

FHO5000 OTDR

Manual



Version: V1.1

Date: 2023-11-2

Foreword

Thank you for purchasing FHO5000 OTDR (Optical Time Domain Reflectometer). This user's manual contains useful information about the instrument's functions and operating procedures and the handling precautions of FHO5000 OTDR. To ensure correct use, please read this manual thoroughly before beginning operation. After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.

Note

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest Grandway dealer.
- Copying or reproducing all or any part of the contents of this manual without Grandway's permission is strictly prohibited

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Version

Version	Date	Content changes	Note
V1.0	2023-1-1	New PRO Version Released	
V1.1	2023-11-2	Add some new functions	

Standard Accessory

OTDR standard accessory showed in next table.

Num.	Description	Quantity
1	Main Unit	1
2	Lithium battery	1
3	Power adapter	1
4	Charge cord	1
5	FC adapter	1
6	USB cable	1
7	Quick guide	1
8	Test report	1
9	Wrist strap	1
10	Carrying bag	1

Safety Precautions

To use the instrument safely and effectively, be sure to observe the precautions given in the user's manual. Not complying might result in injury or death.

Warning

Use the Correct Power Supply

Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the AC adapter and that it is within the maximum rated voltage of the provided power cord.

Use the Correct Power Cord

Use only the power cord that comes with the instrument. Do not use it for other devices.

Use the Correct AC Adapter

Use only the AC adapter specified for the instrument. Do not use it for other devices.

Use Only the Designated Battery pack

Use only the battery pack specified for the instrument. Do not use it for other devices.

Use only this instrument or a charger specified by Grandway to charge the battery pack. If the fast charge does not finish after four hours or more, stop charging the battery pack immediately.

To prevent the possibility of electric shock and accidents, always turn OFF the power switch and remove the AC adapter power supply from the instrument when replacing the battery pack.

Do not throw the battery pack into fire or apply heat to it. This can cause dangerous explosions or spraying of the electrolytes.

Do Not Look at the Laser Light

Do not look at the laser's direct ray, reflected ray from a mirror, or indirect ray without the proper protective eyewear. In addition, avoid being exposed to the laser light. It can cause blindness or damage to the eye.

Do Not Operate in an Explosive Atmosphere

Do not use the thermocouple in a location where any flammable or explosive gas/vapor is present. Operation in such an environment constitutes a safety hazard.

Do Not Remove Covers

The covers should be removed by GRANDWAY's qualified personnel only. Opening the cover is dangerous, because some areas inside the instrument have high voltages.

Carrying and Moving the Instrument

Remove all power cords and connection cables from the main unit before moving the instrument. When carrying the instrument, hold it firmly by the handle. Also, if storage media is inserted into the instrument, always remove the storage media before carrying or moving the instrument. Never leave the media inserted when carrying or moving. The storage media can become damaged.

Apply Correct Signals to the Optical Connectors

Do not apply light that is -10dBm or greater to the FHO5000 optical Connectors. Doing so may damage the FHO5000.

Symbol

Icons on the main unit or in manual



Warning: handle with care. Refer to the user's manual or service manual.

This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in manual to identify those instructions



Hazard, radiation of laser apparatus



Recycle



Direct current



Comply WEEE (Waste Electrical and Electronic Equipment) Directive (2002/96/EC)



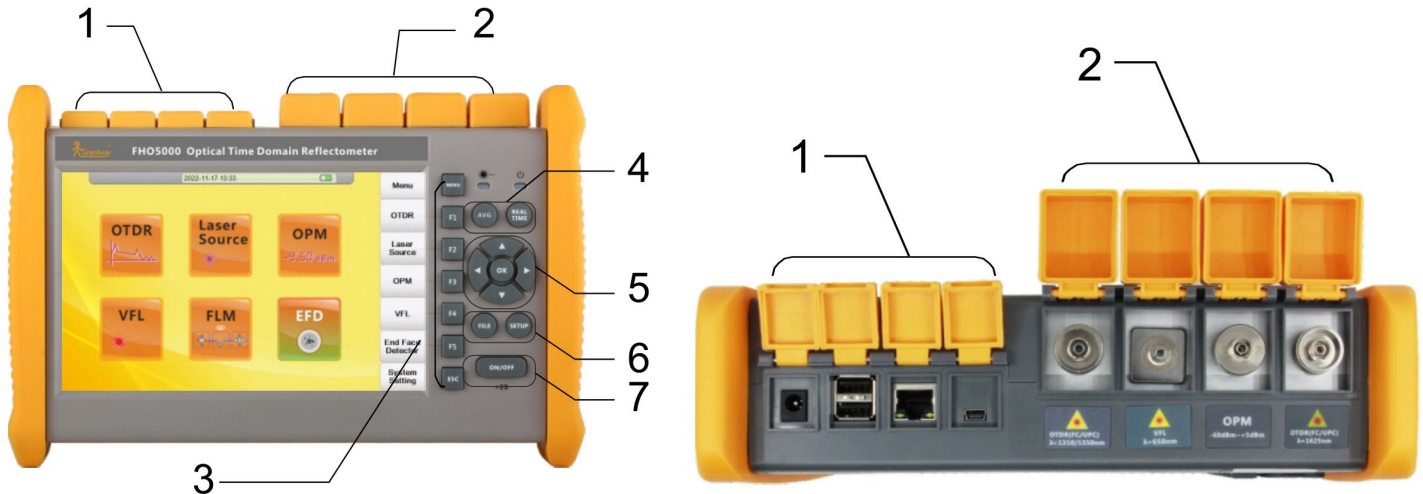
Stand-by (power)

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1: OTDR Interface

1.1 Front Panel and top Panel



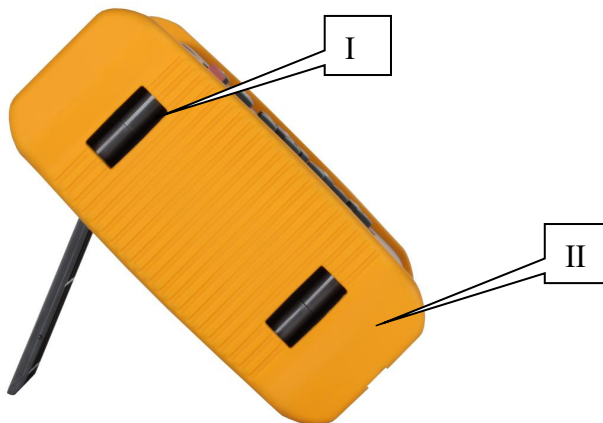
No	Name	Description
1	Electric ports (From left to right)	Charging port: DC input 10V/4A USB 2.0 port: Insert USB disk to upgrade RJ45 Ethernet port: remote control port Mini USB port: Transfer file to PC via USB cable
2	Optical ports (From left to right)	OTDR port1: for 1310nm/1550nm testing VFL port: 2.5mm universal port OPM port: for optical power testing OTDR port2(optional): for 1625nm testing
3	Function key	Menu: Enter the Main menu interface F1-F5: Enter the corresponding menu option ESC: Enter the system setting or back to main menu You can check "System info/language/date/power saving/bright light/IP setting, etc" in system setting
4	Test key	AVG: Perform OTDR average test ; REAL TIME: Perform OTDR realtime test
5	Direction key	Move cursor and confirm
6	File and Setup	File: To enter the saved file storage ; Setup: To enter the OTDR testing setting
7	ON/OFF key	Long press>2s to power on/off the OTDR

Note: Product appearance and parameters are subject to change without notice.

1.2 Back Panel and Side Panel

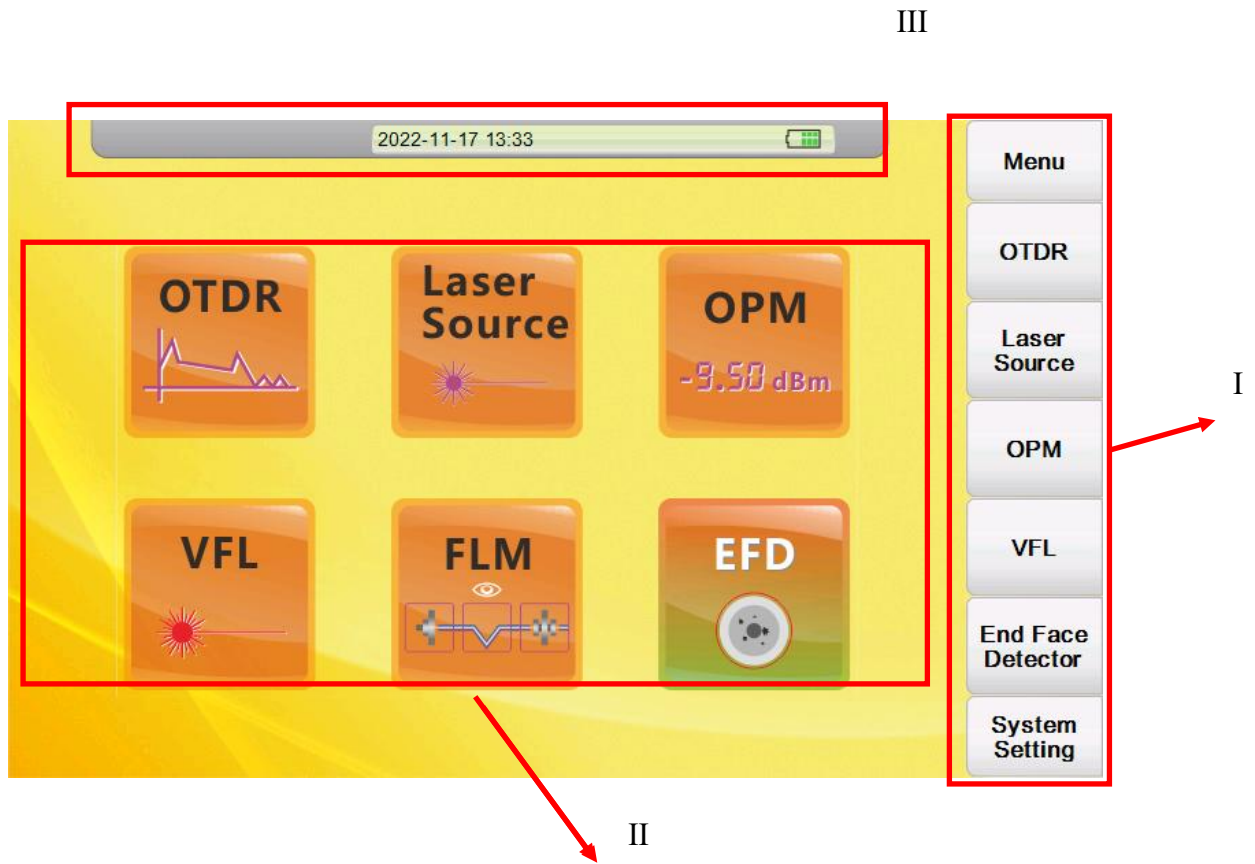


Num	Item
I	Warning label
II	Battery compartments
III	Supporting plate



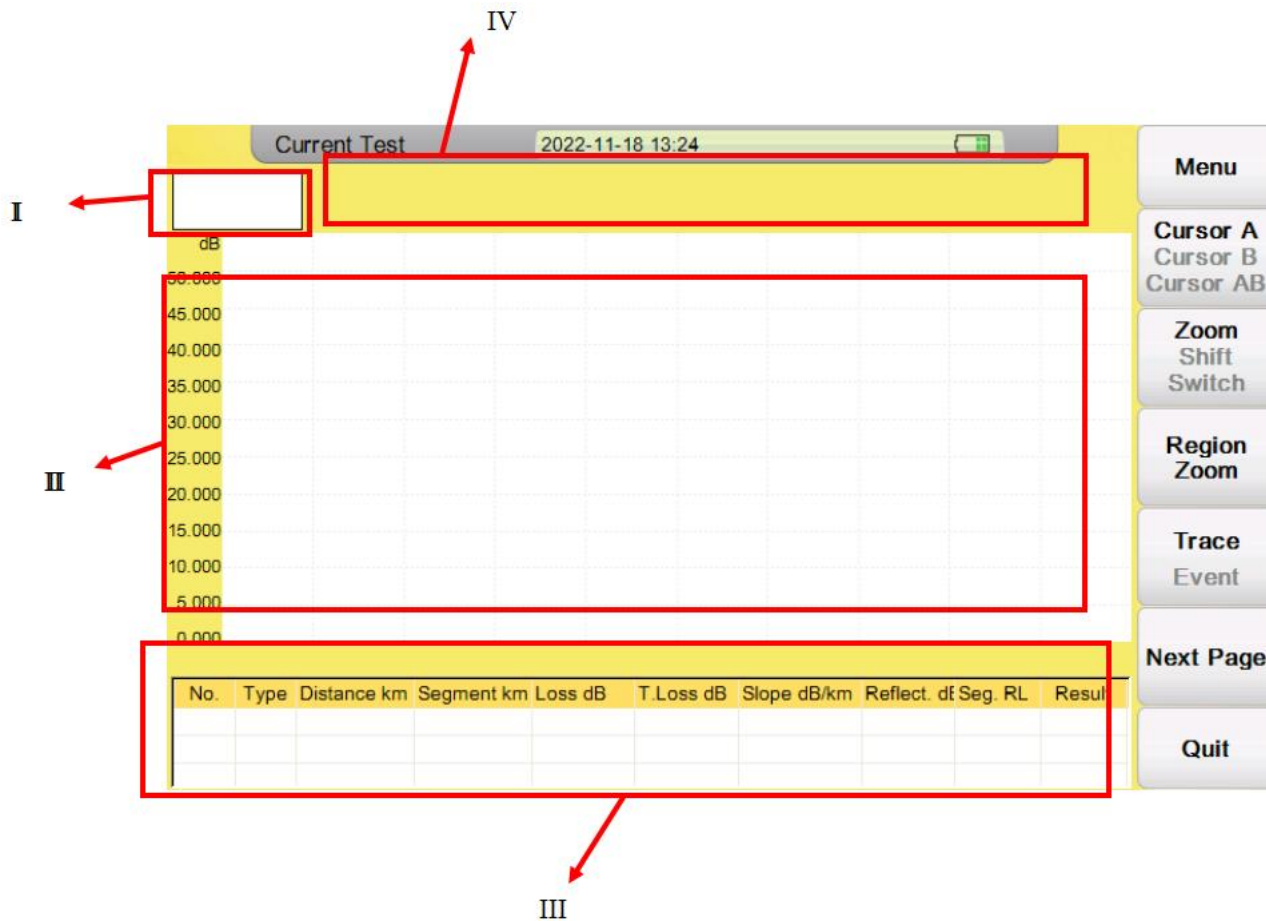
Num	Item
I	Handle belt buckle
III	Rubber outer sheath

1.3 Main Screen Interface



Num	Function	Description
I	Side menu	Enter relevant interface
II	Function Modules Area	Enter relevant module
III	Basic State Information Area	Display information of date ,time and power

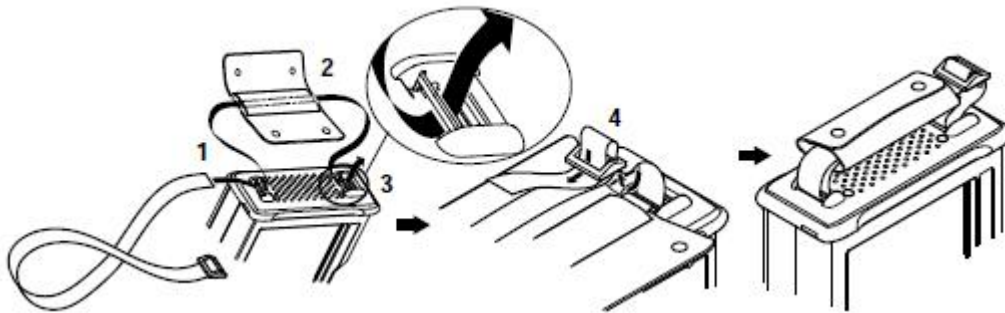
1.4 OTDR Module Interface



Num	Function	Description
I	Thumbnail of current curve	For user's reference to the integrated curve
II	Curve display and operating area	Display events and curves
III	Event list area	Display event information including:"Type", "distance(km)", "Loss(dB)", "T.Loss(dB)", "Slope(dB/km)" and "Reflection(dB)", "Seg.RL", "Result"
IV	Test condition information area	Display condition information of test including "PW"(Pulse width), "WL"(wavelength), resolution of X axis(km/div) and Y axis(dB/div), distance, averaging and total loss from cursor A to cursor B.

2: Preparation

2.1 Attaching the Belt



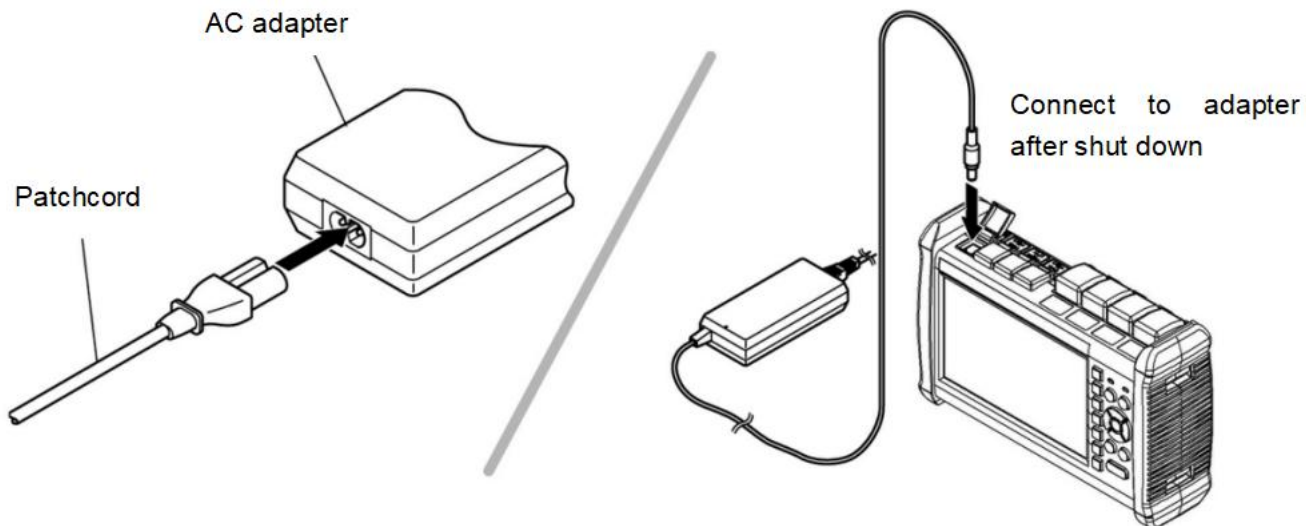
Procedure:

1. Introduce belt through the buckle.
2. Put on the sheath.
3. Introduce belt through another buckle.
4. Fix the belt.

2.2

Connect the power supply

Using AC adapter



Once connect to AC adapter , power indicator turns red(if it is not fully charged), adapter is charging the battery , after fully charged power indicator turns green.

Installing Battery

- 1.Rotate buckle anticlockwise to open.
- 2.Install battery.
- 3.Close the cover, rotate buckle clockwise to close.

Caution

- Proper charging temperature is: -10~40°C,high charging temperature may shorten battery life.
- Charging time is about 5 hours with power on, about 4 hours with power off.
- Don't charge battery more than 8 hours.
- If the battery is not used for a long time, please charge and discharge it regularly.
- Do not keep the battery in a low state for a long time. And stored at room temperature.

2.3 Turning on the OTDR

Press power button(>2s) to turn on OTDR, power state indicator turns green .when power is low some warning information will display on the screen.

Power state indicator

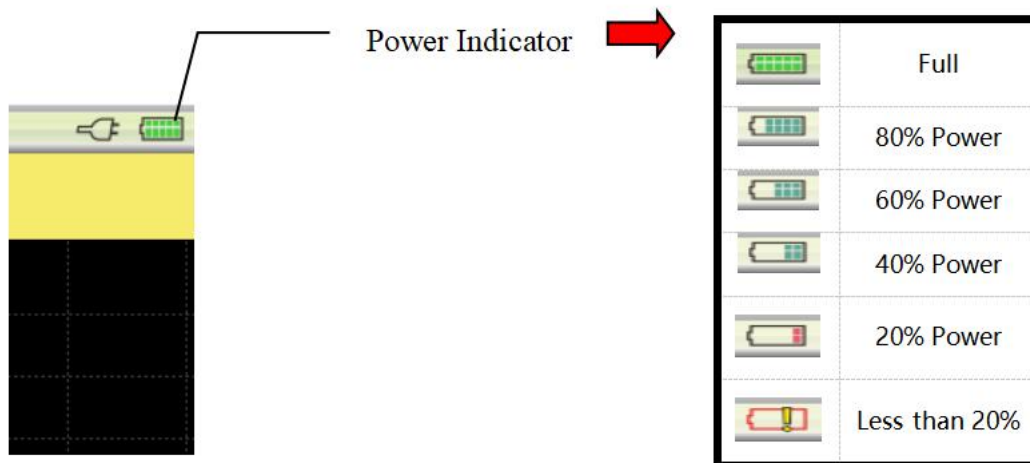
Green light: Working state or fully charged

Red light: Charging state

Launching state indicator

Green light: Proceed realtime test

Red light: Proceed averaging test



Caution

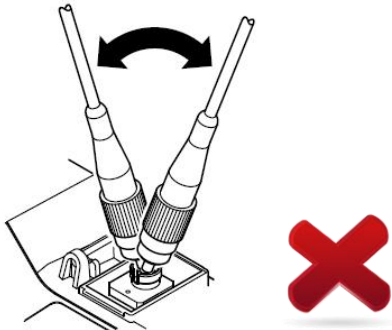
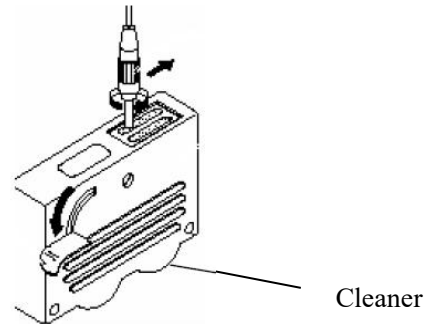
- In case of low power, special icon will appear, and after that for a while FHO5000 will turn off automatically.
- If it has not been used for an extended period of time, FHO5000 will turn off immediately after turned on to protect the internal battery ,please connect the AC adapter adapter.

