

1000M Ethernet Tester

User's Manual

All rights reserved.

1 Notices

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Our company[®] as governed by international copyright laws.

2 Warranty

The material contained in this document is subject to change without notice. Our company[®] makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Our company[®] shall not be liable for errors contained herein or for incidental or consequential damages in connection with furnishing, performance, or use of this material.

The battery is a consumable part and is not subject to the instrument warranty.

ISO9001 Certification

Produced to ISO9001 International Quality System Standard as part of Our company[®], objective of continually increasing customer satisfaction through improved process control.

3 Safety Instructions

During each stage of operation of this instrument, please always observe the following safety instructions. Not taking any safety precautions or following the instructions will violate the safety standards of design, manufacturing and application of these instruments. In no case will Shineway Technologies bear the responsibilities for consequences incurred by violation of the following instructions.

GENERAL

This product is a Safety Class 3 instrument. The protective features of this product may be impaired if it is used in a manner not specified in the operation manual.

Environmental conditions

This instrument (excluding AC / DC adapter) is Class II safety equipment, suitable for use in outdoor environments pollution degree 2 and at the maximum relative humidity 93% (non-condensing). For the AC voltage requirements and operating environment temperature, please refer to the Technical Specifications.

Before applying power

Verify that the product is set to match the available line voltage, the correct fuse is installed, and all safety precautions are taken. Power requirements:DC 24V/4A.

Do not operate in an explosive atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do not remove the instrument cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified service personnel.

Instrument that appears damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Safety Terms Used in This Manual

WARNING!

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personnel injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION!

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or the entire product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Laser Safety Notes

WARNING!

- This instrument is a laser instrument. Users should avoid looking directly into the optic output. And the use of microscope or magnifier should also be avoided, for the use of such devices can focus a highly intense beam onto the retina, which may result in permanent eye damage.
- Please pull out the SFP modules after using the instrument and make sure to put on the dust cap.

Electric Safety Announcements

If need to assure instrument thorough outage, please pull up power line and take the battery out

WARNING!

- ◆ AC/DC adaptor should be used only indoors.
- ◆ The ambient air of this instrument should be free flow.

- ◆ Any using of electric tools near inflammable gas or smog will be a big safety threat.
- ◆ In order to avoid electric shock, please don't use instrument if there is damage on any outside surface part(top cover, panel, etc)
- ◆ Only qualified professional staff can do electrified adjustment, maintenance and repair to the operating instrument.
- ◆ Even the power is cut off; the capacity in the unit might be electrified in some time after that.

Table of Contents

1	Notices	1
2	Warranty	1
3	Safety Instructions	2
	Electric Safety Announcements.....	3
1	Overview	8
	1.1 Contents of the Manual.....	8
	1.2 Product introduction	8
	1.3 Diagram of the product	9
	1.4 Indicators on front panel	9
	1.5 Keys on the front panel	10
	1.6 Port descriptions	11
	1.7 Descriptions of power source.....	13
	1.8 Uses of rechargeable battery.....	13
2	Basic operations for the device	14
	2.1 Starting up or closing the device.....	14
	2.2 Selecting test mode	14
	2.3 Opening/hiding port information bar	15
	2.4 Starting application program	16
	2.5 Starting/stopping testing	16
	2.6 Test report	17
3	Common information setting of the system	18
	3.1 System settings.....	18
	3.1.1 System information	18
	3.1.2 System time/date setting	19
	3.1.3 Optional functions	20
	3.2 Network settings	20
	3.3 Screen calibration	21
	3.4 Power manager	21
	3.5 Storage manager	22
	3.6 System update	23
	3.7 Helps.....	23
4	Testing parameters and common parameter configuration	25
	4.1 Test mode settings.....	25
	4.2 Port setting.....	25
	4.3 Network setting	26
5	Bert	28
	5.1 Configuration of Bert testing parameters	28

5.1.1	Global setting	28
5.1.2	Frame setting.....	29
5.1.3	Traffic settings.....	34
5.1.4	Receiving filter setting	37
5.1.5	Remote control setting.....	38
5.2	Bert testing results.....	39
5.2.1	Abstract.....	39
5.2.2	Errors	40
5.2.3	Warning	42
5.2.4	Traffic statistics.....	43
5.2.5	Events	44
6	RFC 2544.....	46
6.1	Configuring RFC2544 testing parameters	46
6.1.1	Global setting	46
6.1.2	Frame settings.....	47
6.1.3	Throughput setting	49
6.1.4	Delay setting	49
6.1.5	Frame loss setting.....	50
6.1.6	Back-to-back setting.....	51
6.1.7	Remote control setting.....	51
6.2	RFC2544 testing results	53
6.2.1	Abstract.....	53
6.2.2	Throughput.....	53
6.2.3	Delay	54
6.2.4	Frame loss	54
6.2.5	Back to back	55
6.2.6	Events	55
7	Traffic Generation.....	57
7.1	Configuring multi-traffic testing parameters	57
7.1.1	Global setting	57
7.1.2	Frame setting.....	58
7.1.3	Traffic setting.....	58
7.1.4	Remote control setting.....	59
7.2	Testing results of traffic generation	60
7.2.1	Abstract.....	60
7.2.2	Errors	60
7.2.3	Warning	61
7.2.4	Traffic statistics.....	62
7.2.5	Time delay statistics	63
7.2.6	Events	63
8	Y.1564.....	65
8.1	Configuring Y.1564 testing parameters	65

◆ 8.1.1 Global configuration	65
◆ 8.1.2 Frame setting.....	66
◆ 8.1.3 Business setting	67
◆ 8.1.4 Step setting	68
◆ 8.1.5 Remote control setting.....	68
8.2.Y.1564 testing results	69
◆ 8.2.1 Abstract.....	69
◆ 8.2.2 Testing result of business configuration	70
◆ 8.2.3 Testing result of business performance.....	71
◆ 8.2.4 Events	72
9 Loopback.....	73
9.1 Global setting.....	73
9.2 Loopback filtering setting.....	74
9.3 Result abstract	74
10. Ethernet testing tool	76
10.1 Ping.....	76
10.2 Discovery	77
10.3 Trace Route	77
11. Guides of common problems to the instrument.....	79
11.1 Incomplete displaying information or not finding the interface closing button on the top of the interface.....	79
12. Warranty Information	79
Terms of Warranty	79
Exclusions.....	79
Warranty Registration.....	79
Returning Instruments.....	80

1 Overview

1.1 Contents of the Manual

Thank you for choosing our product. Please read this Manual carefully, especially warnings and cautions before using the product, in case of the user's personal injury or damage to instruments because of ill usage.

This Manual includes the essential information on correct operations and maintenance of product, as well as guides to troubleshooting, technical services and support.

1.2 Product introduction

This product is a site testing tool designed for the next generation of metropolitan area network (MAN) and IP bearer network, and also is a complete testing solution aiming at voice, data and video services carried in Ethernet. It can support the traditional SONET/SDH testing functions and expand these functions to the next generation of network services based on IP and OTN, so that it can provide all kinds of testing functions simultaneously by integrating them in one platform.

Design features:


- Portable, compact and durable; flexibly used for lab environment and outdoor sites;
- Applied in any light conditions, with high-resolution color touch screen;
- Clear and simple in the operating mode with graphical user interface, touch screen and navigation keys;
- Support PC remote control management;
- Provide smart detection and far-end control to realize online testing;
- Provide import and export of testing configuration files, testing historic records and test report generation; allow engineers to master testing process and gain testing results timely through FTP or USB interface transmission;
- Have more overall Ethernet test functions, as well as RFC2544 and Y.1564 testing functions;
- Built-in high-capacity lithium batteries allow 4-hour continuous testing, with real-time display of battery capacity.

Functional features:

- Support two 10/100/1000BASE-T RJ45 electrical ports, two 100/1000BASE-X SFP optical ports;
- Can generate a traffic of 10M-1000M;
- Support Layer 1-4 bit error rate testing;
- Support up to 10-stream traffic generation for multi service testing;
- Support standard RFC2544 testing, including throughput capacity, time delay, back to back and frame loss;
- Support standard Y.1564 testing;
- Support VLAN testing and priority configuration, as well as VLAN Q-in-Q testing;

- Support MPLS testing and 3-level MPLS nest testing;
- Support service disruption time test (SDT);
- Support CoS and ToS/DSCP service priority testing;
- Statistical test data analysis;
- Support IP testing and testing of network connectivity;
- Can capture and analysis of all kinds of data packages;
- Support intelligent detection and remote loopback testing;
- Support alternative multi-functional modules.

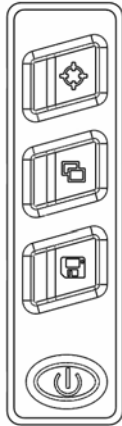
1.3 Diagram of the product









: (Power switch) The key plane is lower than other ones, in case of any maloperation.





1.4 Indicators on front panel

Indicator	Indicator state	Description
Power indicator (LED lighting on the left)	Red, normally on	Shutdown for recharging
	Yellow, normally on	Starting up and recharging
	Yellow-green blinking	External adapter for power supply
	Green, normally on	Battery powered
Alarming indicator (LED lamp on the right)	Off	Shutdown state
	Green blinking	Normal operation of procedures

1.5 Keys on the front panel

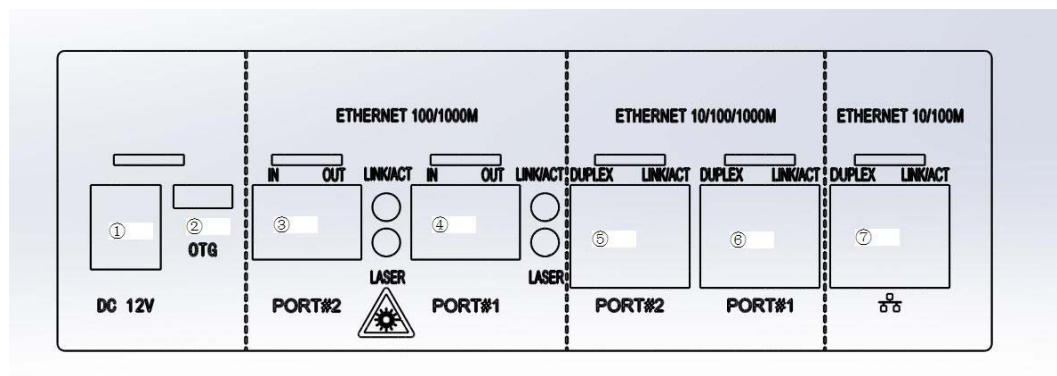


Key name	Functional description
	Power button; see the shutdown interface by pressing it for a short time after starting up, and forced shutdown available by pressing it for a long time;
	Backlight key, adjusting backlight brightness;
	Screen shot by pressing for a short time, and screen calibrating interface by pressing for a long time;
	Interface switchover
	Storing test reports
	Up-down key
	Left-right key
	Confirm
	None

Key name	Functional description
	Starting testing; stopping switchover
	Delete a character before cursor, and delete continuously by pressing for a long time;
	Delete the character(s) selected with cursor;
	Digital, letter and symbol input keys in 0—9, a-z, and 0-9, as well as such characters as *, +/- and #.displayed on the keys

1.6 Port descriptions

Ports on the top



No.	Interface name	Description
①	Ethernet electrical interface	10/100/1000M electrical interface connecting RJ-45 connector
②	1G Fiber Ethernet optical interface	1G Fibere optical interface connecting SFP+ connector
③	1000M Ethernet optical interface	1000M optical interface connecting SF connector
④	USB slave port	Data transmission for device and computer
⑤	USB main interface	Connect USB storage device
⑥	Electrical interface	10/100M electrical interface connecting RJ-45 connector

No.	Interface name	Description
⑦	Audio output interface	Connect earphone
⑧	Audio input interface	Connect microphone
⑨	Power interface	External power source adaptor

Interface indicator

Interface indicator of Ethernet

Indicator	Indicator state	Description
DUPLEX	On	Full duplex mode
	Off	Half duplex mode
	Blinking	Clash detected
LINK/ACT	On	Ethernet link connected
	Off	Ethernet link open
	Blinking	Signal transmitting

Interface indicator of Ethernet

Indicator	Indicator state	Description
LINK/ACT	On	Link connection
	Off	Link breaking
	Blinking	Signal transmission
LASER	On	Laser on
	Off	Laser off

WARNING!

Watching out visible laser radiation: the invisible laser can be emitted out to optical port at a variable interval in the testing of optical fiber system; be careful of your eyes not to see the open optical fiber, optical interface, optical connecting point and other light sources; otherwise, your eyes may be injured because of transmissive laser.

- Don't look in the eye the laser output port in device operation;

- Pull out the optical module and put on the dust cap after operation.

1.7 Descriptions of power source

Following power sources may be applied for this device:

- AC adaptor (connected to standard power socket – only for indoor use);
- Li-ion rechargeable batteries (Auto power supply after disconnecting AC adaptor);
- Battery cover should be well closed during operation;
- May switch over between AC adaptor and battery supply, no hindering operation;
- Built-in Li-ion battery is automatically recharged after connecting AC/DC adaptors;

Only when Li-ion battery runs out of power, the instrument will automatically shut down or doesn't work in the following conditions:

Starting up

- Buzzing alert occurs and stops after one minute continuous alerting when the battery is at less than 15% of its capacity in use; the warning indicator on the panel becomes red. When its electrical capacity is seriously insufficient, the battery symbol on the screen becomes red (indicating low voltage), and the device may shut down automatically.
- The instrument may not start up normally in use if the long-term idle work non-work causes insufficient capacity of the batteries. In this case, start up after connecting the power adaptor, and recharge the batteries simultaneously.

1.8 Uses of rechargeable battery

- Renewable built-in Li-ion rechargeable batteries for this product;
- Recharge exhausted batteries around four hours;
- When the instrument is recharged by the AC/DC adaptor, the left power indicator on the front shell of the instrument becomes red and normally on (shutdown state), or becomes yellow and normally on (starting up state). The indicator is blinking after recharged;
- Recharging state is displayed on the liquid crystal screen after the instrument is starting up and recharged.

NOTE

The power-up battery for this product is the rechargeable Li-ion one; if the device is idle for a long time, the battery should be recharged to 50-70% before it is stored.

CAUTION!

Don't allow battery to contact fire and strong heat; don't unpack battery or connect the battery positive and negative poles in a short circuit.

2 Basic operations for the device

The basic operations will be described in this section, and the detailed usages should be described in the following chapters of this Manual. Please read this Manual carefully in order well to apply this product. If you have any question in use, please feel free contact technical support personnel of our company or agents.

2.1 Starting up or closing the device

Starting up the device:

Press down " (Power switch) key till the power LED is on in the front panel.

Closing the device

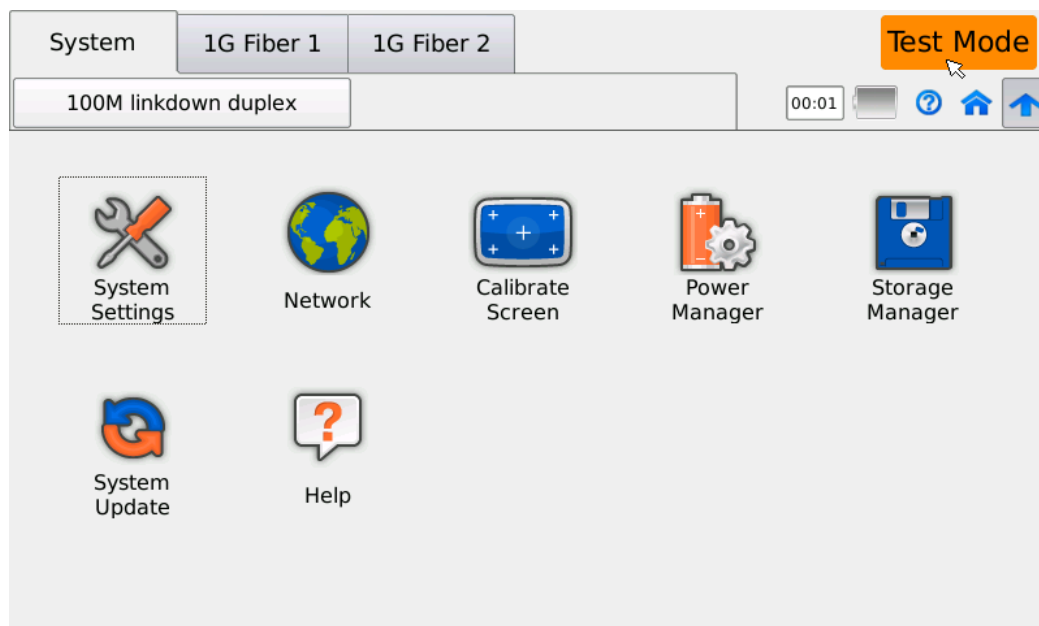
Press down " (Power switch) key till the shutdown menu is displayed on the interface, selecting shutdown, i.e. starting shutdown procedure.

NOTE

Turning off the device refers to turning off the power supply of testing module and platform. When starting up next time, the device will carry out the complete restarting procedure.

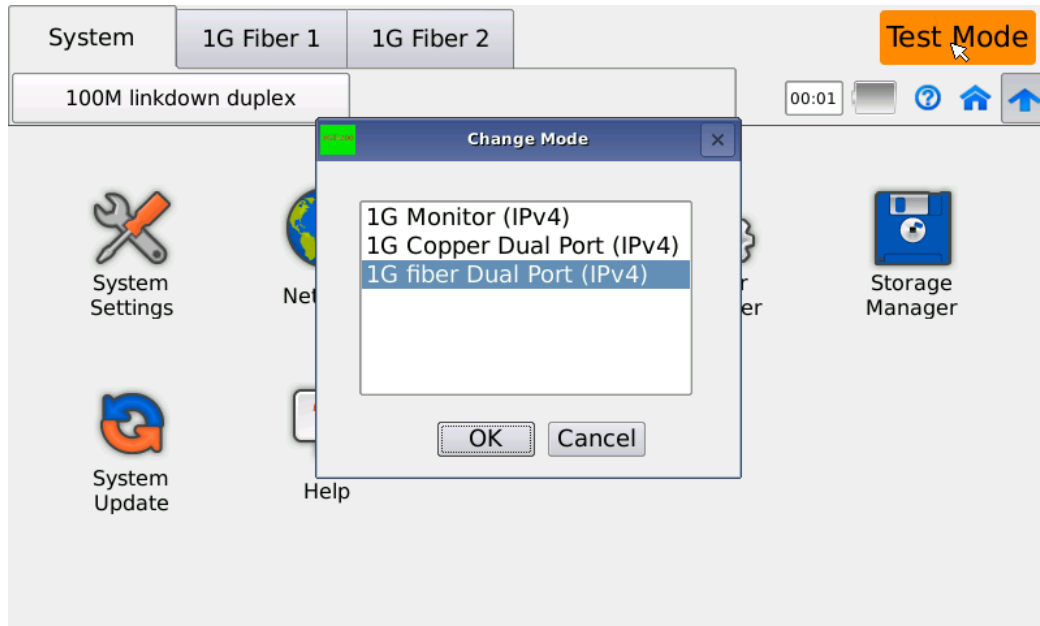
2.2 Selecting test mode

After the device starts up and is powered on, the system will start main procedure automatically and comes into the system main interface, as shown in the following figure.



The system main interface

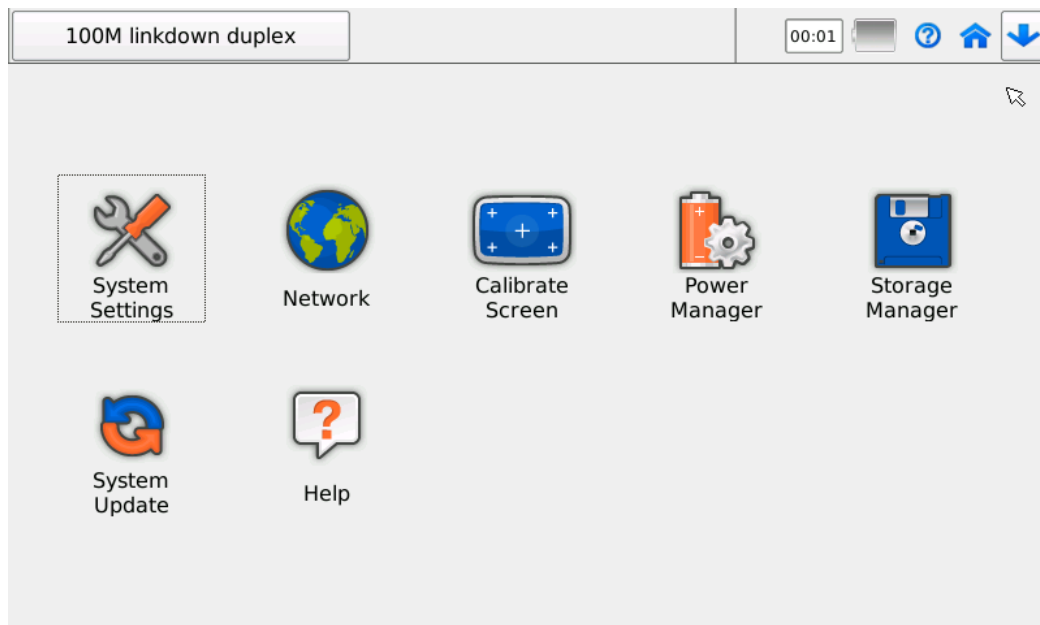
Select the test mode by clicking the 'Test Mode' on the top right corner.

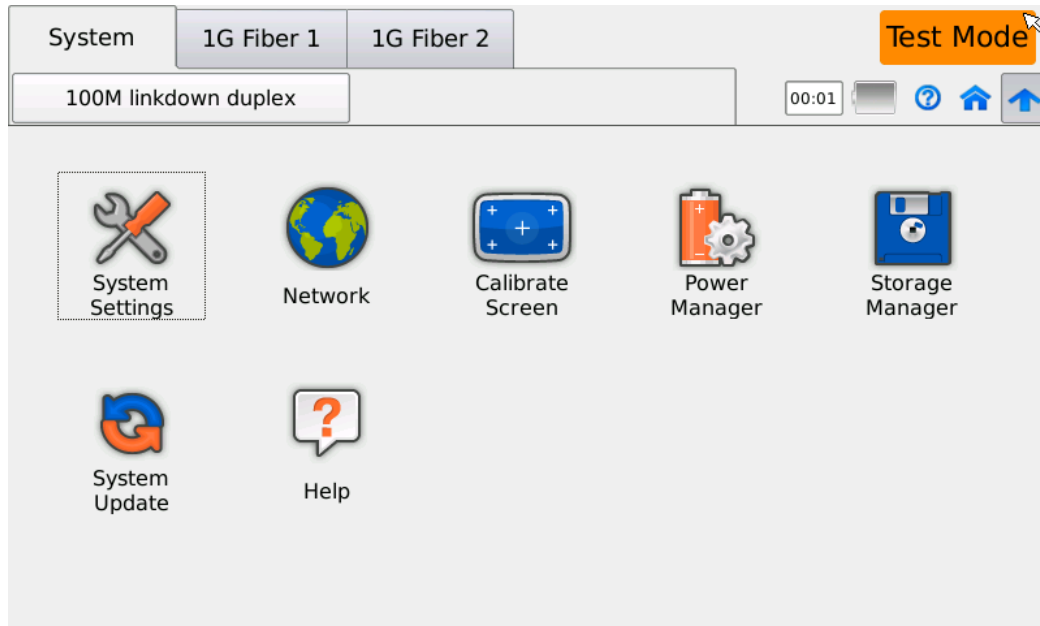


Switching over test mode

2.3 Opening/hiding port information bar

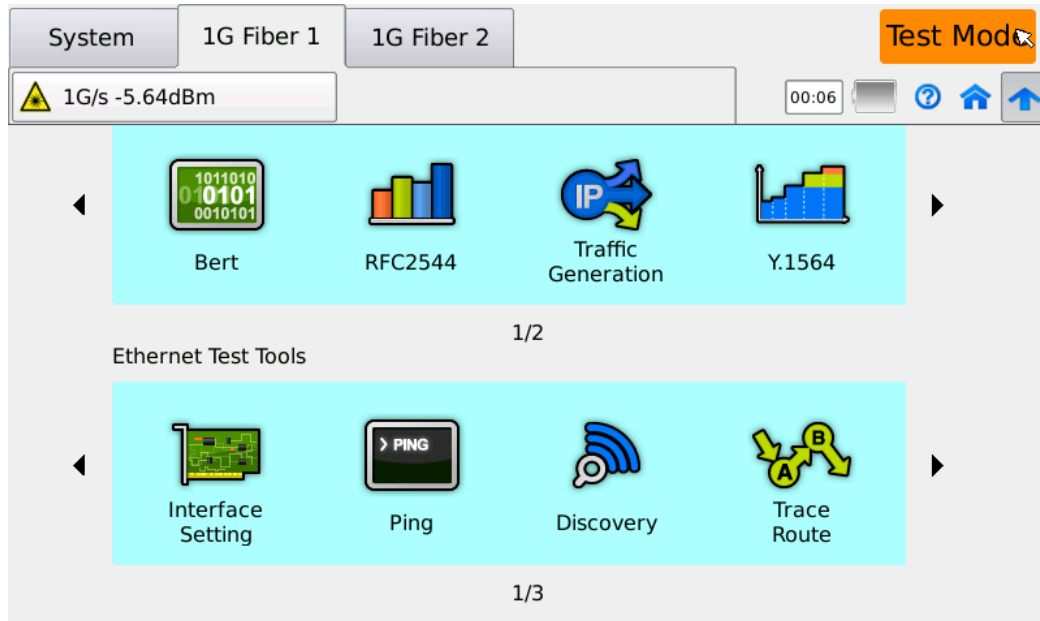
Hide the port information bar by pressing the icon [↑] on the top right side in the tool bar referring to the system main interface; unfold the port information bar by pressing [↓] in the hiding state. This function is applicable for all interfaces of this device. The effect of the hiding port information bar in main interface is shown in the following figure.





