OFIX

V1.0

User's Manual

GCI
General Communication Instruments

Foreword

Thank you for purchasing OFIX (Optical FIX).
This user's manual contains useful information about the instrument's functions and operating procedures and the handling precautions of OFIX.

GCI Inc.

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 Company dealer.

- Copying or reproducing all or any part of the contents of this manual without Company's permission is strictly prohibited.

Version

Version 1.0 2018

Certification Information

FCC part 15B warning statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

RF exposure compliance statement

Any changes or modifications (including the antenna) made to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment.

To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operation in conjunction with any other antenna or transmitter.

This equipment complies with FCC

Standard Accessary

OFIX standard accessary showed in next table.

Num.	Description	Quantity
1	*OFIX Main Unit*	*1*
2	*Power Adapter (Input: 220V 60Hz, Output: 9V 2.5A)*	*1*
3	*Carrying Box*	*1*
4	*Carrying Bag*	*1*
5	*Bumper Case*	*1*
6	*User's Manual*	*1*
7	*OFIX OTDR Mobile App (Android)*	*1*
8	*OFIX Viewer (PC)*	*1*

Module

OFIX optional accessary showed in next table.

Num	Module	Description
1	*OTDR module*	*Standard (SM1550)*
2	*OPM (optical power meter) module*	*Optional*
3	*OTDR module*	*Optional (SM1310,1625,1650)*

※ All changes with standard accessary and optional accessary prices are subject to change without notice.

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

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 Remove Covers
The covers should be removed by Company's qualified personnel only.

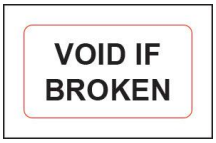
Carrying and Moving the Instrument
Remove all power cords and connection cables from the main unit before moving the instrument. When carrying the instrument, recommended of using carrying bag and carrying box. For better proof it is recommended to use Bumper Case.

Apply Correct Signals to the Optical Connectors
Do not apply light that is 10dBm or greater to the OFIX Optical Connectors.
Doing so may damage the OFIX.

Bluetooth transmitting Frequency
Transmitting Frequency is 2402MHz ~ 2480MHz

Symbol

Icons on the main body



Do not open the cover

Hazard, radiation of laser light

Content

Content

What is OFIX?

OFIX is a brand of GCI Inc.

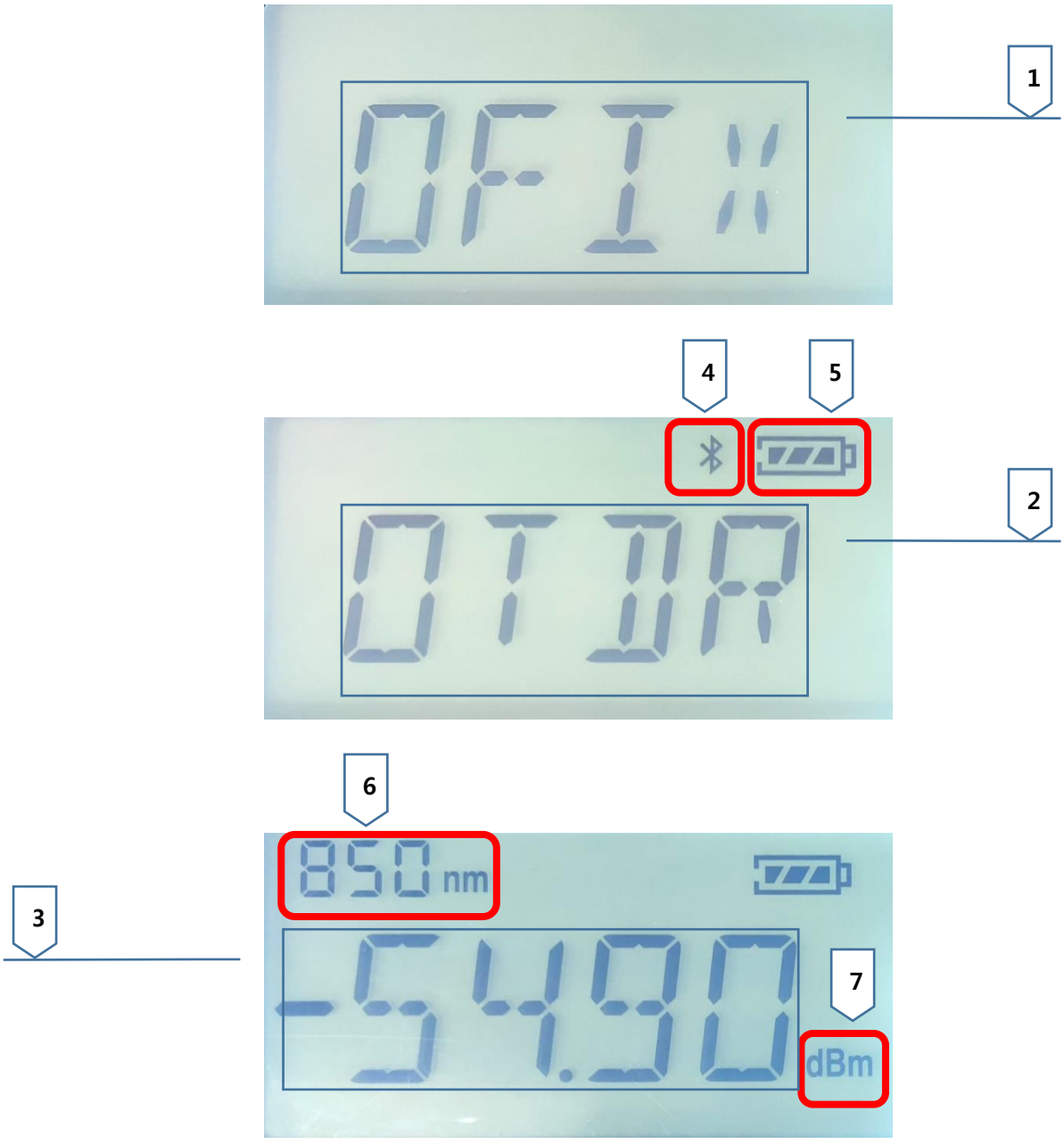
OFIX is an optical measurement device brand developed by GCI Inc. that includes an OTDR (Optical Time Domain Reflectometer), OPM (Optical Power Meter), VFL (Visual Fault Locator) and other various measurement functions. Currently, the modularized, portable optical power meter is on the market that is able to be separated. Our main products are OTDR and optical power meters that are meant for short-distance (less than 25km) optical cable maintenance that are expanding rapidly in the wire/wireless communications market. In the communications service environment where the optical cable spreads rapidly to the antenna tower, the OFIX is able to grasp the characteristics of the optical cable in one scan. This quickly tells the abnormal point, which enables maintenance and therefore fast restoration work. It is gathering attention as essential equipment for optical cable and system establishment and application.