2.4 Connecting the fiber

Before connect fiber to FHO5000, clean fiber end first ,the dust which on the end of connector may damage the optical port or reduce test quality.

Procedure:

1. Put connector against the cleaner.
2. Press the handle of cleaner.
3. Rub each other carefully to clean the contaminant.
4. Repeat procedure 1 and 3.
5. Open the protecting cover of optical port.
6. Insect fiber into optical port carefully.



Caution

Insert fiber carefully into optical port , unproper operation may cause the damage of optical port.

Warning

Before connection make sure that there is no optical signal exist inside the fiber,any signal which is larger than -30dBm will disturb the sampling of OTDR,even cause permanent damage of sensor.

3: Introduction of OTDR

3.1 Purpose of Measurement

OTDR shows the back-scatter light power of the optical signal relative to the distance. With this information, the OTDR could measure a series of important information of an optical fiber such as the quality of the line, distance of the line and etc.

3.2 Content of Measurement

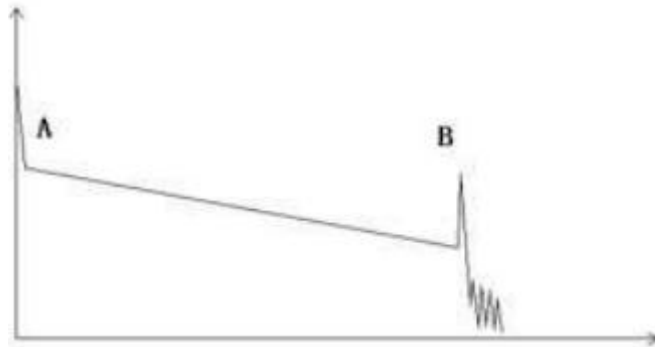
- Event position----- a broken point or the end of the tested fiber
- Optical attenuation coefficient of a optical fiber
- Single event loss, such as the loss of a connection or a macro bending. Or the loss of a end-to-end line on the tested optical fiber

3.3 Analyze of Curve

OTDR can auto analyze a tested trace, the position process shows below:

- Get the reflection events generated by connectors or mechanical splicer.
- Non-reflection events(usually it is splicing points or macro bending).
- End: the first point which the loss of it is over the threshold would be scanned as the end of a trace.
- Events list: event type, loss, reflection and distance.

Normal Curve



A normal trace shows as above, the A mark is a start-peak and the B mark is a end-reflection-peak. The tested trace is oblique, the total loss will become bigger with the increasing of the fiber length. The total loss(dB) divides total length is the average loss(dB/km) of a fiber.

Curve with reflective event



If there is additional reflection peak in a tested trace, this may be caused by a connection point or some other reasons. Anyway, appearance of the reflection peak shows that the two connecting surfaces of the connection are smooth. The smoother the connection surfaces are, the higher the reflection peak is. For an instance, if a broken optical line is under test, the OTDR trace will show a broken point. After a maintenance of this line, use the OTDR test it again, we may see a reflection peak replacing the broken point on the OTDR trace, this shows the maintenance is done.

Curve with Broken Point



If the tested trace is just like the figure shows above, this might be caused by several reasons like: a bad connection between the connector and the launching port, the optical pulse cannot be launched into the optical fiber or a short distance broken point of the tested fiber from the initial connection and the preset testing distance and pulse width is larger.

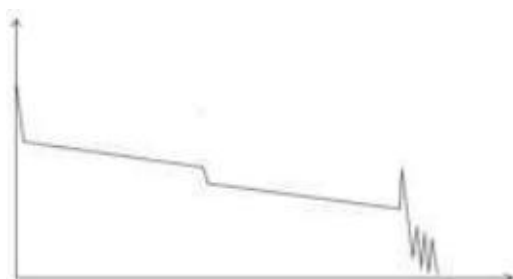
To fix this problem, we should:

1. Check the connection of the connector and the launching point
2. Reset the test parameters, decrease the preset distance and the pulse width.

If the problem still exists, we could estimate:

1. The connector of the test fiber is broken or polluted.
2. The launching port on the OTDR is broken or polluted.
3. The distance of the broken point of the from the initial connection is too close.

Curve with Non-reflective Event



There is a common phenomenon that an obvious step is on the middle of a tested trace, it often caused by a fiber bending, fiber knot, being pressed by something heavy or a fuse splicing point. The step means a bigger loss of a fiber, it is also called event point. If the direction of it is downward, it could be called

non-reflection event. If the direction is upward, we can call it reflection event.

Sometimes, the loss value could be a negative value, it does not mean the loss does not exist. It is a common phenomenon called pseudo gain, it is by a connection of two fibers with different back scatter coefficients, the scatter coefficient of the back fiber is large than the front one's. In addition, the different refractive ratio also can cause the phenomenon. To avoid it, we could test a fiber bi-directionally.

Abnormal Condition



The situation that there is no reflection peak at the end of a trace shows above should be paid attention on. If the distance of the tested fiber is available and the distance shown on OTDR is not equal to the original distance, this shows that the fiber might be broken down or twisted and the bending radius of it is over limited. The distance shown on OTDR is the position of the fault point.

This phenomenon is often used in maintenance. If a fiber is uncertain, we can bend a fiber and make sure the bending radius is over limited, then use real time testing function of the OTDR to confirm the fiber.

Distance is Too long



This situation often happened in a long distance testing, caused by under-range dynamic range of the OTDR that the energy of it can not support a long distance transmission or caused by a under-range preset testing range of distance or pulse width corresponding to the actual fiber length.

To avoid this situation, adjust the testing distance and the pulse bigger and extend the sampling time.

3.4 Fundamental of OTDR

OTDR—Optical Time Domain Reflector is a high precision optical testing meter that use the theory of Rayleigh scattering and Fresnel reflection. It is widely used in the maintenance, construction and monitoring of an optical line. All the important parameters like fiber length, optical loss, connection loss, broken or twisted point and etc. of a fiber can be shown on the OTDR. When the a light transmits along a fiber, it would be scattered to various directions caused by the difference of come properties of the transmission medium, this phenomenon called Rayleigh scattering. During the scattering process, some of the light will be scattered along the absolutely converse direction, this phenomenon is called Rayleigh back-scattering. It provides some details about the fiber length. The parameters about fiber length can be got by calculation with the parameter of time(This is the derivation of TD in OTDR—Time Domain).

These back-scattering signals shows the loss level of a fiber and through these information, OTDR can generates a backward oblique trace which reflects several important attributes of a optical fiber. When the light, transmitting downward along the fiber, meet a different density medium, a part of the light will be reflected, this phenomenon is called Fresnel reflection. There are many reasons can cause the changing of the medium density like a little slot at the splicing point, a broken of fiber or etc. This phenomenon is usually used to locate the discontinuous point. Compare to the Rayleigh scattering, the consuming amount of the light in Fresnel reflection is much more then it is in Rayleigh scattering. The power of Fresnel reflection is tens of thousands times to the back-scattering's. The reflection level depends on the changing grade of refraction ratio.

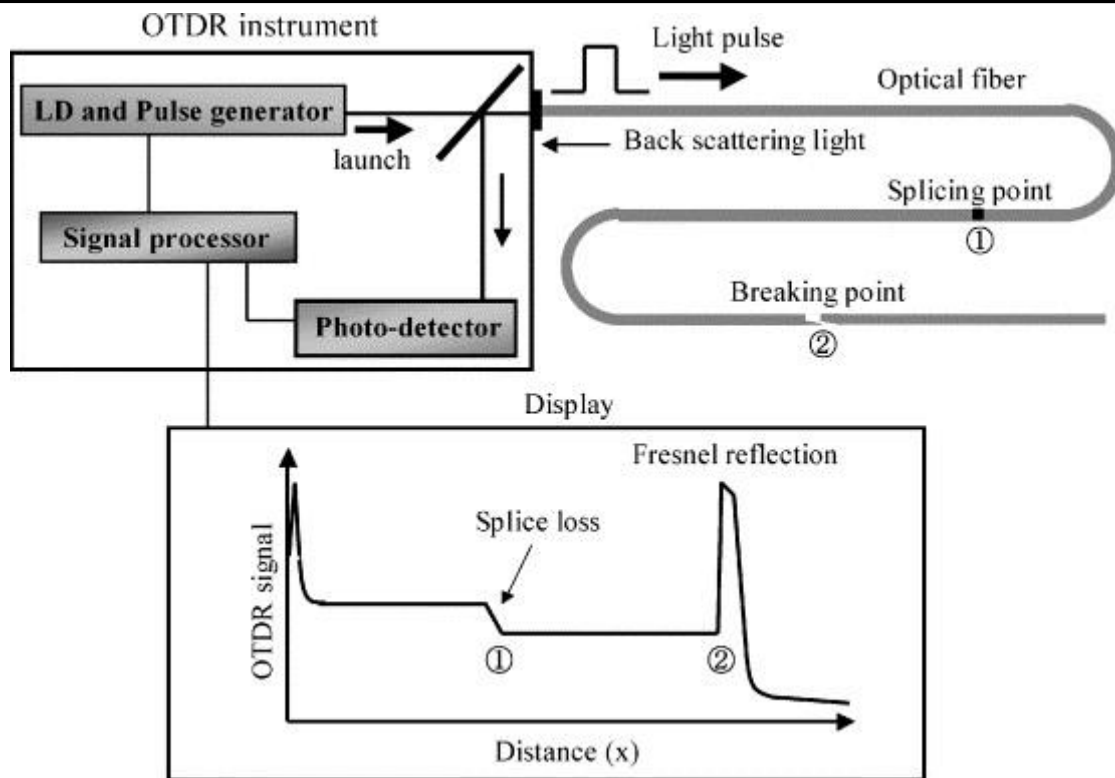
Formula of the distance: $\text{distance} = (c/n) \times (t/2)$

Here: **c** is the light speed traveled in vacuum($2.998 \times 10^8 \text{m/s}$)

t is the delay between launching pulse and receiving pulse

n is the refraction ratio of the testing fiber(specified by manufacturer)

When display the whole trace, each point of the trace represents the average value of several sampling points. By zoom in and zoom out function, the value of each sampling point can be got.



Working Principle of OTDR

3.5 Event Type of OTDR

Start event or non reflection event	Reflection event	End event

Types of event

The events on trace are all the points that the value of power loss fluctuates abnormally. It usually contains various types of connection and bending, crack, broken and etc. The event points marked on trace with special marks are the abnormal points in a fiber that cause the excursion of a normal trace.

The events can be divided into Reflection-event and Non-reflection-event

Start event

The Start-Event on a OTDR trace is the initial point. Under the default setup, Start-Event is located on the first event(usually it is an connection between the OTDR launching port and the connector of a fiber) of a fiber. It is a Reflection-event.

End event

The End-Event on a OTDR trace is the end point of a fiber. Under the default setup, End-Event is located on the last event(usually it is an end face or a broken down point of a fiber). Usually, it is a Reflection-event.

Reflection-event

The phenomenon on a trace that some power of the optical pulse is reflected called a reflection event. Reflection-event is displayed as a peak signal on a trace.

Non-reflection-event

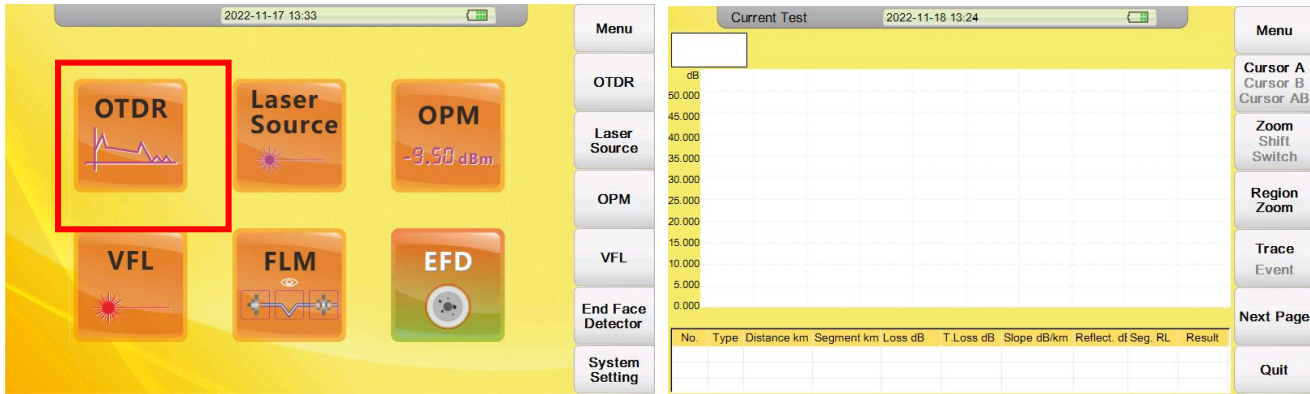
The phenomenon on a trace that there exists some abnormal loss in a optical line, but no reflection occurred is called a Non-reflection-event. It is displayed as a drop with no peak on a trace.

Event detection

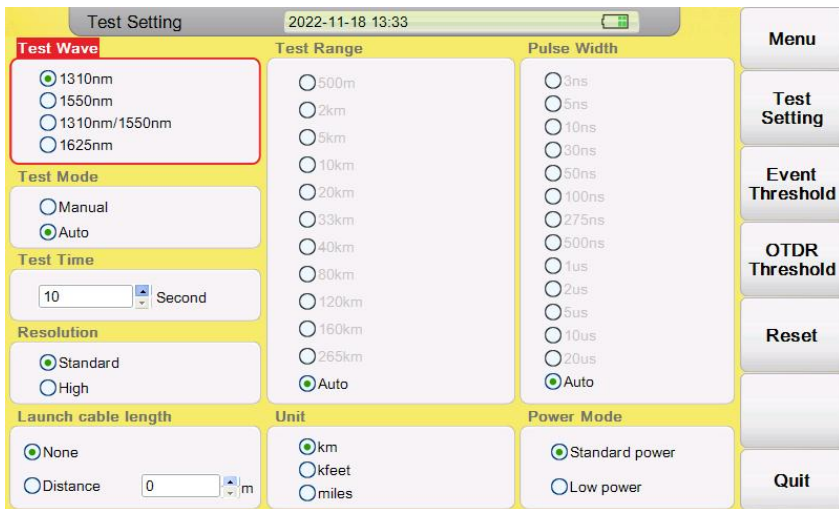
OTDR launches a bunch of optical pulse into a under-test fiber, receives the returned optical signal and starts calculating the distance from a event. The more the distance from the event is, the longer the returning time is cost. According to the receiving time,distance can be calculated. By detecting the trace generated by the returned optical signal, the attributes of the fiber itself, the connector of the fiber, adaptor in the fiber and splicing point in the fiber can be confirmed.

4: OTDR Measurement

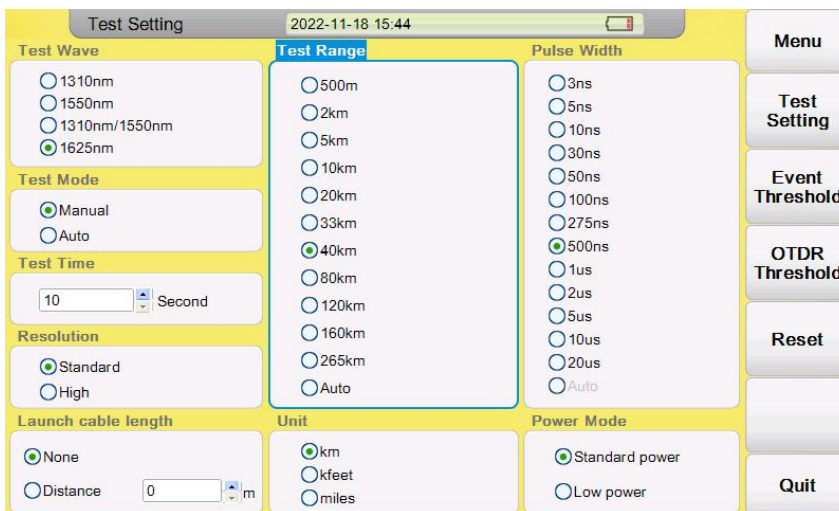
4.1 OTDR Test Mode



1. Enter OTDR function and click “Setup” to enter the OTDR testing parameter setting.



Auto Test Mode



Manual Test Mode

The meaning of items indicated in the following table:

Test Wave	Test Wavelength of OTDR, including 1310nm,1550nm and 1310nm/1550nm, 1625nm, 850nm and 1300nm According to the OTDR model.
Test Mode	Auto Mode: OTDR will set best parameters for current test Manual Mode: Set parameters manually
Test Time	Under averaging test mode(TEST),longer test time has better SNR (Signal Noise Ratio) but takes more time .
Test Range	Test distance of OTDR .adjust only in manual mode, Usually set to 1.5~2 times of the actual fiber length. In auto mode this item set as "Auto".
Pulse Width	Wider pulse has stronger backward signal, OTDR has longer detecting distance but wide pulse width will cause the saturation of backward signal, make blind area bigger.so the selection of pulse width has close relationship with the length of fiber. Select the appropriate pulse width according to the measured fiber length. Pulse width could only modified in "Manual"mode.
Resolution	Sampling resolution of test high resolution has more sample point and high precision,but take more memory space
Unit	Unit of test result,including km/kfeet/miles
Launch cable length	The test introduces the launch cable fiber, which can reduce the deadzone at the first connector of the tested optical fiber

Caution

- When "Pulse width" set to "Auto", test will choose proper pulse width automatically
- When "Test Range" set to "Auto", test will choose proper range automatically
- Once you set the "Test range", "Pulse width" item will adjust automatically, but you could also adjust manually if inappropriate.

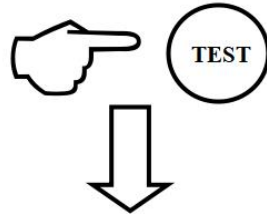
Proper relationship between Test Range(TR) and Pulse width(PW) (For user's reference only.) :

TR \ PW	500m	2km	5km	10km	20km	33km	40km	80km	120km	160km	240km
3ns	√	△	△	△	△	△	△	△	△	△	△
5ns	√	√	△	△	△	△	△	△	△	△	△
10ns	√	√	√	△	△	△	△	△	△	△	△
20ns	△	√	√	√	√	△	△	△	△	△	△
50ns	△	√	√	√	√	√	△	△	△	△	△
100ns	△	△	√	√	√	√	√	△	△	△	△
275ns	△	△	△	△	√	√	√	√	△	△	△
500ns	△	△	△	△	△	△	√	√	△	△	△
1us	△	△	△	△	△	△	√	√	√	△	△
2us	△	△	△	△	△	△	△	√	√	√	△
5us	△	△	△	△	△	△	△	√	√	√	√
10us	△	△	△	△	△	△	△	△	√	√	√
20us	△	△	△	△	△	△	△	△	△	△	√

4.2 Average test mode

Average test mode can calculate the data of curve over a period of time and display as a averaging one ,the period time is according to the "Test Time" in "Test Setting".

Press **【TEST】** button on the control panel, test state indicator turns red,enter average test interface.



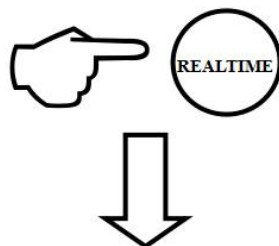
Averaging test interface

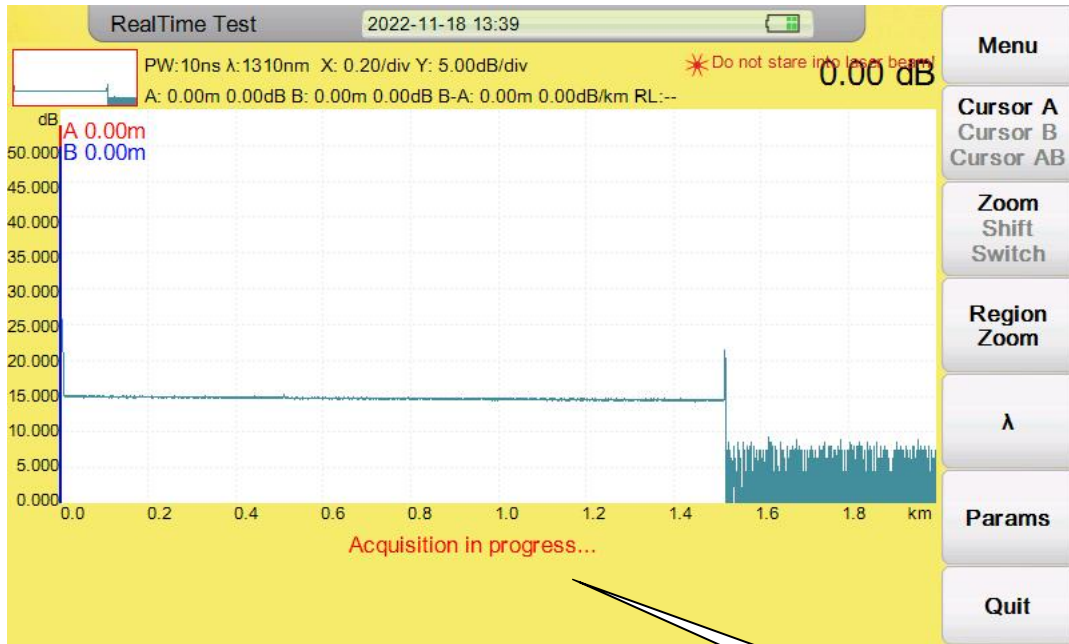
Average test has a test progress bar

4.3 Real-time test mode

During real-time testing, OTDR will continue to transmit optical signal pulses until we stop, which is used for fast scanning and realtime monitoring of optical fiber lines. Any change in the optical fiber line can be detected in real time.