2.4 Starting application program

Click corresponding testing port in system/testing port Tab on the top left side of the system main interface, then enter testing main interface of this port; enter the following interface by clicking '1G Fiber1'.



Start any testing application program on this interface; click corresponding icon and enter the applied global setting interface.

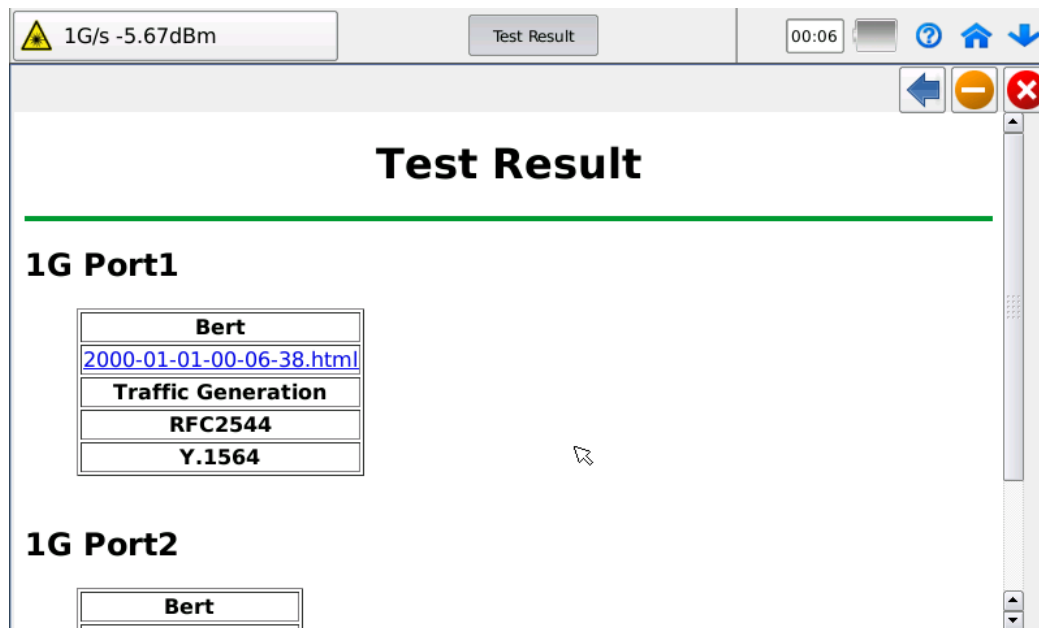
2.5 Starting/stopping testing

After opening test application program, the Start/Stop button appears on the tool bar on the right of the interface. Click Start to start up before testing; stop the test by clicking Stop in the testing process.

2.6 Test report

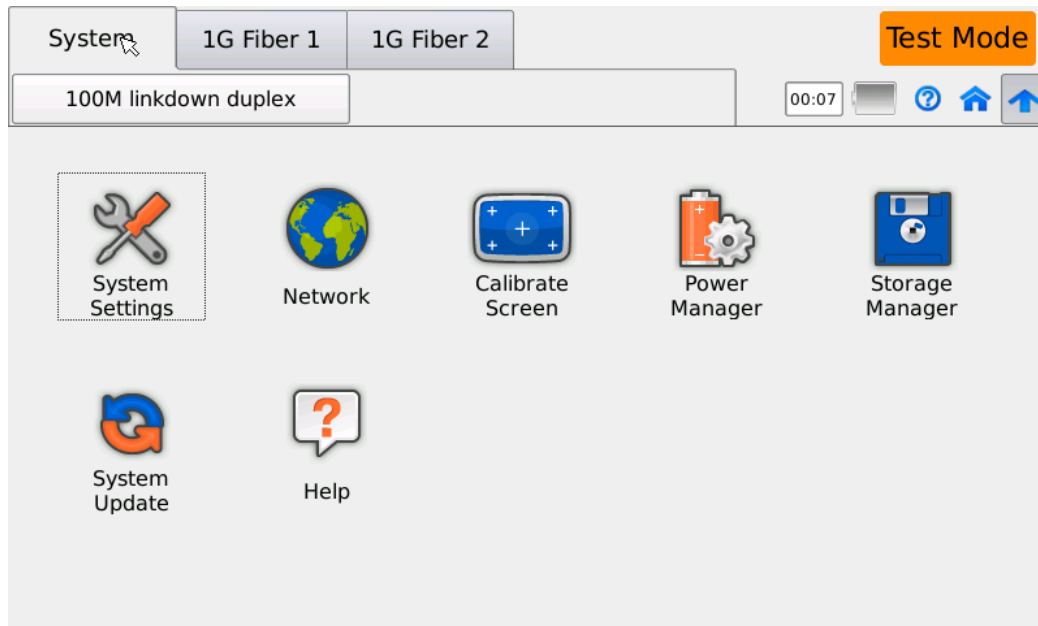
Besides loopback, other testing application programs may generate test reports after testing. Click Storage button on the right of the tool bar, and store relevant settings and testing results as test reports for this testing, where, the reports are stored in an html format, and default names are the present time.

As for the stored test reports, click the Test Report in the test tool on the testing main interface, and open and check in the corresponding testing application category.



3 Common information setting of the system

Enter the system interface after starting up; the system main interfaces mainly include the following seven buttons: [🔧] System, [🌐] Network, [📺] Calibrate screen, [🔋] Power manager, [💾] Storage manager, [🔄] System update, [?] Help; browse or set relevant information by single click above any button.



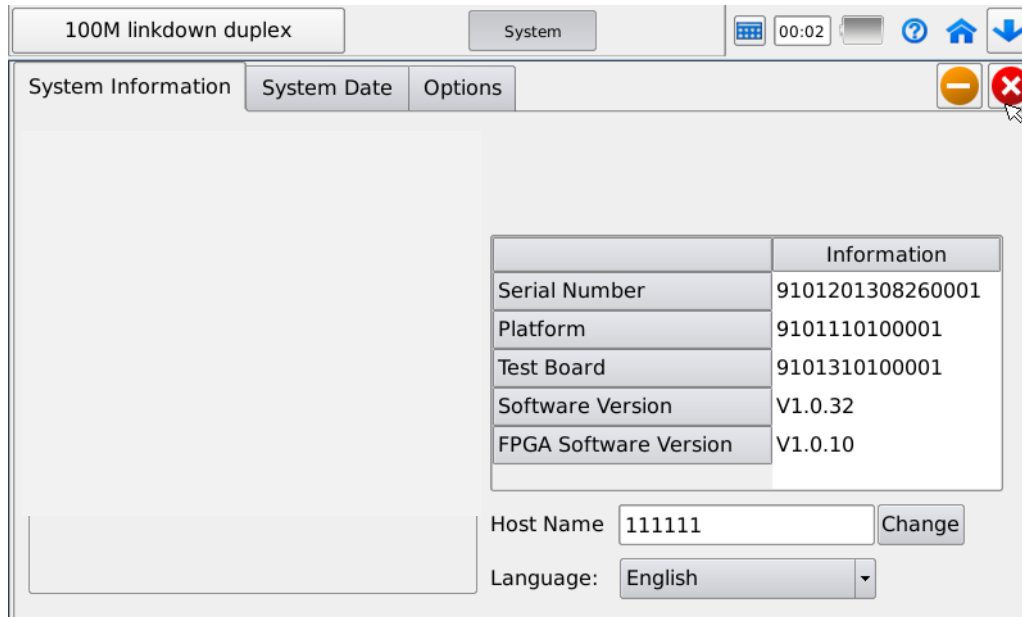
System main interface

3.1 System settings

In the main interface after starting up, press on the icon button [🔧] and enter the system interface, including system information, time/data setting, and introduction to optional functions.

3.1.1 System information

Browse contact information, product hardware and software version information, main machine name and system language information of Shineway Tech Headquarters Service Center, as shown in the following:



System information setting

On the right side is the contact information of the Our company Headquarters Service Center;

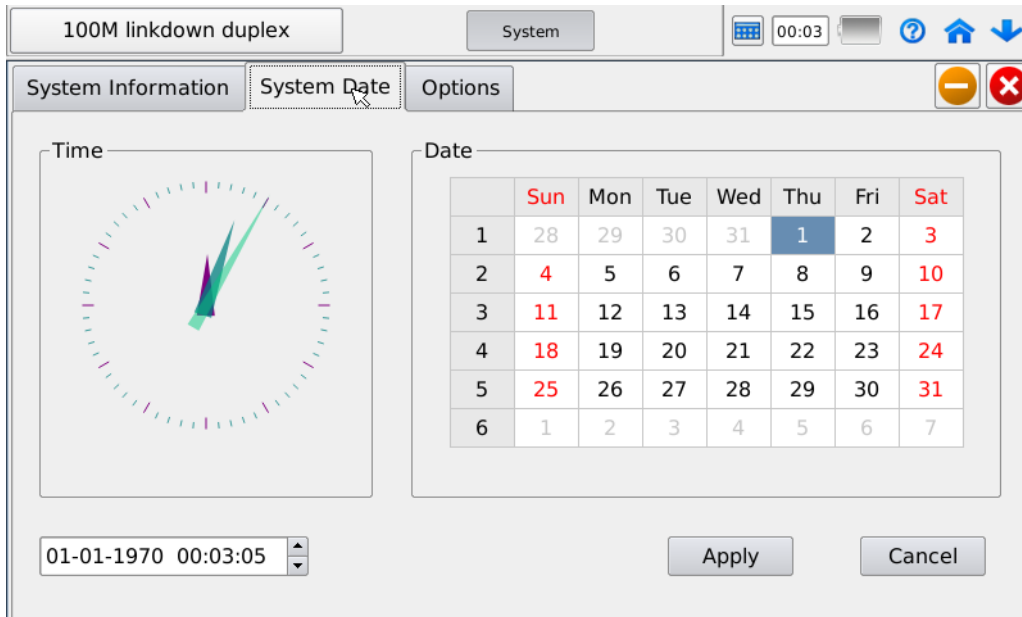
On the top right side is the basic information of the instrument, including product serial number, platform and testing version numbers, software version, FPGA software version information.

On the mid and low right side is main machine name information, which can be customized. Click Change button after setting, and enter force after restarting.

On the right low side is the system language; select the language to be switched from the pull-down list, and enter effect after restarting.

3.1.2 System time/date setting

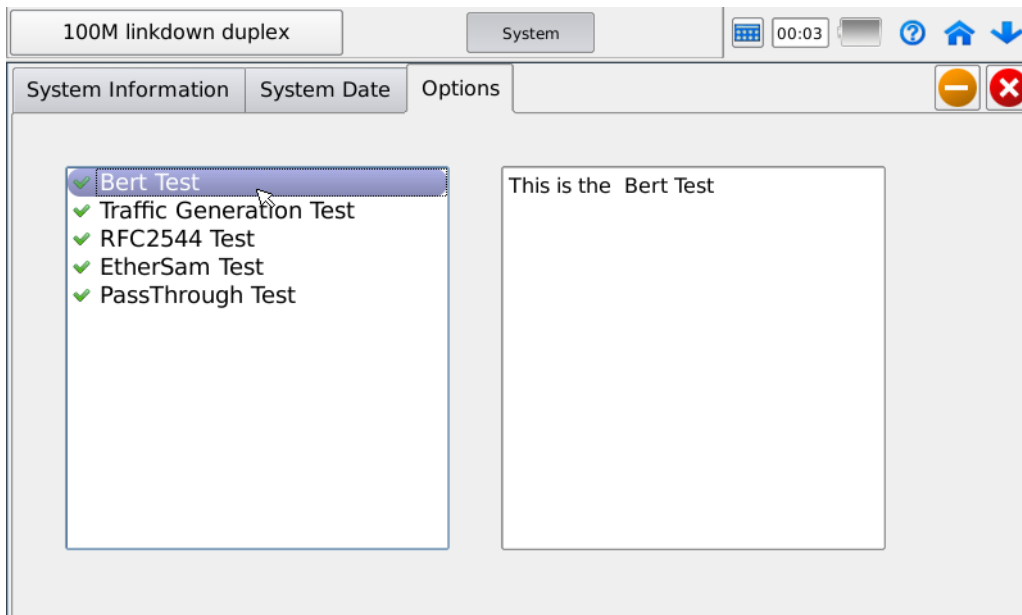
You may set time and date respectively in the input box on the left bottom of the interface. The date is edited in the sequence of Month, Day and Year, and Hour; Minute and Second for the time, which can be adjusted by up and down regulation buttons on the right of the time box. After editing, click Confirm for modification. If the modification result is not saved, press on the Cancel button to cancel the modification as shown in the following figure:



Time/date settings

3.1.3 Optional functions

All testing modules available for the product are listed on the interface, and each item can be introduced briefly, where, the item marked with green ✓ in the front represents the function has been purchased, as shown in the following figure:

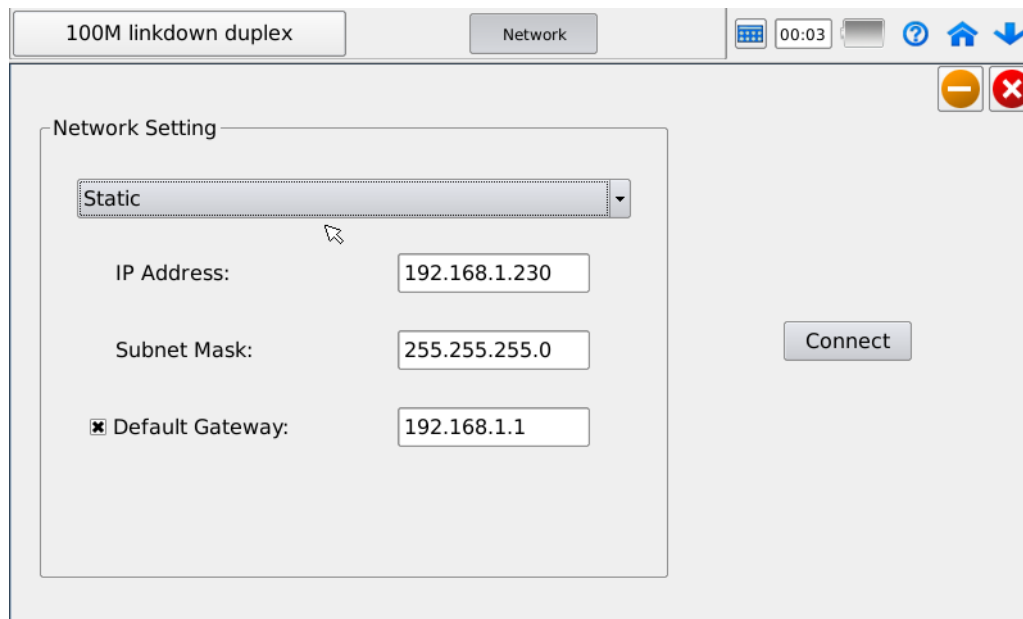


Optional functions interface

3.2 Network settings

On the main interface after starting up, enter network interface pressing the following icon button [🌐], where, the auxiliary network interface can be set (10/100M electrical interface connecting RJ-45 connector); automatically gain IP address by selecting DHCP (dynamic host configuration protocol), or manually configure IP address, subnet masks, and default gateway by selecting Static, as shown in the

following figure:



Network setting interface

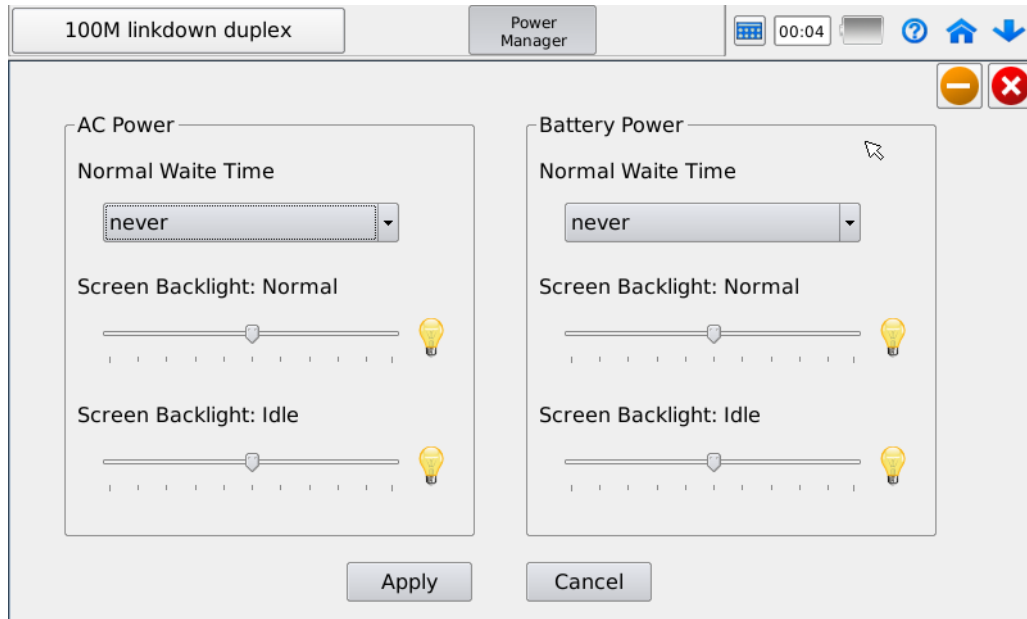
Note: Click 'Connect' button and enter effect after modification.

3.3 Screen calibration

If abnormality occurs on the touch screen (e.g. current item is selected difficultly), the re-calibration should be required. Enter the screen calibration interface pressing on [📏] or [🔍] for a long term on the starting-up main interface, then calibrate the screen by single clicking '+' on the screen with a touchpen. Complete the calibration by single click five times; the touch screen calibration can be completed repeatedly.

3.4 Power manager

On the main interface after starting up, press down [🔋] and enter the power manager interface, where the screen stand-by time can be set for two power supply modes of external power and battery power supply, and backlight brightness can be set. After settings, click Application of this modification. If cancelling the operation, click Cancel and exit, as shown in the following figure:



Power manager interface

Note: Cancel the screen stand-by state by pressing on any key or clicking any position on the screen in the stand-by screen.

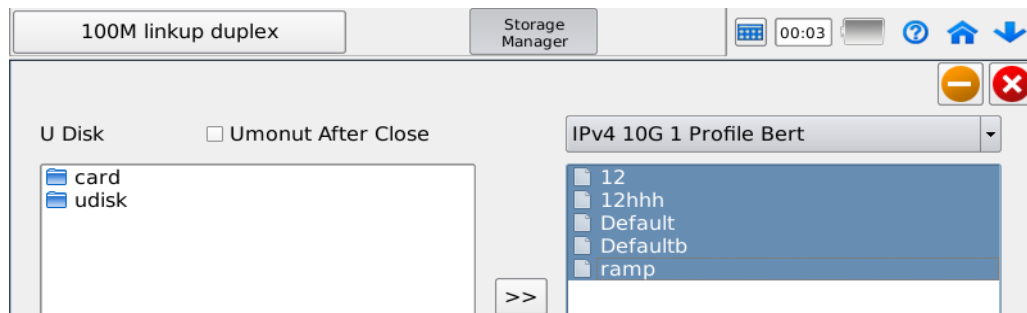
3.5 Storage manager

On the main interface after starting up, press down [] and enter the storage manager interface, where, such information as parameter configuration file, test reports and screen shots can be copied to external USB, or the files in the USB can be copied to the list, or files in the list can be deleted.

On the left of the interface is external storage card files, and storage files in the list on the right side. The file route can be selected in the pull-down on the top right.

Deleting files: Select the file to be deleted on the storage manager interface, and click 'X' button at the middle, only deleting one file each time.

Copying files: After inserting USB, (check the contents in USB can be read successfully on the right of Udisk), select the file to be copied from the right of the file fold, then select Udisk (storage position), and clicking '<<' and complete the copy. The files in USB can be copied to the file fold in the list by clicking '>>'.




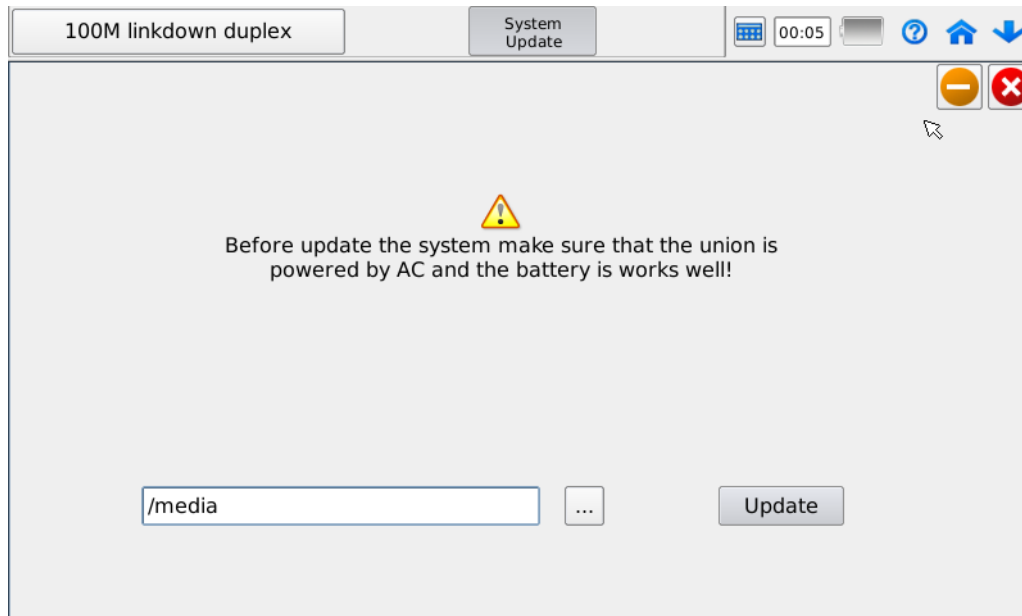
Open the USB by double clicking the 'U Disk' on the right, and browse the files in USB, as shown in the following:

Note: Before exit of the USB, select 'Umonut After Close', then close this interface,

and pull out the USB.

3.6 System update


On the main interface after starting up, press down [] and enter the system update interface; open the filefold where the update program exists, and select the update program; confirm Exit, and the system may restart update automatically by clicking Update button.

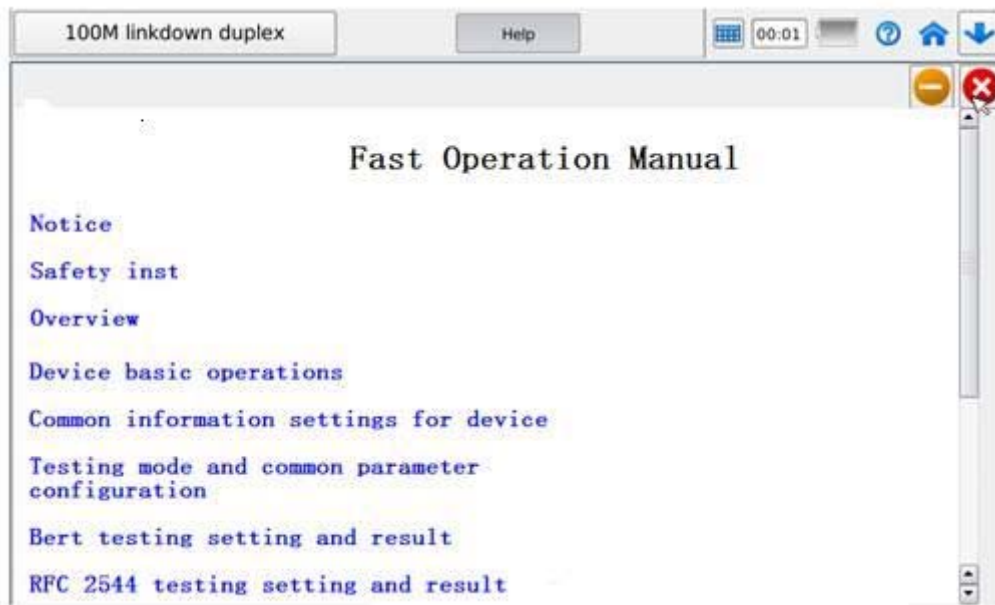


System update interface

Note: Carry out the system update only in full battery capacity or external power supply in the normal working condition, and restart the system after updating.