Names and Functions of Parts

OFIX Interface

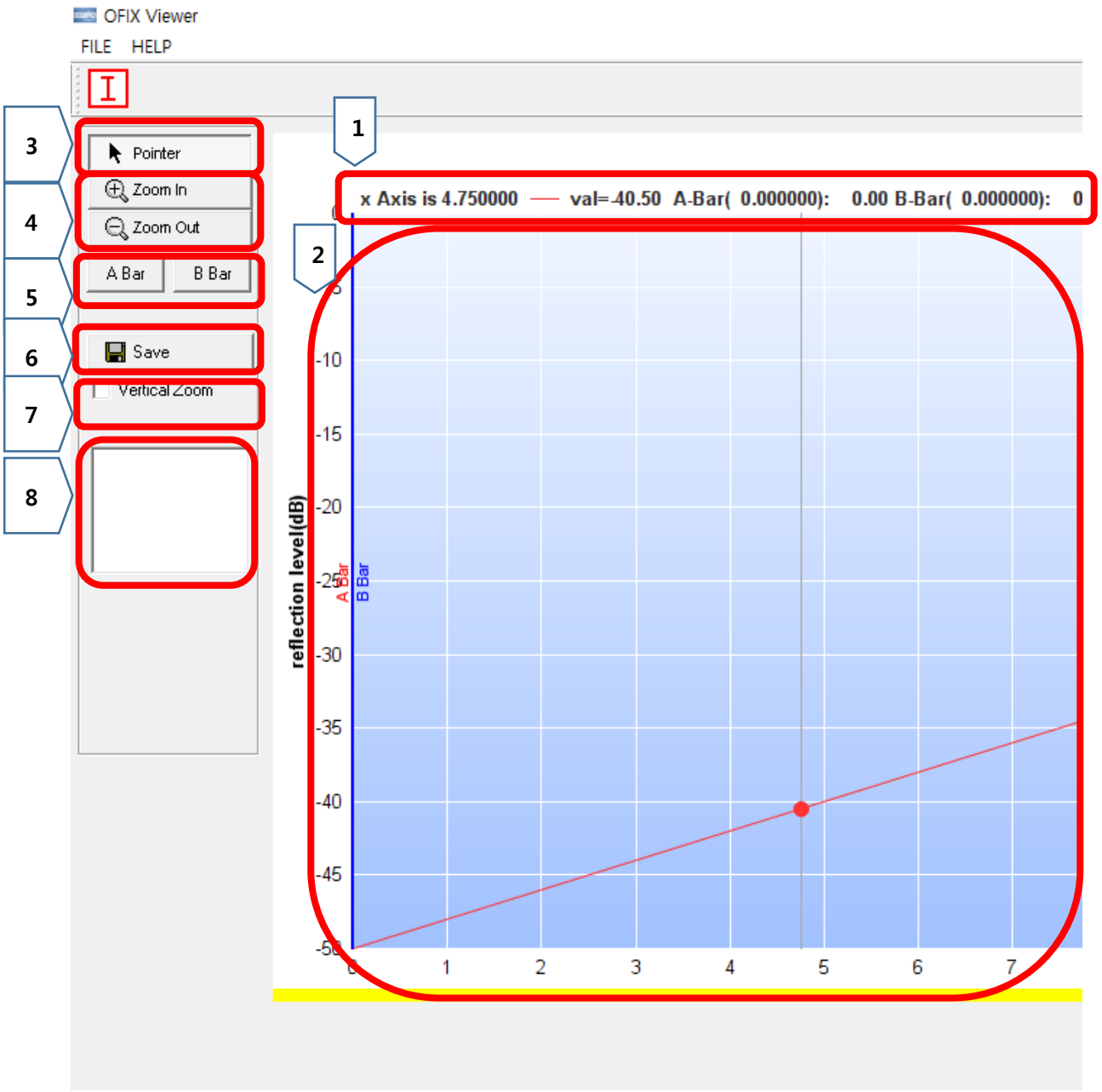
Num	Name	Description
1	***Power Switch***	*Power ON/OFF Switch*
2	***Port***	*Charging Port*
3	***LCD***	*Display Information*
4	***Refresh (Button)***	*Refresh State*
5	***Select (Button)***	*Select Wavelength*
6	***Parameter (Button)***	*Select dB/mW*

OFIX LCD



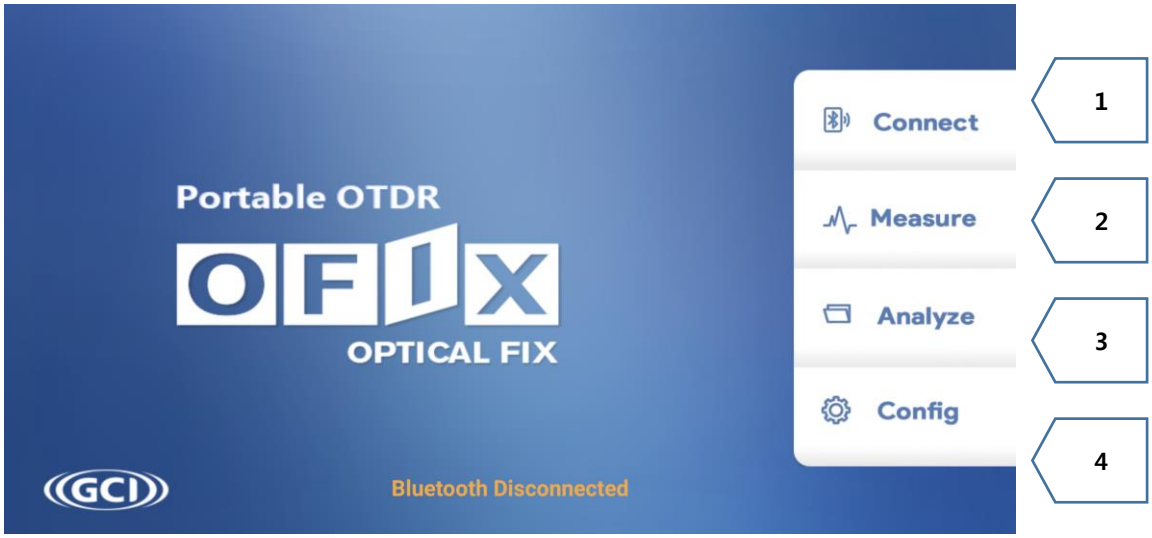
Num	Name	Display
1	***OFIX***	*Reading State*
2	***OTDR***	*OTDR MODE*
3	***OPM***	*OPM MODE*
4	***Bluetooth***	*Bluetooth Status*
5	***Battery***	*Power Indicator*
6	***Wavelength***	*Wavelength*
7	***Unit***	*Unit dB/mW*