Press **【REALTIME】** button on control panel, test state indicator turns green,enter realtime test interface.

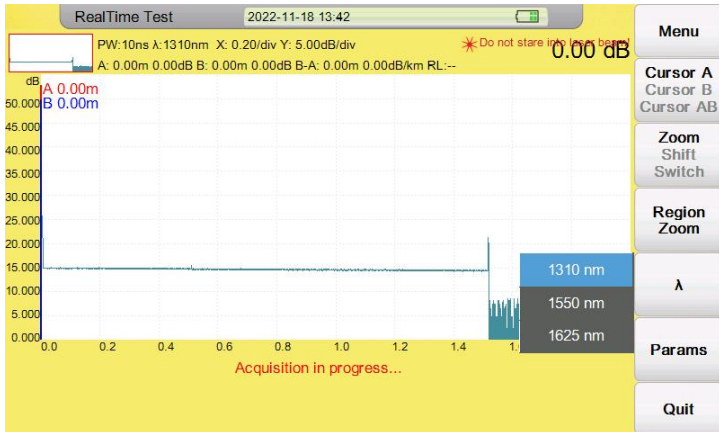




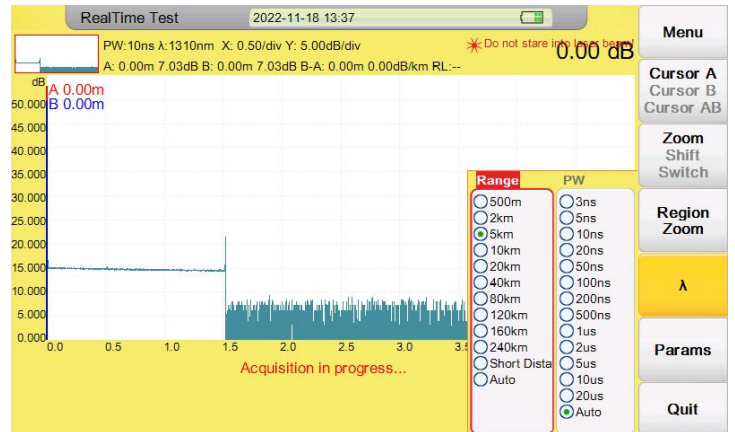
Realtime test interface

Realtime test has no test progress bar

During **REAL TIME** testing, the wavelength can be changed by “λ” button, also the test range and pulse width can be changed by “Params” button. After switching parameters, click **OK** to execute the new real-time test.



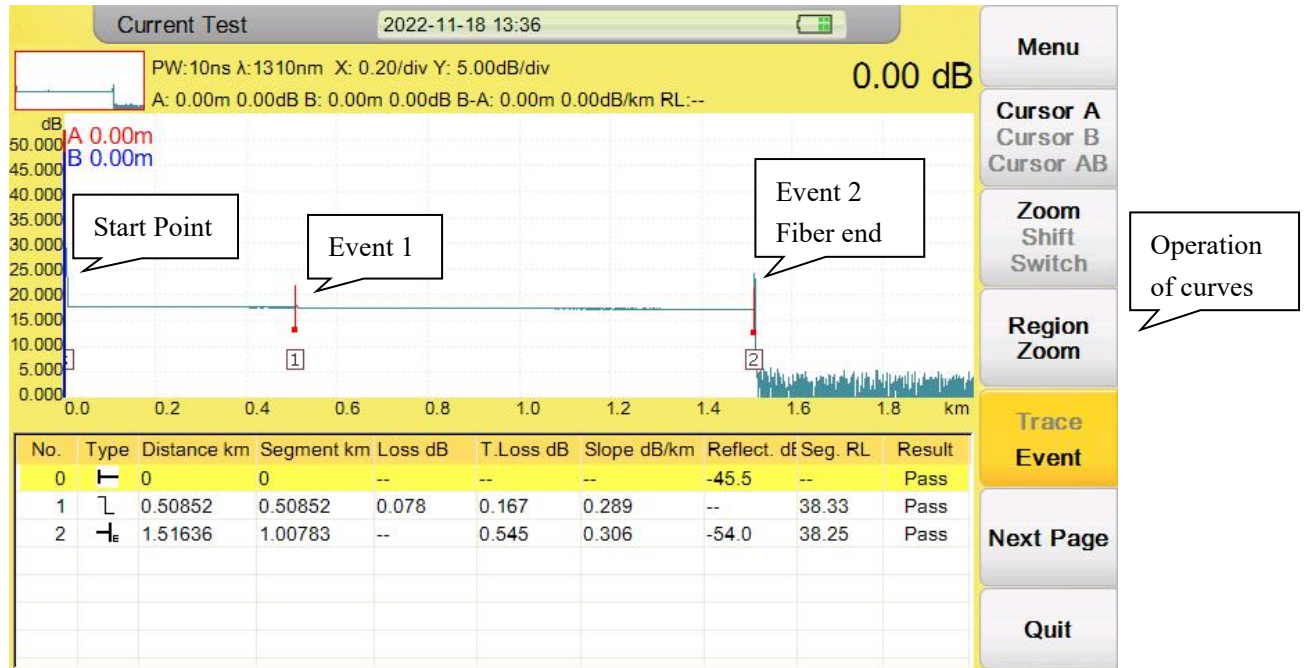
Adjust wavelength in **REAL TIME** testing



Adjust Range and PW in **REAL TIME** testing

4.4 Interpretation of Curves

After average test, Curves and events list will appear immediately at the bottom of the window, user could get detail information about this test from the list.



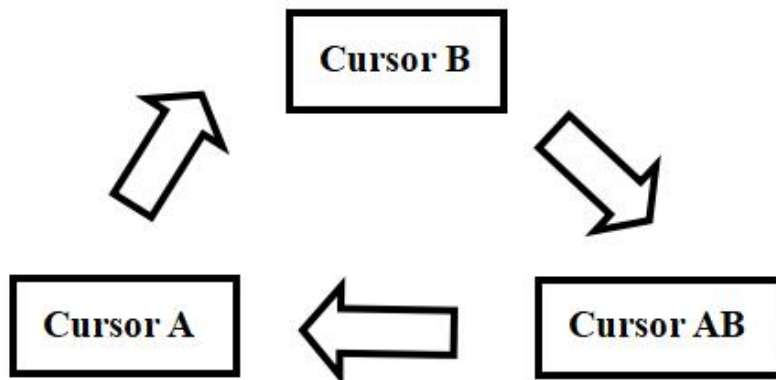
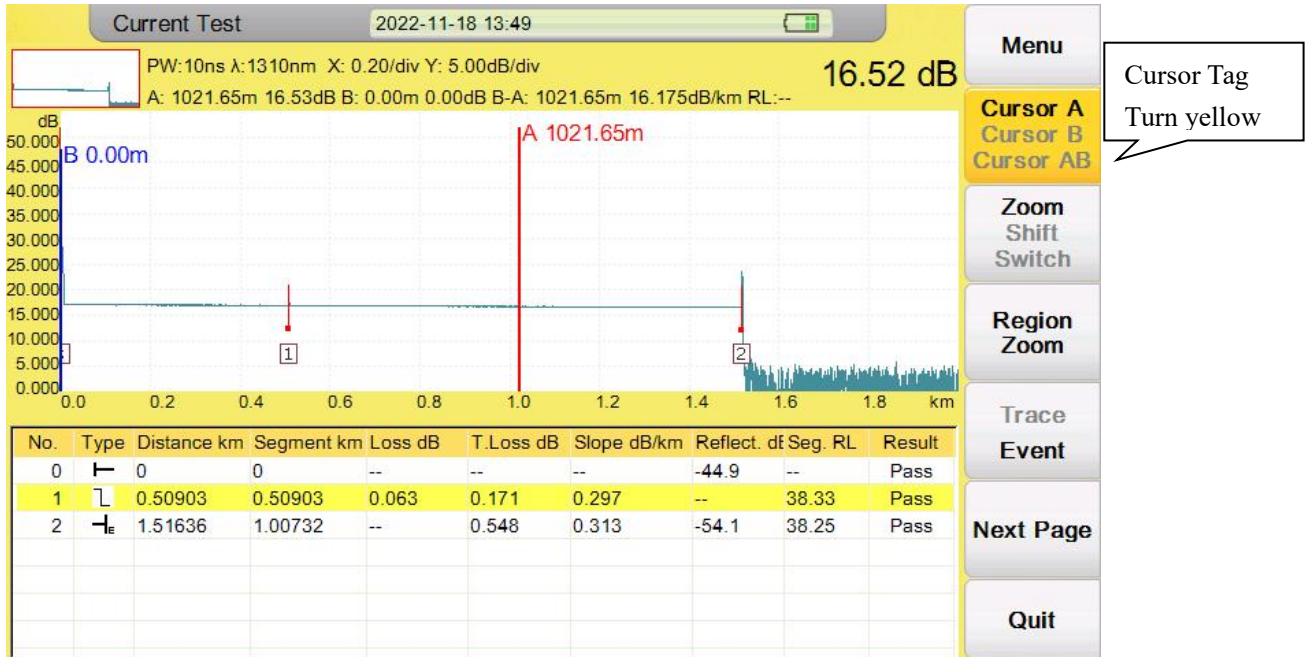
Description of items showed in chart below:

Num	Item	Description
1	Type	Type of event (Start event, Non-reflection events, Reflection events and End event)
2	Distance	Distance from start point to event
3	Segment	Distance from this event to last event.
4	Loss	Loss of this single event (dB)
5	T. Loss	Total loss from start event to this event (dB)
6	Slope dB/km	Ratio of event loss value (dB) (from this event to last event) to distance (km) (distance from this event to last event)
7	Reflect. dB	Return loss of this event (dB)
8	Seg. RL	Return loss of segment fiber (dB)
9	Result	Pass/Fail judgement according to the event threshold

4.5 Operation of Curves

1, Cursor A, Cursor B and Cursor A/B

In "Current Test" interface, press **[F1]** button, "cursor" tag turns yellow, means it has been activated. Now the cursor A can be moved by press **[◀]**, **[▶]** button, long press to move cursor faster. Press **[F1]** button again to switch cursor.



Sequence of cursor switching

2, Zoom, Shift, Switch

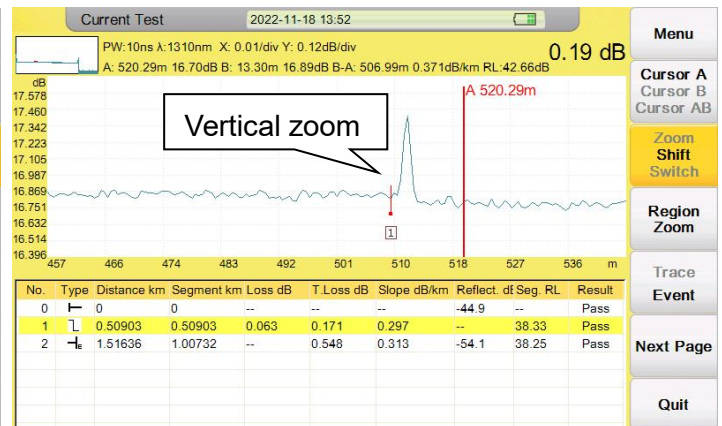
Curve Zoom

In "Current Test" interface, press **[F2]** button, Zoom tag turns yellow, press **[▶]** button to Horizontal zoom, Press **[OK]** button to reset curve.



In "Current Test" interface, press **[▼]** button to Vertical zoom.

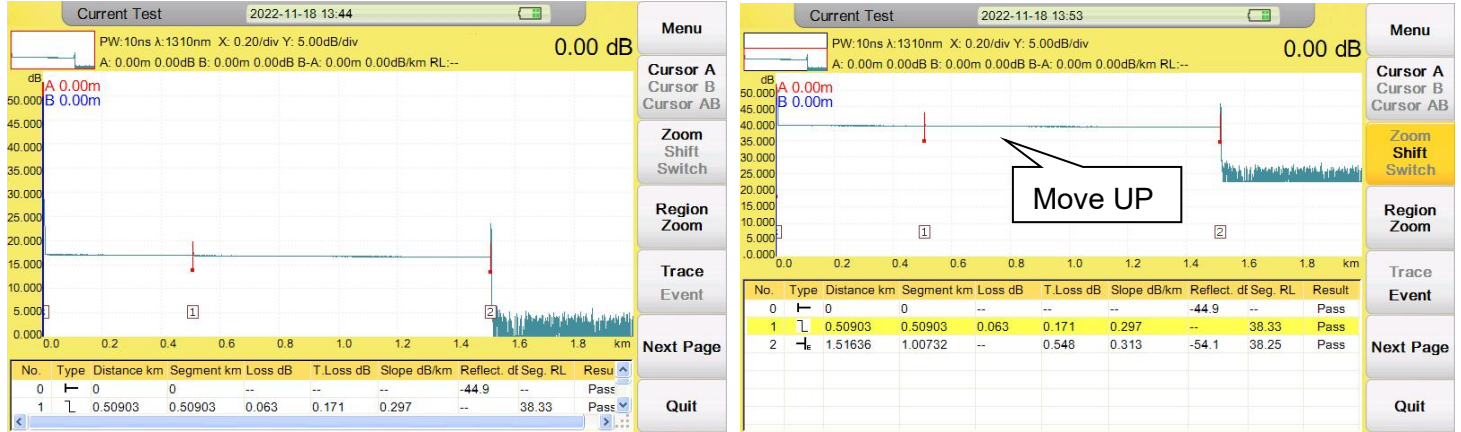
Press **[OK]** button to reset curve.



Curve Shift

In "Current Test" interface, press **[F2]** button, Shift tag turns yellow, press **[▲]**, **[▼]** button to move up or down.

Press **[OK]** button to reset curve.

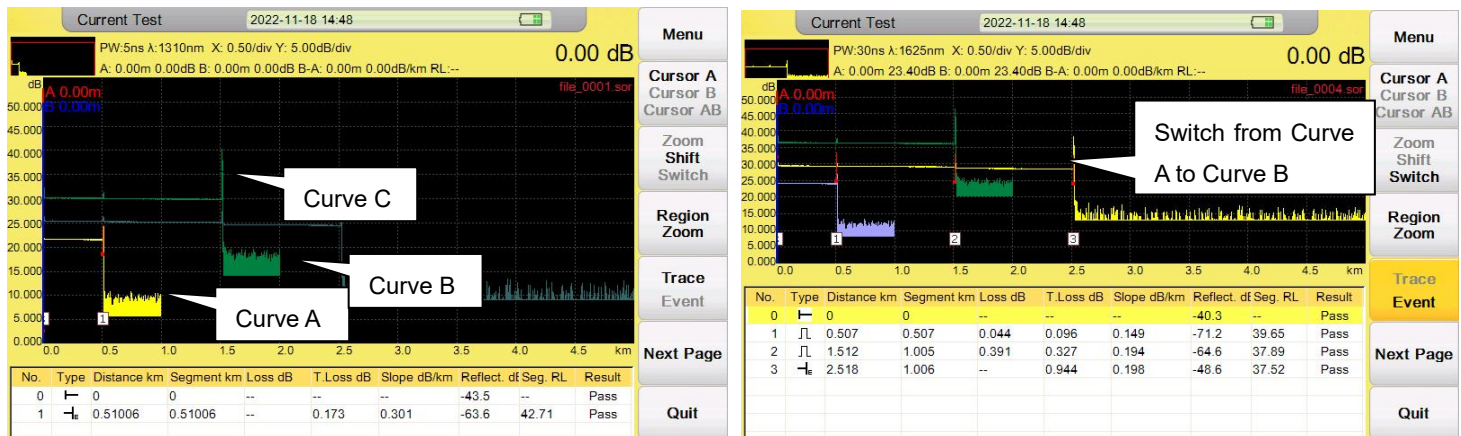


Curve Switch

1: In "Current Test" interface, Up to 8 test curves can be loaded simultaneously, and the curve can be switched by activating the **[F2]** Switch tag.

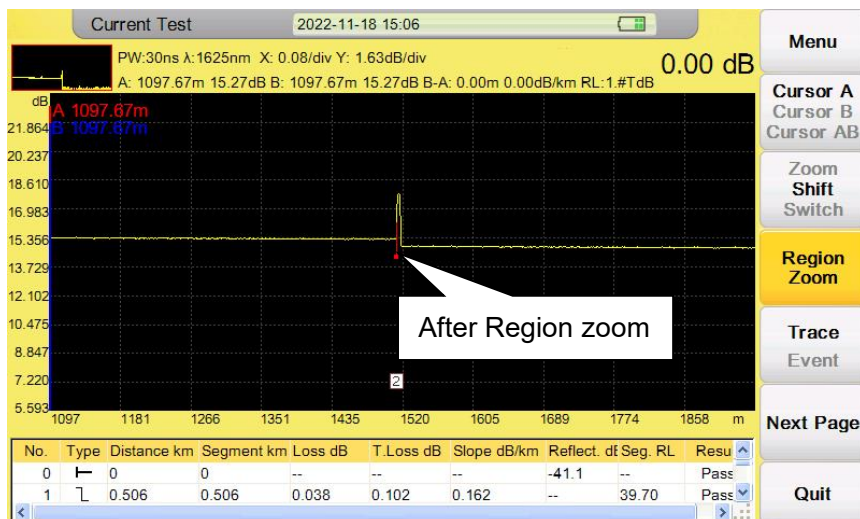
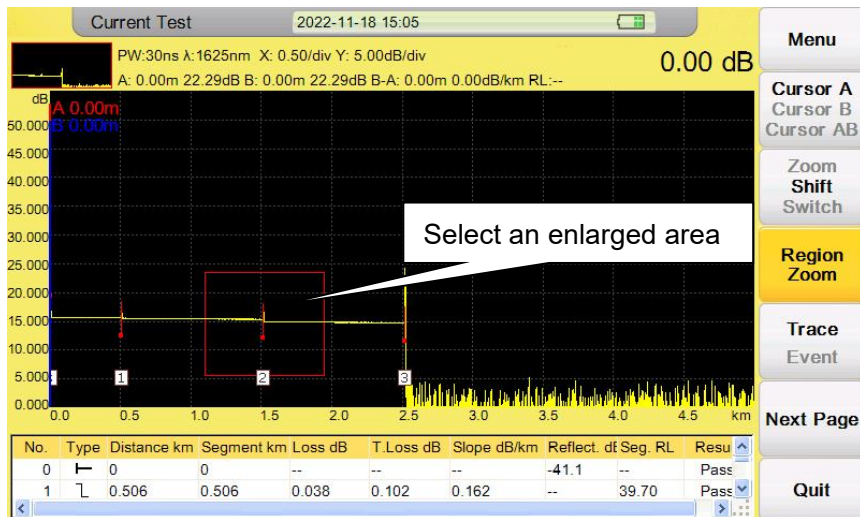
2: Control **[▲]**, **[▼]** button to switch between curves. **[▲]**: switch to above curve **[▼]**: switch to below curve

3: The currently selected waveform is displayed in yellow.



3, Region Zoom

In "current test" interface, press **【F3】** button activate the "Region Zoom" function, tag turns yellow. Use finger to touch the screen to draw a square in the region area. The corresponding area will be zoomed in.

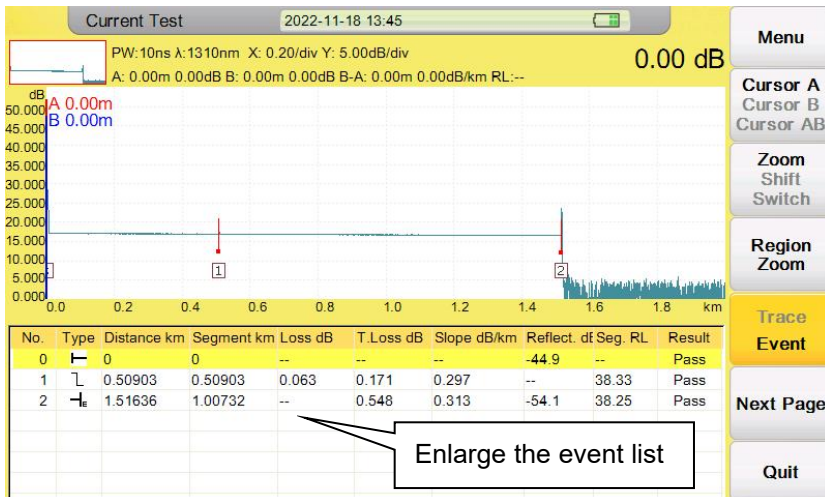


4, Trace/Event

In "current test" interface, press **【F4】** button to switch between "Curve" and "Event", expand each section after switch, this function could also switch between cursor ("Curve") and selection tag ("Event").