3.7 Helps

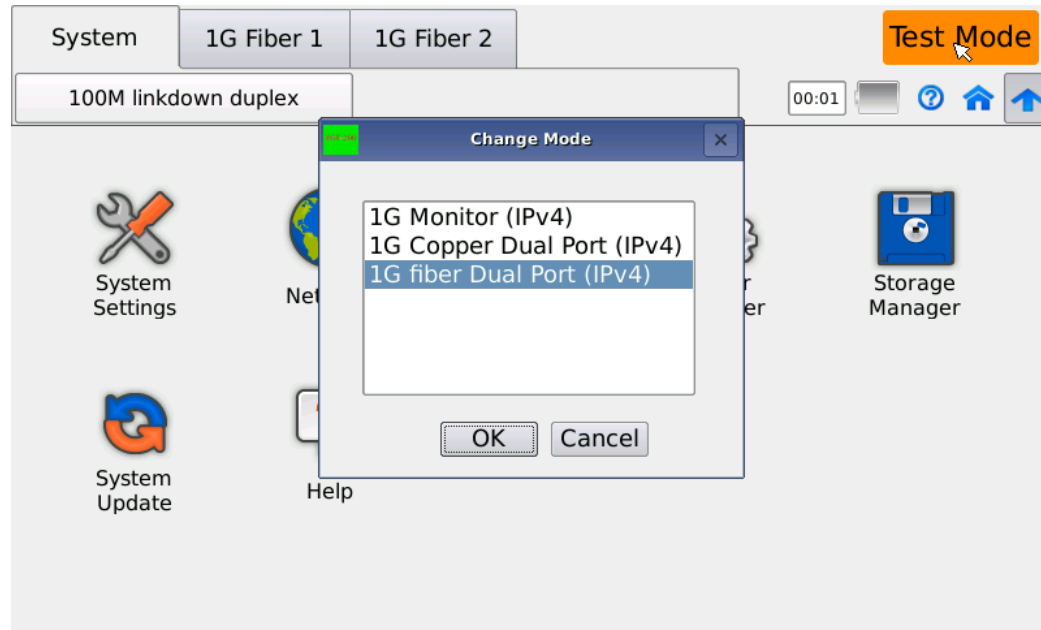
Press down [] and open the Help fold on the main interface after starting up.



4 Testing parameters and common parameter configuration

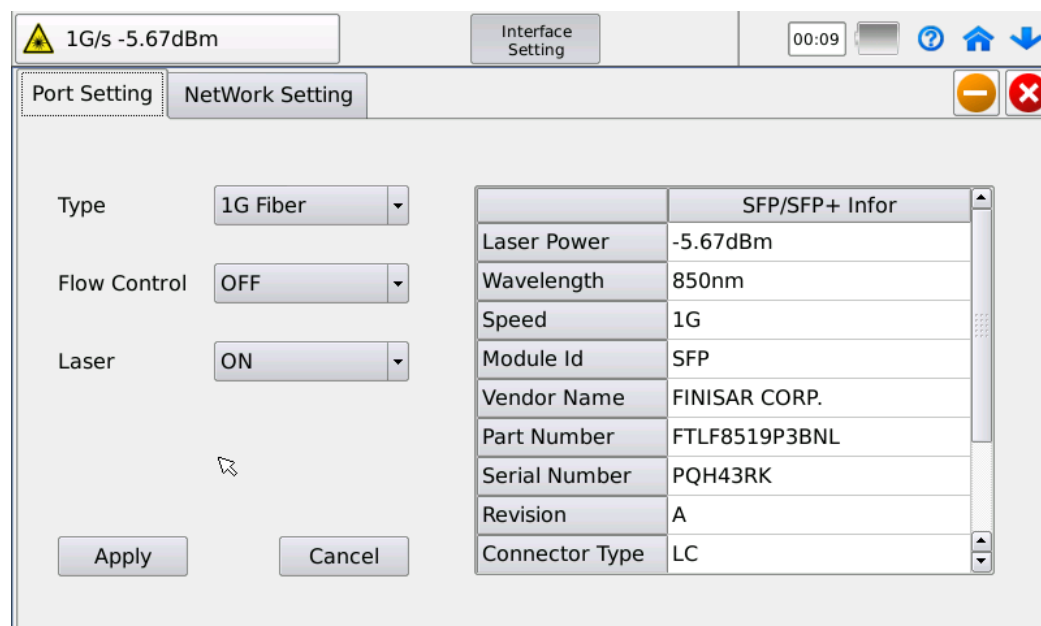
4.1 Test mode settings

On the starting main interface, click 'Test Mode' on the top right side and select the test mode.



4.2 Port setting

On the testing main interface, select the port setting [] to set such information as testing port network configuration. The port settings include two parts: port information setting and network information setting. On the port setting interface, on the left is SFP/SFP+ Parameter information, and on the right is port configuration information as shown in the following figure:



SFP/SFP parameters:

SFP is the optical transceiver inserted in optical interface, the SFP module is selected for 10/100/1000M is optical interface.

Laser power: the received laser power;

Wavelength: 850nm, 1310nm and 1550nm;

Speed: 1000M, 1G Fiber, etc.

Module Id: SFP;

Vendor Name: Optical module manufacturer name;

Part Number: Set by the manufacturer;

Serial Number: Set by the manufacturer;

Revision: Set by the manufacturer;

Connector type: LC

Type: SW, SR, LR, and ER

Mode: Single mode fiber (SMF) or Multi-mode fiber (MMF);

Port type: Select LAN mode or WAN mode;

Traffic control: Select starting or forbidden traffic control functions. In starting up, the machine will stop the sending in the requesting time assigned by traffic control frame received; in the forbidden traffic control, ignore the received pause frame, where, the setting is defaulted as Forbidden.

Laser: Select open or close laser. Open the laser in testing, and it is defaulted as Open.

Select Application after above settings are modified, or select Cancel to give up this modification.

4.3 Network setting

On the setting interface, select the network setting tab, and enter the network setting interface, as shown as follows:

The screenshot displays the 'Network Setting' configuration window. At the top, there's a status bar showing '1G/s -5.66dBm' and 'Interface Setting'. The main window has two tabs: 'Port Setting' and 'Network Setting', with the latter being active. Inside the 'Network Setting' tab, the 'Profile' is set to 'Default'. Below this, the 'Static' network mode is selected. The configuration fields are as follows:

- IP Address: 192.168.1.6
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.1.1
- VLAN: Off
- MPLS: Off

At the bottom of the configuration area, there are buttons for 'Global', 'VLAN', and 'MPLS'. A 'Connect' button is located on the right side of the form.

Profile: Select the data stored previously in the preset values, and store the present setting information.

IP: Select static IP or DHCP (dynamic host configuration protocol). When selecting DHCP, all parameters are values gained by DHCP automatically; when selecting static IP, manually input IP address information.

IP address: Click Address Box, and open Input Interface for editing from '0.0.0.0' to '255.255.255.255'.

Subnet mask: Click Address Box and open the Input Interface for editing from '0.0.0.0' to '255.255.255.255'.

Default gateway: Select starting or forbidden default gateway; starting up by select the front check box, and defaulting Forbidden. Click the Address Box and open the input interface for editing from '0.0.0.0' to '255.255.255.255'.

NOTE

Select 'Up' to execute this modification after configuration. After modification, directly close this interface and the modification is invalid.

5 Bert


Bert: Error rate testing is mainly used to verify error codes in data transmission in transparent transmission of SDH/OTN/DWDM/dark optical fiber carried by Ethernet.

supports Layer 2-4 Bert testing in VLAN and MPLS environments. The engineer may set number of layers, size of frame, band width, MAC address and pseudorandom code pattern in the load area of Bert testing data frame by touch screen setting. Besides standard pseudorandom code patterns (PRBS31, PRBS23, PRBS15, PRBS11 and transmission pattern), also supports such pressure testing code patterns as CJPAT and CRPAT, and may be used to simulate different application environments by customizing code pattern by the engineer. In the Bert testing process, the error injection mode supports multiple errors types like Bit, CRC, IP Checksum and TCP/UDP Checksum to verify the abnormal frame processing capacity of the tested network or tested point.


Essentials of test setting and results

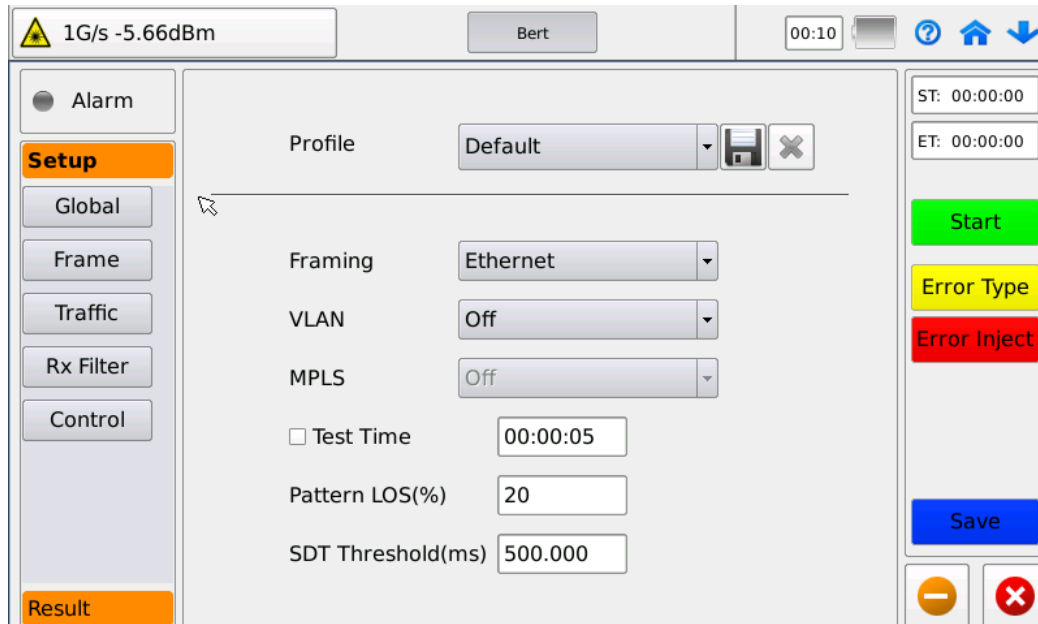
- ✓ Layer 1-4 bit error code rate test;
- ✓ Customizable frame size, from 64 to 9600 bytes;
- ✓ Select test patterns by supporting pseudorandom code patterns (PRBS 2E11-1, PRBS 2E15-1, PRBS 2E23-1, PRBS 2E31-1 and transmission pattern), as well CRPAT and CJPAT pressure testing code patterns, or customized code patterns;
- ✓ Traffic mode supports four control modes: fixed band width, step, burst (two bandwidth cycles) and single burst (fixed frame number);
- ✓ Rx filtering: Filter the frames received by selecting specific characters;
- ✓ Insert different error codes (Bit, CRC, IP Checksum and TCP/UDP Checksum) by operating fault injection mode on the interface in the testing process to verify abnormal frame processing capacity of the tested network or tested point;
- ✓ Testing results include statistics based on error codes, service interruption, frame loss and traffic.

5.1 Configuration of Bert testing parameters

Before configuring the test parameter, setting interface network information first is recommended. Select the interface setting [] on the testing main interface; set the test mode, traffic control, and laser on/off; set Layer 3 network information in network Tab. See the [Interface and Network Parameter Configuration](#).

5.1.1 Global setting

On the testing main interface, click Bert testing icon [] in testing application, i.e. coming into Bert testing global setting interface, as shown in the following figure:



Profile: Select preset configuration files; storing setting conditions is recommended often for follow-up test application. If deleting the configuration files, select in the pull-down items to delete it; if storing the configuration files, select, then confirm the setting name is saved and exit;

Framing: select Layer of testing: Framed, Ethernet, IP, TCP and UDP;

VLAN: When either of Ethernet/IP/TCP/UDP is selected, VLAN option is available. The user can select VLAN layer to be configured;

MPLS: When either of IP/TCP/UDP is selected, MPLS option is available. The user can select MPLS layer to be configured;

Duration: Select the Check Box for timing testing; set the testing duration from '00:00:05' to '23:59:59'; default as the time-unlimited testing, and manually stop the testing at any time;

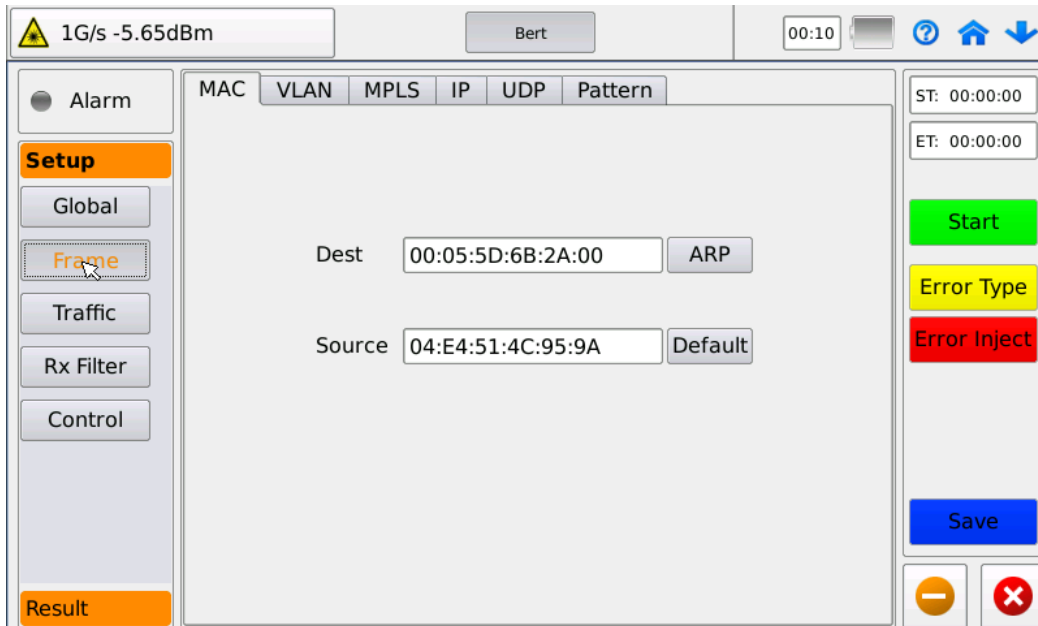
Pattern LOS(%): Set the pattern loss threshold value; judge the testing doesn't pass when the testing value is greater than the value.

5.1.2 Frame setting

On the Bert testing interface, click the set Frame and enter the frame setting interface for the frame information setting. The Tab displayed on the interface is related to the global setting configuration.

MAC:

On the Frame setting interface, select MAC on the top Tab and enter MAC setting interface, as shown in the following figure:

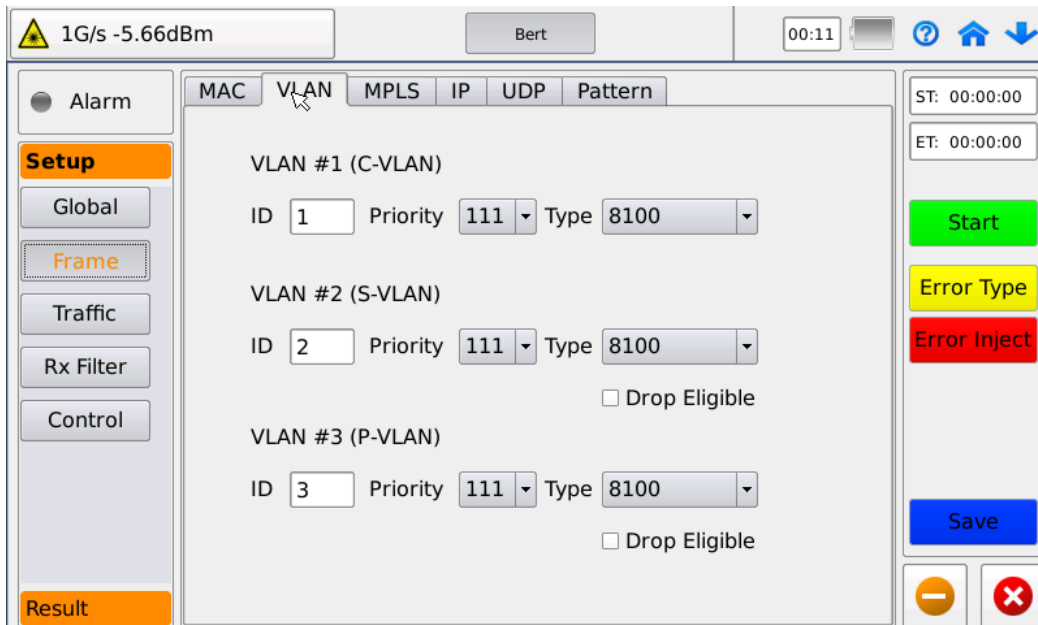


Target MAC address: input manually, or click ARP button by inputting the correct target IP address, e.g. resolve the MAC address corresponding to target IP address;

Source MAC address: input manually, or set default the MAC address of this device as source MAC address by pressing Default button;

VLAN:

On the Frame setting interface, select VLAN in the Tab and enter VLAN setting interface, as shown in the following figure:



ID: VLAN marking, and input value ranges from 0 to 4095;

Priority: VLAN priority, ranging from 0 to 7 from high to low in a binary representation;

Type: VLAN type; and selectable VLAN types: 8100, 88A8 and 9100;

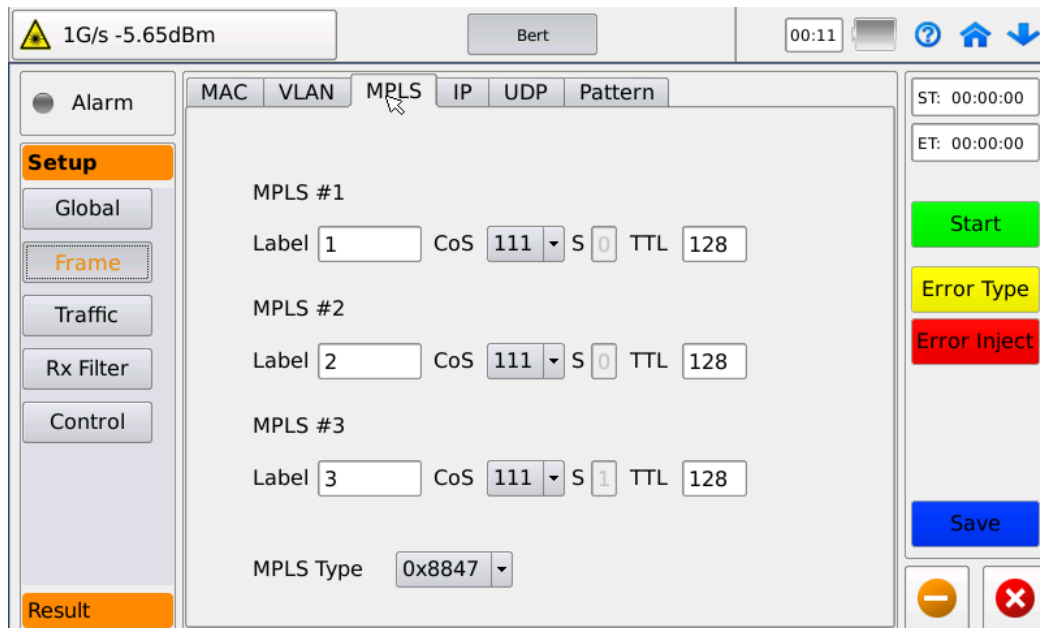
Drop Eligible:

Drop eligible: Give up marking

Note: VLAN parameters can be configured after starting VLAN in the global setting; start three layers of VLAN at most.

MPLS:

On the Frame setting interface, select MPLS in the Tab and enter MPLS setting interface, as shown in the following figure:



Label: Label value field, which is used for the forwarded pointer, at input values from 0 to 1048575;

CoS: service type; 3 bytes, at selecting values from 0 to 7;

S: Stack bottom marking; no manual setting;

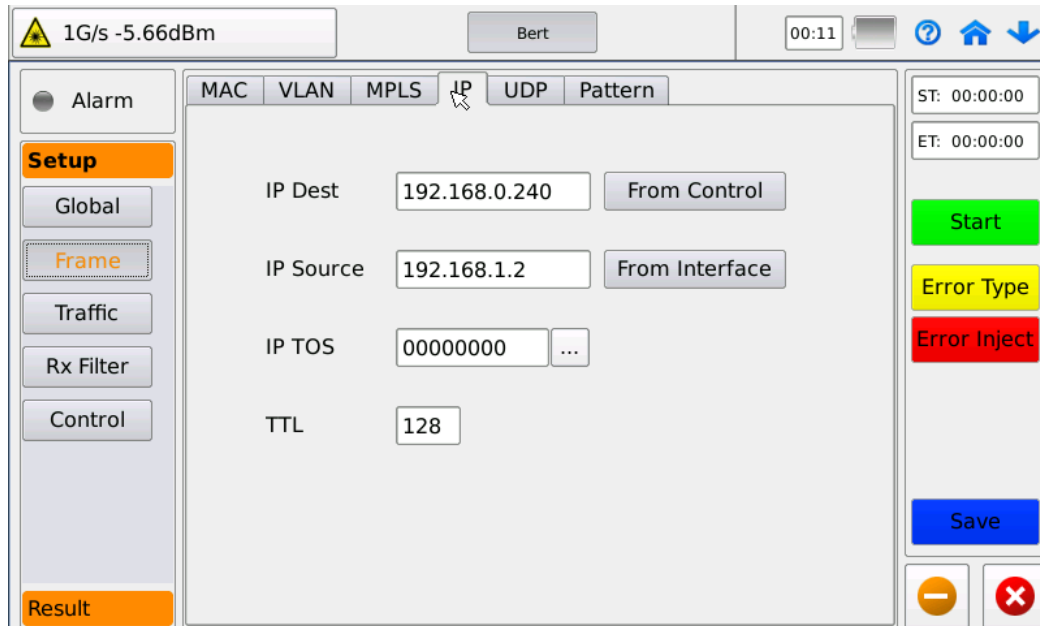
TTL: Survival time; the number of segment that the appointed data package have passed before they are dropped by the router. TTL is set by the main transmission host, in case of endless circulation of data package in IP Internetwork. When IP data package is forwarded, the router is required to reduce TTL by 1 at least.

MPLS Type: 0X8847 or 0X8848.

Note: the MPLS parameter cannot be configured until MPLS is started in the global setting; start three layers of MPLS at most.

IP:

On the Frame setting interface, select IP in the Tab and enter IP setting interface, as shown in the following figure:



Target IP address: Manually input IP address of the device to be tested, or by pressing From Control button, set the remote IP address set in the Control as the present IP address;

Source IP address: Manually input IP address of the testing port, or by pressing From Interface button, set the IP address in interface setting as the present source IP address;

IP TOS: Service type (8 bits) fields include one 3-bit priority sub-field, 4-bit TOS sub-field and 1-bit reserved place. The 4-bit TOS represents: minimum time delay, maximum throughput, highest reliability and minimum cost. If all 4-bit values are 0, it means general service.

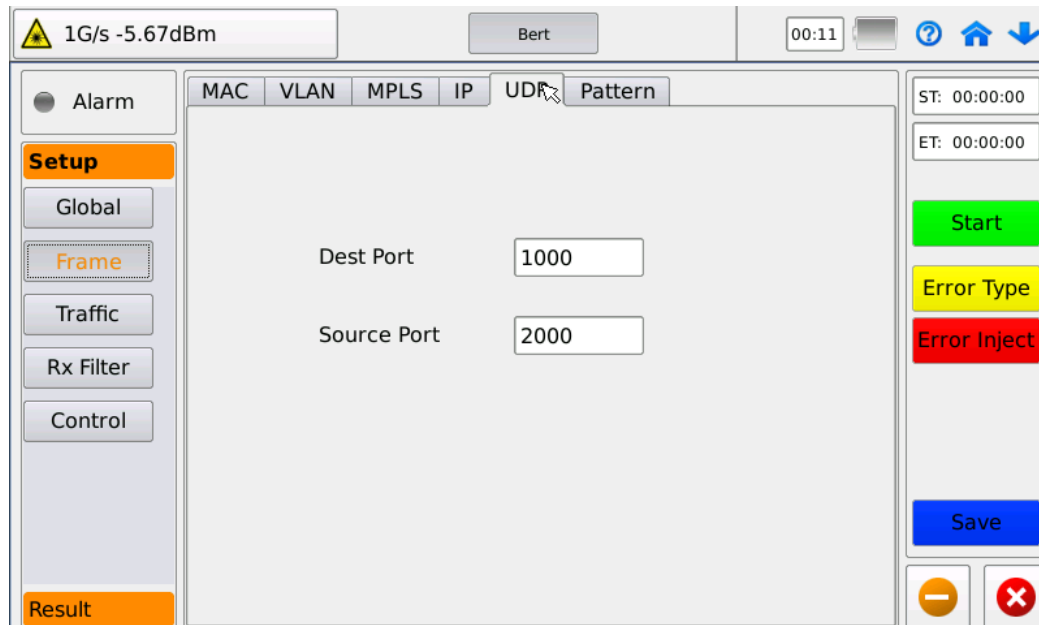
Parameter	Value	Default
Priority	000 (regular), 001 (priority), 010 (immediate), 011 (flash memory), 100 (flash memory coverage), 101 (CRITIC/ECP), 110 (Internet control), and 111 (network control)	000 (normal)
Delay	0(normal), 1(low)	0(normal)
Throughput	0(normal), 1(high)	0(normal)
Reliability	0(normal), 1(high)	0(normal)
Cost	0(normal), 1(low)	0(normal)
Reserved Place	0, 1	0

TTL: Survival time; assigning approved network segment quantity before the data

package is abandoned by the router. TTL is set by the main transmission host, in case of endless circulation of data package in IP Internetwork. When IP data package is forwarded, the router is required to reduce TTL by 1 at least. Range is 0-255.