OFIX Viewer (PC)



Num	Name	Description
1	***Info Panel***	*Display Distance and Loss*
2	***Trace***	*Trace Screen*
3	***Pointer***	*To move left or right*
4	***Zoom***	*Zoom In, Out*
5	***A, B Bar***	*To set Start position and End position*
6	***Save***	*Save as (JPG, BMP, PNG, PDF)*
7	***Vertical Zoom***	*To turn on Vertical Zoom*
8	***Note***	*To do some comments*

OFIX OTDR Mobile App (Android)

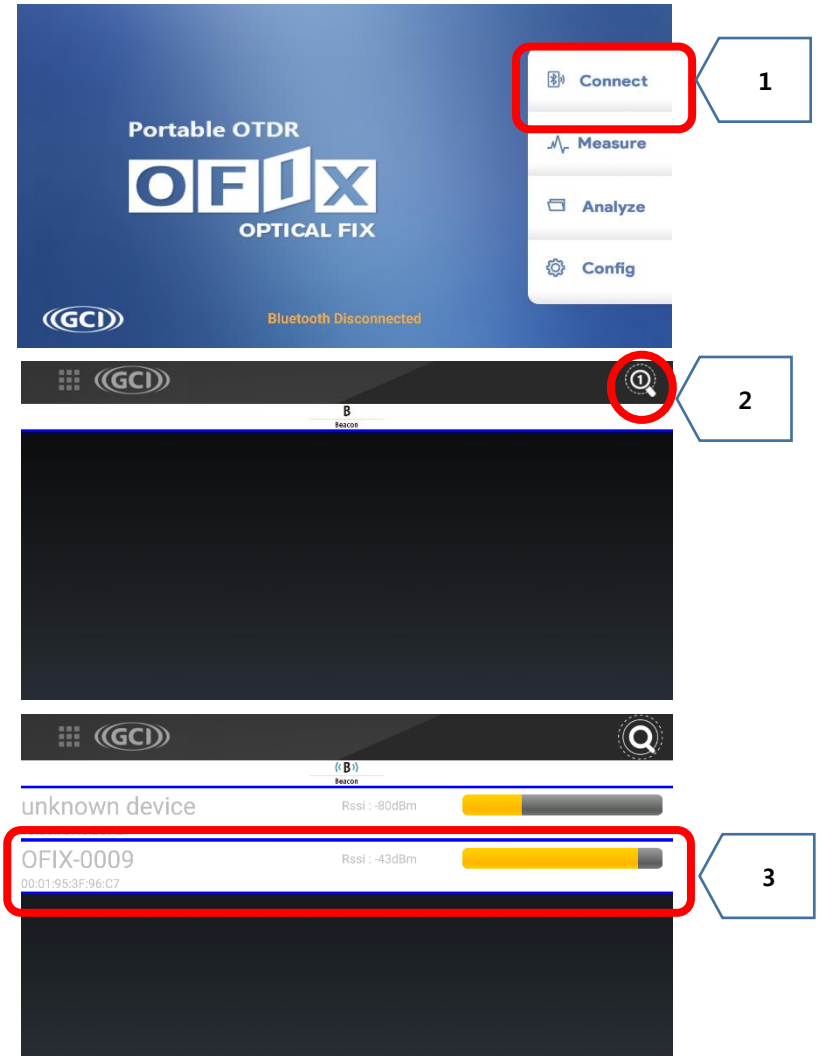


Num	Function	Description
1	***Connect***	*Choose & Connect to OFIX*
2	***Measure***	*ODTR Measure*
3	***Analyze***	*Analyze (to view saved SOR files)*
4	***Config***	*To View Settings.*

OFIX OTDR Mobile App (Connect)

Enter to **[Connect]** menu, press Find icon to display BLE devices around,

Choose your OFIX device (Bluetooth name is on the back side of OFIX platform)