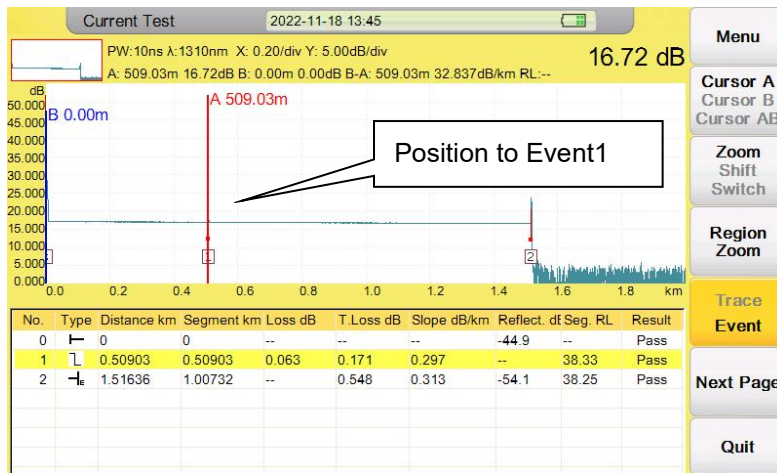


Press **【F4】** to expand event list



Enlarge the event list

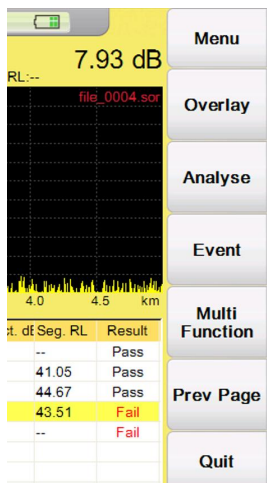
Control **[▶]**, **[◀]** or **[▲]**, **[▼]** to move selection tag. The cursor will automatically position on the selected event.



Every time move selection bar to an event in event list, cursor will move synchronously to relevant event on curve. User could use "Zoom", "Shift", "Switch" function to adjust curve to a better position.

5, Overlay

Press **[Next Page]** to enter the next curve operation interface.



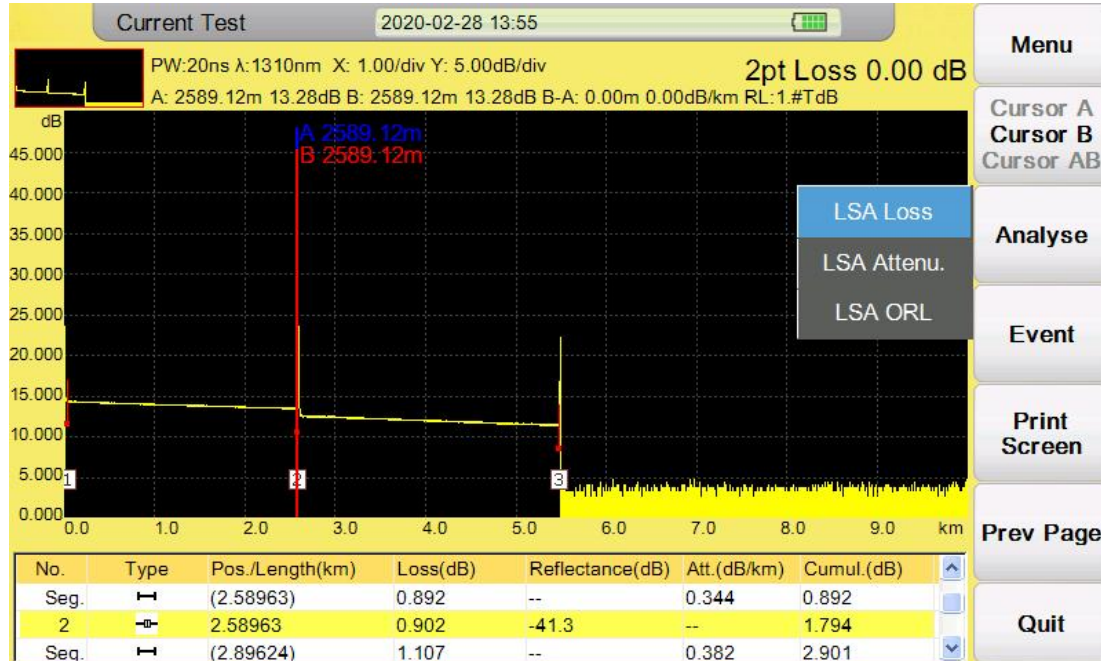
Overlay

In "Current Test" interface, press **[F1]** button, Enter **Overlay** function:

- **Remove Current Trace** Remove the Curve which has been selected.
- **Remove Other Trace** Remove the Curve(s) which has not been selected.
- **Remove All** Remove all the Curves.

6, Analyse

In "current test" interface, press **[F2]** button to activate the **Analyse** function. Click **LSA loss** and use the 4-point method to test the attenuation loss of event2.



Zoom the curve and click marker to place X1, X2, X3, X4 and X, (X1 and X2 are placed in front of the event point, and X3 and X4 are placed behind the event point. The slope of X1-X2 and X3-X4 should be as consistent as possible.)

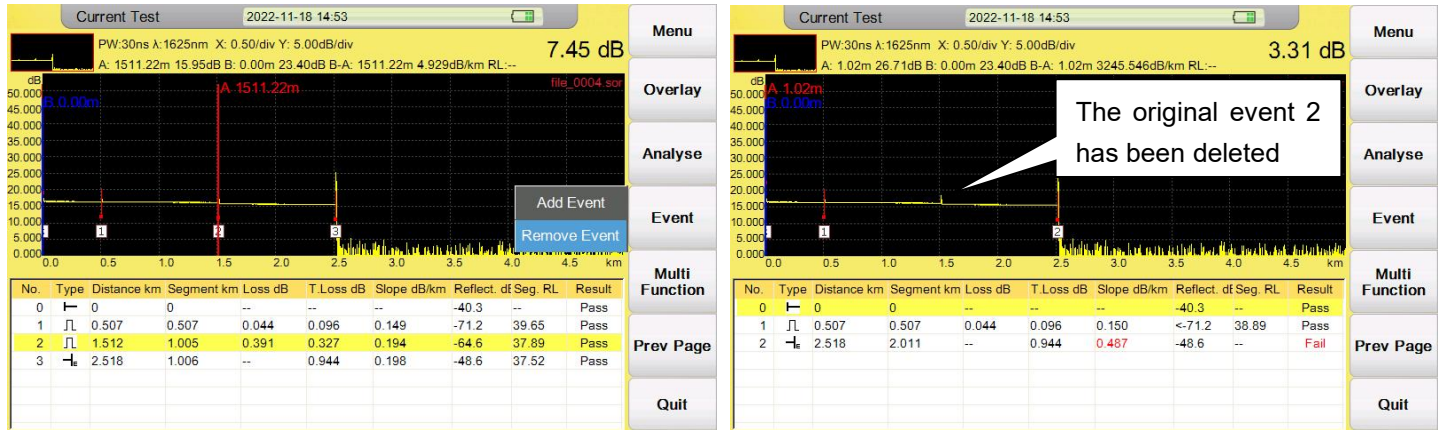
As shown in the figure below. The attenuation loss measured by 4-point method is 0.921db.



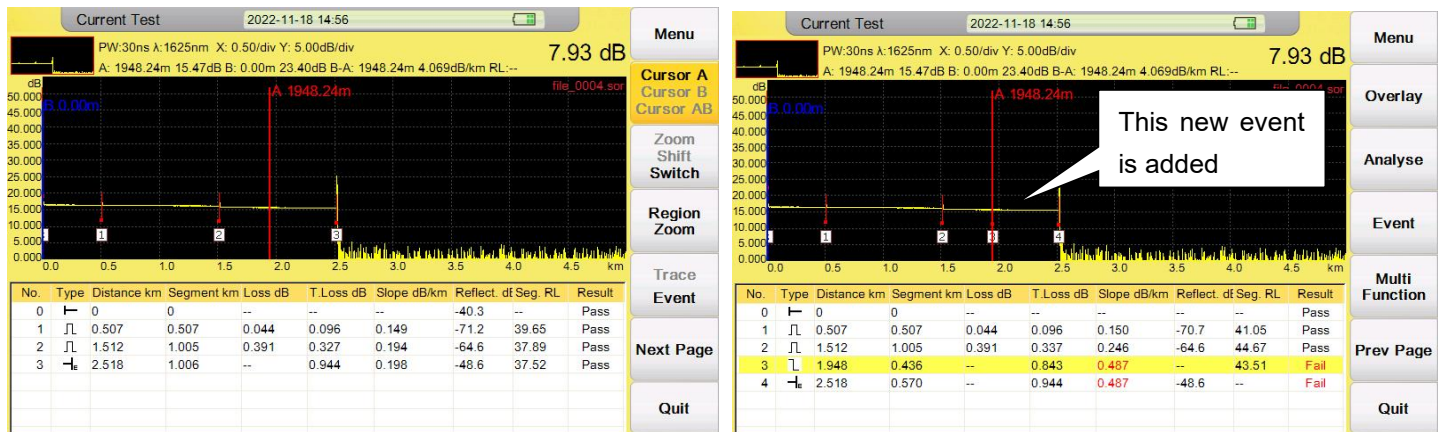
7, Event

In "current test" interface, press **[F3]** button to activate **Event** function.

1: Select the event you want to delete, and press **[Remove Event]** to delete the current event.



2: Move the cursor A or B to the position where you want to add an fiber event. and press **[Add Event]** to create new event at this position.



Caution

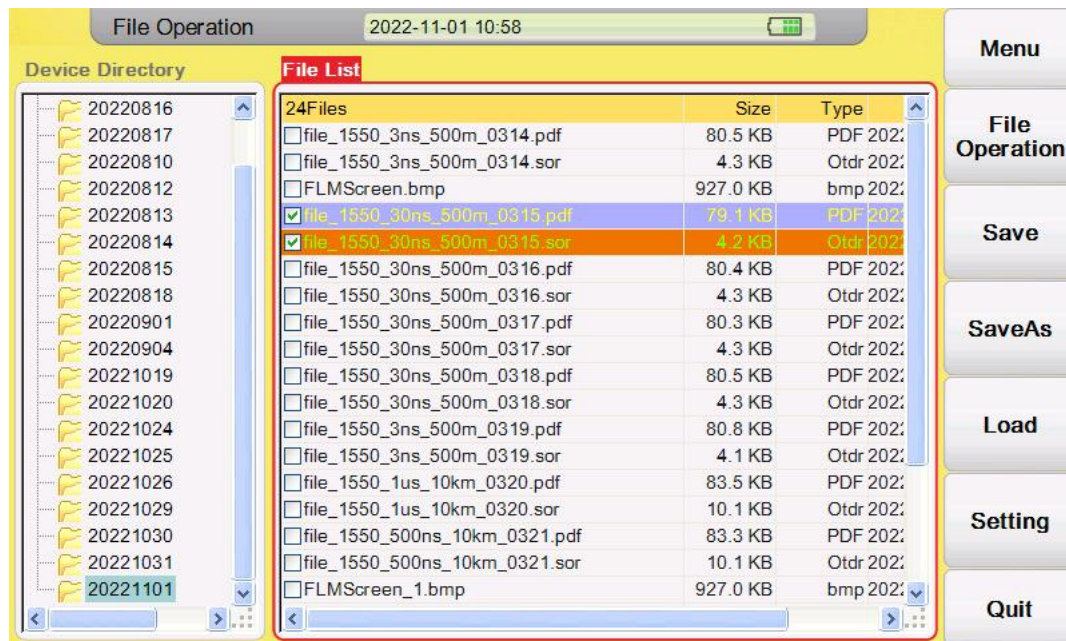
Event addition may not operate successfully for too close to another event, user could move cursor a bit away from near event and have another try.

8, Multi Function

In "current test" interface, press **[F4]** button to activate **Multi Function**.



OTDR could capture current screen and save as "BMP" format screenshot and generate current sor file to PDF report. The saved BMP file and PDF report will be saved in the file.



5: File Operation

5.1 File Management

In any OTDR interface, press **【FILE】** button on the Key board to enter the file management.

In "Device Directory" window,

1: In "current File" interface, When Auto Save is open, the test file will be saved in a folder named after the test date, and the saved file type is either **sor** or **sor+pdf report**.

2: Press **【▲】**、**【▼】** to choose folder and press **【▶】** to check the sor file in this date folder.

3: Press **【▲】**、**【▼】** and **【OK】** to select the file, Multiple choices are possible.

4: In "current File" interface, Press **“File Operation”** button,

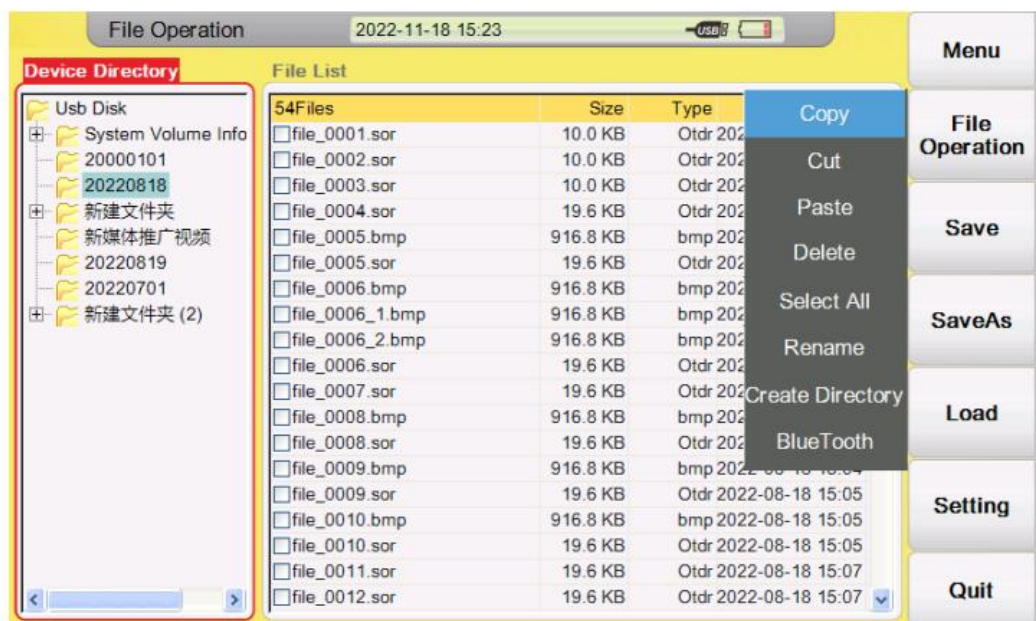
the user can do “Copy/Cut/Paste/Delete/Select All/Rename” operation for the file in the folder.

5: In "current File" interface, Press **“Create Directory”** to create a subfolder under the current folder.

6: In "current File" interface, Press **“Save”** button to save the test data to current folder manually.

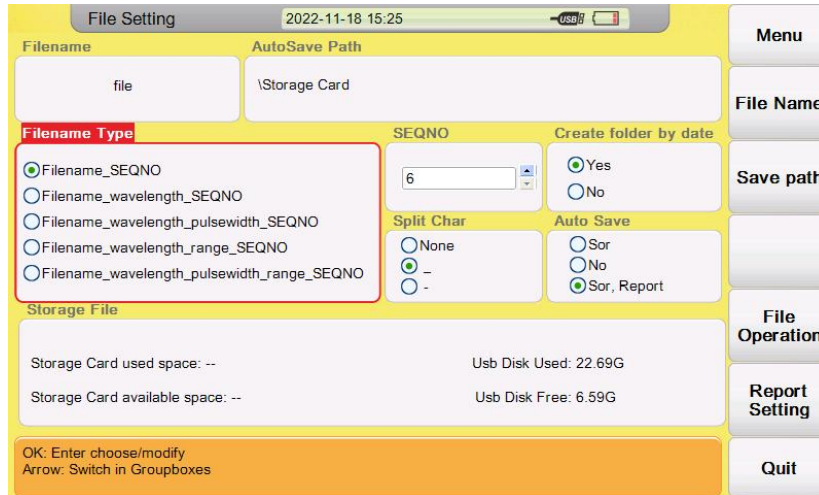
7: In "current File" interface, Press **“SaveAs”** button to save as the test data to current folder manually.

8: In "current File" interface, Press **“Load”** button to load OTDR curves, Up to 8 curves can be loaded simultaneously.



5.2 File Operation Setting

1: In "current File" interface, Press **[F5]** to enter the File Setting Menu.



Tags:

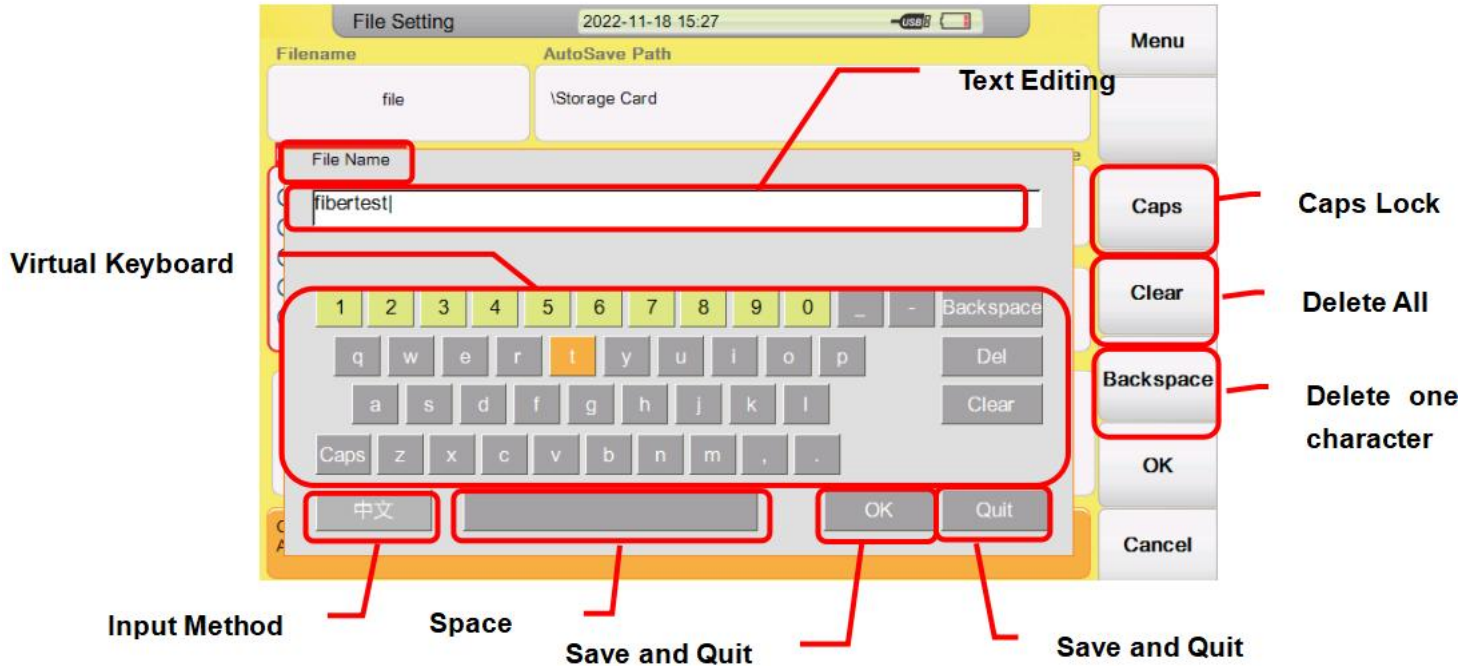
Item	Description
Menu	Back to main menu
File Name	Modify prefix of file name
Save Path	Modify the save path of files
File Operation	Back to "File Operation" interface
Report Setting	Edit customized information for pdf test reports, such as project name, cable name, cable location, etc
Quit	Quit current interface

Items:

Item	Description
Filename	Prefix of file name , modify by "Filename"tag menu
AutoSave Path	Save path of auto save, Storage Card or U disk
Filename Type	Naming way of files after auto save
SEQNO	Sequence number of next test,and auto increment after each test
Create folder by date	Set create folder by today's date and save files separately into them.If select No, the file will be saved to the root directory
Split char	Set the type of separator
Auto save	Set Auto save mode

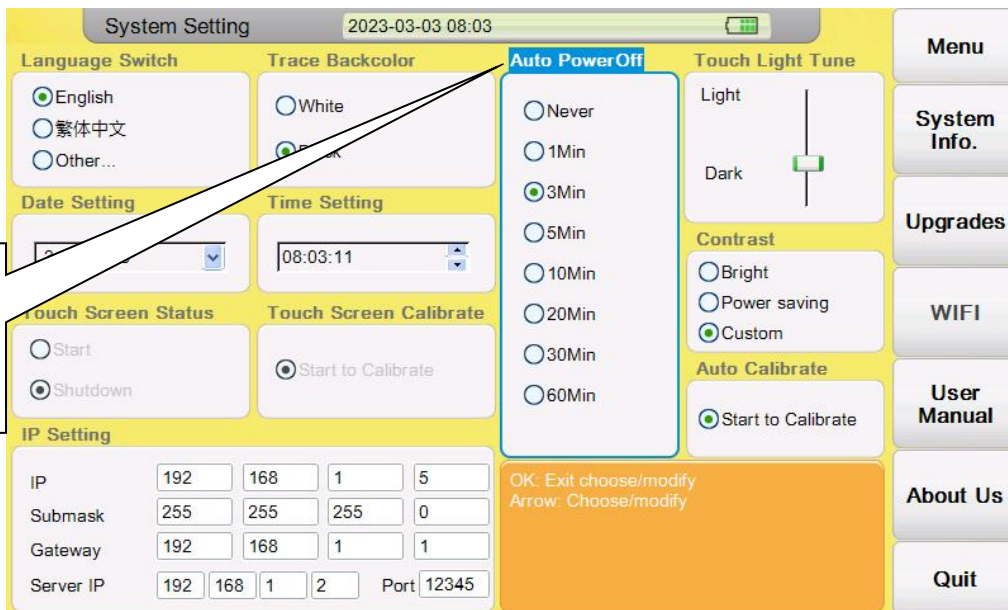
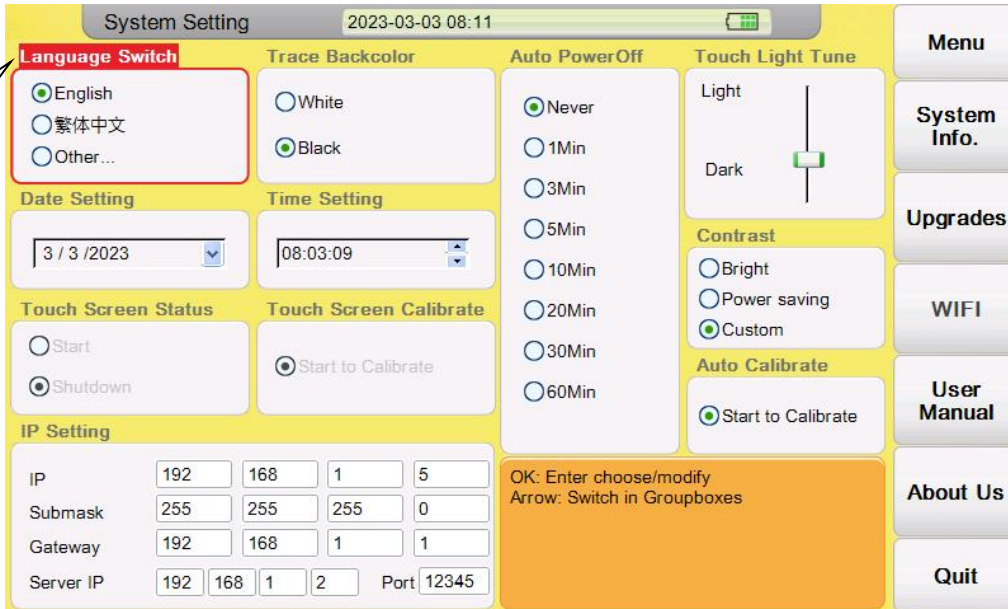
2: In "current File" interface, Press **【F1】** File Name to enter the File Name Setting Menu.