UDP:

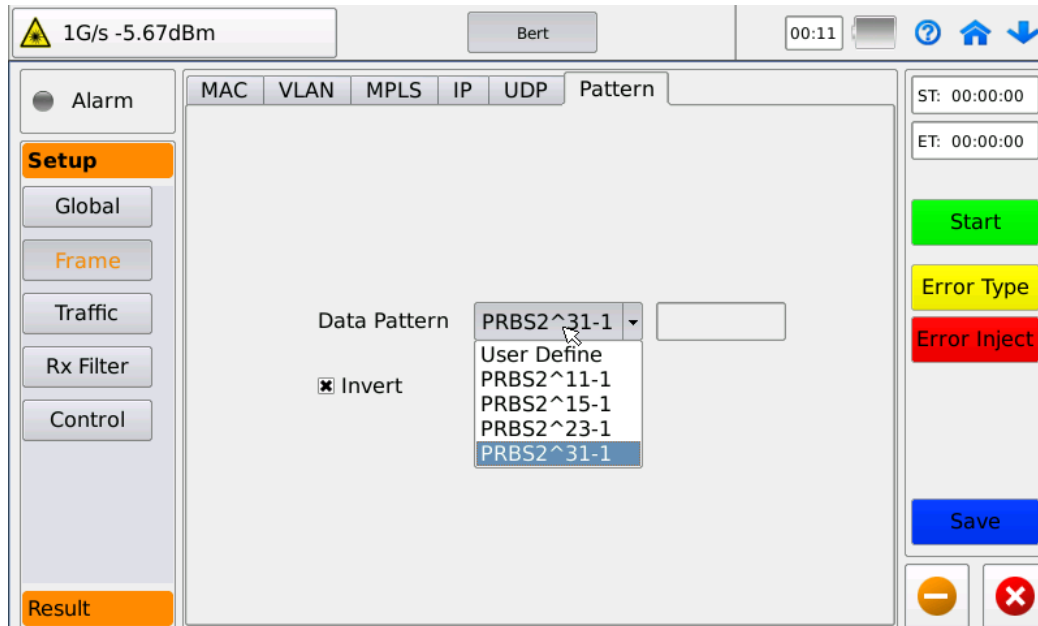
On the Frame setting interface, select TCP or UDP in the Tab and enter the TCP/UDP setting interface, as shown in the following figure:



TCP and UDP have the same setting items, which are sourced from TCP/UDP port number and target TCP/UDP port number, at the input value from 0 to 65535;

Pattern:

On the Frame setting interface, select Pattern in the Tab and enter the Pattern setting interface, as shown in the following figure:



Based on byte error code testing pattern, the selection scope for all layers of testing are as follows:

When selecting Framed by framing in global setting, the Pattern may be selected as CRPAT (long continuous random testing code pattern) or CJPAT (long continuous jitter testing code pattern);

When selecting Ethernet, IP, TCP or UDP by framing in global setting, select PRBS 2E11-1, PRBS 2E15-1, PRBS 2E23-1, PRBS 2E31-1 or user-defined code pattern; the scope defined by users ranges from 00000000 to FFFFFFFF;

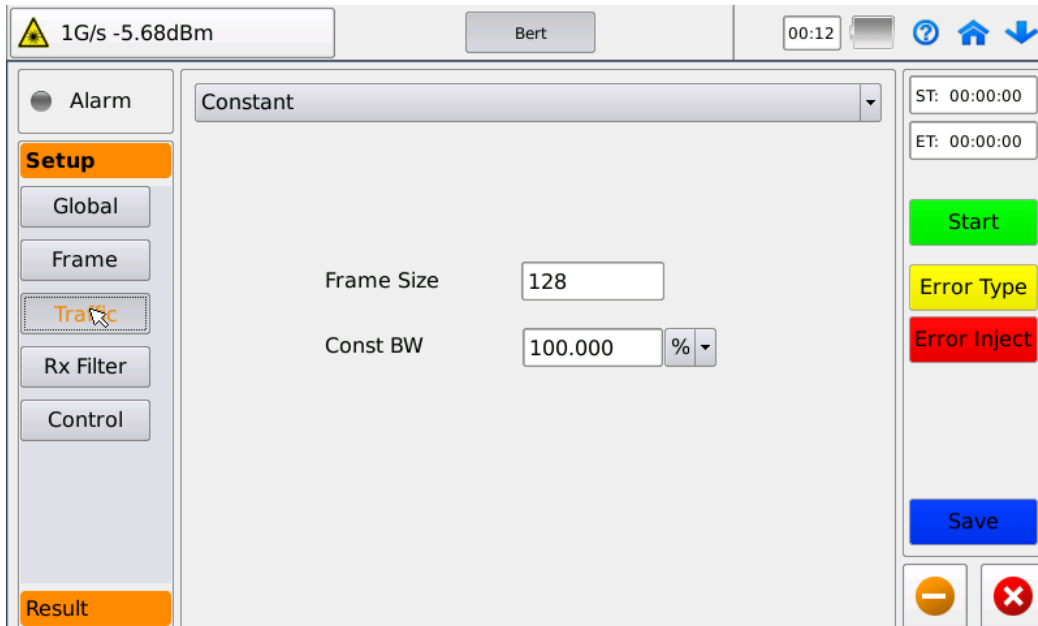
Code inversion: 0 and 1 set in all places 0 and 0 may be inverted after selection (not applicable for CRPAT and CJPAT).

5.1.3 Traffic settings

On Bert testing interface, click the set Traffic and enter the Traffic setting interface, where, the test mode may be configured;

Constant:

Constant traffic testing, that is, continuing testing is done in fixed bandwidth and frame size; select Constant in the pull-down menu on the top of the Traffic setting interface, as shown in the following figure:

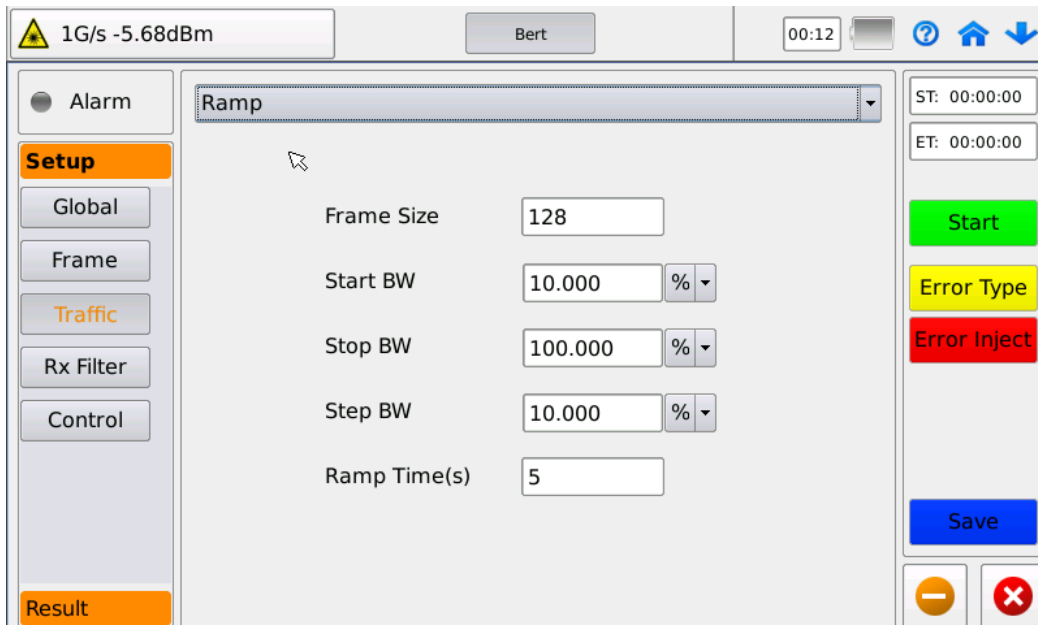


Frame size: set the testing frame size to support the 9600 byte frame size at most;

Const BW: set the testing bandwidth by % of line rate, or select G/M/K;

Ramp:

Ramp traffic testing: by configuring a series burst traffic, and start to send at the assigned min frame rate, up to the max frame rate gradually; then circulate it; select Ramp in the pull-down menu on the top of the Traffic setting interface, as shown in the following figure:



Frame size: Set the testing frame size to support 9600 byte frame size at most;

Start BW: Set the step start bandwidth by % of line rate, or select G/M/K;

Stop BW: Set the step end bandwidth by % of line rate, or select G/M/K;

Step BW: Set the step size bandwidth, i.e. set the difference value between adjacent testing bandwidths by % of line rate; or select G/M/K;

Ramp time: set duration for each ramp step length by second (s), at 3-1000s;

Burst:

Burst traffic testing: configure two kinds of bandwidths; send by assigning the frame rate for each burst traffic; perform the cycle testing between two bandwidths; select Burst in the pull-down options on the top of the Traffic setting interface, as shown in the following figure:

The screenshot shows the 'Burst' configuration interface. At the top, there is a status bar with '1G/s -5.70dBm', a 'Bert' button, and a timer '00:12'. On the left, a sidebar has 'Alarm' (selected), 'Setup', 'Global', 'Frame', 'Traffic', 'Rx Filter', and 'Control'. The main area is titled 'Burst' and contains the following fields:

- Frame Size: 128
- Burst1 BW: 10.000 %
- Burst1 Time (s): 5
- Burst2 BW: 20.000 %
- Burst2 Time (s): 5

On the right side, there are fields for 'ST: 00:00:00' and 'ET: 00:00:00', a green 'Start' button, a yellow 'Error Type' button, a red 'Error Inject' button, a blue 'Save' button, and two circular buttons with minus and plus signs.

Frame size: set the testing frame size, to support the 9600 byte frame size at most;

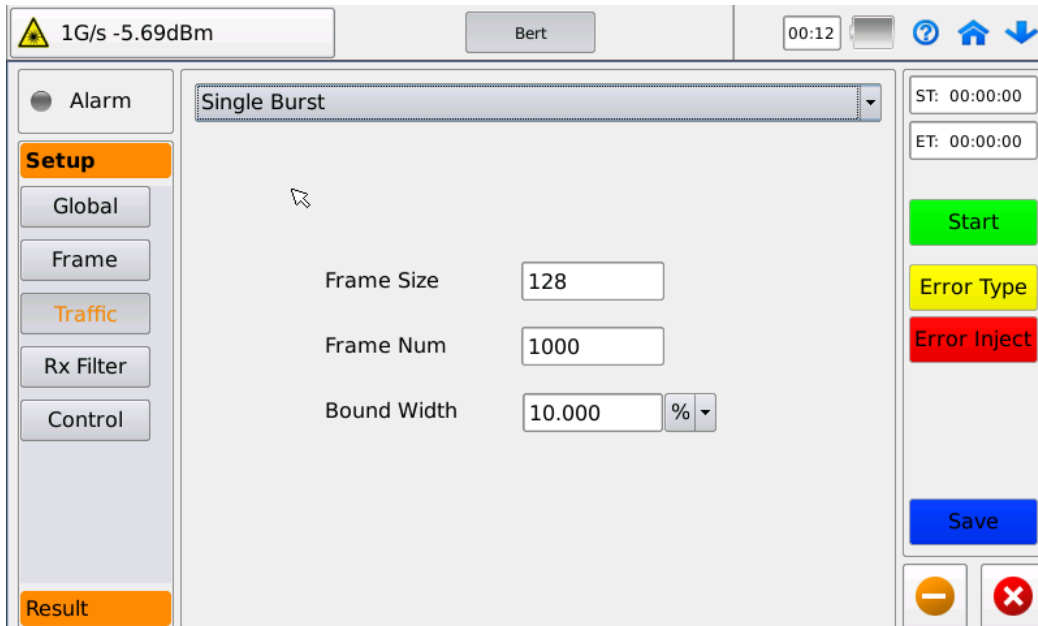
Burst 1 BW: Set the first burst testing bandwidth by % of line rate, or select G/M/K;

Burst 1 Time: Set the duration of Burst 1 by second (s) at a range of 3-1000000s;

Burst 2 BW: Set the second burst testing bandwidth by % of line rate, or select G/M/K;

Burst 2 Time: Set the duration of Burst 2 by second (s) at a range of 3-1000000s;

Single burst testing: send specific quantity of frames in fixed bandwidth, and select Single Burst in the pull-down menu on the top of the Traffic setting interface, as shown in the following figure:



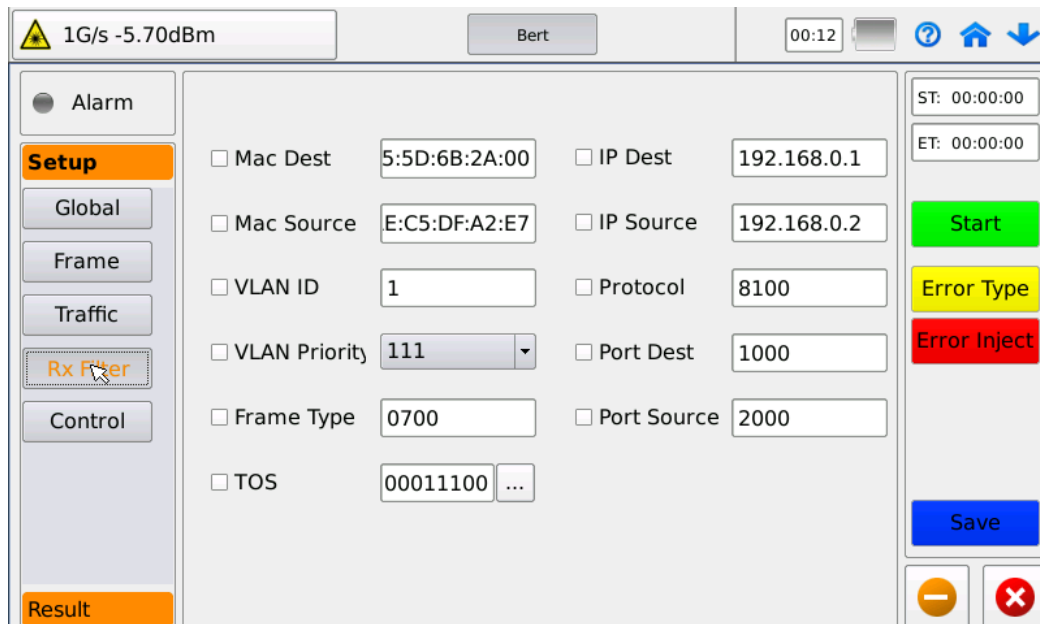
Frame size: Set the testing frame size to support the 9600 byte frame size at most;

Frame Num: Set the sent frame number;

Band Width: Set the testing bandwidth by % of line rate, or select G/M/K;

5.1.4 Receiving filter setting

On the Bert testing interface, click the set Receive Filter and enter the receiving filter setting interface as follows:



Carry out the filtering of frames received according to the set conditions; the frames only in line with limited conditions are counted in the receiving end. The filter setting is valid only selecting the preset check box.

Target MAC address: filter out the frames in line with the setting in target MAC address from the received frames;

Source MAC address: filter out the frames in line with the setting in source MAC

address from the received frames;

VLAN ID: filter out the set frames in line with the setting in the outermost layer VLAN ID from the received frames; if starting one layer VLAN, it is represented as ID of C-VLAN; when starting two layers of VLAN, it represents ID of S-VLAN; when starting three layers of VLAN, it represents ID of P-VLAN.

VLAN priority: filter out the frames in line with the setting in the outermost layer VLAN priority; if only starting one layer of VLAN, it represents the priority of C-VLAN; if starting two layers of VLAN, it represents the priority of S-VLAN; if starting three layers of VLAN, it represents the priority of P-VLAN.

Frame type: filter out the frames in line with the setting in the frame patterns from the received frames;

TOS: filter out the frames in line with the setting in TOS from the received frames;

Target IP address: filter out the frames in line with the setting in the target IP address from the received frames;

Source IP address: filter out the frames in line with the setting in source IP address from received frames;

Protocol: filter out the frames in line with the setting in the protocol types from the received frames;

Target port address: filter out the frames in line with the setting in the target port address from the received frames (TCP or UDP address);

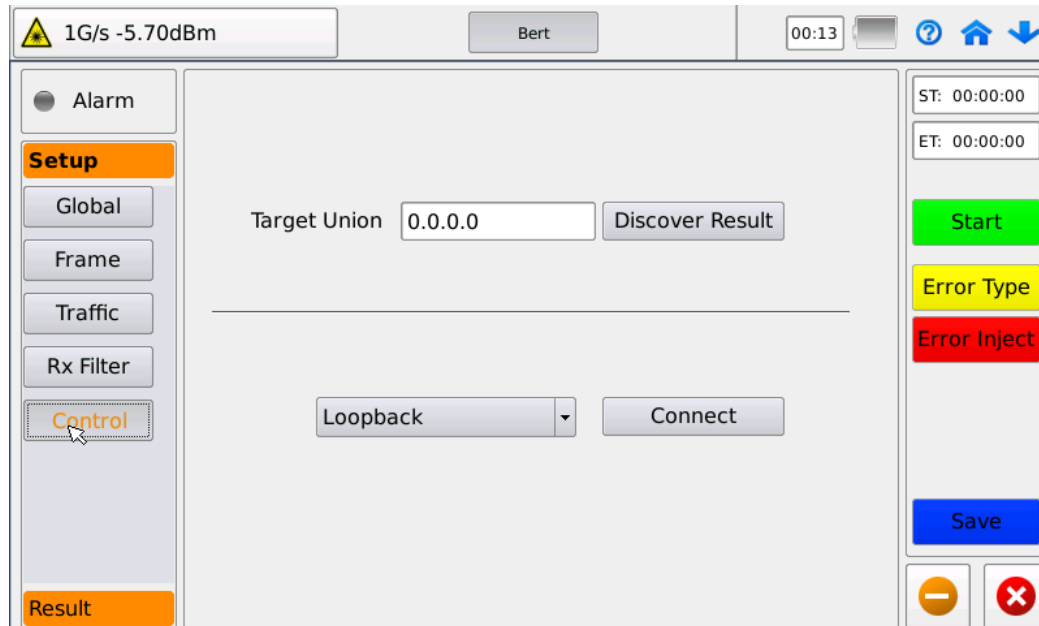
Source port address: filter out the frames in line with the setting in the source port address from the received frames.

The selectable conditions in layers of testing are as follows:

Filtering condition	Layer 1 (Unframed)	Layer 2 (Ethernet)	Layer 3 (IP)	Layer 4 (TCP/UDP)
Target MAC address	×	√	√	√
Source MAC address	×	√	√	√
VLAN marking	×	√	√	√
VLAN priority	×	√	√	√
IP TOS (service type)				
Target IP address	×	×	√	√
Source IP address	×	×	√	√
Protocol type				
Target port number	×	×	×	√
Source port number	×	×	×	√

5.1.5 Remote control setting

In the Bert testing interface, click the set Control and enter the remote control setting interface, which can be connected with the remote device; the interface is as follows:



Target union: the far-end device may be locked by two ways: one is to input IP address of the far-end device directly, which is applicable for the determination of far-end IP address; the other is to select the required IP address or device in the search results. The requisite for this operation is to execute **Discover** [🔍] first, then find the target union; select the device, and confirm the exit; the IP address for this device is displayed in target address bar.

Click Connect after completing IP address input of the target union, and set the far-end device as a loopback mode; the layer number of the locating framing settings is consistent with the far-end loopback layer number.

In testing, the local module sends the testing traffic to the far-end module to execute loopback; the testing traffic comes back to the local module, and is received and analyzed the local module.

5.2 Bert testing results

5.2.1 Abstract

The interface switches to the result abstract interface after starting the testing interface, or select the Result-Abstract in Bert main interface. In this interface, you can see basic information in the sending end and receiving end, as shown in the following figure:

The screenshot shows the Bert testing interface. At the top, there is a status bar with a warning icon, '1G/s -5.70dBm', a 'Bert' button, and a timer showing '00:13'. Below this is a sidebar with buttons for 'Alarm', 'Setup', 'Result', 'Summary', 'Error', 'Alarm', 'Traffic', and 'Event'. The main area contains a table with the following data:

	Tx	Rx	Accuracy
Line Rate	0.000K	0.000K	
Framed Rate	0.000K	0.000K	Auto
Data Rate	0.000K	0.000K	Auto
Utilization	0.000%	0.000%	
Total Byte	0	0	
Total Frame	0	0	
Bad Frame	0	0	

On the right side of the interface, there are buttons for 'Start', 'Error Type', 'Error Inject', and 'Save', along with a timer showing 'ST: 00:00:00' and 'ET: 00:00:00'. There are also minus and close buttons at the bottom right.

Tx stands for the sending end information, Rx is the receiving end information, and Accuracy is the precision of setting frame and data rates; the unit is determined in K/M/G, defaulted as Automatic.

Line Rate: line rate of the test line;

Frame Rate: sending/receiving frame rate;

Date Rate: data rate of sending/receiving;

Utilization: percentage of sending/receiving test bandwidth in line rate;

Total Byte: total byte number of sending/receiving data;

Total Frame: total counted sending/receiving frame number;

Bad Frame: sending/receiving error code number

5.2.2 Errors

On the Bert testing main interface, select Result-Error, and see the number of errors received from the receiving end and proportion in total receiving frame number, and also find number of errors received currently and accumulative quantity, as shown in the following figure:

	Current	Total
Bits	0	0
BER	0.000000e+00	0.000000e+00
FCS/CRC	0	0
FCS/CRC(%)	0.000000e+00	0.000000e+00
IP Checksum	0	0
IP Checksum(%)	0.000000e+00	0.000000e+00
TCP/UDP Checksum	0	0
TCP/UDP Checksum(%)	0.000000e+00	0.000000e+00
Jabber Frame	0	0
Runt Frame	0	0

Bits: number of error codes received;

BER: error code rate, i.e. ratio of the bytes of errors received in all received bytes, represented by the negative power of 10;

FCS/CRC: invalid FCS/CRC frame number received;

FCS/CRC(%): ratio of received invalid FCS/CRC frame number in total frame number;

IP Checksum: received invalid IP Checksum frame number;

IP Checksum(%): ratio of received invalid IP Checksum frame number in to the received frame number;

TCP/UDP Checksum: received invalid TCP/UDP Checksum frame number;

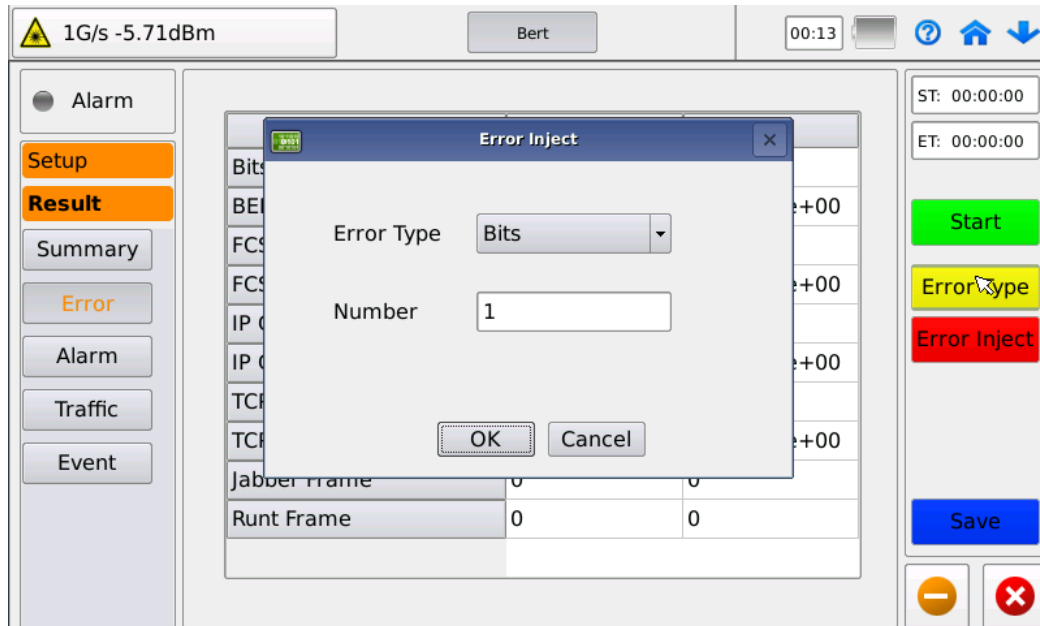
TCP/UDP Checksum(%): ratio of received invalid TCP/UDP Checksum frame number in total received frame number;

Jabber Frame: jabber frame refers to the number of frames greater than 1518 (non-VLAN), 1522 (1 layer of VLAN), 1526 (2 layers of VLAN) or 1530 (3 layers of VLAN) bytes;

Runt Frame: disabled frame, referring to the number of frames less than 64 bytes.