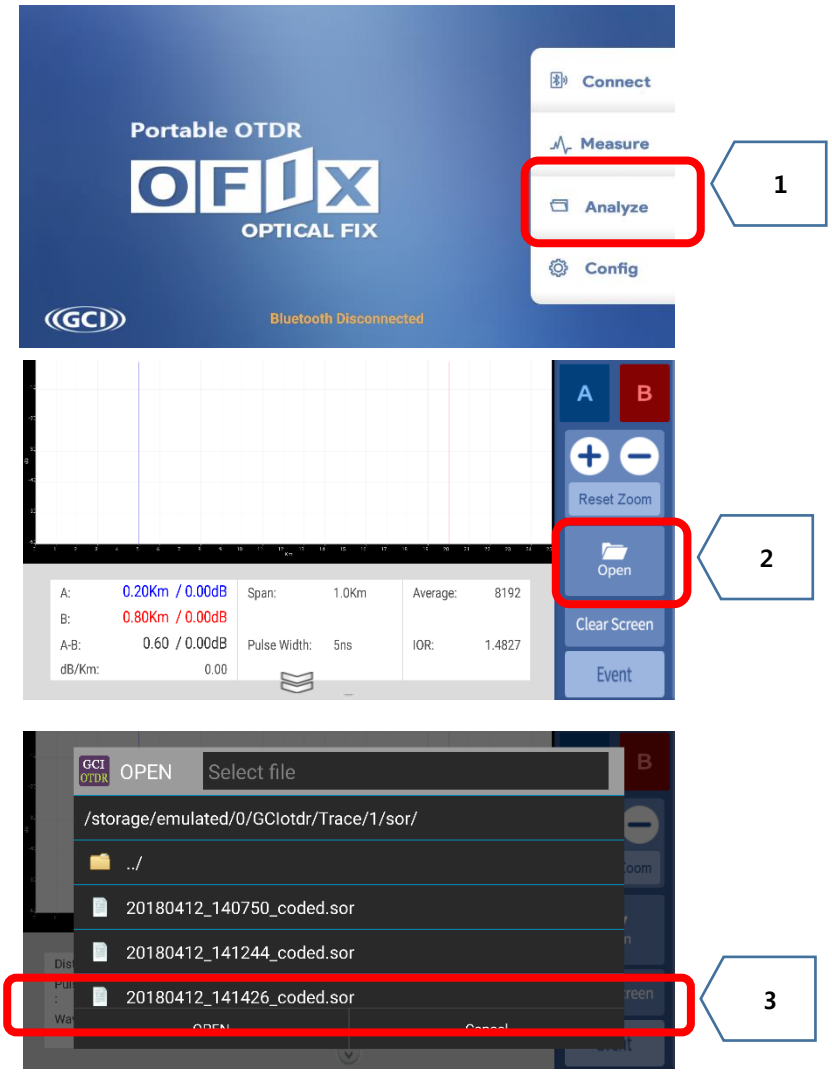


Num	Function	Description
1	***Connect***	*To enter Connect Menu*
2	***Find***	*To display Bluetooth devices*
3	***Choose***	*To choose OFIX we need*

OFIX OTDR Mobile App (Measure)

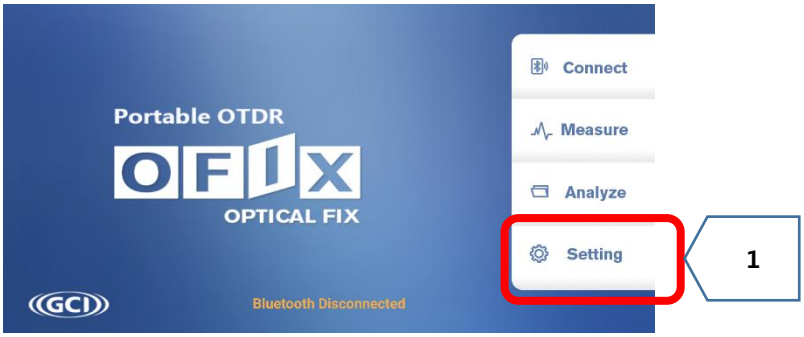
Num	Function	Description
1	***Measure***	*To enter Measure Menu*
2	***A, B bar***	*To choose distance or point we need*
3	***Zoom***	*To Zoom in/out or Reset Zoom*
4	***Measure Start***	*To start Measure using OFIX*
5	***Clear***	*To clear Screen*
6	***Info panel***	*Display event information*
7	***Trace screen***	*Display Trace graphically*

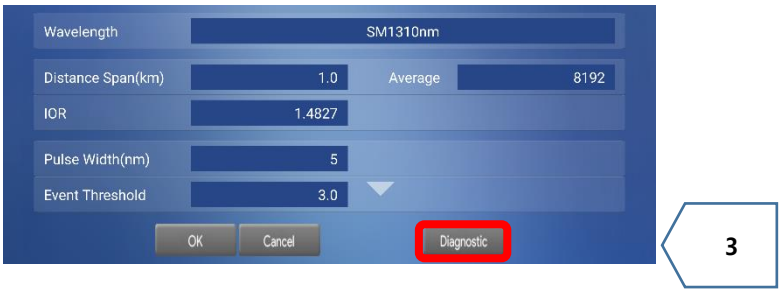
OFIX OTDR Mobile App (Analyze)



Num	Function	Description
1	***Analyze***	*To enter Analyze Menu*
2	***Open***	*To choose automatically saved SOR file*
3	***Choose***	*To open SOR file*

OFIX OTDR Mobile App (Setting)



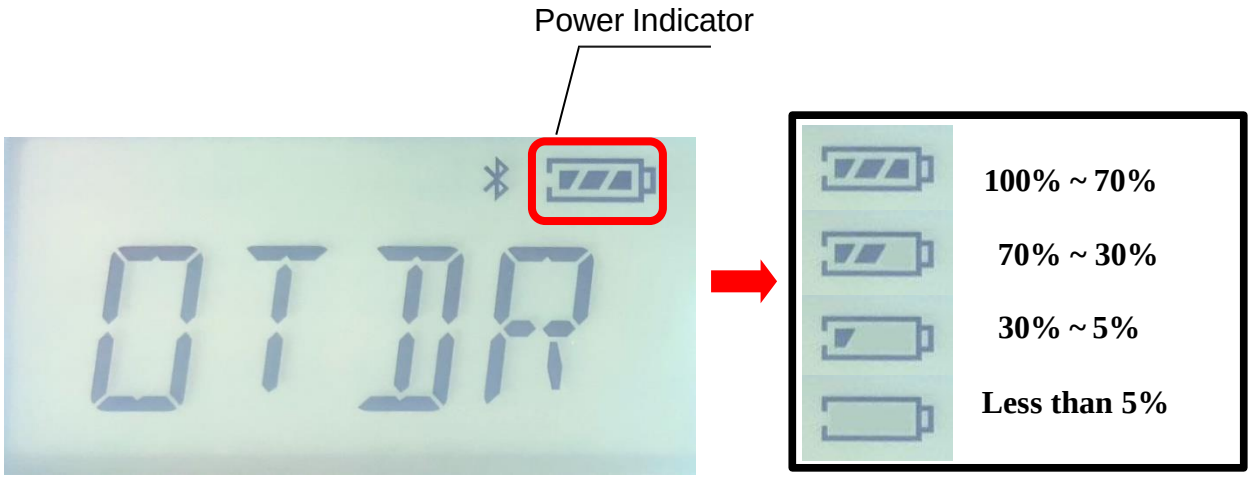


Num	Function	Description
1	***Config***	*To enter User Setting*
2	***User Config***	*To view User Setting*
3	***Diagnostic***	*To view H/W, S/W version*

Preparation

Turning on OFIX

1. Switch Power to turn on OFIX
2. Insert OTDR module
3. Information about POWER LEVEL and OTDR MODE will display on the screen.

