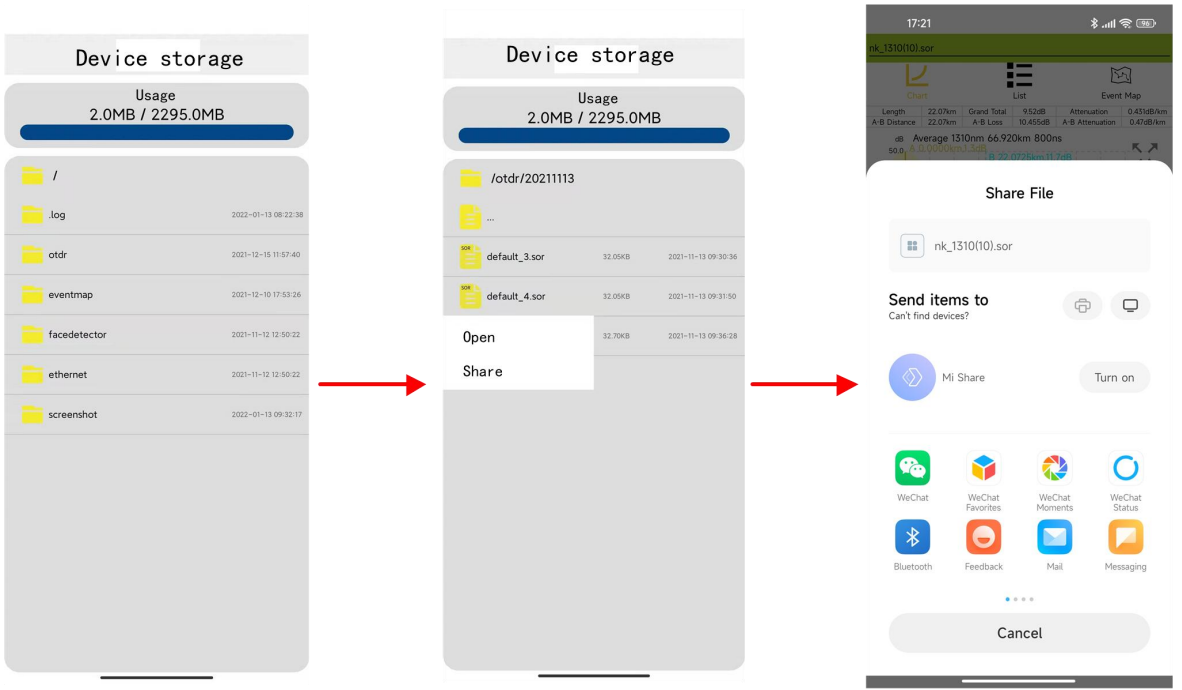
:In WIFI mode use phone APP scan the QI code to establish the WIFI connect.

Step 3: The APP terminal can control the operation of the light source function, the optical power meter function (OPM) and the red light function (VFL);





Step 4: APP terminal operates the OTDR function, sets the test parameters, starts the test and checks the test results;



Step 5: Open and share test results.