Manually inserting error code:

Set the error type and the number of errors inserted each time by pressing the Error Type button on the right of the interface, as shown in the following figure:



Confirm and exit after setting; set the error inserting sending traffic of number by pressing on Error Insert button in the testing; the selectable error type for each layer of testing is as follows:

First layer (Unframed): Bits

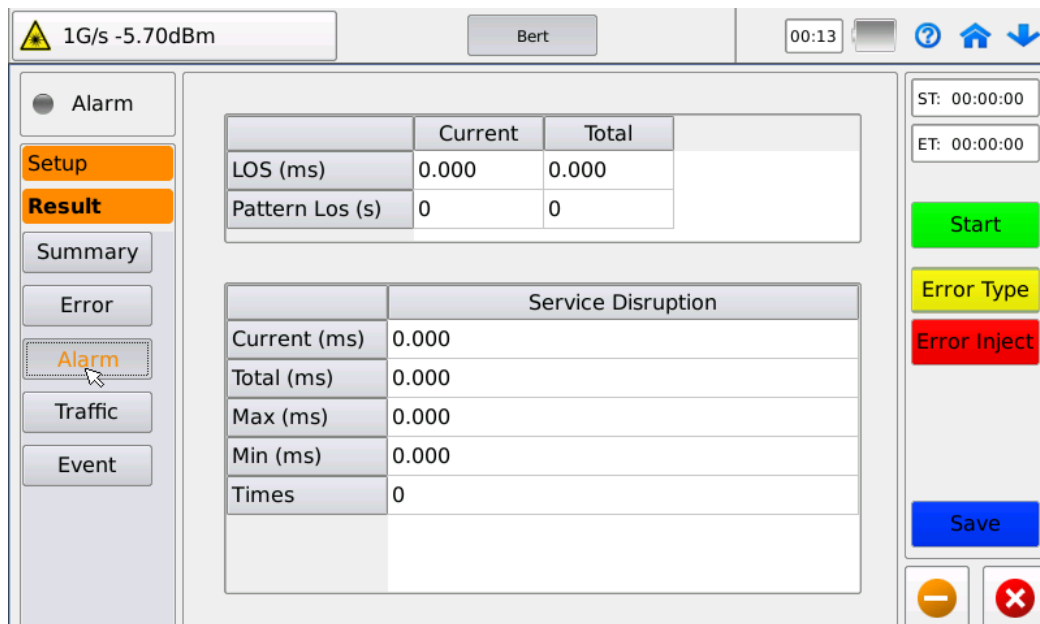
Second layer (Ethernet): Bits, CRC

Third layer (IP): Bits, CRC and IP Checksum

Fourth layer (TCP/UDP): Bits, CRC, IP Checksum and TCP/UDP Checksum

5.2.3 Warning

On the Bert testing main interface, select Result-Warning, and come into the warning interface, and browse warning information appearing in testing, as shown in the following figure:



LOS: time losing optical port signal, by ms; it can display current interrupt time and

accumulative interrupt time;

Pattern LOS: the warning when error code exceeds limit value which is set in global setting interface;

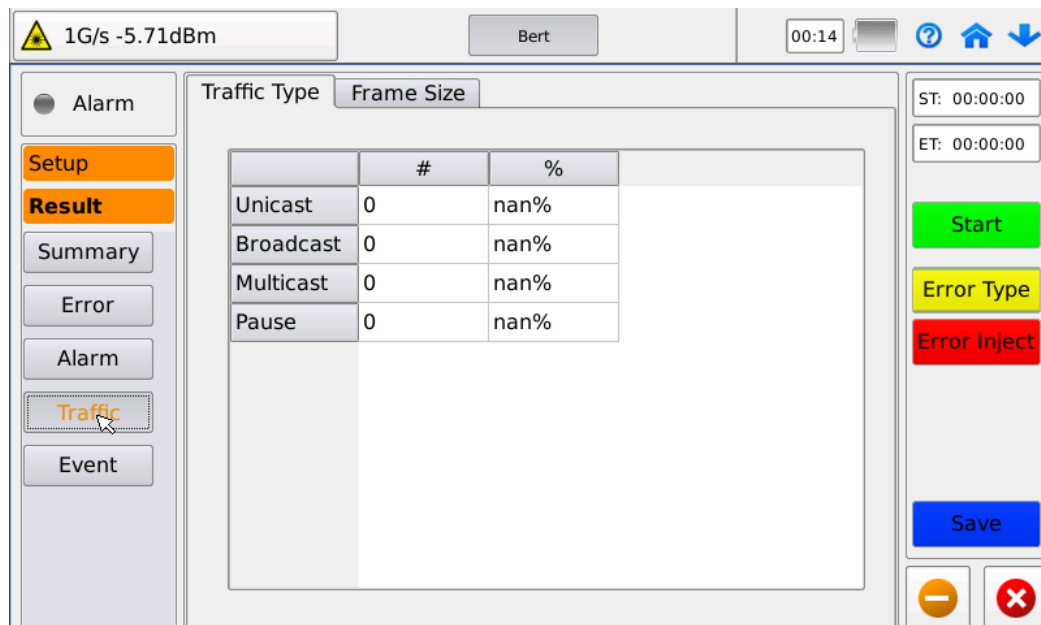
Business interruption: count the current or last business interrupt time, total business interrupt time, longest business interrupt time, shortest business interrupt time, and times of business interruption.

5.2.4 Traffic statistics

On the Bert testing main interface, select Result-Traffic and come into the traffic statistic interface, where, the results counted by frame types and length are included;

Type of frames

On the traffic statistical interface, select the Tab of Frame Type, and browse number and proportion of all types of frames in the received frames, as shown in the following figure:



Unicast: the received unicast frame number and its percentage in total frame number;

Broadcast: the number of received broadcast frames and its percentage in total frame number;

Multicast: the number of received multi-cast frames and its percentage in total frame number;

Pause frame: the number of Pause frames and its percentage in total frame number;

Frame length:

On the traffic result statistical interface, select the frame length Tab and browse the number of frames of each received frame size and its percentage in total frame number, as shown in the following figure:

The screenshot shows the Bert testing main interface. At the top, there is a status bar with a warning icon, '1G/s -5.70dBm', a 'Bert' button, and a timer showing '00:14'. Below the status bar, there is a navigation menu on the left with buttons for 'Alarm', 'Setup', 'Result', 'Summary', 'Error', 'Alarm', 'Traffic', and 'Event'. The 'Traffic' button is highlighted. The main area displays a table with two tabs: 'Traffic Type' and 'Frame Size'. The 'Frame Size' tab is active, showing a table with three columns: 'Traffic Type', '#', and '%'. The table contains the following data:

Traffic Type	#	%
<64	0	nan%
64B-127B	0	nan%
128B-255B	0	nan%
256B-511B	0	nan%
512B-1023B	0	nan%
1024B-1518B	0	nan%
>1518B	0	nan%

On the right side of the interface, there are several controls: a timer showing 'ST: 00:00:00' and 'ET: 00:00:00', a green 'Start' button, a yellow 'Error Type' button, a red 'Error Inject' button, a blue 'Save' button, and two circular buttons with minus and plus signs.

<64: the frame at a length less than 64 bytes

64-127: the frame at a length of 64—127 bytes

128-255: the frame at a length of 128—255 bytes

256-511: the frame at a length of 256—511 bytes

512-1023: the frame at a length of 512—1023 bytes

1024-1518: the frame at a length of 1024—1518 bytes

> 1518: the frame at a length greater than 1518 bytes

5.2.5 Events

On the Bert testing main interface, select Result-Event and come into the event record interface, and browse the events recorded in testing in a chronological order.

1G/s -5.70dBm Bert 00:14

Alarm

Setup

Result

Summary

Error

Alarm

Traffic

Event

Events		
1	00:14:23	2000-01-01, Start BERT Test
2	00:14:25	2000-01-01, Stop BERT Test

ST: 00:14:23

ET: 00:14:25

Start

Error Type

Error Inject

Save

- X

6 RFC 2544

In RFC2544 test, throughput, time delay, packet loss rate and back-to-back testing are used to evaluate and verify the performance of the tested network or network device. RFC2544 testing suites support seven predefined frame lengths (64, 128, 256, 512, 1024, 1028 and 1518) and user-defined length. The small-sized frames can add number of transmission frames, and as tested networks or their pressure. In testing meter, RFC2544 test is packed as an automatic testing, and used to test items by freely selecting throughput, time delay, frame loss rate, and back-to-back, and to judge test results by the clear testing result table in UI.


Throughput: the maximum transmission rate when the frame-sending number is consistent with the frame number transmitted by the tested line;

Time delay: for storing and forwarding devices, the time difference of the last byte in one testing frame arrives at the input port and the first byte of the frame leaving output port is called the time delay;


Frame loss rate: percentage of data frames and total data frames un-forwarded due to lack of network resources in stable state of network;

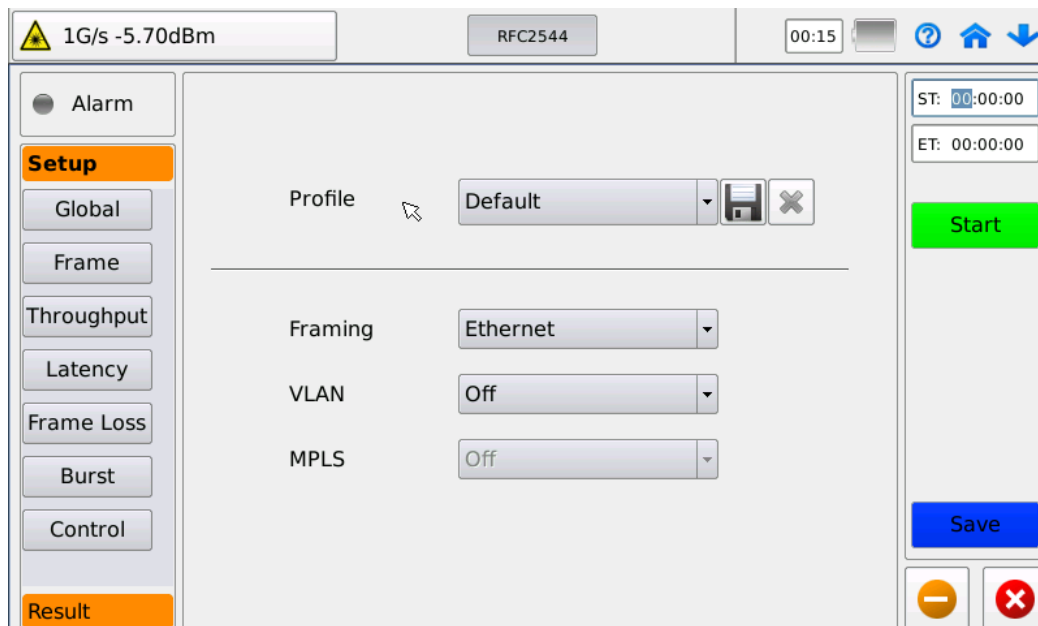
Back-to-back: the number of burst frames processed at most for the tested device without frame loss.

6.1 Configuring RFC2544 testing parameters

Setting the port network information is required before configuring the testing parameter. Select the port setting [] on the testing main interface; set testing mode, starting traffic control or not, and laser starting and closing on the port tab; set the third layer of network information in the network tab; see the [Port and Network Parameter Configuration](#).

6.1.1 Global setting

On the testing main interface, click RFC2544 testing icon [] in the test application, and come into RFC2544 testing global setting interface, as shown in the following figure;



Configuration file: select the pre-storing configuration file; it is recommended the common setting conditions can be stored for the follow-up testing use. If deleting the configuration files, select [✕] in the pull-down menu for deletion; select [💾] to save the configuration files; confirm the setting name is saved, and exit.

Framing: select the testing layer number; four options totally: Ethernet, IP, TCP and UDP;

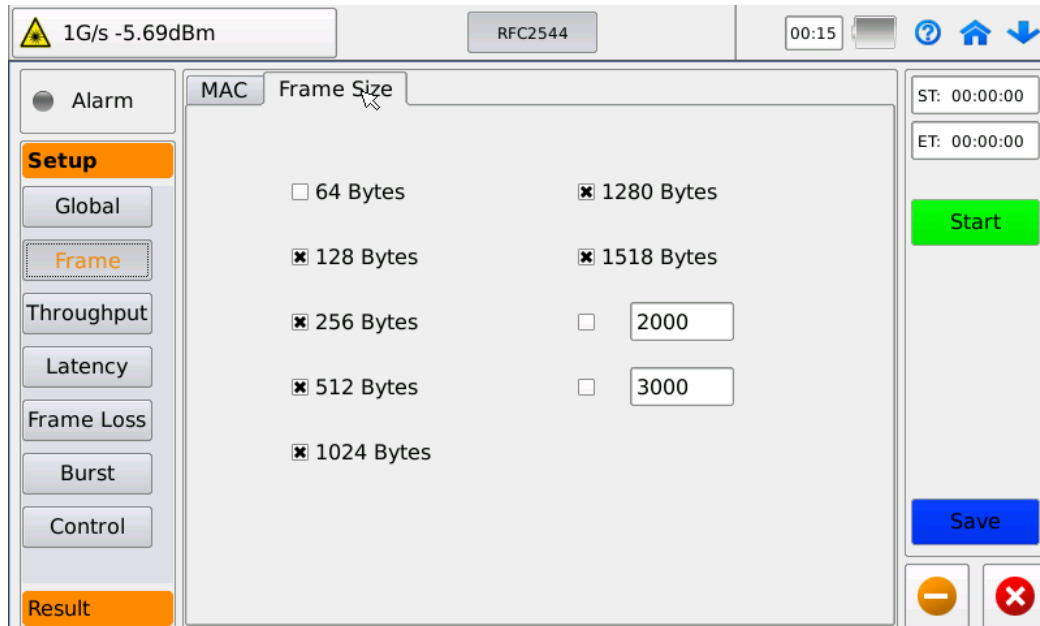
VLAN: select the number of VLAN layers to be configured with VLAN functions open when any one of Ethernet/IP/TCP/UDP for the testing layer number; three layers at most;

MPLS: select the number of MPLS layers to be configured with MPLS functions open when any one of IP/TCP/UDP is selected for the framing; three layers at most.

6.1.2 Frame settings

On the RFC2544 testing interface, click the set Frame, and come into the frame setting interface to set the frame information. The tab displayed on the interface is related to the configuration of global setting.

Information configuration of MAC, VLAN, MPLS, IP, TCP and UDP is consistent with the corresponding configuration in Bert testing. See 5.1.2 Frame Setting. For RFC2544 testing, the testing frame length is required to be set as shown in the following figure:



Inclusive of 7 standard frame lengths and 2 user-defined frame lengths in IPv4 version, standard frame lengths for testing layers are as follows:

	Frame 1 (byte)	Frame 2 (byte)	Frame 3 (byte)	Frame 4 (byte)	Frame 5 (byte)	Frame 6 (byte)	Frame 7 (byte)
Ethernet	64	128	256	512	1024	1280	1518
IP	72+VLAN×4+MPLS×4	128	256	512	1024	1280	1518
TCP	92+VLAN×4+MPLS×4	128	256	512	1024	1280	1518
UDP	80+VLAN×4+MPLS×4	128	256	512	1024	1280	1518

Notes:

Except the minimum frame length (Frame 1), other standard frame length is fixed in layers;

When the framing is Ethernet, the minimum frame length is 64 bytes whether the VLAN is started or not.

When the framing is IP, the minimum frame length is 72 bytes in closing VLAN and MPLS. With one layer added for VLAN or MPLS, four bytes of the frame length increase. The minimum frame length is 96 bytes in three layers of VLAN and three layers of MPLS.

When the framing is TCP, the minimum frame length is 92 bytes in closing VLAN and MPLS. With one layer added for VLAN or MPLS, four bytes of the frame length increase.

When the framing is UDP, the minimum frame length is 80 bytes in closing LVAN and

MPLS. With one layer added for VLAN or MPLS, four bytes of the frame length increase.

6.1.3 Throughput setting

On the RFC2544 testing interface, click the set Throughput and come into the throughput setting interface, as shown in the following figure:

Max rate: set the max rate of throughput. It is expressed by % of line rate, or by G, M and K, with a line rate at a range of 0.01—100%;

Resolution: the testing resolution is set by % of line rate, or by G, M and K; no matter what unit is selected, the testing resolution is 0.01-1% of line rate;

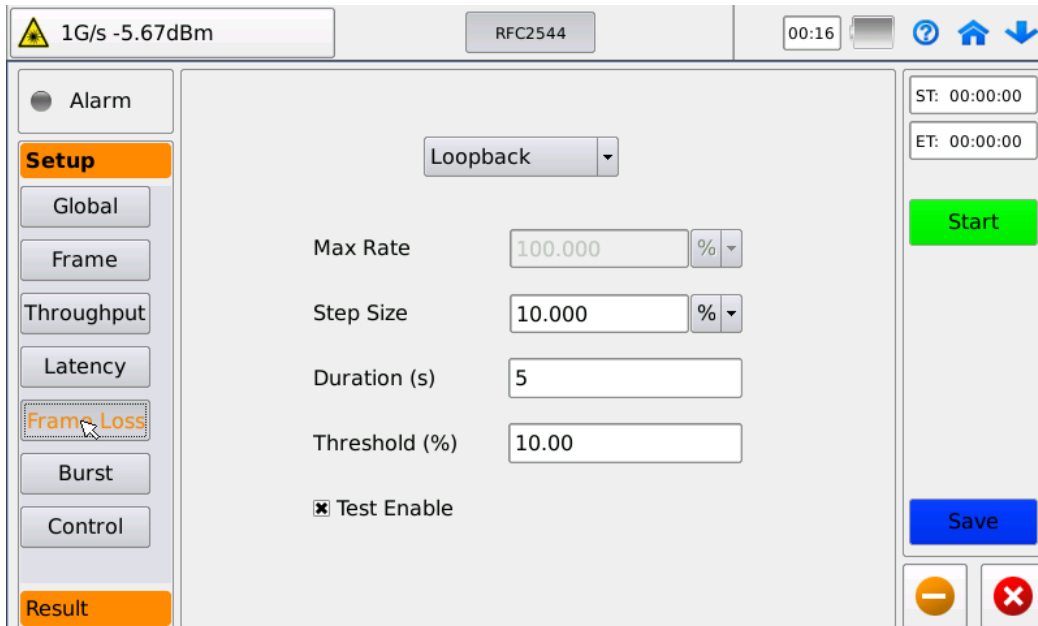
Testing time: set testing duration at a range of 5—1000s;

Threshold: set testing threshold by % of line rate, or by G, M and K; if the tested throughput is greater than or equal to the set threshold, it is judged as Pass; otherwise, not Pass.

Test enable: set whether the test is done or not. The throughput test can be done only when the check box is selected.

6.1.4 Delay setting

On RFC2544 testing interface, click the set Delay, and come into the delay setting interface, as shown in the following figure:



Max rate: directly select the max rate value of cited throughput; or select customer rate for resetting, the unit is selectable, at a line rate of 0.01—100%;

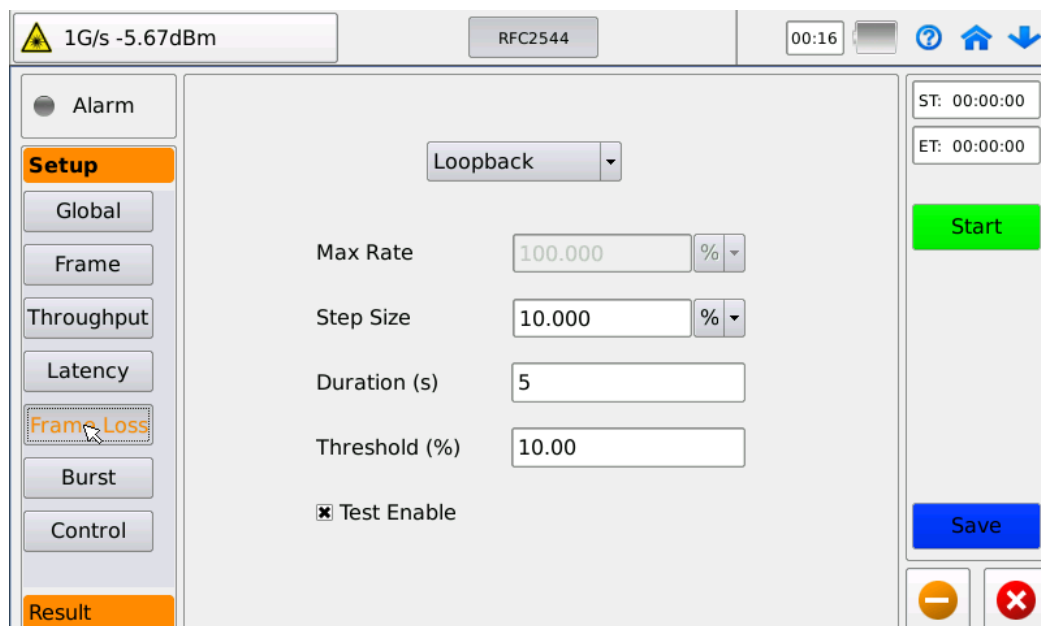
Testing time: set the testing duration at a range of 5—1000s;

Threshold: set delay threshold. If delay for all tested frames is less than or equal to the set threshold, then it is judged as Pass; otherwise, not Pass; the value is assumed as 0—99.99ms;

Test enable: select whether this test is done or not; the delay test is done only when the check box is selected.

6.1.5 Frame loss setting

On the RFC2544 testing interface, click the set Frame Loss, and come into the frame loss setting interface, as shown in the following figure:



Max rate: set the max rate to be tested. It is expressed by % of line rate, or by G, M and K, with a line rate at a range of 0.01—100%;

Step length: set the testing stepping value. if the test at the max rate is not Passed, then the set max rate is reduced by step, till the test can be passed, at the max rate of 5—50%;

Testing time: set testing duration at 5—1000s;

Threshold: set the frame loss threshold. If the frame loss of all testing frames is less than the set threshold, then it is judged as Pass; otherwise not Pass. The value is assumed at the max rate of 0—99.99%;

Test enable: select whether this test is done or not; the frame loss test is done only when the check box is selected.

6.1.6 Back-to-back setting

On the RFC2544 testing interface, click the set Back-to-Back and come into the back-to-back setting interface, as shown in the following figure:

The screenshot displays the RFC2544 testing interface. At the top, it shows '1G/s -5.66dBm' and 'RFC2544' with a timer at '00:16'. The interface is divided into several sections:

- Left Sidebar:** Contains navigation buttons: Alarm, Setup (highlighted in orange), Global, Frame, Throughput, Latency, Frame Loss, Burst (highlighted with a mouse cursor), Control, and Result (highlighted in orange).
- Main Area:** Features a 'Loopback' dropdown menu. Below it are input fields for:
 - Max Duration (s): 5
 - Resolution (#): 12
 - Repetition: 1
 - Threshold (%): 99.00
 A checkbox labeled 'Test Enable' is checked.
- Right Panel:** Includes start and end time fields (ST: 00:00:00, ET: 00:00:00), a green 'Start' button, a blue 'Save' button, and two circular buttons with minus and plus signs.

Max burst time: set the longest burst time; input the value between 2 and 5 seconds;

Testing accuracy: expressed by frame, and input the value between 1 and 100;

Number of testing: at a range of 1—100;

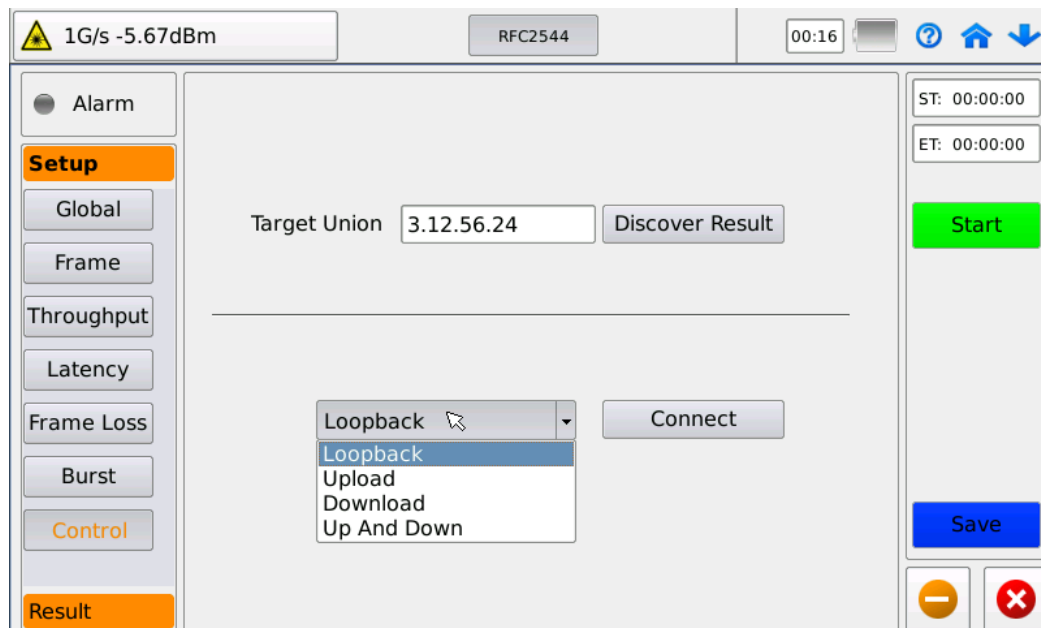
Threshold: set the back-to-back threshold. If the ratio of the number and theoretical number of back-to-back for all frames is greater than or equal to the set threshold, then it is judged as Pass; otherwise not Pass. The value is assumed as at the max rate of 0—99.99%;

Testing enable: select whether this test is done or not.