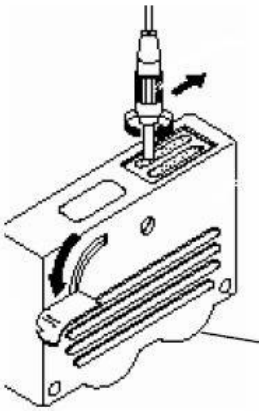


Caution

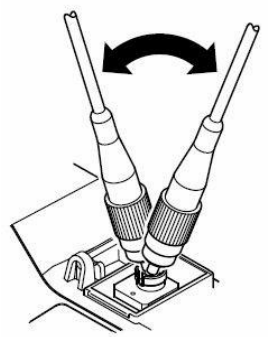
- In case of low power, OFIX will turn off automatically.
- If it has not been used for an extended period of time,
  after turned on OFIX to protect the internal battery, connect the AC adapter.
- Proper charging temperature is: -10~50℃,
  high charging temperature may shorten battery life.
- Charging time is about 5 hours with power on, about 3 hours with power off.
- Don't charge battery more than 8 hours.

Connecting the Fiber

1. *Before connect fiber to OTDR module, clean fiber end first*
2. *The dust which on the end of connector may damage the optical port or reduce test quality.*



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. Prepare the optical port of OTDR module.
6. Insect connector into optical port carefully.



Caution

1. Insect connector carefully into optical port
2. Unproper operation may damage of optical port.

Warning

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

Introduction of OTDR

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.

Content of Measurement

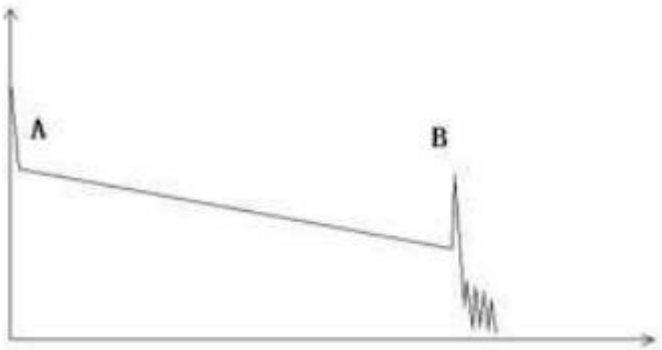
- Event position ----- a broken point or the end of the tested fiber
- Optical attenuation coefficient of an optical fiber
- Single event loss, such as the loss of a connection or a macro bending. Or the loss of an end-to-end line on the tested optical fiber

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 an 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 Jumper Connected

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 en point. After a maintenance of this line, use the OTDR test it again, we may see flection peak replacing the broken point on the OTDR trace, this shows the ıtenance 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 lunching 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.

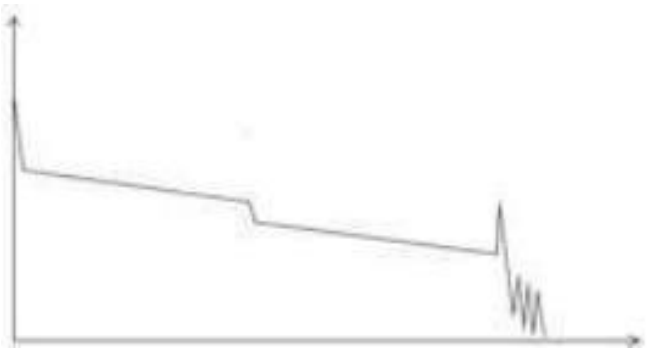
To fix this problem, we should:

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 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.

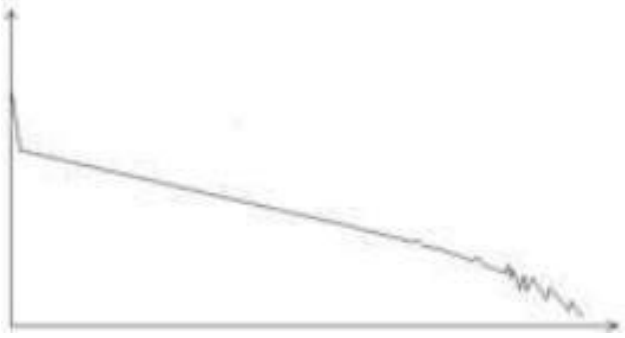
Sometimes, the loss value could be a negative value, it does not means the loss does not exist. It is common phenomenon called pseudo gain, it is by a connection of two fibers with different back scatter coefficient, the scatter coefficient of the back fiber is large than the front one's. In addition, the different refract 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 cannot support a long distance transmission or caused by an 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.

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.

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 an 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. The reflection level depends on the changing grade of refraction ratio.

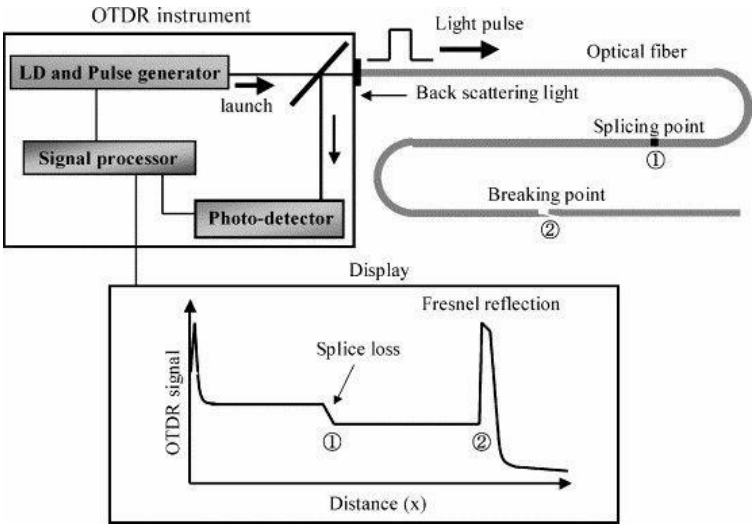
Formula of the distance: distance = (c/n) × (t/2)

*Here: **c** is the light speed traveled in vacuum (2.998×108m/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.