You can enter file names and comments from the character input screen shown below when saving the measured waveforms.



5.3 System Setting

1: In the main menu interface, Press **【ESC】** button to enter the System Setting Menu. Control **【▶】** , **【◀】** or **【▲】** , **【▼】** to switch the items.



Tags:

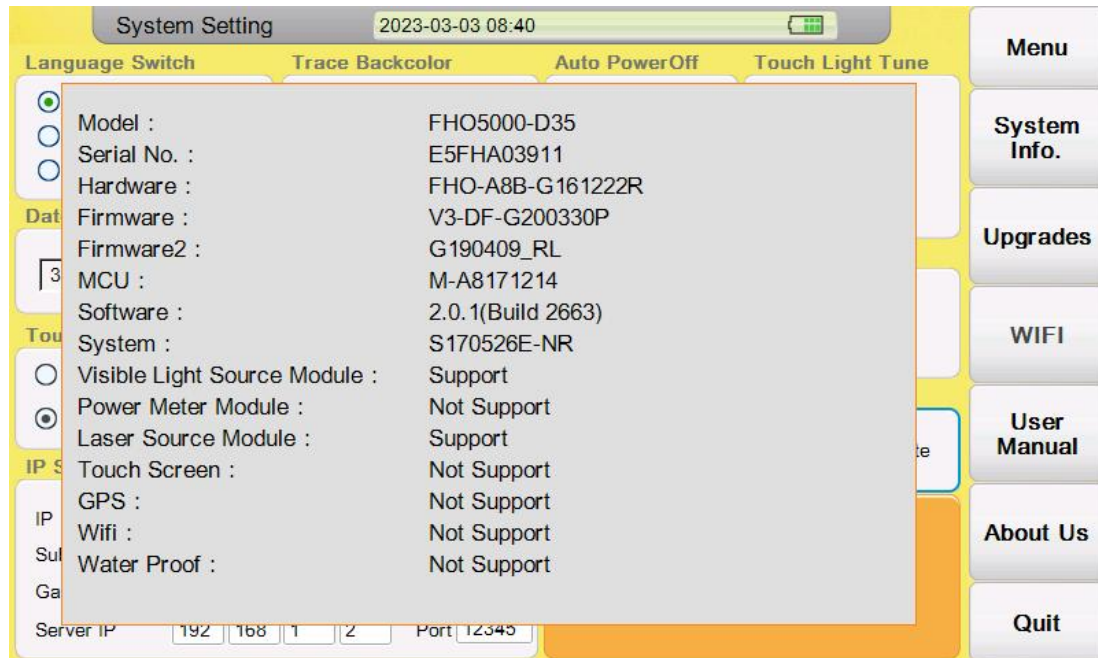
Item	Description
System Info.	Check the machine system information
Upgrade	Upgrade the machine
WIFI	Not available now
User Manual	Quick operation guide
About us	About company information
Quit	Quit current interface

Items:

Item	Description
Language switch	Switch overseas languages
Trace Backcolor	Select the Trace backcolor "white" or "black"
Auto PowerOff	Set the Auto poweroff time
Touch Light Tune	Adjust the backlight
Contrast	Adjust the contrast "Bright" "Power saving" "Custom"
Date and time Setting	Set the machine date and time
Touch Screen Status	Enable or disable the touch screen
Touch Screen Calibrate	Calibrate the Touch screen function
Auto Calibrate	Adjust the light strength threshold value of the light alarm
IP Setting	Adjust the machine IP information.

5.4 System Information

1: In the System Setting interface, Press **【F1】** to display the machine system information.

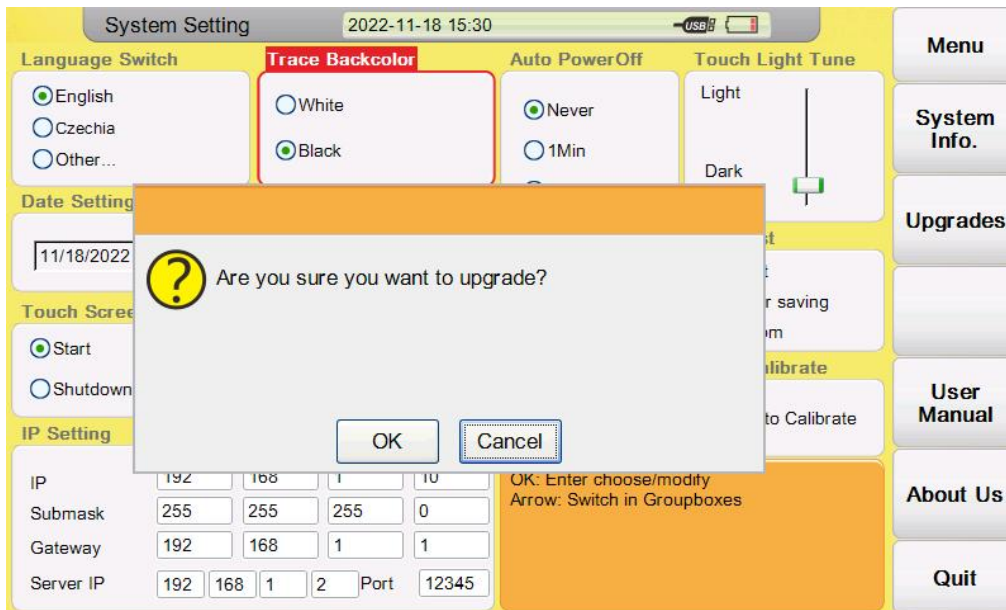


5.5 System Upgrade

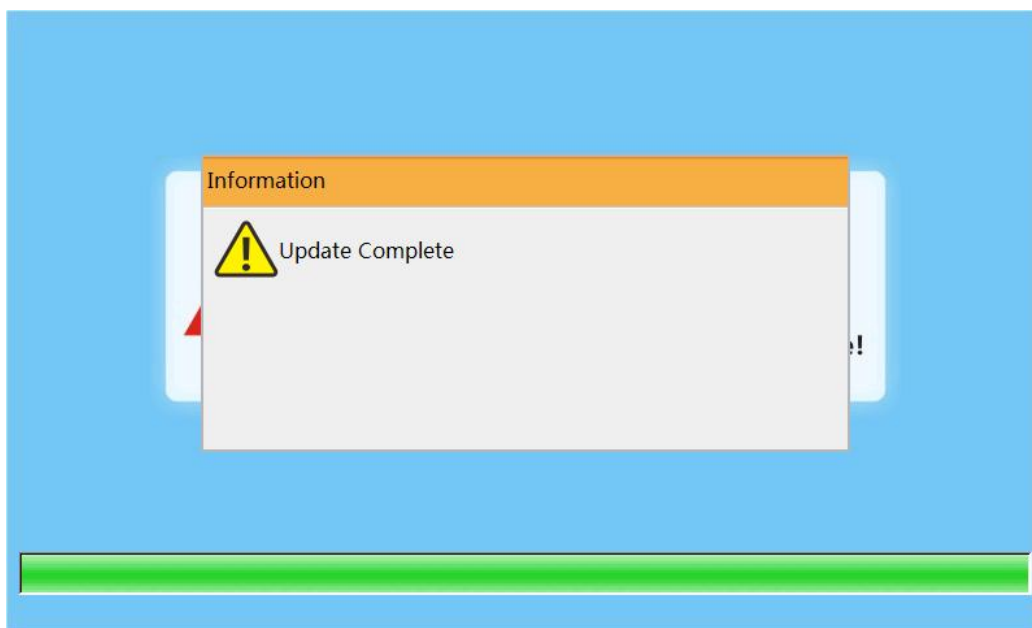
The product could proceed update by one U disk. Generally, OTDR does not need to be upgraded unless there is a software failure or algorithm update. Please contact us or local agent before upgrading.

Procedure:

1. Download upgrade file from us and storage into U disk(**✘must storage in root directory**).
2. Insert U disk into OTDR USB port.
3. Turn on OTDR, press **【ESC】** to enter system setting, press **【F2】** to proceed upgrades.

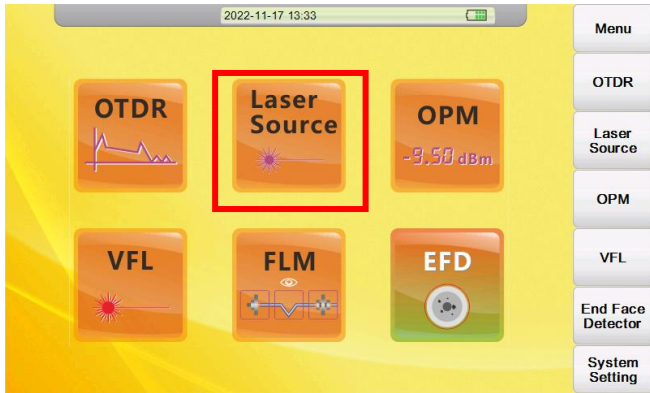


Press "OK" to confirm

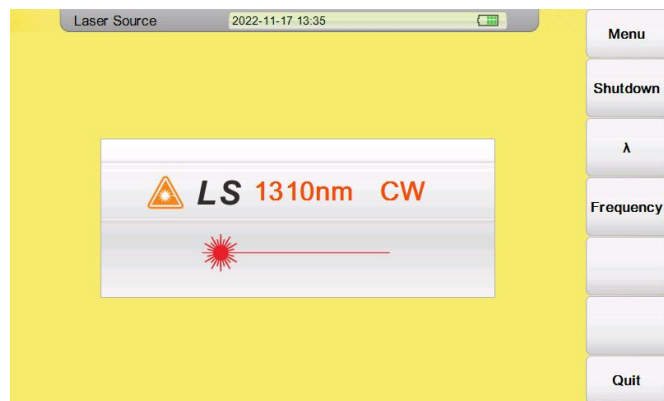
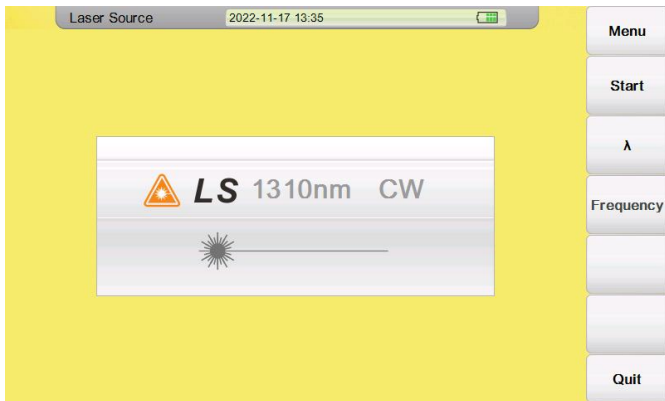


Update Complete

6: Laser Source Module



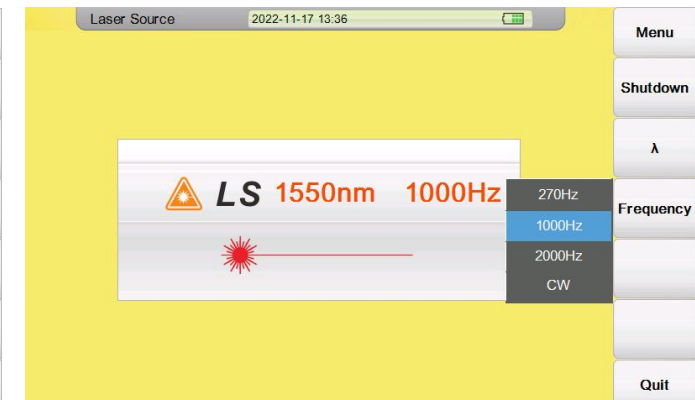
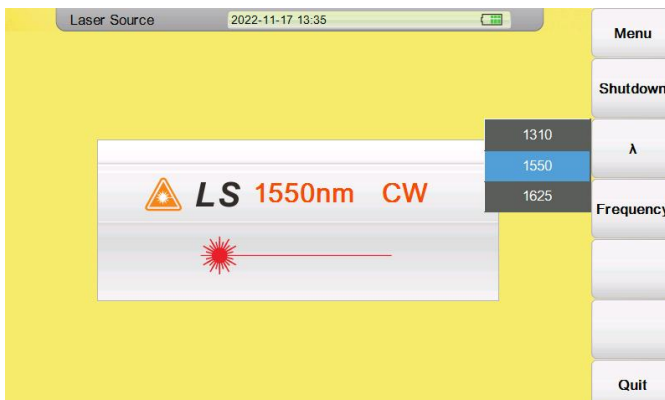
(1) Press "Laser Source" to enter Laser Source module, default display 1310nm wavelength. Laser source remains off state. Press "Start" button to activate the Laser source function, the output power is >-8dBm. Press "λ" button to switch the wavelength. (The laser source wavelength is consistent with OTDR wavelength except 850nm and 1300nm).



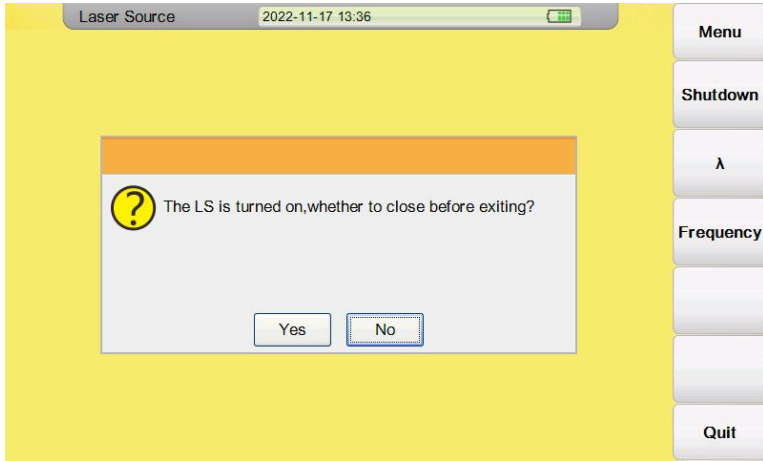
(2) Press "λ" button to switch the wavelength. (The laser source wavelength is consistent with OTDR wavelength except 850nm and 1300nm). Press "Frequency" button to change the output frequency among CW/270Hz/1000Hz/2000Hz.

Note:

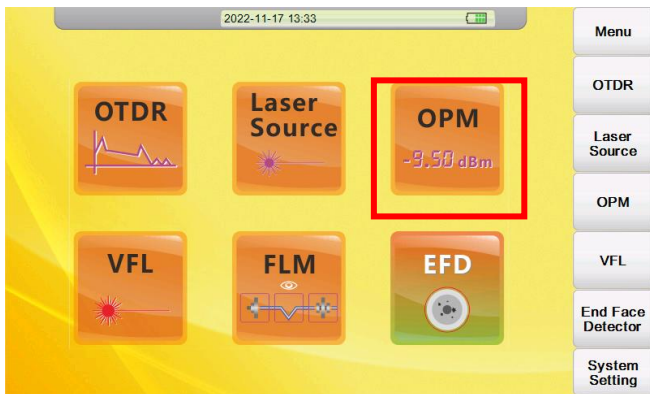
- When the Laser source module is working at 270Hz/1000Hz/2000Hz modulation frequency, the output power will be reduced by 3dB.
- The laser source is invisible. When the laser is emitted, please do not face the human eye



(3) Press "Quit" to quit the Laser source module. When exiting, you can choose whether to turn off the laser source. If choose "No", The laser source will not be turned off. At this time, it can be used together with the optical power meter function of OTDR to detect the optical loss.



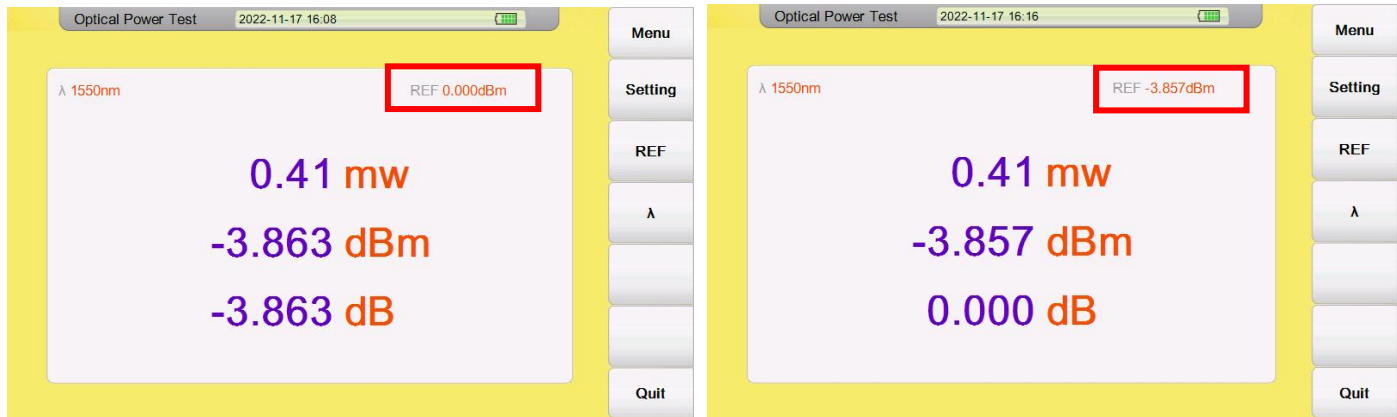
7: Optical Power Meter Module



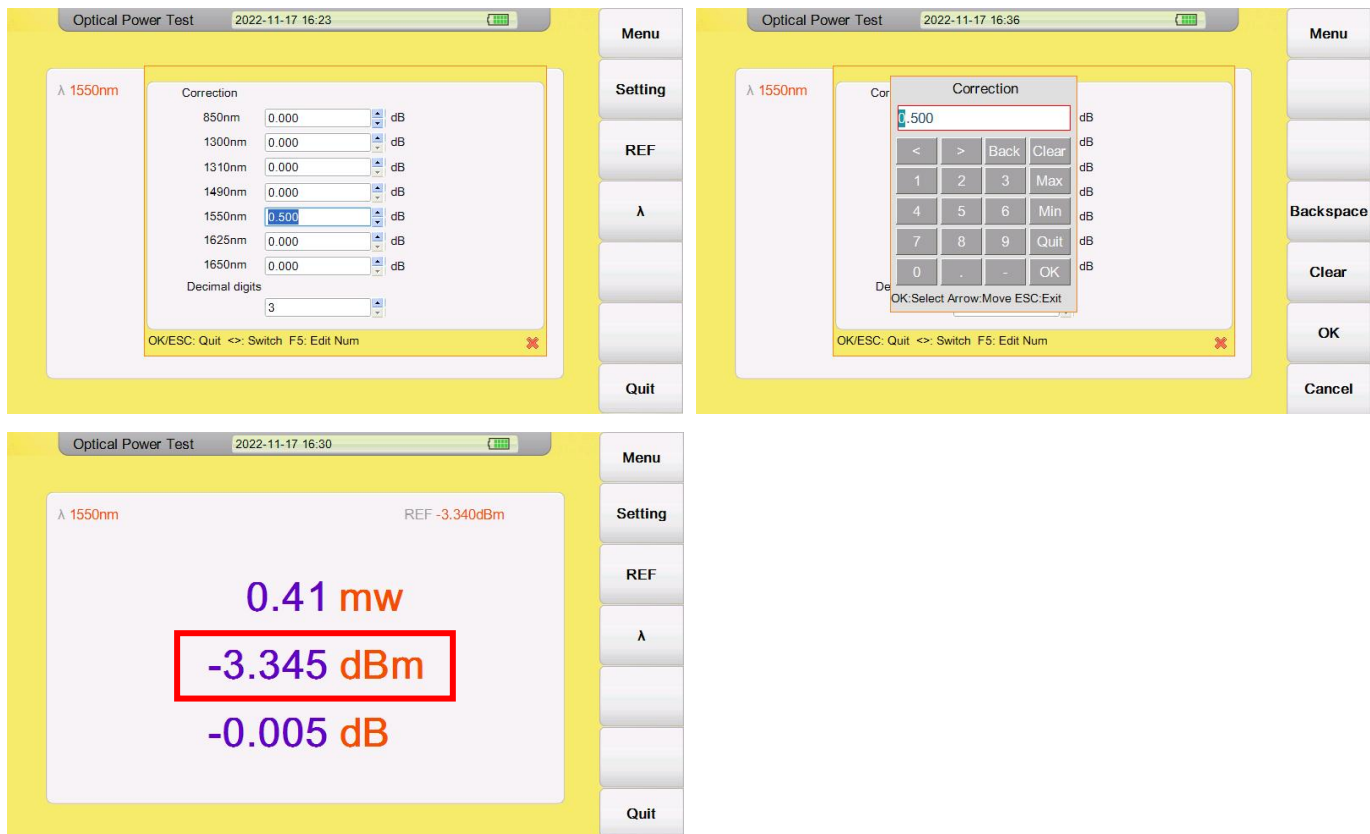
(1) Press "OPM" to enter optical power meter module, there are seven calibrated wavelength 850nm/1300nm/1310nm/1490nm/1550nm/1625nm/1650nm. Press "λ" button to switch the correct wavelength.