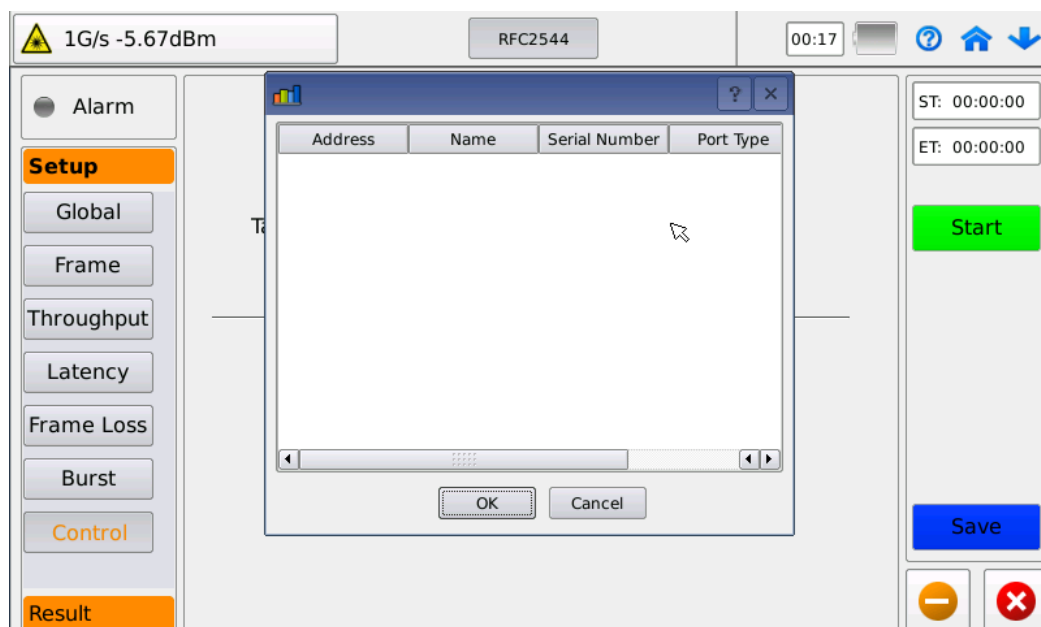
6.1.7 Remote control setting

On the RFC2544 testing interface, click the set Control and come into the remote

control setting interface, as shown in the following figure:



Targeted module: Lock the far-end device by two ways: one is to directly input the IP address of the far-end device, which is applicable for the determined far-end IP address; the other one is to select the required IP address or device in the Search Results; the prerequisite for this operation is to execute Discover [🔍] first, then to find out the targeted device; select the device, and the device IP address is displayed in the target address bar after confirming the exit.



Selecting test mode: Select any of up, down, up-down or loopback mode; click the connection to connect the local module and far-end device together after setting;

Loopback: set the far-end device as the loopback mode, and keep the number of layers set by the local framing consistent with the far-end loopback layer number. In

testing, the local module sends the testing traffic to the far-end module to execute loopback, then the testing traffic comes back to the local module, and is received and analyzed by the local module.

Up mode: set the far-end device in the up mode; the local module only executes analysis on up data.

Down mode: set the far-end device in the down mode; the local module only executes the analysis on the down data.

Up and down modes: set the far-end device in up and down modes; the local module only executes the analyses on up and down data respectively.

Note: the up and down modes are set respectively for such as parameters as throughput, frame loss and back-to-back when the up and down tests are selected.

6.2 RFC2544 testing results

6.2.1 Abstract

Turn to the result abstract interface after starting testing, or select Result—Abstract on RFC2544 testing main interface, and also come into the interface, as shown in the following figure:

	Throughput	Frame Loss	Burst
128 Byte	Pass		
256 Byte	Testing...Ⓞ		
512 Byte			
1,024 Byte			
1,280 Byte			
1,518 Byte			

On the result abstract interface, see schedule and results of all kinds of testing; the testing order is: throughput, delay, frame loss and back to back. Every testing should be done based on the set frame length successively. The green Pass is shown for the qualified testing, while the red Fail is shown for the unqualified testing.

6.2.2 Throughput

On the RFC2544 testing main interface, select Result-Throughput, and come into the throughput result interface, where, testing results of throughput for frames can be seen. The word is green for the qualified throughput, while the word is red for the unqualified throughput, as shown in the following figure:

	Throughput
128 Byte	1000.0 M
256 Byte	1000.0 M
512 Byte	1000.0 M
1,024 Byte	1000.0 M
1,280 Byte	Testing
1,518 Byte	

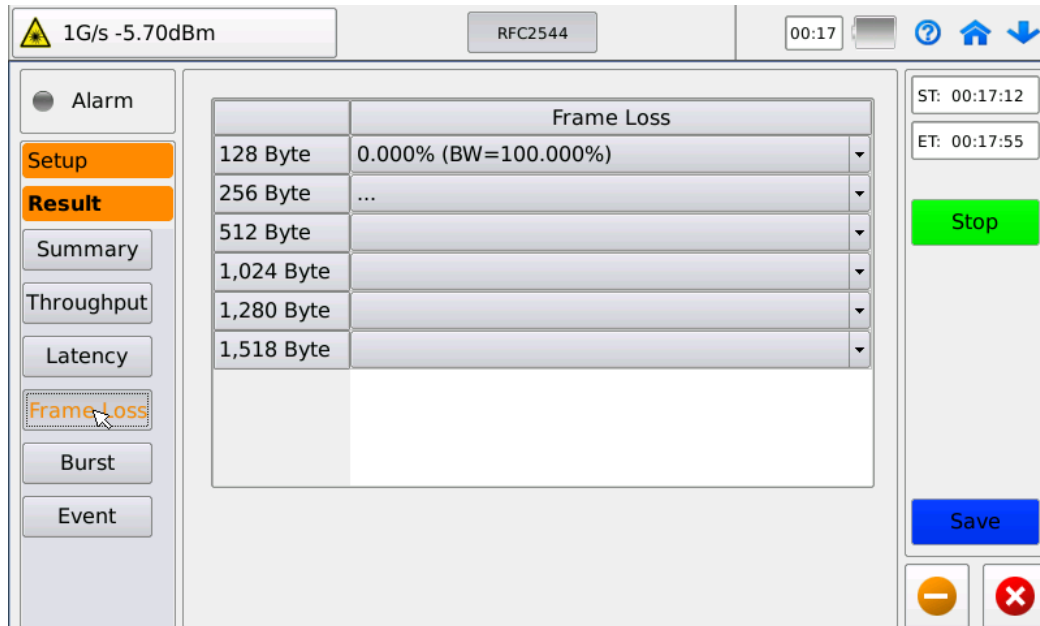
6.2.3 Delay

On the RFC2544 testing main interface, select Result-Delay, and come into the delay result interface, where, the delay of testing for frame lengths. The word is green for the qualified delay, while the word is red for the unqualified delay, as shown in the following figure:

	Latency
128 Byte	
256 Byte	
512 Byte	
1,024 Byte	
1,280 Byte	
1,518 Byte	

6.2.4 Frame loss

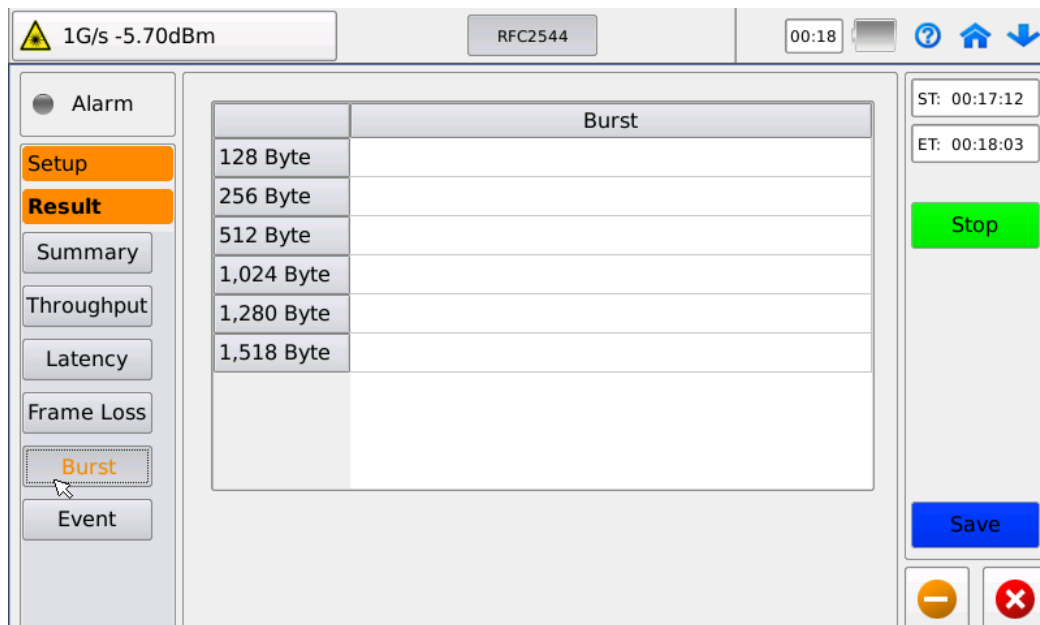
On the RFC2544 testing main interface, select Result-Frame Loss, and come into the frame loss result interface, where, the frame loss values for frame lengths can be seen, as shown in the following figure:



Note: The test is done at the set max rate at the beginning of testing. When the frame loss exceeds the set threshold, the bandwidth reduces by step; continue the test till the test is qualified or the bandwidth reduces to the minimum value.

6.2.5 Back to back

On the RFC2544 testing main interface, select Result—Back to back, and come into the back-to-back result interface, where, the back-to-back results of frame lengths. The green word is shown in qualified back-to-back testing, while the red word is shown in unqualified one, as shown in the following figure:



6.2.6 Events

On the RFC2544 testing main interface, select Result-Event and come into the event record interface, where, the events recorded in test can be seen in chronological order, as shown in the following figure.

1G/s -5.70dBm RFC2544 00:18

Alarm

Setup

Result

Summary

Throughput

Latency

Frame Loss

Burst

Event

Events		
1	00:17:12	2000-01-01, Start RFC2544 Test
2	00:17:12	2000-01-01, Start Throughput Test
3	00:17:48	2000-01-01, Stop Throughput Test
4	00:17:48	2000-01-01, Start Frameloss Test

ST: 00:17:12

ET: 00:18:11


Stop

Save

— ×

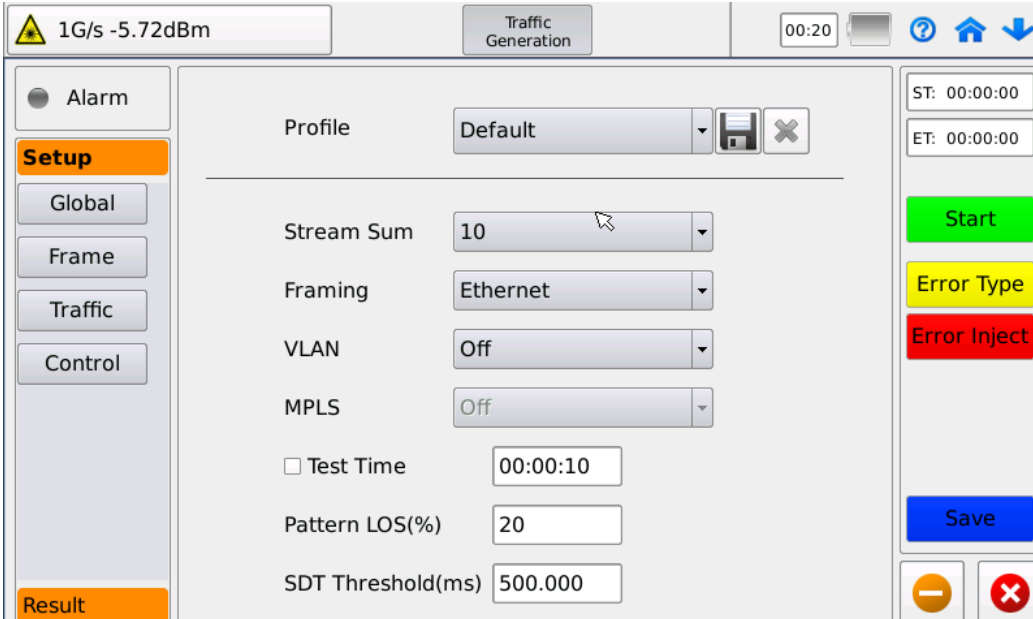
7 Traffic Generation


7.1 Configuring multi-traffic testing parameters

Before configuring the testing parameter, set the port network information first. On the test main interface, select the port setting []. Set testing mode, whether starting traffic control or not, and starting and closing of laser in the port tab; set the third layer of network information in the network tab. See the [Port and Network Parameter Configuration](#).

7.1.1 Global setting

On the testing main interface, select Traffic Generation testing icon [], and come into the traffic testing global setting interface, as shown as follows:



Configuration file: select the pre-stored configuration files. It is recommended the common set conditions can be saved for the follow-up testing. If the configuration file is deleted, select for deletion in the pull-down menu; select [] to save the configuration file; confirm the setting name is saved, and exit.

Traffic number: set the number of testing traffics, and select 1—10 traffic numbers;

Framing: select the number of testing layers; four options totally: Ethernet, IP, TCP and UDP;

VLAN: select the number VLAN layers (three layers at most) to be configured with VLAN functions open when any of Ethernet/IP/TCP/UDP is selected for the testing layers;

MPLS: select the number MPLS layers (three layers at most) to be configured with MPLS functions open when any of IP/TCP/UDP is selected for the testing layers;

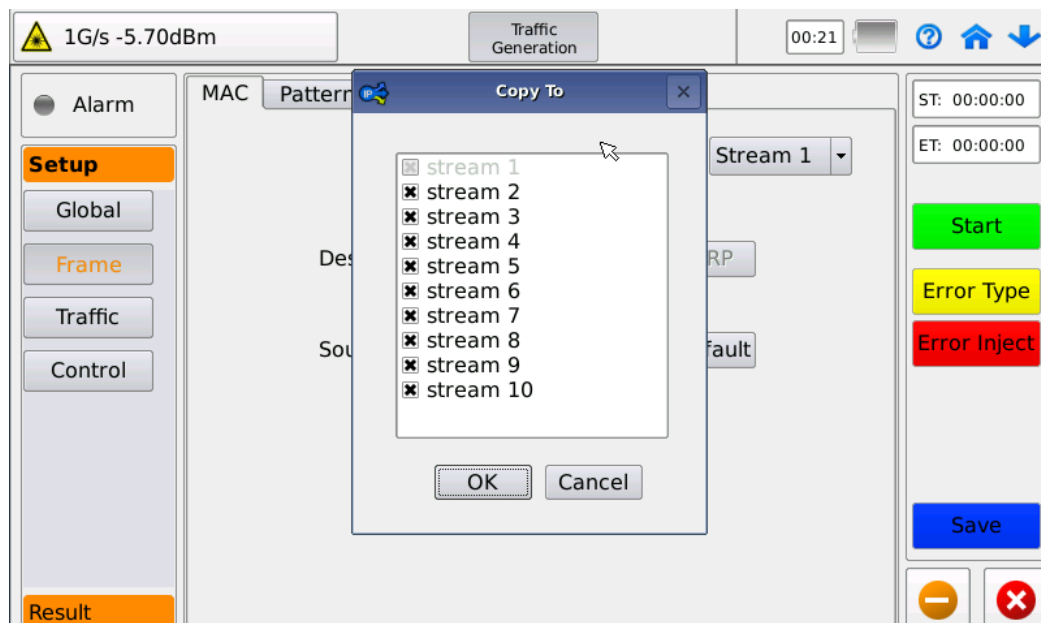
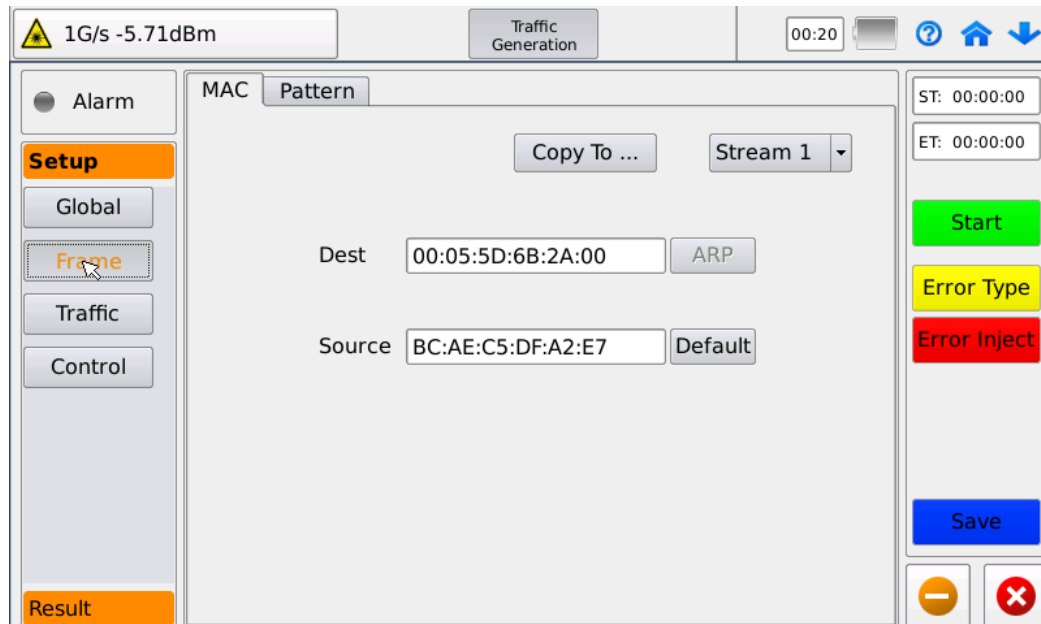
Testing time: select the check box to limit the testing time, at a range of 00:00:05--23:59:59;

Code mode loss: set the threshold of code mode loss at a range of 1—99. When the result exceeds this value, the result is judged as not Pass.

7.1.2 Frame setting

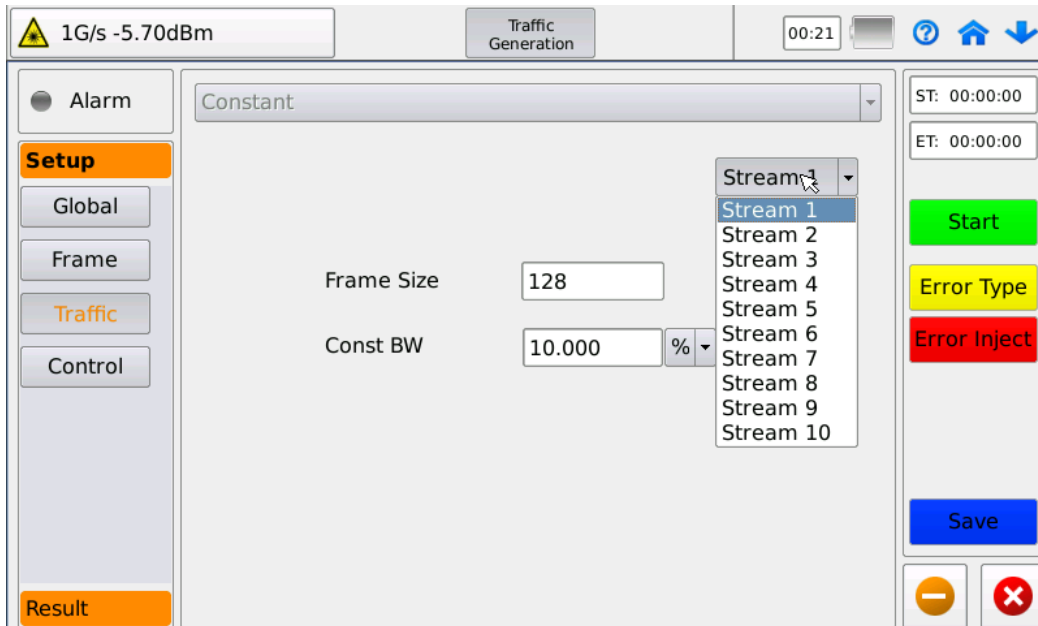
On the multi-traffic testing interface, select the set Frame and come into the frame setting interface for the frame information setting. The tab shown on the interface is related to configuration of the global setting.

MAC, VLAN, MPLS, IP, TCP, UDP and Pattern information configuration is consistent with the corresponding configuration in Bert testing. See 5.1.2 Frame Setting. It is noted that business traffics of multi-traffic testing should be configured respectively; or select to Copy Other Traffics, so that some traffic's configuration is copied to other business traffics.



7.1.3 Traffic setting

On the multi-traffic testing interface, select Setting-Traffic, and come into the traffic setting interface. This test only supports the fixed traffic testing, but for each business, frame length and bandwidth can be set separately as follows:

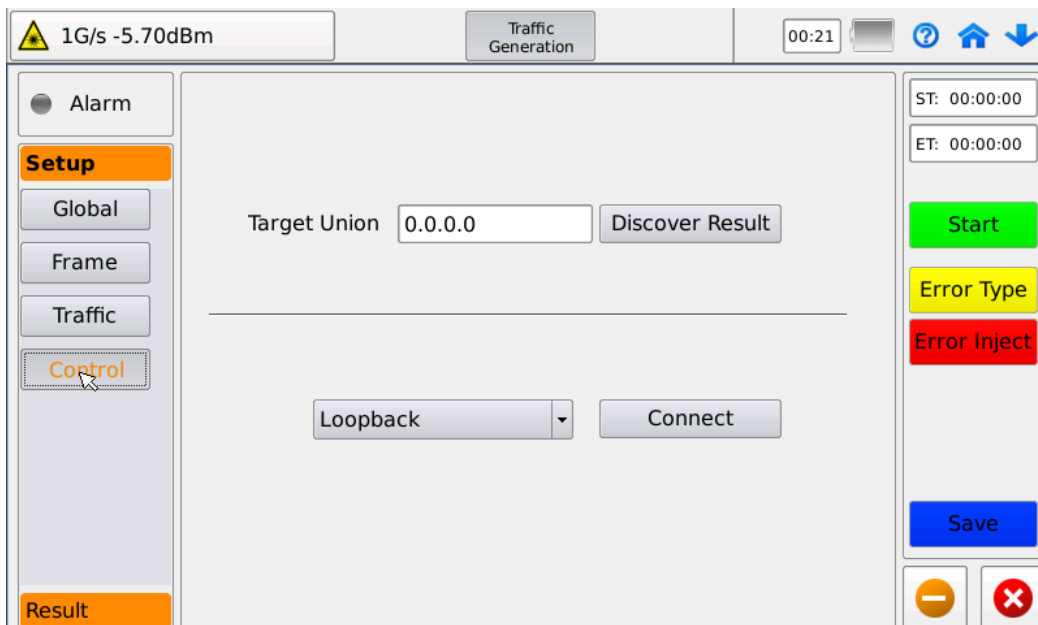


Frame size: set the testing frame length to support the 9600-byte frame length to the maximum.

Const BW: set the testing bandwidth by % of line rate, or by G/M/K;

7.1.4 Remote control setting

On the multi-traffic testing interface, select Setting-Control, and come into the receiving control setting interface. It may be connected with far-end device, and the interface is shown as follows;



Targeted device: Lock the far-end device by two ways: one is to directly input IP address of the far-end device, which is applicable for the determined far-end IP address; the other one is to select the required IP address or device in the Search Results. The prerequisite for this operation is to execute Discover [🔍] first, and find

out the targeted device to select the device. Confirm the IP address of this device is displayed in the target address bar, and exit.

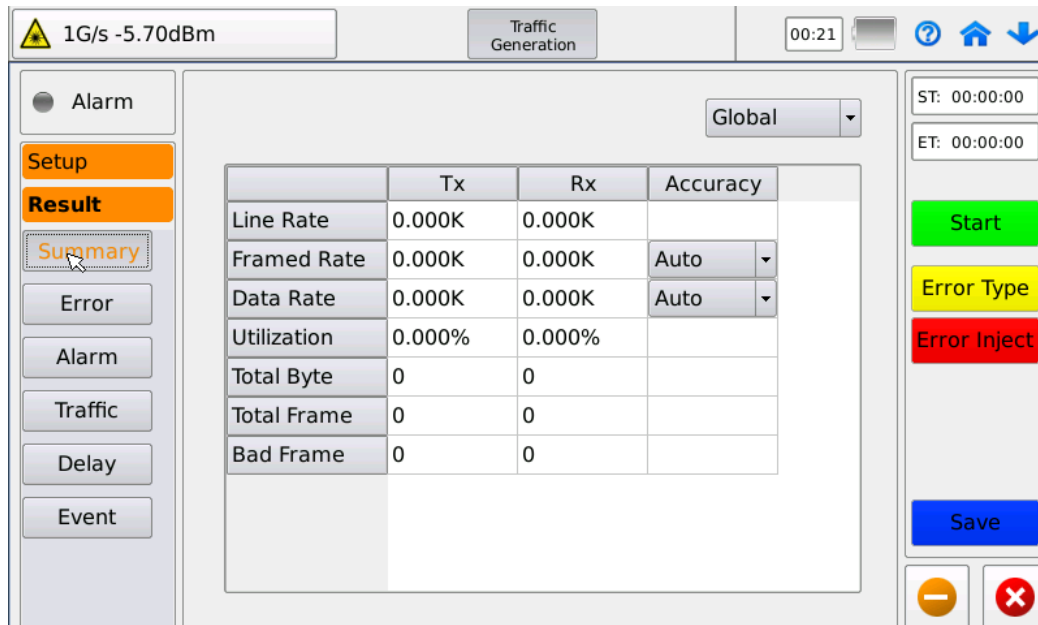
Click Connection after completing IP address input of the target device, and set the far-end device as the loopback mode; the number layers set by the local framing is consistent with the far-end loopback layer number.