Event Type

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 an OTDR trace is the initial point. Under the default setup, Start-Event is located on the first event (usually it is a 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 an 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 an 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 an under-test fiber, receives the returned optical signal and starts calculating the distance from an 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.

Setting Measurement Conditions

Go to the 【**Measure**】 on the Main Screen of OFIX Mobile application.
Choose the parameter you need and set it.

The meaning of items indicated in the following table:

Span	Distance from start point to display end
Pulse Width	Pulse width of transmit signal
Average	Number of average
IOR	Index of Reflection

Setting to Auto Mode

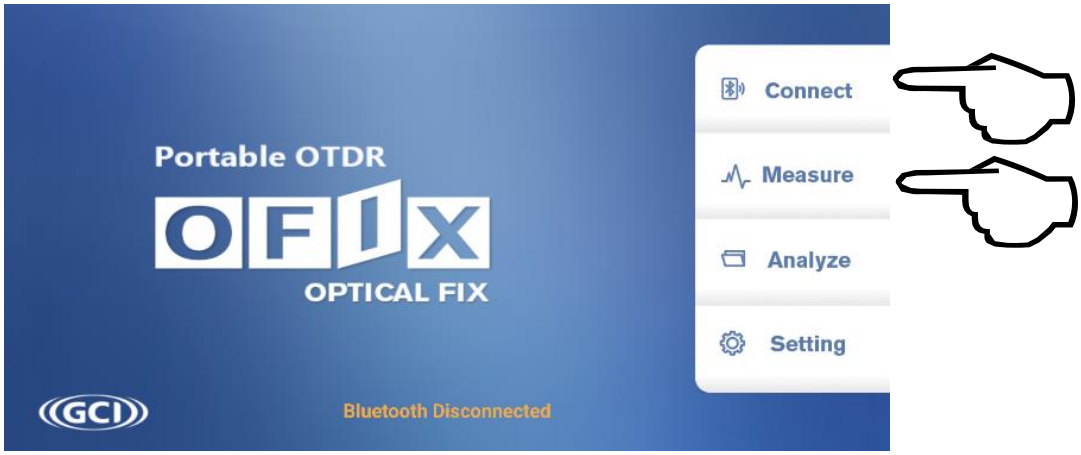
In Auto mode, you could just proceed test by setting proper wavelength.

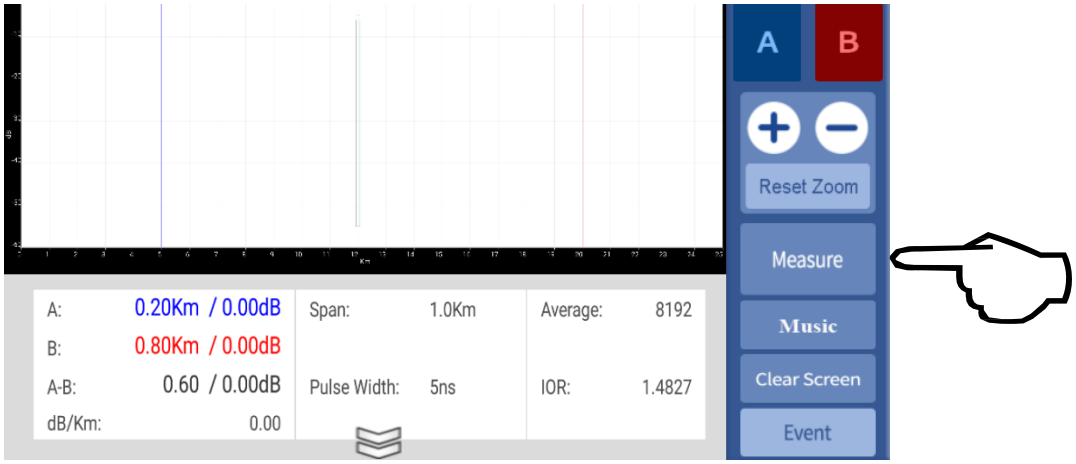
Setting to Manual Mode

In manual mode, user could set proper range and pulse width manually.

Making Measurements

1. Open the OFIX Mobile application on your smartphone
2. Press [Connect] button on Main Screen of OFIX Mobile application
3. Choose the OFIX you want to connect
4. Press [Measure] button on Main Screen of OFIX Mobile application
5. Then press [Measure] button again, to start OTDR Measure.