(2) Press "REF" button to set the current power as the reference value. The current REF will display on the right top corner. dB unit can intuitively display the value of relative power.

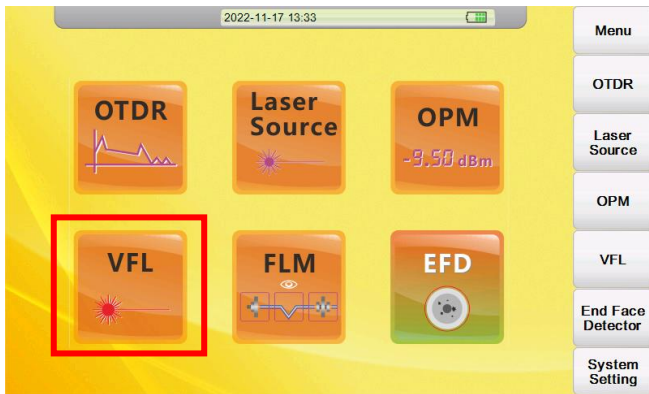


(3) Press "Setting" to enter the function of power meter manual correction. This function can be used when the optical power value deviates. For example, the power value of 1550nm deviates 0.5dB which means the reading power is 0.5dB weaker than the actual optical power. Press F5 to edit the correction value to "0.5dB" to correct the power value. After correction, the 1550nm reading power will increase by 0.5dB.

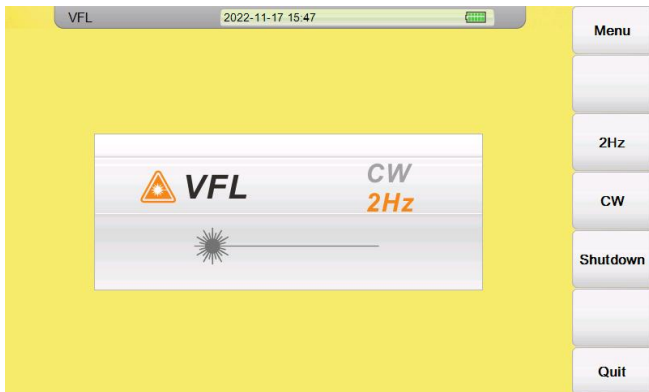


8: Visual Fault Locator Module (VFL)

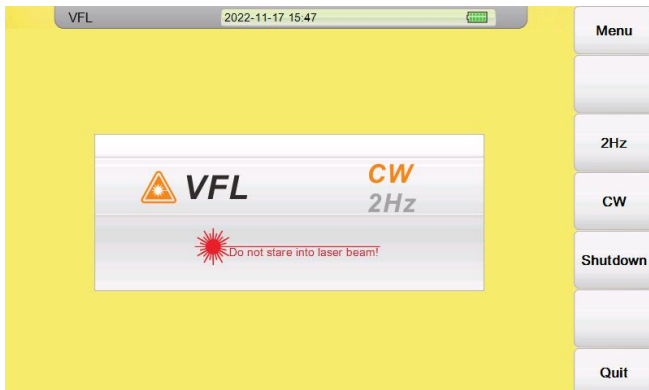
VFL module is used to find the broken point in the near fiber or finding the fiber. The VFL function use the 650nm red light which can test more than 10km fiber. The VFL output power is 10mw, Class IIIB laser safety class, so avoid facing human's eyes when using this function. The VFL port is the second optical port on the top which adopt 2.5mm universal adapter suitable for FC/SC/ST fiber connector.



(1) Connect the fiber to the VFL port and press "VFL" button to enter the VFL function.



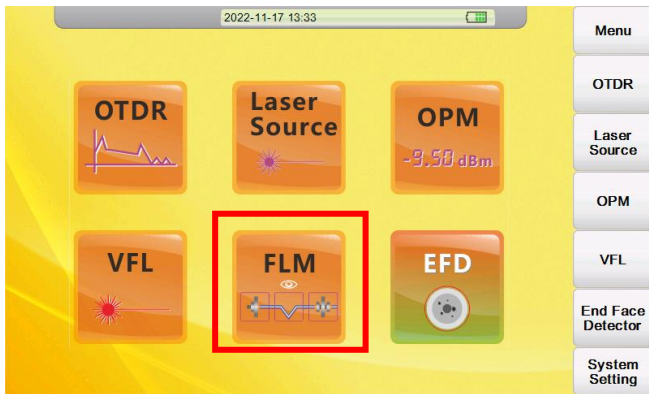
(2) Press "CW" or "2Hz" to activate the VFL red light. When CW mode, the VFL is continuous. When 2Hz mode, the VFL is working in the flashing way. Press "Shutdown" to turn off the VFL function.



9: Fiber Link Map Module (FLM)

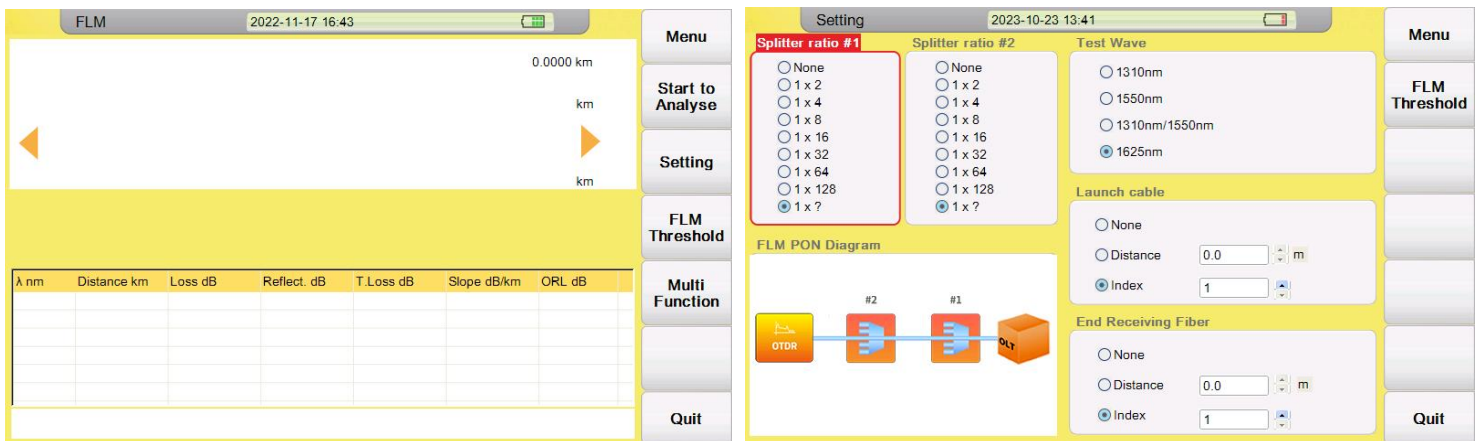
With improved hardware and advanced algorithm, the PON series OTDR can easily pass through 1x64 splitter (even 1x128 splitter, depend on the OTDR dynamic range)and accurately describe the overall structure of PON network.

In particular, with FLM mode, users can automatically test without complicated settings to obtain the most accurate and intuitively test results. In addition, FLM provides the Pass/Fail function of the PON network, which can intuitively display the failure event in PON network



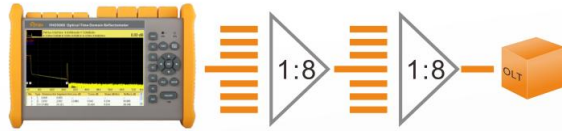
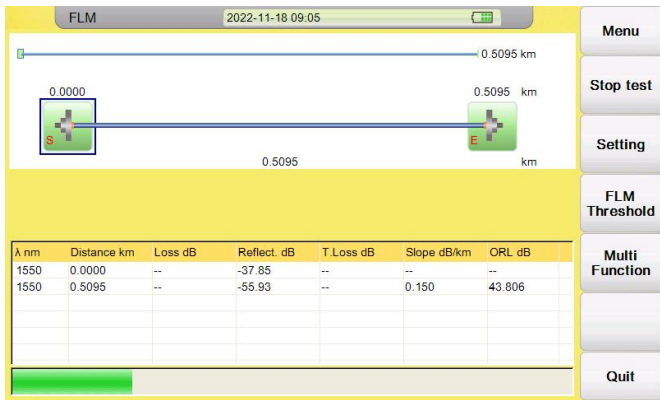
(1) FLM Setting

Press “FLM” button to enter the Fiber link map function. Before you test the fiber link via FLM function, need some simple setting. Press “Setting” to choose the wavelength and splitter information. In the setting interface, you need to choose the testing wavelength among 1310nm/1550nm/1625nm according to your OTDR model. Among them, 1625nm support live fiber testing. Except wavelength, If the link you are testing has a splitter, you need to set the number and type of the splitter. If you are not clear, you can choose 1x? mode. If no splitter existing, set the first splitter/second splitter as “None”.

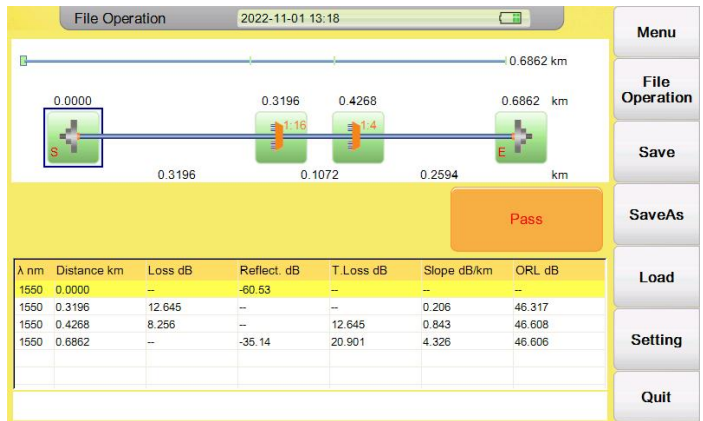
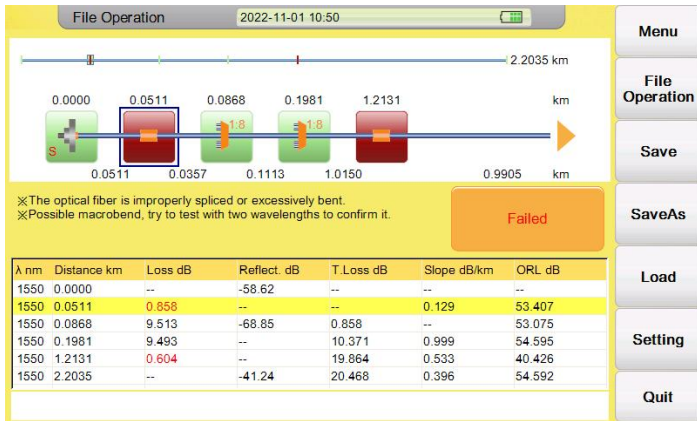


(2) Start to Analyse

Connect the fiber to the OTDR port according to your selected wavelength and press “Start to Analyse”. FLM testing mode will adopt multiple pulse widths to test the fiber link, Through comprehensive analysis of the collected measurement results, the optical eye will finally display the link characteristics in a graphical manner. In combination with the threshold setting, the PASS/FAIL result will be displayed at the same time.



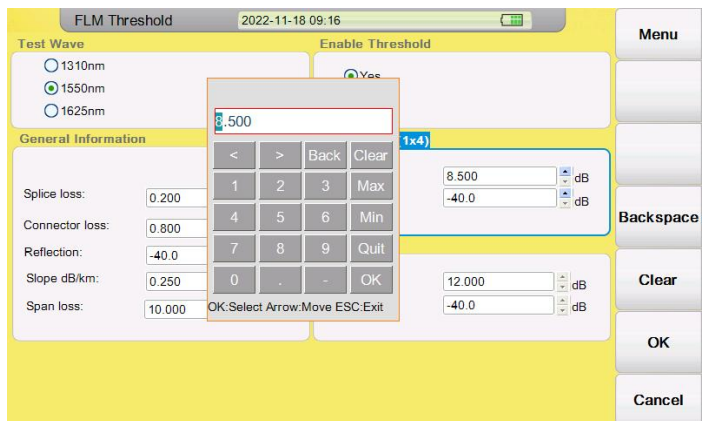
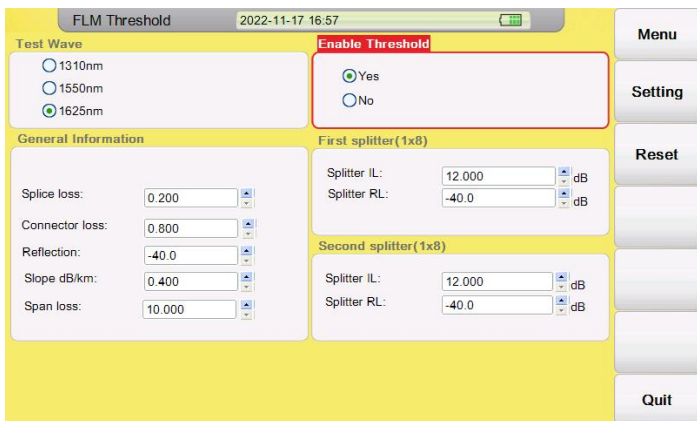
FLM is testing, Check the test progress with the green progress bar below. The test time depends on the complexity of the fiber link.



The test results will show the fiber link total loss, total distance and total ORL. If Pass/Fail judgment is enabled, events that do not meet the threshold value will be displayed in red and display the cause analysis of the problem.

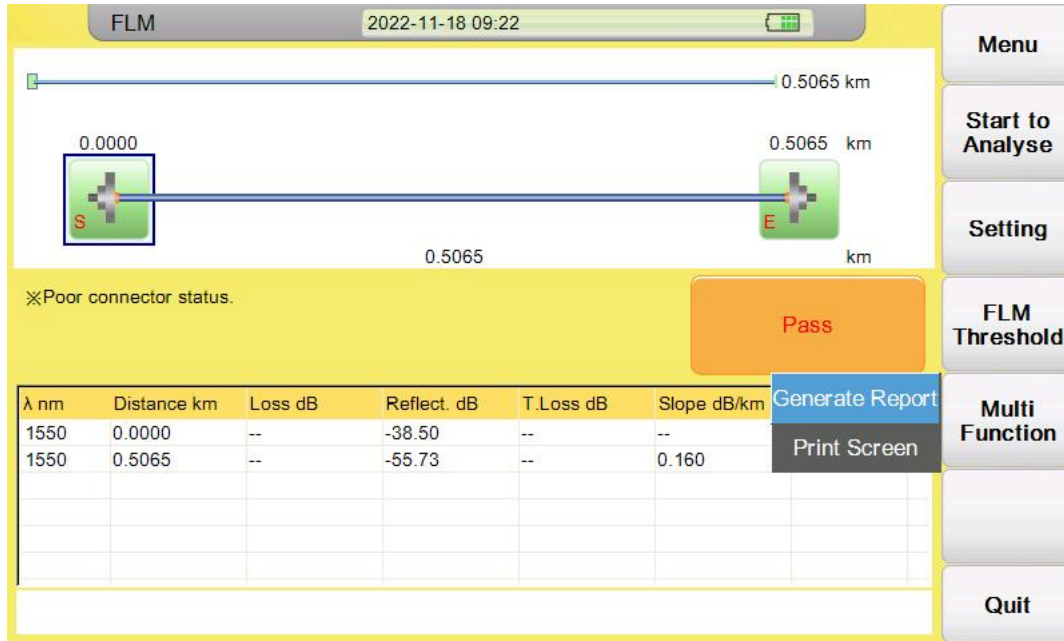
(3) FLM Threshold

Setting the FLM result threshold, in the FLM threshold, the user can set the Pass/Fail threshold for Splice loss, Connector loss, Reflection, Slope and Span loss. If the splitter is tested, the loss threshold and return loss threshold of the splitter can be set. Press "Reset" to restore default settings.



(4) Multi Function

Press "Multi Function" to generate the FLM test report and print screen.


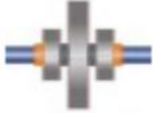








The screenshot shows the FLM test interface. At the top, it displays 'FLM' and the date '2022-11-18 09:22'. Below this is a fiber link diagram with a distance of 0.5065 km. A 'Pass' status is shown in an orange box. A table below the diagram provides test data for two wavelengths: 1550 nm and 1550 nm. The table has columns for Wavelength (λ nm), Distance (km), Loss (dB), Reflect. (dB), T.Loss (dB), and Slope (dB/km). A 'Multi Function' menu option is highlighted, which includes 'Generate Report' and 'Print Screen'.

λ nm	Distance km	Loss dB	Reflect. dB	T.Loss dB	Slope dB/km
1550	0.0000	--	-38.50	--	--
1550	0.5065	--	-55.73	--	0.160



(5) FLM ICON Explanation

The following figure lists the event icons that may appear in the FLM test.

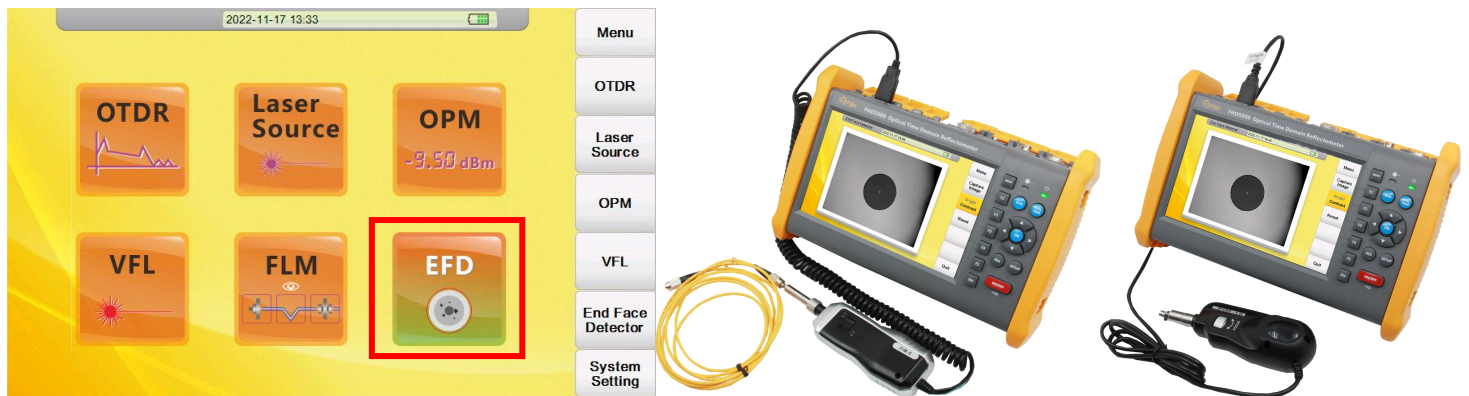
FLM Event type	ICON	FLM Event type	ICON
Start Point		Connector	
Fusion Splice		Bending Point	
End Point		Splitter	
Insufficient Dynamic		Unknown	

10: Fiber Microscope Module

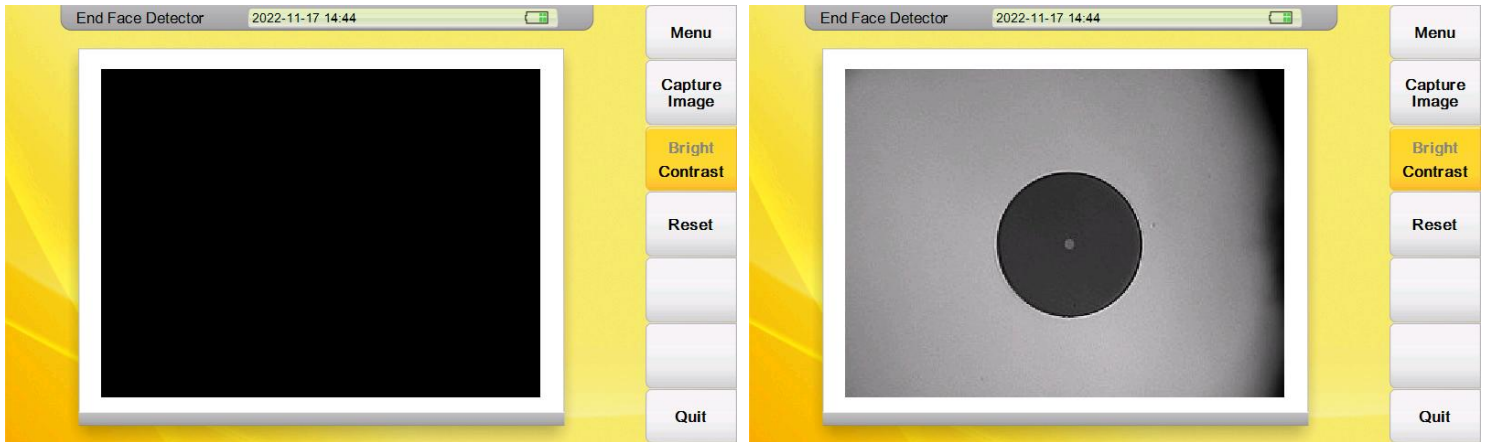
The product supports checking the condition of the optical fiber endface on the screen, and can save the screenshot of the condition of the optical fiber end face in the OTDR. Although the OTDR software supports the EDF function, you need to purchase an additional Fiber microscope to match with the OTDR.