In testing, the local module sends the testing traffic to the far-end module to execute the loopback, and the testing traffic comes back to the local module, and is received and analyzed by the local module.

7.2 Testing results of traffic generation

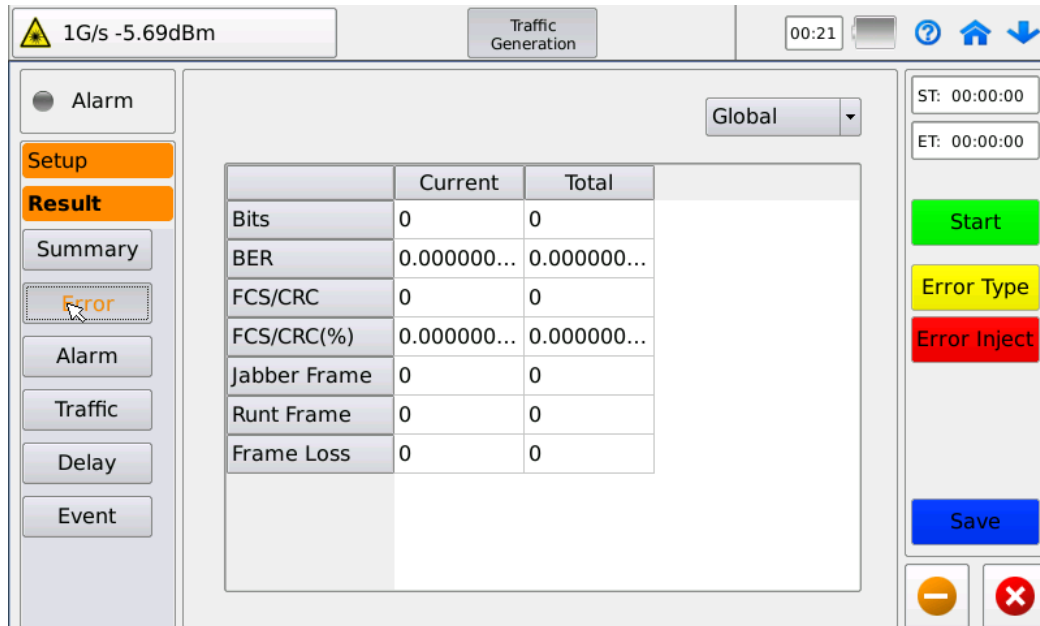
7.2.1 Abstract

Turn to the abstract interface after starting testing, or select Result—Abstract on the multi-traffic main interface. On this interface, you can browse basic information on the sending and receiving ends, and the statistical contents are consistent with Bert testing. See 5.2.1 Bert Result Abstract, defaulting to display overall results. If browsing testing results of traffics, select them in the tab on the top right corner, as shown in the following figure:



7.2.2 Errors

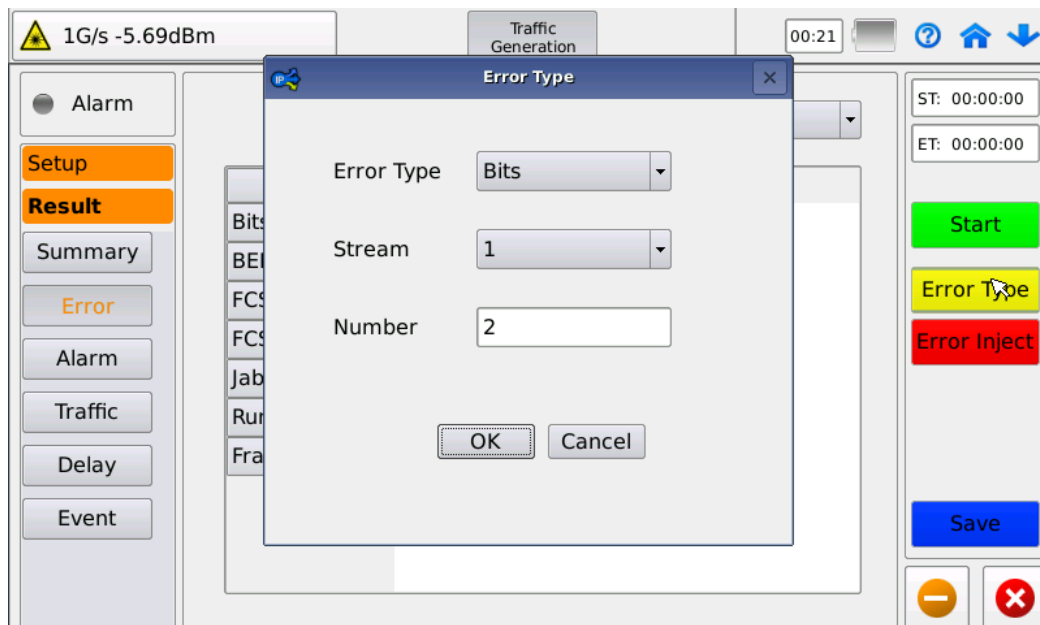
On the multi-traffic testing main interface, select Result-Error, and browse number or errors received and its proportion in total frame number. The statistical contents are consistent with the Bert testing for the most part. See 5.2.2 Bert Testing Error Statistics, defaulting to display overall results. If browsing testing results of traffics, select them in the tab on the top right corner, as shown in the following figure:



The Frame Loss statistics is added for the multi-traffic compared with Bert. The multi-traffic may be used to count the number of frame loss for traffics.

Manually inserting error code

Set the business traffic of inserting business, error type and number of errors inserted each time by pressing the Error Type button in the toolbar on the right of the interface. It is shown in the following:



Confirm the setting and exit. Insert the errors set in quantity into the set business traffic by pressing down the following Error Inserting button in testing.

7.2.3 Warning

On the multi-traffic testing main interface, select Result-Warning, and come into the warning interface, where, the warning information in testing can be browsed. All contents see [5.2.3 Bert Testing Warning Information](#) as follows:

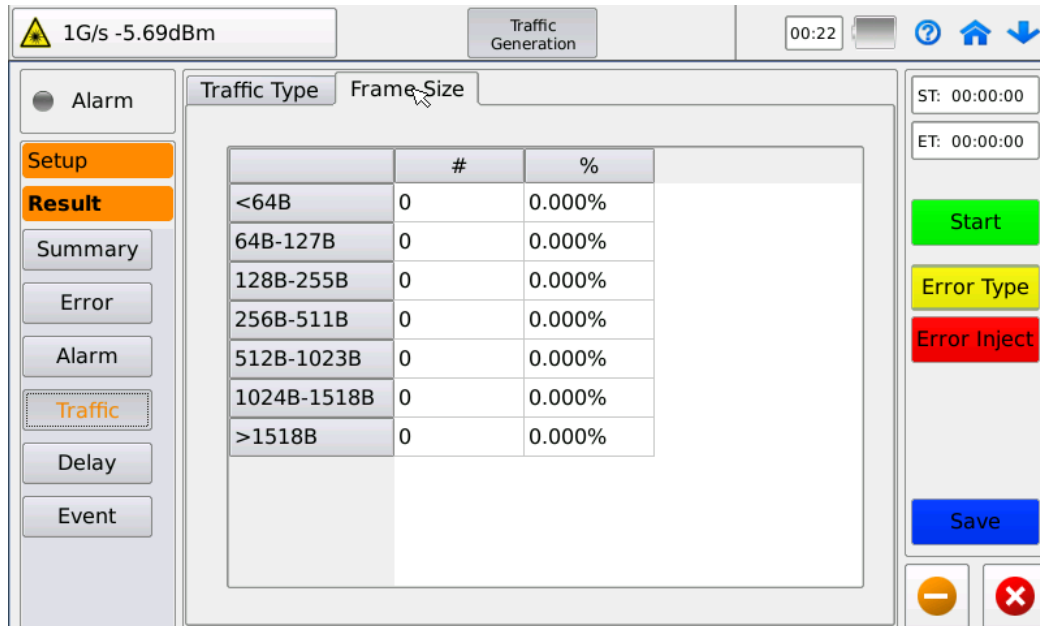
	Current	Total
LOS (ms)	0.000	0.000
Pattern Los	0	0

	Service Disruption
Current	0.000 ms
Total	0.000 ms
Max	0.000 ms
Min	0.000 ms
Times	0

7.2.4 Traffic statistics

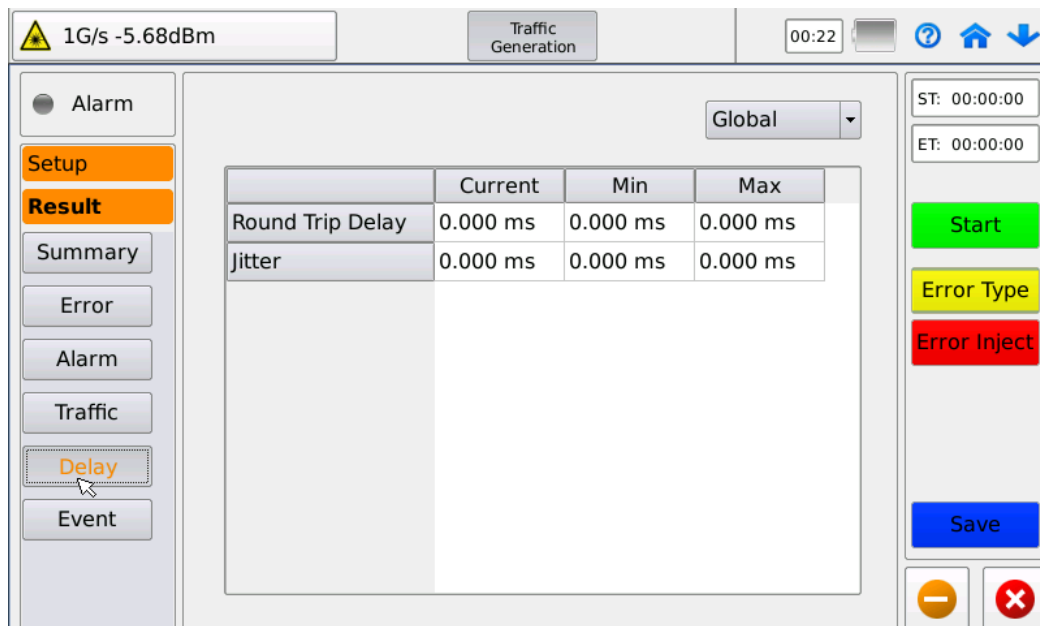
On the multi-traffic testing main interface, select Result-Traffic, and come into the traffic statistical interface, where, the statistical results by frame type and length are included. All contents see [5.2.4 Bert Testing Traffic Statistics](#) as follows:

Traffic Type	#	%
Unicast	0	0.000%
Broadcast	0	0.000%
Multicast	0	0.000%
Pause	0	0.000%



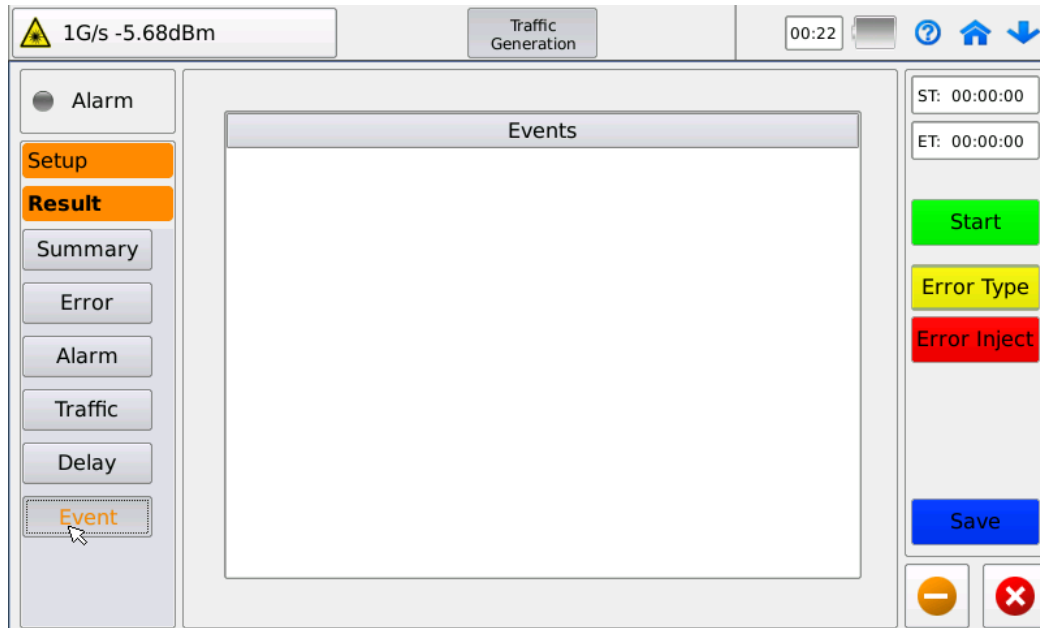
7.2.5 Time delay statistics

On the multi-traffic testing main interface, select Result-Delay, and come into the delay statistical interface, where, the loopback delay and jitter results can be browsed, defaulting to display overall results. If browsing the testing result of one traffic, select the traffic in the tab on the top right corner of the interface as follows:



7.2.6 Events

On the multi-traffic testing main interface, select Result-Event, and come into the event record interface, where, the events recorded in testing can be browsed in the chronological order as follows:



8 Y.1564

ITU - T Y.1564 is a new testing standard introduced for the operators' Ethernet service open and late troubleshooting. It is an official testing method for the Ethernet open. The method is mainly used to verify correct configuration and reliable performance in the mode of commercial and Ethernet business-carrying online business. Compared with RFC2544 testing, Y.1564 testing can be used to verify more accurately the service quality for each Ethernet meets its all SLA parameters. Y.1564 testing may be divided into stages: service configuring testing and service performance testing.


Service configuring testing

The service configuring testing is used to verify the service is deployed properly or not, and all specific SLA parameters are up to the standard or not. The service configuring testing can confirm the network is configured with one single data traffic setting CIR, and can select single or mixing packet for testing. It can be used to perform the max value testing at the set rate in hierarchies such as 25%, 50%, 75%, 100% and 100%+EIR, or at single rate. All services are offered in a configuring order.


Service performance testing

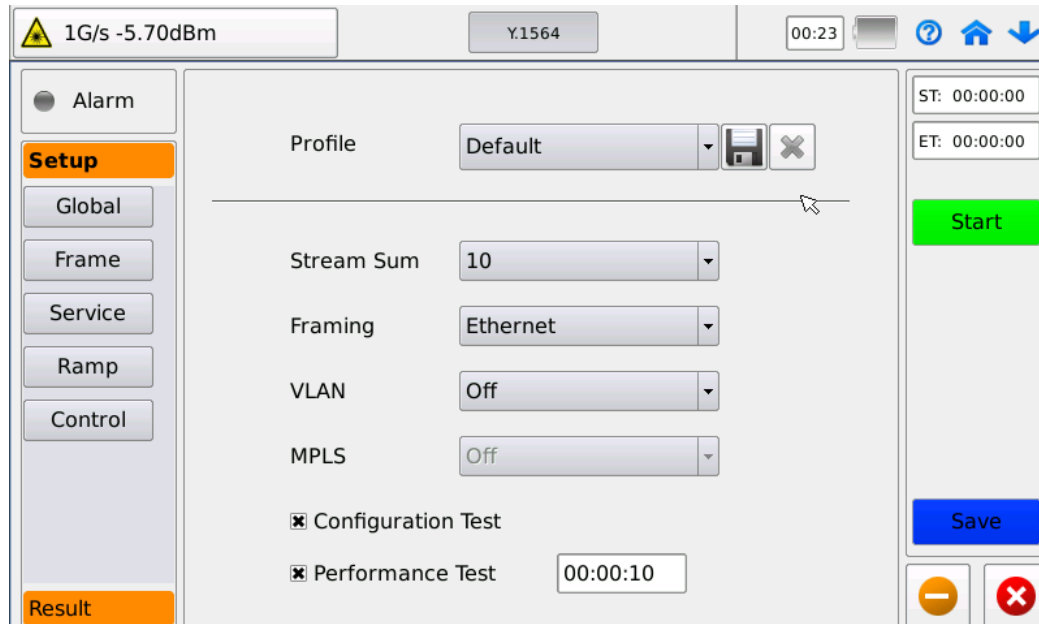
After service configuring testing is completed, all service quality can be verified by the service performance testing simultaneously. In this stage, CIR is set aiming at different services, and all SLA for each service is tested. It takes only some minutes in the whole process, and it is also used for the long-term pressure test.

8.1 Configuring Y.1564 testing parameters

Before the testing parameter is configured, it is recommended that the port network information is set first. On the testing main interface, select the port setting []; set testing mode, starting traffic control or not, and starting and closing of laser in the port tab; set the third layer of network information in the network tab. See the [Port and Network Parameter Configuration](#).

◆ 8.1.1 Global configuration

On the testing main interface, click Y.1564 testing icon [] in the testing application, and come into the Y.1564 testing global setting interface, as shown in the following figure:



Configuration file: select the pre-stored configuration file. It is recommended the common setting conditions can be saved for the follow-up testing. If deleting configuration file, select [✕] for deletion in pull-down menu; select [💾] to save the configuration file. Confirm the setting name is saved and exit.

Traffic number: set the number of testing traffics, and perform testing by selecting 1—10 traffics;

Framing: select the number of testing layers; four options totally: Ethernet, IP, TCP and UDP;

VLAN: Select the number of VLAN layers (three layers at most) to be configured with VLAN functions open when any of Ethernet/IP/TCP/UDP is selected for testing layer number;

MPLS: Select the number of **MPLS** layers (three layers at most) to be configured with **MPLS** functions open when any of IP/TCP/UDP is selected for testing layer number;

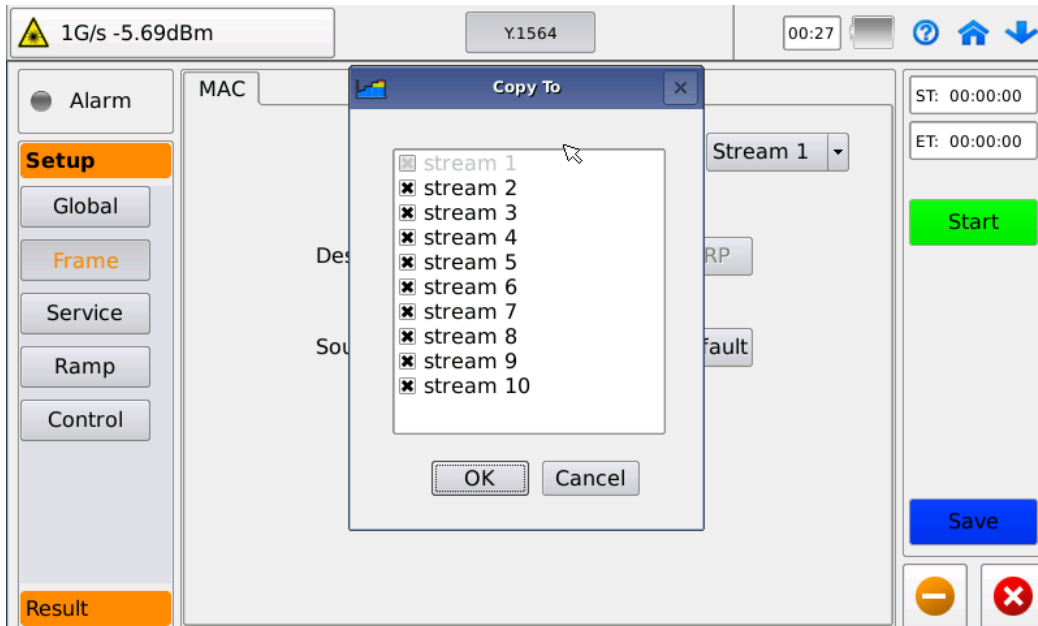
Service configuration testing: select check box for this item testing;

Service performance testing: select the check box for the item testing. The testing time should be set at a range of 00:00:05—23:59:59.

◆ 8.1.2 Frame setting

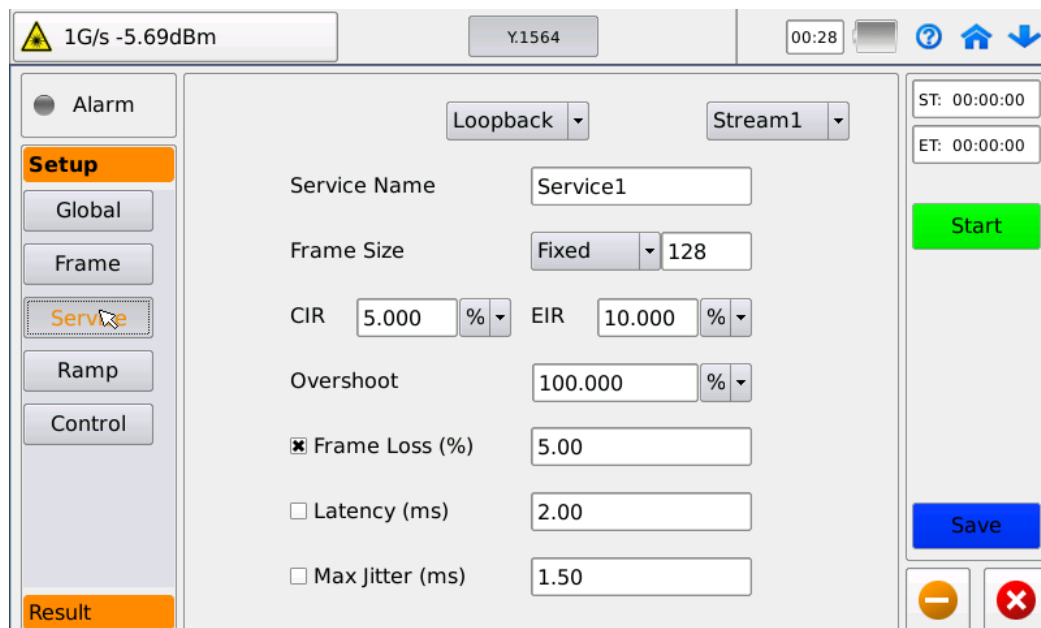
On Y.1564 testing interface, click Setting-Frame, and come into the frame setting interface, where the frame information is set. The tab displayed in the interface is related to the global setting configuration.

MAC, VLAN, MPLS, IP, TCP and UDP information configuration is consistent with the corresponding configuration in Bert testing; see [5.1.2 Frame Setting](#). The frame information for each traffic should be configured respectively, or configuration of one traffic is copied to other traffics by pressing Copy button, as follows;



◆ 8.1.3 Business setting

On Y.1564 testing interface, click Setting-Business, and come into the business setting interface as follows:



Testing mode: four modes: loopback, up, down, up-down modes, which are set in Control. In up-down testing, the up and down parameters should be configured separately.

Business traffic: Select different business traffics for business configuration from the pull-down menu based on business traffic number set in the global options;

Business name: the name displayed in the result can be customized as requested; the default name is Service 1 to 10;

Frame length: set testing frame length; the max frame length is 9600 bytes.

CIR: set the commitment information rate, i.e. business rate secured by SLA. It may

be expressed by % of line rate, or by G, M and K;

EIR: set excess information rate, i.e. the max business rate. It is expressed by % of line rate, or by G, M and K;

Overshoot: set overshoot rate, i.e. rate limitation of network. It is expressed by % of line rate or by G, M and K;

The rate setting principle is: $CIR + EIR \leq \text{Overshoot} \leq \text{line rate}$, and total sending rate for all business traffics should be less than or equal to line rate.

Threshold limitation:

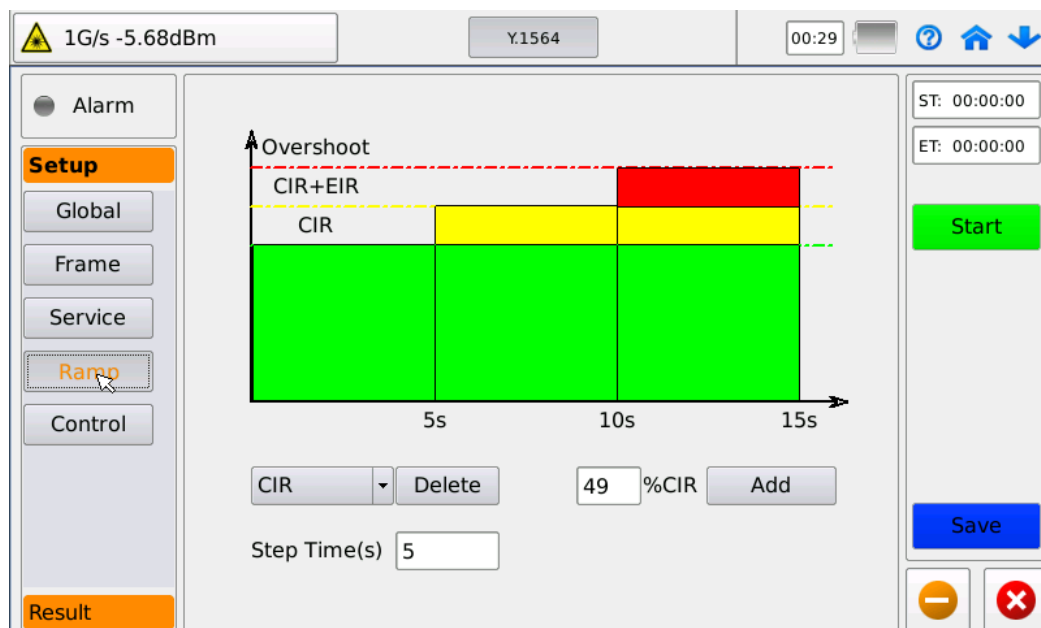
Frame loss: percentage of frame loss. Select this item, and judge the test is Pass if the test frame loss value is greater than the set threshold; the set range is 0—50%;

Time delay: to and fro delay. Select this item, and judge the test is not Pass if the testing to and fro delay value is greater than the set threshold; the set value is 0.015—8000ms;

Max jitter: Max jitter. Select this item, and judge the test is not Pass if the testing max jitter value is greater than the set threshold; the set range is 0.0015—8000s.