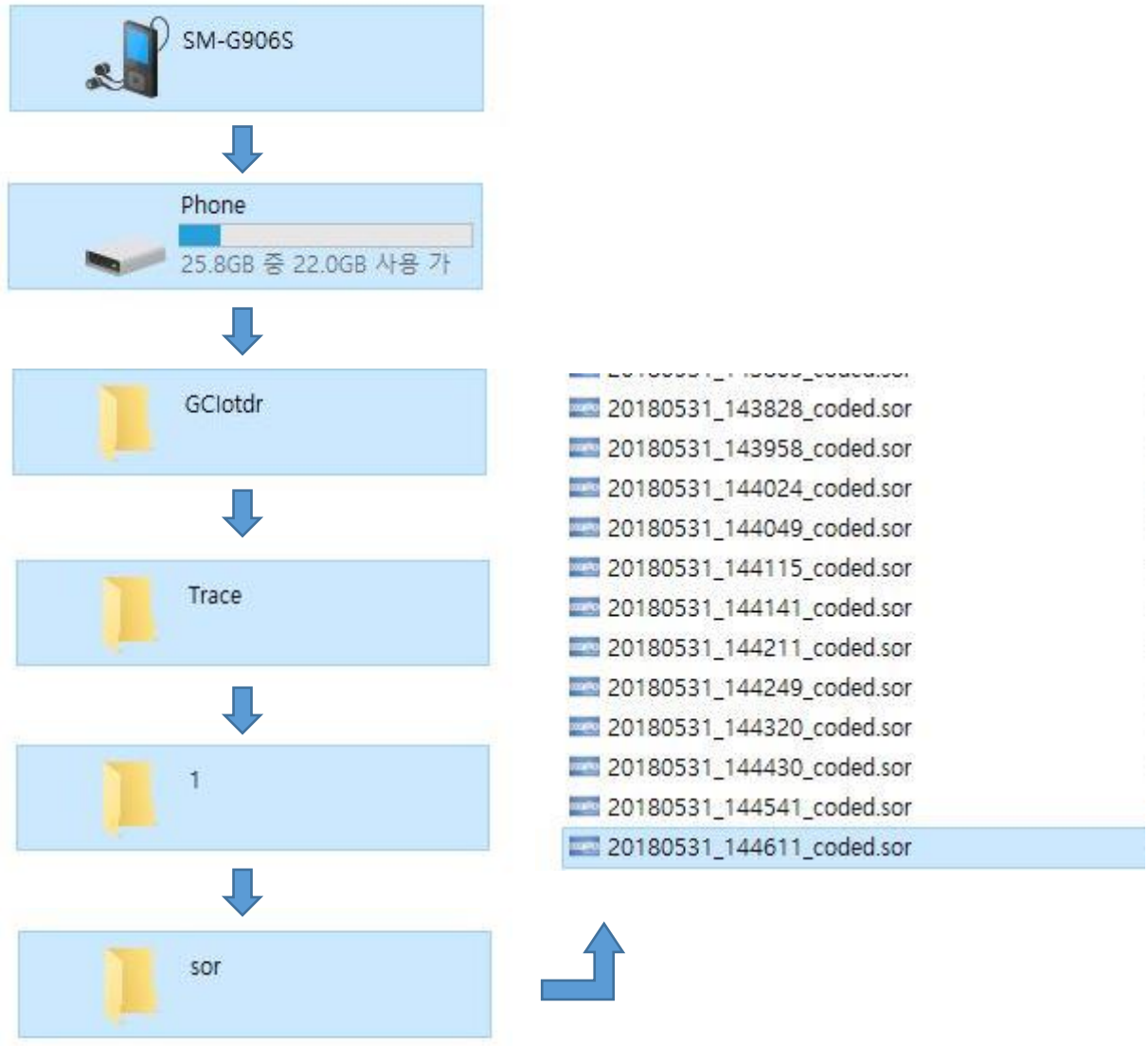
Distance and Loss Measurement

Measure the distance from one point to another.

1. Open the OFIX Mobile application on your smartphone
2. Press **[Measure]** button on Main Screen of OFIX Mobile application
3. Press [Measure] button
4. After Measurement was finished hold Blue bar and move it to the START point
5. Then hold Red bar and move it to the END point
6. Under the graphic we can see Distance and Loss Information

File Operation (OFIX Viewer)

1. Connect your smartphone to PC
2. Open smartphone folder
3. Go to Phone -> GClotdr -> Trace -> 1 -> sor
4. Choose the file you need
5. Click and open it



Distance and Loss Measurement using OFIX Viewer

1. When you choose and opened SOR file you need

2. Hold and move A, B bar to the point we want to measure

3. Above the graphic we can see the distance between A and B bar

4. Also we can see the Loss on that part of distance

Optical Power Meter Module (Optional)

OPM Module is used to quick get the power of terminal port.at site

1. Insert OPM Module
2. Press Refresh button
3. Set Wavelength
4. Set Unit

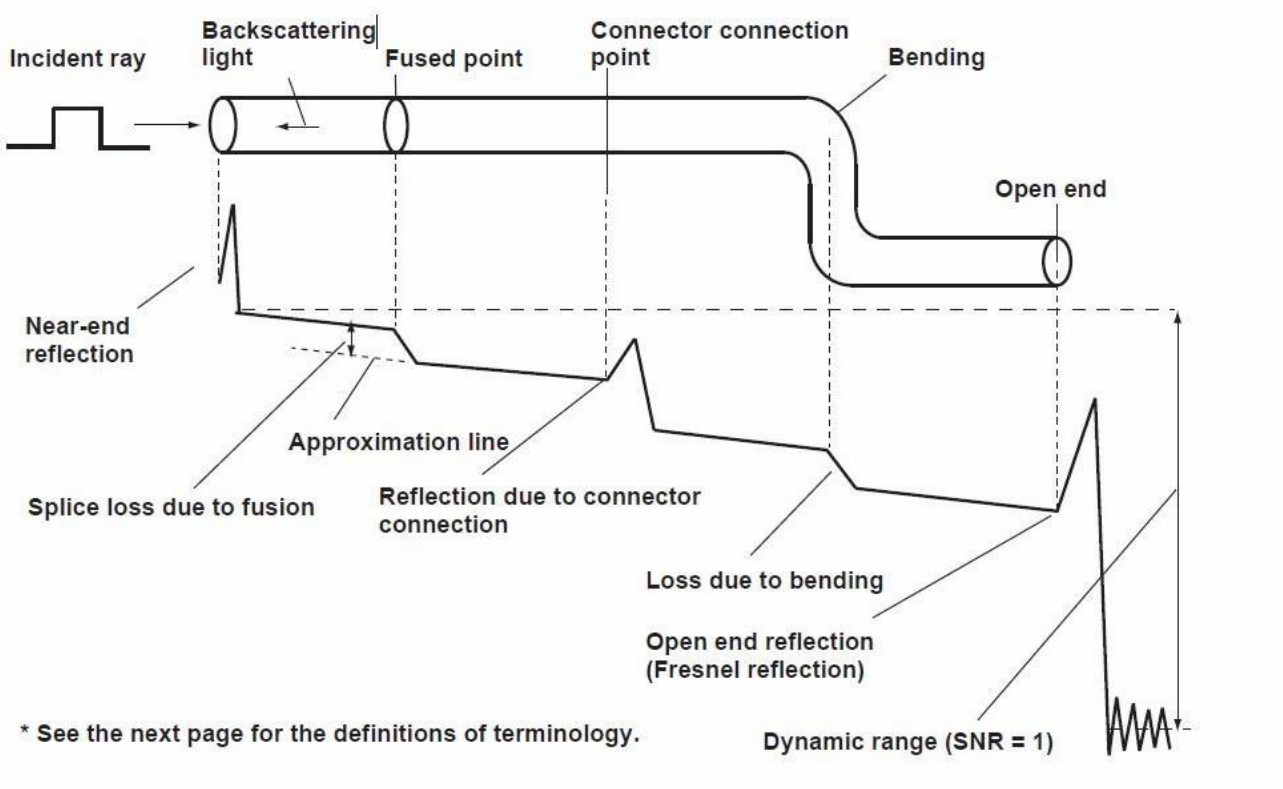
REFRESH *(Refresh state of OFIX)*

SELECT *(Switch Wavelength 850/1310/1490/1550 nm)*

PARAM *(Switch Unit dBm / mW)*

Background Information on Measurements

Viewing the Optical Pulse Measurement Waveform



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.