Fiber Microscope Model	Picture	Standard tips
FIM-4 fiber microscope		SC-PC-F(for SC/PC female bulkhead) FC-PC-F(for FC/PC female bulkhead) LC-PC-F(for LC/PC female bulkhead) 2.5PC-M(for 2.5mm/PC male connector)
FIM-18 fiber microscope		25-U-M (for 2.5mm/PC male connector) 125-U-M(for 1.25mm/PC male connector) FC-U-F(for FC/PC female bulkhead) SC-U-F(for SC/PC female bulkhead) LC-U-F(for LC/PC female bulkhead)

(1) Press “EDF” button to enter the Fiber microscope module, connect the optional FIM-4 or FIM-18 microscope to the USB port of the OTDR.



(2) Connect the optical fiber end face to the fiber microscope to check the male connector or insert the fiber microscope to the female bulkhead to check the inside fiber endface. Optical fiber endface and fiber core can be clearly displayed through 400 times amplification.



(3) Press "Capture Image" button to save the fiber endface image to the OTDR as bmp format.

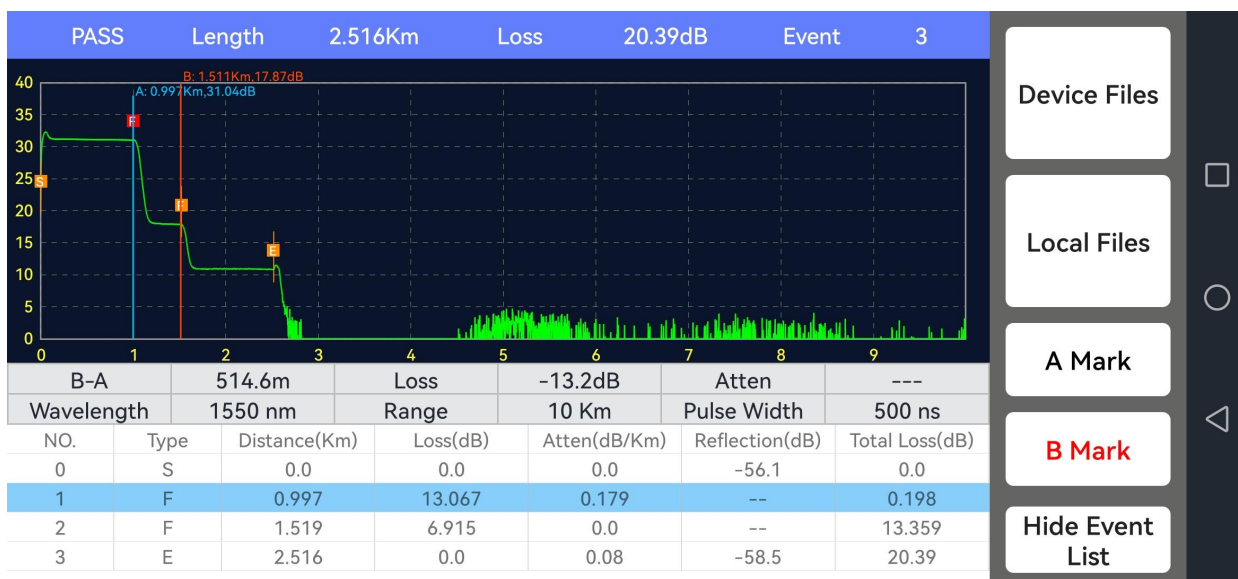
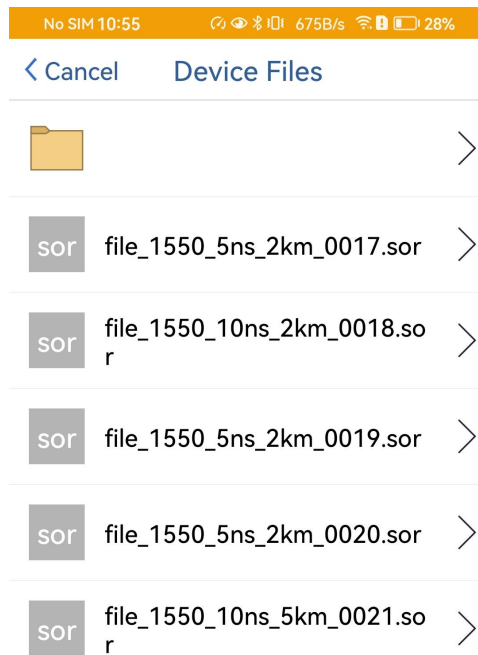
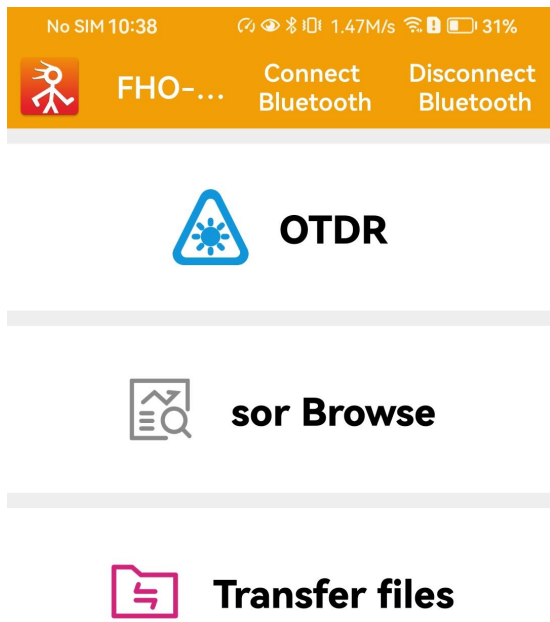


11: Bluetooth function

Download the FHO5000 PRO Android mobile phone app

<https://www.grandwaytelecom.com/En/Skippower/downloadFile/id/135.html>

FHO5000 PRO supports Bluetooth function and can connect to Android mobile app. On mobile phone software, OTDR testing, OTDR file viewing and sor file sending can be performed.

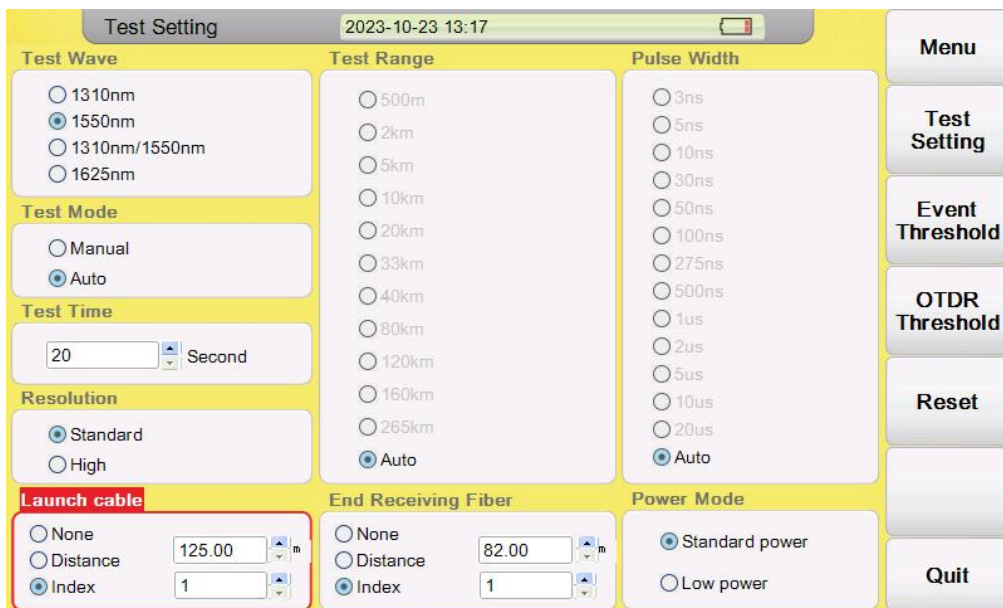


12: New functions

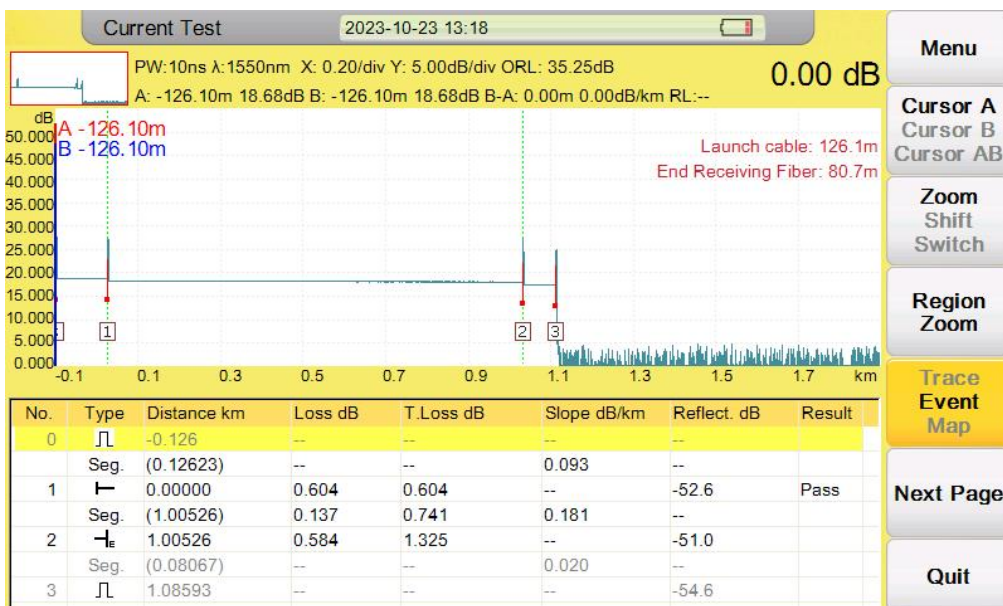
12.1 Launch Cable function

There are two modes to set the start launch fiber and end receiving fiber:

- a: according to the pre-set fiber length
- b: according to the event number, OTDR will take the fiber before the event1 as the starting launch fiber and treat the last second point to end event as the end receiving fiber.



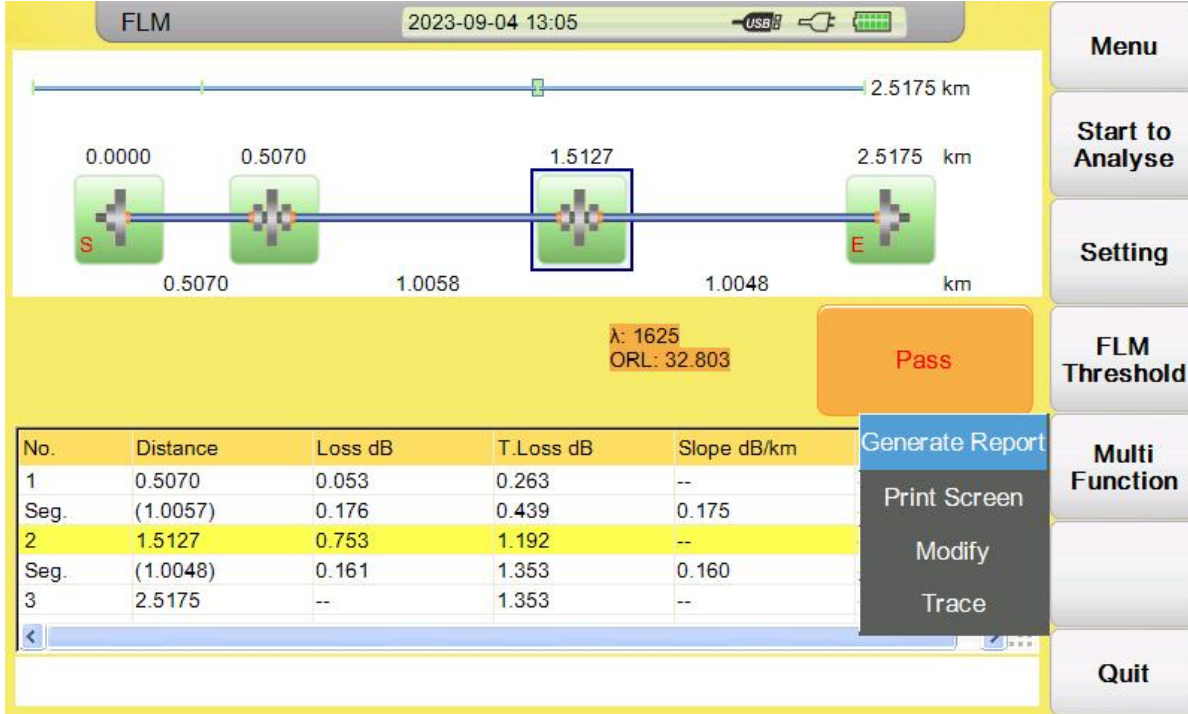
Set the launch cable and receiving fiber according to the fiber event



The middle part of the green dashed line is the actual line part

12.2 Conversion of OTDR trace and Fiber link map

In FLM test result, press "Multi Function" and select "Trace" to switch to OTDR trace.



FLM 2023-09-04 13:05

0.0000 0.5070 1.5127 2.5175 km

0.5070 1.0058 1.0048 km

λ: 1625 ORL: 32.803 Pass

No.	Distance	Loss dB	T.Loss dB	Slope dB/km
1	0.5070	0.053	0.263	--
Seg.	(1.0057)	0.176	0.439	0.175
2	1.5127	0.753	1.192	--
Seg.	(1.0048)	0.161	1.353	0.160
3	2.5175	--	1.353	--

Generate Report
Print Screen
Modify
Trace

Menu
Start to Analyse
Setting
FLM Threshold
Multi Function
Quit

OTDR trace and event map can displayed on the same screen together.



Current Test 2023-09-04 13:07

PW:- λ:1625nm X: 0.30/div Y: 5.00dB/div ORL: 32.80dB 0.00 dB

A: 0.00m 27.72dB B: 0.00m 27.72dB B-A: 0.00m 0.00dB/km RL:--

FLM_1625_0904_13.07.03

50.000 dB
45.000
40.000
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0.000

0.0 0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 km

0.0000 0.5070 1.5127 2.5175

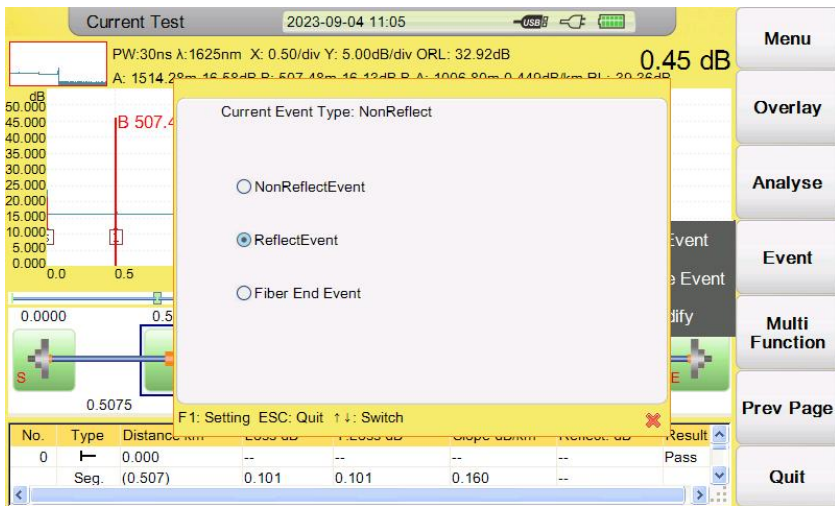
0.5070 1.0058 1.0048 km

No.	Type	Distance km	Loss dB	T.Loss dB	Slope dB/km	Reflect. dB	Result
0	┆	0.000	0.209	--	--	-49.9	
Seg.		(0.507)	0.209	0.209	--	--	

Remove Current Trace
Remove Other Trace
Remove All
Back

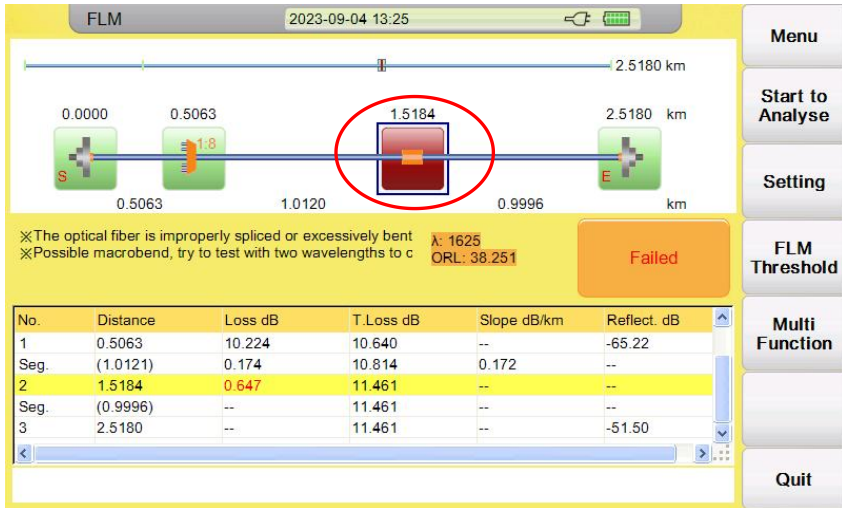
12.3 Modify wrong event type in OTDR trace mode

Sometimes the reflection of APC connections is very low, and OTDR may think it is a fusion point as non-reflection event.



12.4 Modify wrong event type in FLM test mode

Sometimes the reflection of APC connections is very low, and FLM may think it is a fusion point as non-reflection event.



FLM 2023-09-04 13:25

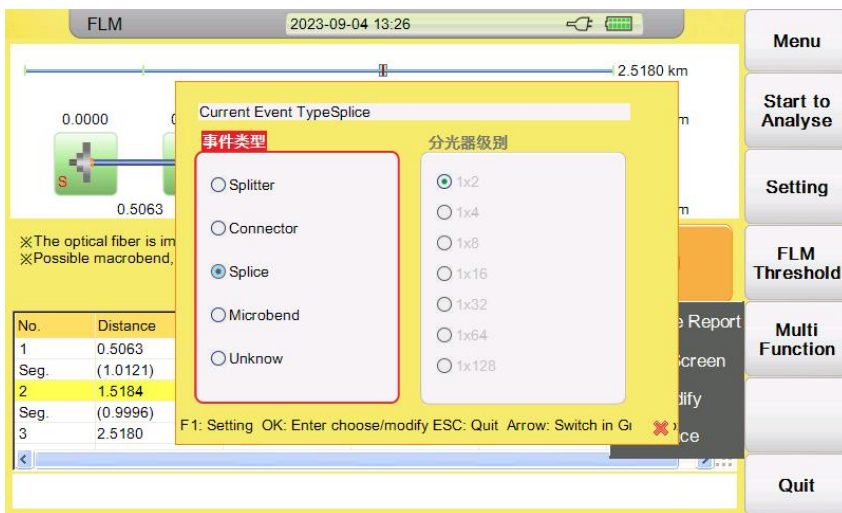
0.0000 0.5063 1.5184 2.5180 km

0.5063 1.0120 0.9996 km

×The optical fiber is improperly spliced or excessively bent
×Possible macrobend, try to test with two wavelengths to c

λ: 1625 ORL: 38.251 **Failed**

No.	Distance	Loss dB	T.Loss dB	Slope dB/km	Reflect. dB
1	0.5063	10.224	10.640	--	-65.22
Seg.	(1.0121)	0.174	10.814	0.172	--
2	1.5184	0.647	11.461	--	--
Seg.	(0.9996)	--	11.461	--	--
3	2.5180	--	11.461	--	-51.50



FLM 2023-09-04 13:26

0.0000 0.5063 1.5184 2.5180 km

0.5063 1.0120 0.9996 km

×The optical fiber is im
×Possible macrobend,

Current Event Type Splice

事件类型

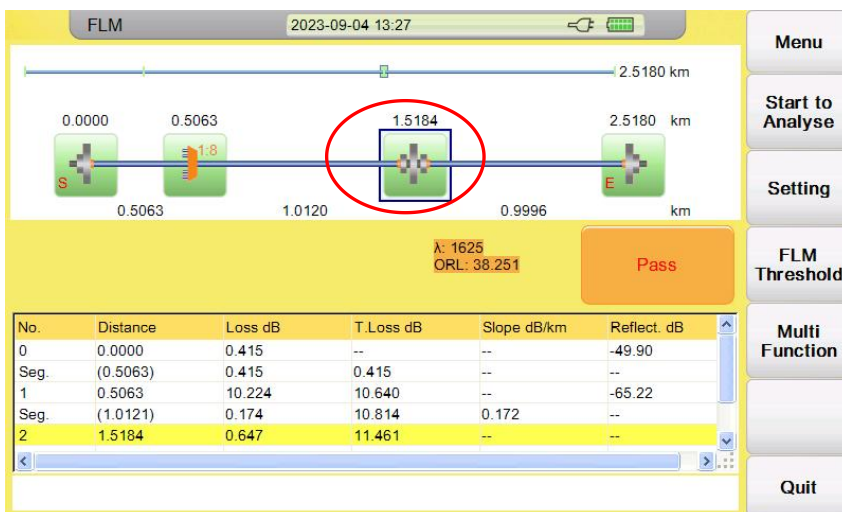
- Splitter
- Connector
- Splice
- Microbend
- Unknow

分光器级别

- 1x2
- 1x4
- 1x8
- 1x16
- 1x32
- 1x64
- 1x128

F1: Setting OK: Enter choose/modify ESC: Quit Arrow: Switch in Gi

No.	Distance	Loss dB	T.Loss dB	Slope dB/km	Reflect. dB
1	0.5063	10.224	10.640	--	-65.22
Seg.	(1.0121)	0.174	10.814	0.172	--
2	1.5184	0.647	11.461	--	--
Seg.	(0.9996)	--	11.461	--	--
3	2.5180	--	11.461	--	-51.50