Back scattering light

When light propagates through the optical fiber cable, a phenomenon called Rayleigh scattering occurs due to the non-uniformity 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.

Diagnosis Center

FAQ

Fault	Reason	Solution
Can't turn ON	1.Power switch is broken 2. Run out of power/battery 3. No battery 4. Too cold	1. Replace a power switch 2. Connect external power / Replace a new battery 3. Install battery 4. Change another environment
Battery doesn't work properly	1. Temperature is too high 2. Battery is nearly broken	1. Try to decrease temperature 2. Replace a new one
Measuring graphic only has front end reflection	1. Connector loose, polluted, damaged or unmatched	1. Clean and reconnect
No response		Restart

Specification

Physical Parameter

Display	2.75" Custom LCD
Battery	7.4V Lithium-Polymer (with CE certification) Continuously test: 8 hours Charging time: 4 hours
Data Storage	Up to smartphone memory
Interface	TBD
Working Temp	- 10℃~+ 50 ℃
Storage Temp	- 20℃~+70 ℃
Humidity	≤ 95% (non-condensation)
Dimension	188(L) × 102(W) × 37(D) mm / 0.55 kg (battery included)
Accessories	Main unit, Power adapter 9V/2.5A, Carrying Box, Carrying Bag, Bumper Case, Manual, OFIX OTDR Mobile App, OFIX Viewer (PC)

OTDR Module

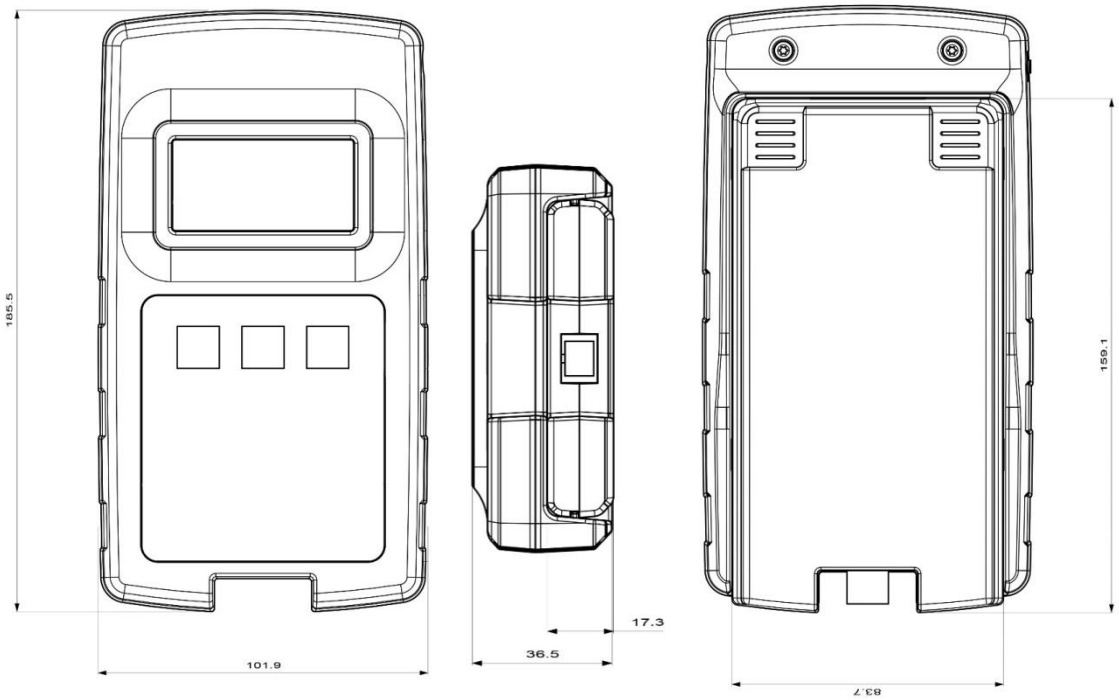
Type	Testing wavelength	Dynamic range①	Event/Attenuation dead-zone②
GOM20	**1310 / 1625 nm**	**25 dB**	**2 / 5 m**

Pulse width	5ns, 10ns, 20 ns, 50ns, 100ns, 200ns, 500ns, 1us, 2us, 5us, 10us
Testing distance	500m, 1 km, 5km, 10km, 20km, 30km, 40km, 50km
Sampling resolution	2.5m
Sampling point	12,000 point
Linearity	≤0.05dB/dB
Scale indication	X axis: 4~70m/div, Y axis: 0.09~5dB/div
Loss threshold	0.01dB
Loss resolution	0.001dB
Distance resolution	2.5m
Distance accuracy	±(1m+measuring distance x3x10^-5+sampling resolution) (excluding IOR uncertainty)
Refractivity Setting	1.2000~1.5999, 0.0001 step

OPM Module (Optional)

Wavelength Range	1100 ~ 1620 nm
Calibrated Wavelength	1300, 1310, 1490, 1550, 1625, 1650nm
Test Range	-60 ~ +5 dBm
Resolution	0.01dB
Accuracy	±0.35dB ± 1nW
Modulation identification	TBD

Dimension



Unit: mm

Warranty

Terms of Warranty

All Company 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 Company free of charge. In no case will Company liabilities exceed the original purchase price of the product.

Warranty period is one year from the date of shipment to the original customer.

Exclusions

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

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

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

Customer Service and Support

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MANUFACTURER : GCI Inc.

Made in Korea

General Communication Instruments