FLM 2023-09-04 13:27

0.0000 0.5063 1.5184 2.5180 km

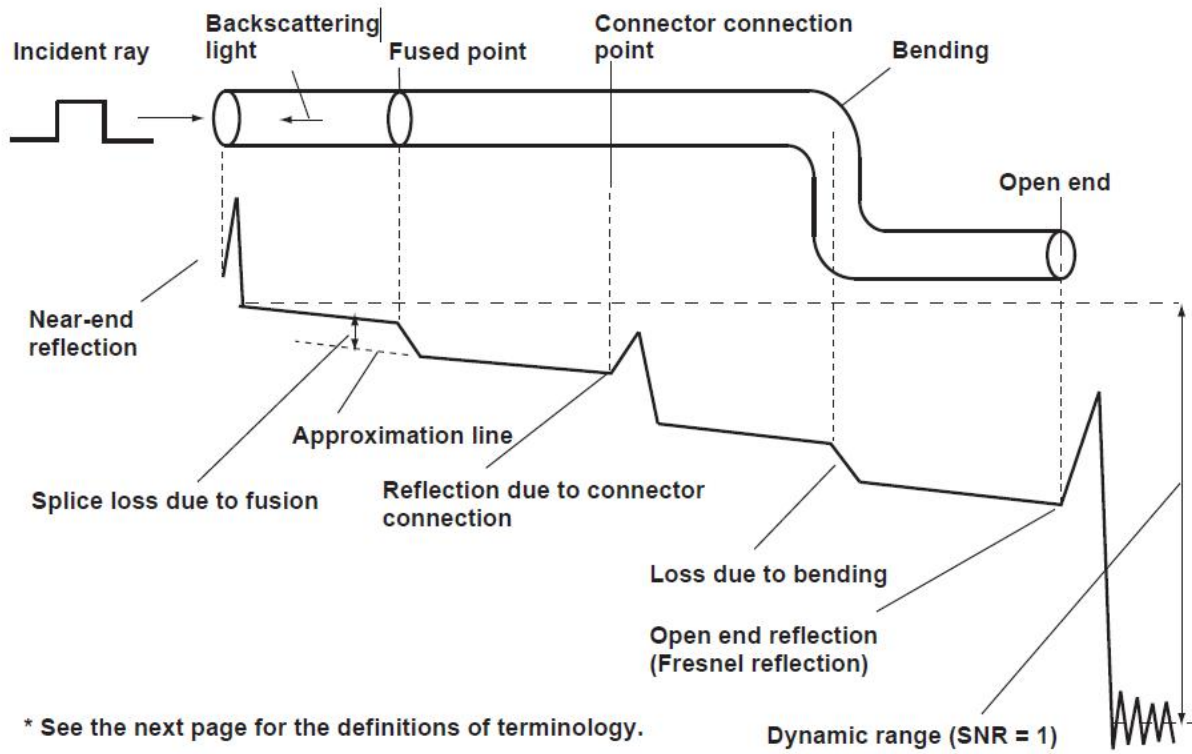
0.5063 1.0120 0.9996 km

λ: 1625 ORL: 38.251 **Pass**

No.	Distance	Loss dB	T.Loss dB	Slope dB/km	Reflect. dB
0	0.0000	0.415	--	--	-49.90
Seg.	(0.5063)	0.415	0.415	--	--
1	0.5063	10.224	10.640	--	-65.22
Seg.	(1.0121)	0.174	10.814	0.172	--
2	1.5184	0.647	11.461	--	--

13: Background Information on Measurements

13.1 Viewing the Optical Pulse Measurement Waveform



13.2**Terminology****Near-end reflection**

A reflection occurs in the gap between the OTDR and the connector for the optical fiber cable. Losses and reflections of the connection points cannot be detected in the section in which this reflection is detected. This section is called a dead zone.

Backscattering light

When light propagates through the optical fiber cable, a phenomenon called Rayleigh Scattering occurs due to the nonuniformity of the density or constituents of materials smaller than the wavelength unit. The scattered light that is transmitted opposite to the direction of propagation is called backscattering light.

Splice loss due to fusion

A splice loss occurs at the fused section mainly due to axis offset and angle offset.

Reflection due to connector connection

Unlike the fused section, a slight gap occurs in the connection section of connectors. Because the group refraction index changes in this gap, a reflection occurs causing a loss.

Fresnel reflection at the far end of the optical fiber cable

Fresnel reflection occurs at the location where the optical fiber cable is broken or a location where the group refraction index changes such as the far end of the cable (glass and air) when light enters the cable. If the end face of the optical fiber cable is vertical, approximately 3.4 % (−14.7 dB) of the incident light power is reflected.

Dynamic range

Dynamic range refers to the difference between the backscattering light level at the near end and the noise (RMS = 1).

Dead zone

The locations where measurements cannot be made due to the effects of Fresnel reflection, connection point of connectors, etc.

14: Maintenance

14.1 Notice

The product use rechargeable Li-ion battery.

Pay attention to the following :

- Keep OTDR dry and clean store at room temperature(15°C~30°C).
- Remove and charge the battery monthly if you don't use it for a long time(more than one month).
- keep Optical port clean by alcohol soaked cotton and recover dust cap after use.
- Clean optical port and connector at fixed period .

Follow the principles below before cleaning:

- Shut off before cleaning.
- Any operations contrary to the instructions may result in dangerous laser injuries.
- Disable laser launching before cleaning.
- When the instrument is in operation, please always avoid looking directly into optic output. Although laser radiation is invisible, it may do serious injury to eyesight,
- Be cautious of electric shock and make sure AC power is disconnected from the instrument before cleaning. Always use dry or moist soft cloth to clean the outside of the instrument, and never touch inside.
- Don't proceed any modification on OTDR.
- For maintenance, please always operated by qualified worker.

14.2 Cleaning Tools

1. Optic fiber cleaner (for cleaning of optic connectors)
2. Optic fiber cleaning rod (for cleaning of optic adapter)
3. Optic fiber cleaning tissue (for cleaning optic interfaces)
4. Isopropyl alcohol
5. Cotton ball
6. Paper tissue
7. Cleaning brush
8. Cleaning pen

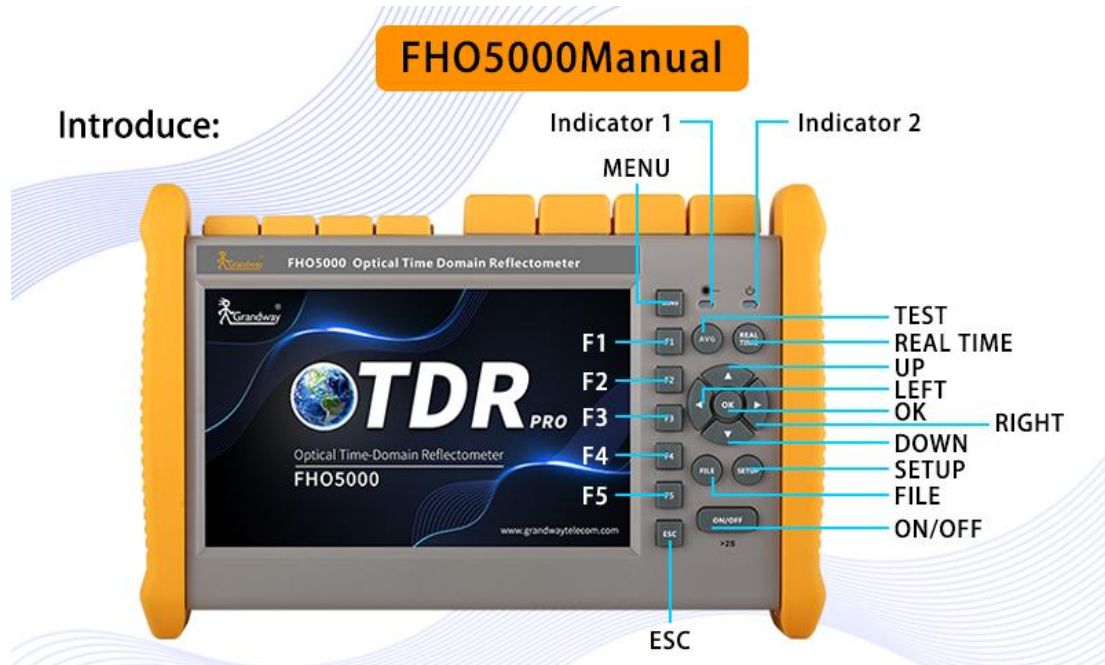
15: Diagnosis Center

15.1 FAQ

Fault	Reason	Solution
Can't turn on	<ol style="list-style-type: none"> Holding time on power button is not enough(>2s). Run out of power / battery has broken. No battery. Too cold there. 	<ol style="list-style-type: none"> Long press on ON/OFF key. Connect external power/ Replace a new battery. Install battery. Change another environment.
Display shows nearly nothing after turned on	<ol style="list-style-type: none"> Brightness need to be adjusted. Connection between display and motherboard is not good. 	<ol style="list-style-type: none"> Adjust brightness. Open and reconnect.
Battery does not work properly	<ol style="list-style-type: none"> Temperature is too high. Connection is not proper. Battery is nearly broken. 	<ol style="list-style-type: none"> Try to decrease temperature. Reconnect battery. Replace a new one.
Power state indicator turns yellow	Battery has broken	Replace a new one
Measuring graphic only has front end reflection	<ol style="list-style-type: none"> Connector loose,polluted, damaged or unmatched. Locating pin has broken. 	<ol style="list-style-type: none"> Clean and reconnect. Change a new adapter.
No response		Restart
Find Ghost	<ol style="list-style-type: none"> Often happened in large plus width,long range and short link condition. Common ghost caused by continuous reflection of connector. 	<ol style="list-style-type: none"> Use proper measuring range and pulse width setting. Reconnect fault point of Reflection event, reduce reflection strength.

15.2 Help Information

The product has an build-in manual with essential information



Procedure:

Turn on OTDR

1. Press **【ESC】** enter system setting, press **【F4】** to read manual, Control **【▲】** **【▼】** button to flip over.
2. Press **【ESC】** to quit.

16: OTDR Specification

General Specification

Dimension	253×168×73.5mm/1.5kg (battery included)
Display	7 inch touch screen TFT-LCD with LED backlight
Interface	1×RJ45 port, 3×USB port (USB 2.0, Type A USB×2, Type B USB×1)
Power Supply	10V(dc)/4A, 100V(ac) to 240V(ac), 50~60Hz
Battery	7.4V(dc)/5.2Ah lithium battery (with air traffic certification) Operating time: 6 hours①, Telcordia GR-196-CORE Charging time: <4 hours (power off)
Power Saving	Backlight off: Disable/1 to 99 minutes Auto shutdown: Disable/1 to 99 minutes
Data Storage	Internal memory: 16GB
Language	User selectable (English, traditional Chinese, French, Korean, Russian, Spanish, Portuguese, Turkish, Italian, German, Thai, Hungarian, Czech, Vietnamese, Polish-contact us for availability of others)
Environmental Conditions	Operating temperature and humidity: -10°C~+50°C, ≤95% (non-condensation) Storage temperature and humidity: -20°C~+75°C, ≤95% (non-condensation)
Accessories	Standard: Main unit, power adapter, Lithium battery, FC adapter, USB cord, User guide, carrying case Optional: SC/ST/LC adapter, Bare fiber adapter, Fiber microscope, Launch cable box

Model Selection

Type②	Testing Wavelength (MM: ±20nm, SM: ±20nm)	Dynamic Range (dB)③	Event/Attenuation Dead-zone (m)④
FHO5000-M21	850/1300	19/21	1/4
FHO5000-MD21	850/1300	19/21	1/4
	1310/1550	35/33	1/4

FHO5000-MD22	850/1300	19/21	1/4
	1310/1550	40/38	0.8/3
FHO5000-D26	1310/1550	26/24	1/4
FHO5000-D35	1310/1550	35/33	1/4
FHO5000-D40	1310/1550	40/38	0.8/3
FHO5000-D43	1310/1550	43/41	0.8/3
FHO5000-D45	1310/1550	45/43	0.8/3
FHO5000-D50	1310/1550	50/48	0.8/3
FHO5000-T26F	1310/1550/1625	26/24/24	1/4
FHO5000-T35F	1310/1550/1625	35/33/33	1/4
FHO5000-T40F	1310/1550/1625	40/38/38	0.8/3
FHO5000-T43F	1310/1550/1625	43/41/41	0.8/3
FHO5000-T45F	1310/1550/1625	45/43/43	0.8/3
FHO5000-T50F	1310/1550/1625	50/48/48	0.8/3
FHO5000-TC35F	1310/1550/1650	35/33/33	1/4
FHO5000-TP35	1310/1490/1550	35/33/33	1/4

Test Parameter

Pulse Width	3ns, 5ns, 10ns, 30ns, 50ns, 100ns, 275ns, 500ns, 1μs, 2μs, 5μs, 10μs, 20μs
Testing Distance	500m, 2km, 5km, 10km, 20km, 33km, 40km, 80km, 120km, 160km, 265km
Sampling Resolution	Minimum 5cm
Sampling Point	Maximum 256,000 points
Linearity	≤0.05dB/dB
scale Indication	X axis: 4m~70m/div, Y axis: Minimum 0.09dB/div
Distance Resolution	0.01m
Distance Accuracy	±(0.75m+measuring distance×3×10 ⁻⁵ +sampling resolution) (excluding IOR uncertainty)
Reflectance Accuracy	Single mode: ±2dB, multi-mode: ±4dB

IOR Setting	1.2000~1.7000, 0.0001 step
Units	Km, miles, feet
OTDR Trace Format	Telcordia universal, SOR, issue 2 (SR-4731) OTDR: User selectable automatic or manual set-up
Fiber Event Analysis	-Reflective and non-reflective events: 0.01 to 1.99dB (0.01dB steps) -Reflective: 0.01 to 32dB (0.01dB steps) -Fiber end/break: 3 to 20dB (1dB steps)
Other Functions	<ul style="list-style-type: none"> ◆ Built in multi-language OTDR/FLM PDF report generation ◆ Live Fiber detect: Verifies presence communication light in optical fiber ◆ Dual wavelength(1310nm/1550nm) analysis-Macro bending detection ◆ Built-in Bidirectional test analysis function ◆ Trace overlay and comparison (most 8 traces) ◆ Define the Pass/Fail result of each event through threshold settings ◆ Powerful PC analysis software "OTDRviewer" ◆ Remote control on PC software "Server" via RJ45 cable ◆ Bluetooth and Android mobile APP is available on PRO version

VFL Module

Wavelength	650nm(±20nm)
Output Power	10mw,CLASSIII B
Test Range	12km
Connector	Universal 2.5mm interface
Launching Mode	CW/2Hz

OPM Module

Wavelength Range	800~1700nm
Calibrated Wavelength	850/1300/1310/1490/1550/1625/1650nm
Test Range	Type A: -60~+5dBm (standard); Type B: -40~+23dBm (optional)
Resolution	0.01dB

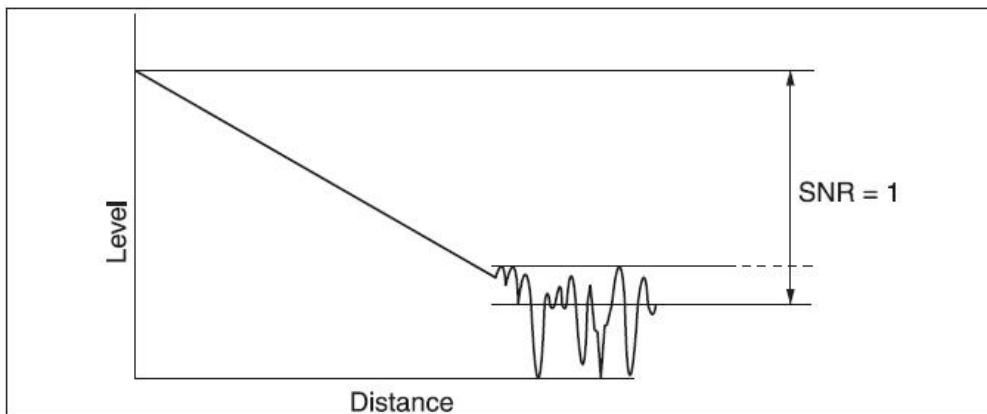
Accuracy	$\pm 0.35\text{dB} \pm 1\text{nW}$
Connector	FC/UPC or SC/UPC or customized

LS Module (Laser Source)

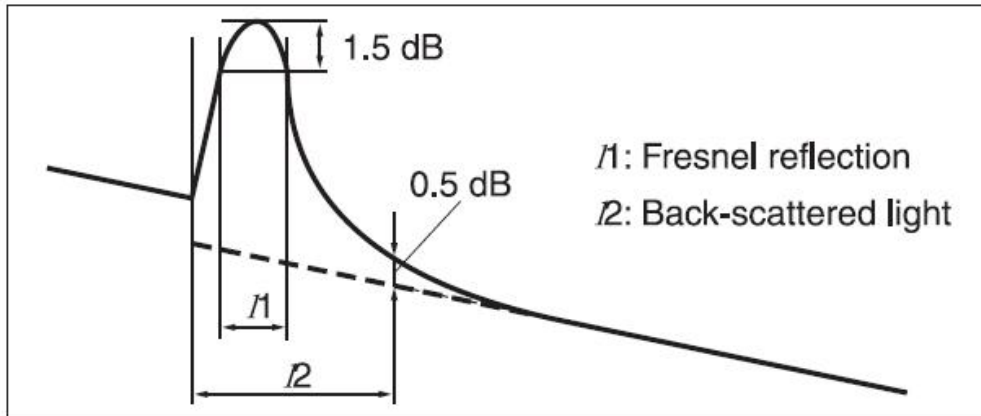
Working Wavelength	Consistent with OTDR (Except 850nm/1300nm)
Output Power	$\geq -8\text{dBm}$
Output Mode	CW/270Hz/1kHz/2kHz
Accuracy	$\pm 0.5\text{dB}$
Connector	FC/UPC or SC/UPC or customized

Notes:

- ① Typical, backlight off, sweeping halted at 25°C, 6 hours typical continuous testing.
- ② Model T26F/T35F/T40F/T43F/T45F/T50F/TC35F are integrated with optical filter, which allow them to test live fiber (by using 1625nm/1650nm wavelength) and will not interrupt the online signal of fiber.
- ③ Dynamic range is measured with maximum pulse width, averaging time is 3 minutes, SNR=1; The level difference between the RMS noise level and the level where near end back-scattering occurs.



- ④ Event dead zone is measured with pulse width of 3ns and return loss $\geq -45\text{dB}$. Dynamic range $> 5\text{dB}$
- Attenuation dead zone is measured with pulse width of 3ns and return loss $\geq -55\text{dB}$. Dynamic range $> 5\text{dB}$

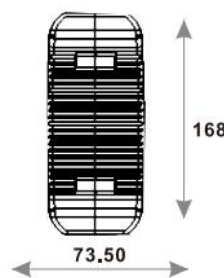
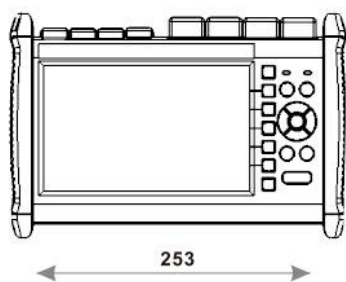


⑤ 1310/1550nm uses OTDR1 port, and 1625nm/850nm/1300nm uses OTDR2 port.

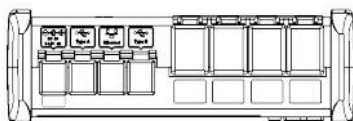
CAUTION:



VIEWING THE LASER OUTPUT WITH CERTAIN OPTICAL INSTRUMENTS (FOR EXAMPLE: EYE LOUPES, MAGNIFIERS AND MICROSCOPES) WITHIN A DISTANCE OF 100 MM MAY POSE AN EYE HAZARD.



Unit:mm
 Except where noted, tolerance default as: ±3%
 (if size < 10mm, tolerance: ±0.3mm)



*Specifications are subject to change without notice.

17: Warranty

17.1 Terms of Warranty

All products are warranted against defective material and workmanship for a period of time from the date of shipment to the original customer. Any product found to be defective within the warranty period would be repaired or replaced by our company free of charge.

17.2 Exclusions

The warranty on your equipment shall not apply to defects resulting from the following:

- Unauthorized repair or modification
- Misuse, negligence, or accident

Our company reserves the right to make changes to any of its products at any time without having to replace or change previously purchased units.

17.3 Transportation

To return instrument for reasons of yearly maintenance or other, please contact us. to obtain additional information and RMA#code(Return Materials Authorization number). And describe briefly reasons for the return of the equipment, to allow us offer you more efficient service.

To return the instrument in the case of repair, calibration or other maintenance, please note the following:

- Pack the instrument with soft cushion like Polyethylene, so as to protect the shell of the instrument.
- Please use the original hard packing box. If use other packing material, please ensure at least 3 cm soft material cover around the instrument.
- Be sure to correctly fill out and return the warranty registration card, which should including following information: company name, postal address, contact, phone number, email address and problem description.
- Seal the packing box with exclusive tape.
- Ship to your representative or the agent of the Company in a reliable way.

17.4 Customer Service and Support

Shanghai Grandway TelecomTech. Co., Ltd.

Address: 6F, Xin'an Building, No.99 Tian Zhou Road,

Caohejing Hi-Tech Park, Shanghai ,200233, China

Tele: +86-21-54451260/61/62

Fax: +86-21-54451266

Email: overseas@grandway.com.cn

Web: www.grandwaytelecom.com



Grandway Website