◆ **8.1.4 Step setting**

On Y.1564 testing interface, click Setting-Step, and come into the setting interface, as shown in the following figure:



Divide several ramp steps to CIR before CIR, and set the step time. The setting is represented only in business configuration testing results

Delete: select testing period for step to be deleted(refer to graph), and press Delete to delete this step. Only delete the steps below CIR;

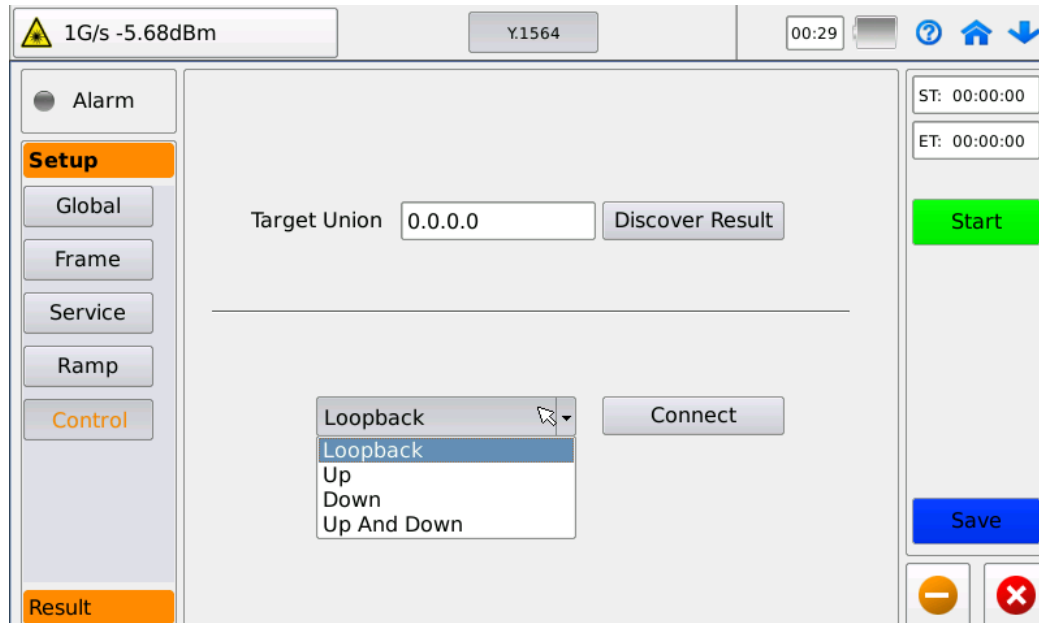
Add: input CIR percentage. Press Add to add new ramp sub-steps; only add 7 sub-steps at most;

Step time: set the testing time for steps, at a range of 5—60s.

◆ **8.1.5 Remote control setting**

On multi-traffic testing interface, click Setting-Control, and come into the receiving

control setting interface. It may be connected with far-end device, and the interface is show as follows:



Targeted device: Lock the far-end device by two ways: one is to directly input IP address of far-end device, which is applicable for determining far-end IP address; the other one is to select the required IP address or device in the Search Results.

The prerequisite for this operation is to execute Discover [🔍] first, and find out the targeted device and select the device. Confirm the device IP address is displayed in the target address bar and exit.

Selecting testing mode: select any of up, down, up-down or loopback mode; click Connection after setting to connect the local module with far-end device.

Loopback: Set the far-end device in the loopback mode, keep the number of layers set by local framing consistent with the far-end loopback layer number. In testing, the local module sends the testing traffic to the far-end module to execute loopback, and the testing traffic comes back to the local module, and is received and analyzed by the local module.

Up: set the far-end device in the up mode, and the local module only executes the analysis on up data;

Down: set the far-end device in the down mode, and the local module only executes the analysis on down data;

Up-down: set the far-end device in up-down mode, and the local module only executes the analysis on up-down data.

Note: set the business configuration respectively when selecting up-down testing.

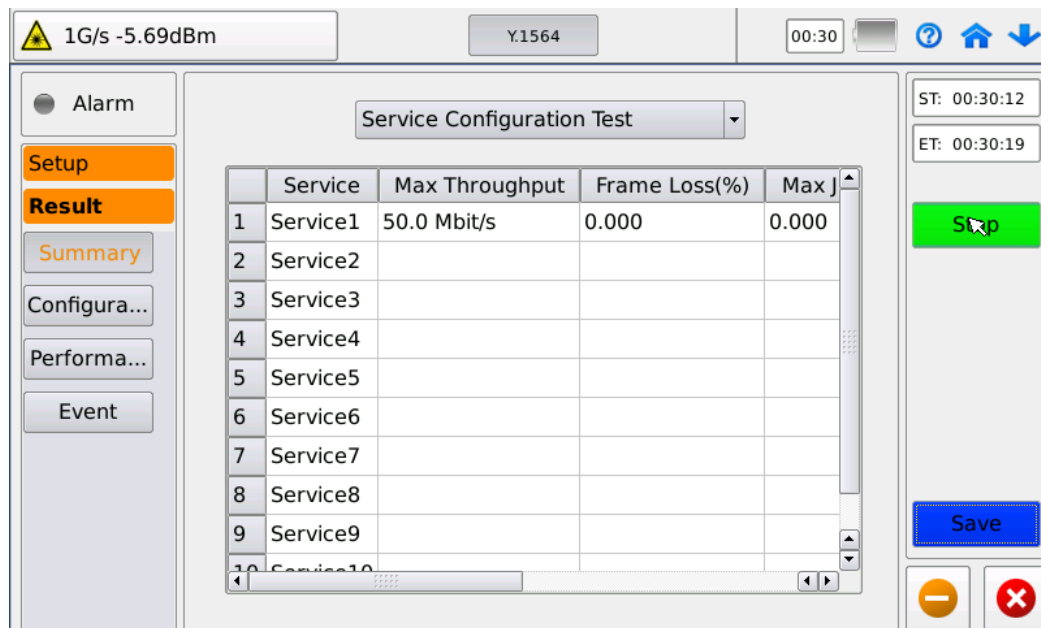
8.2 Y.1564 testing results

◆ 8.2.1 Abstract

Turn to the result abstract interface after starting testing, or select Result-Abstract in Y.1564 testing main interface, where testing results of service configuration and performance. The two results are displayed by switching over in the pull-down menu.

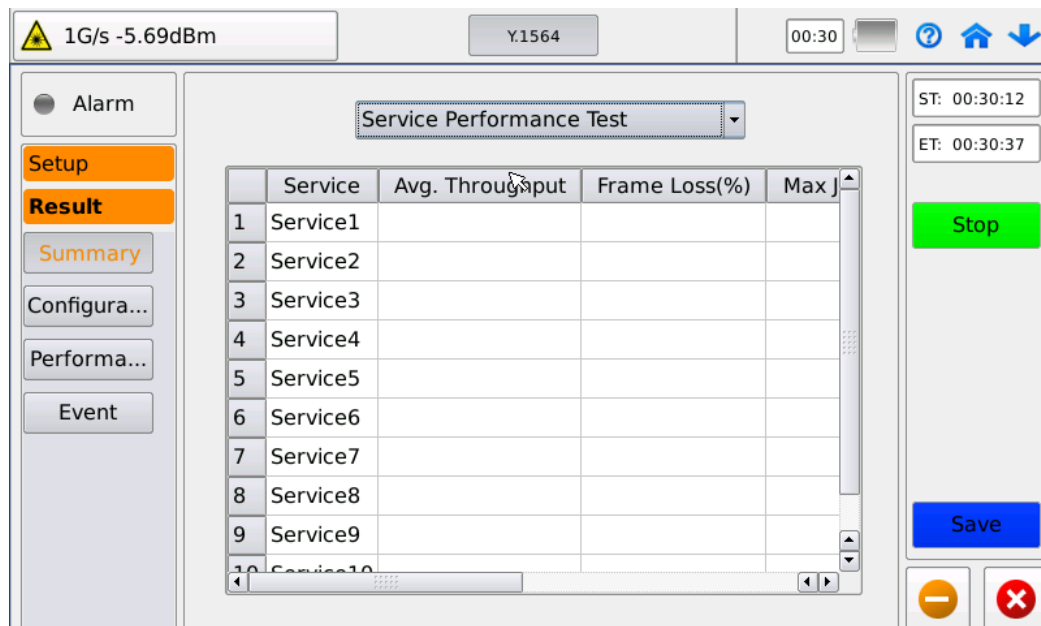
Testing results of business configuration:

It can display max throughput, frame loss rate, max jitter and delay the business traffic configuration testing, and the business traffic test passes the judgment or not. If yes, the judging result is shown as Pass; if not, it is shown as Fail.



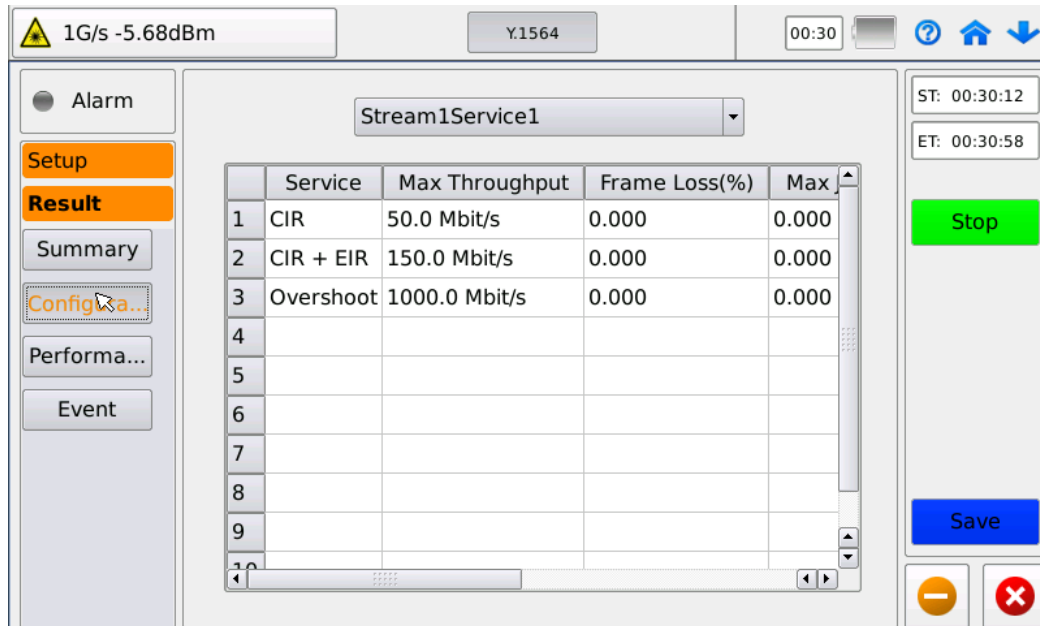
Testing result of business performance

It can display mean throughput, frame loss rate, max jitter and delay of business traffic performance testing, and the business traffic testing passes the judgment or not. If yes, the judging result is shown as Pass; if not, it is shown as Fail.



◆ 8.2.2 Testing result of business configuration

On Y.1564 testing main interface, select Result-Business Configuration Testing Result, and browse the testing results of steps. Select the business traffic to execute the test in the tab on the top, as shown in the following figure:



Service: display the steps set from min bandwidth to overshoot based on the set step value;

Max throughput: max throughput of all steps;

Frame loss rate: frame loss rate of all steps;

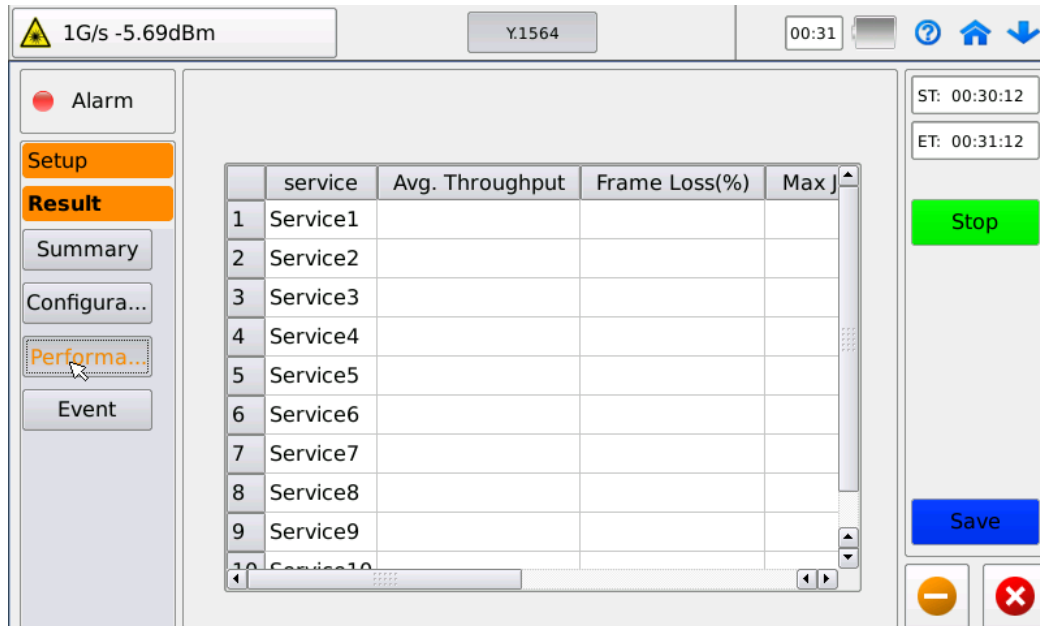
Max jitter: max jitter of all steps;

Delay: delay of all steps;

Result judgment: Compared with the set threshold, judge the test passes the judgment or not; if yes, it is shown as Pass; if not, it is shown as Fail.

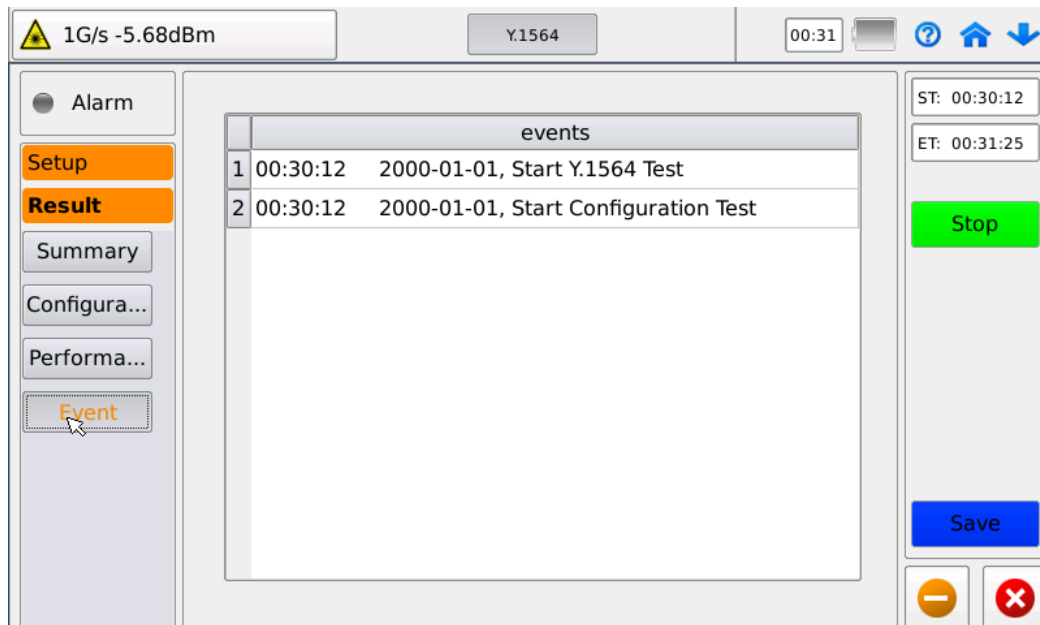
◆ 8.2.3 Testing result of business performance

On Y.1564 testing main interface, select Result-Business Performance Testing Result, and come into the business performance testing result interface. The contents are the same as the business performance testing result in the Result Abstract; select the specific business traffics from the pull-down list on the top, as shown in the following figure:




◆ 8.2.4 Events

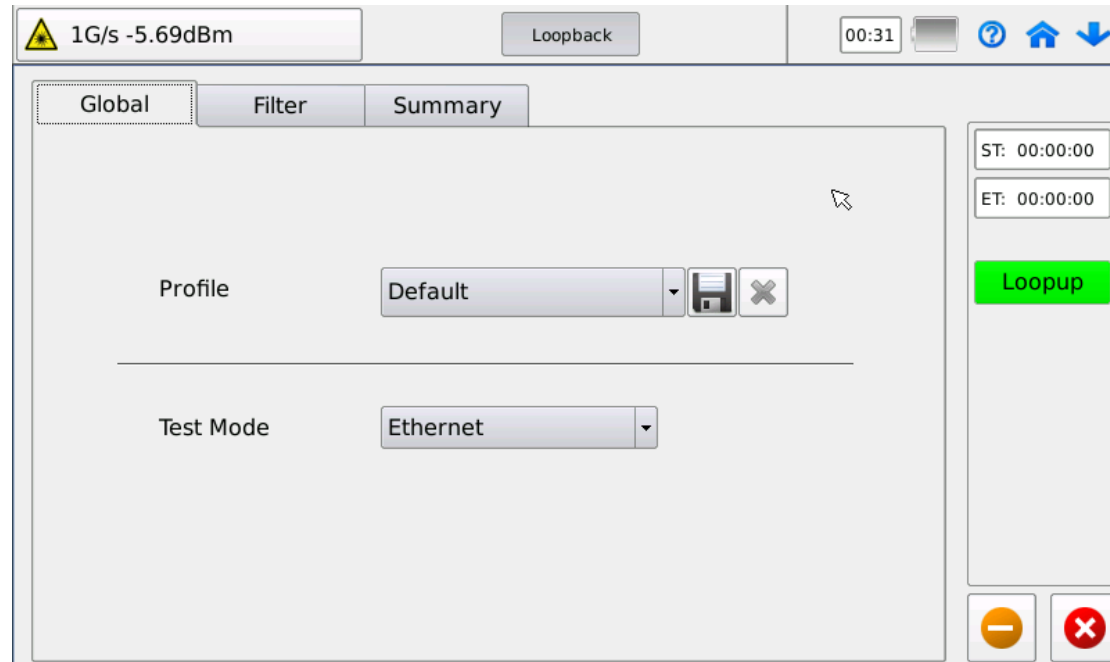
On Y.1564 testing main interface, select Result-Event, and come into the event record interface, where the recorded events in test are browsed in a chronological order, as shown in the following figure:





9 Loopback

9.1 Global setting

On testing main interface, click Loopback testing icon [] in the testing application, and come into the Loopback testing global setting interface, as shown in the following figure:



Configuration file: select the pre-stored configuration file. It is recommended the common setting conditions can be saved for the follow-up testing. If deleting configuration file, select it and [] for deletion from the pull-down menu; select [] to save the configuration file. Confirm the setting name is saved, and exit.

Testing mode: Select 1- 4 layer loopbacks, i.e. Transparent, Ethernet, IP and TCP/UDP. The policies for frame loss of loopbacks in layers are as follows:

Transparent: any processing of data received should not be done, and they are looped back directly;

Ethernet: give up the wrong CRC, and make loopback after exchanging MAC address;

IP: give up the wrong CRC and IP Checksum, and make loopback after exchanging MAC and IP addresses;

TCP/UDP: give up the wrong CRC, IP Checksum and TCP/UDP Checksum, and make loopback after exchanging MAC and IP addresses, and TCP/UDP port number.

9.2 Loopback filtering setting

On the Loopback testing main interface, select the filtering tab, and come into the filtering interface, as shown in the following figure:

The screenshot displays the Loopback testing interface. At the top, there is a status bar showing '1G/s -5.69dBm', a 'Loopback' button, and a timer '00:31'. Below the status bar are three tabs: 'Global', 'Filter', and 'Summary'. The 'Filter' tab is selected. The main area contains several filtering conditions, each with a checkbox and a text input field: 'MAC Source' (00:00:00:00:00:00), 'MAC Dest' (00:00:00:00:00:00), 'IP Source' (0.0.0.0), 'IP Dest' (0.0.0.0), 'Port Source' (0), 'Port Dest' (0), 'Vlan ID' (0), 'Vlan Priority' (0), and 'IP Tos' (00000000). On the right side, there are two time input fields: 'ST: 00:00:00' and 'ET: 00:00:00', a green 'Loopup' button, and two buttons at the bottom: a yellow minus sign and a red 'X'.

Set the filtering condition and select the check box before the condition; loop back the received frame in line with the setting condition.

9.3 Result abstract

Enter the loopback result abstract interface after starting loopback. The information displayed by result abstract should be the same as Bert testing. Refer to [Bert Result Abstract](#), as shown in the following figure:

Global Filter Summary

	Tx	Rx	Accuracy
Line Rate	0.000K	0.000K	
Framed Rate	0.000K	0.000K	Auto ▾
Data Rate	0.000K	0.000K	Auto ▾
Utilization	0.000%	0.000%	
Total Byte	0	0	
Total Frame	0	0	

ST: 00:00:00


ET: 00:00:00

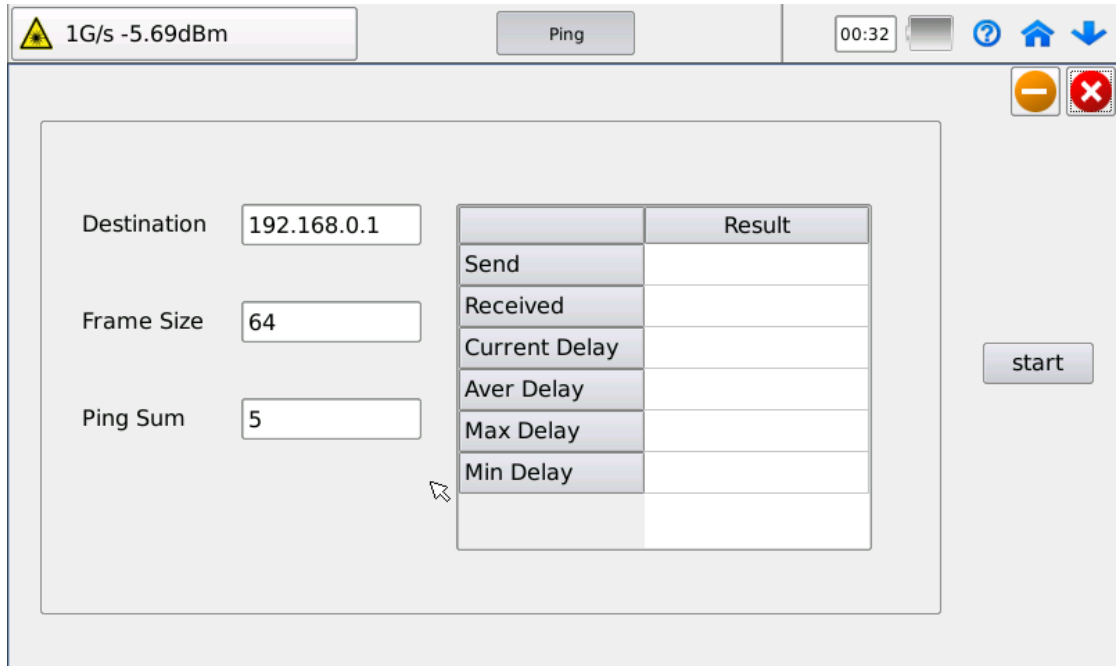
Loopup

⊖ ⊗

10. Ethernet testing tool

10.1 Ping

Ping testing is used to detect the tested device is connected or not, and test the network rate based on time delay. Select Ping [] on the testing main interface, and enter Ping testing interface, as shown in the following figure:



Settings:

Destination address: fill in the destination IP address of the tested device;

Frame length: set the sending frame length, and the fame length ranges from 64 to 1500 bytes.

Ping number: set the sent frame number;

After setting, press Start for testing.

Results:

Sending: count the sent frame number;

Receiving: count the received frame number;

Present delay: round trip time of frames received currently;

Mean delay: mean round trip time of frames received;

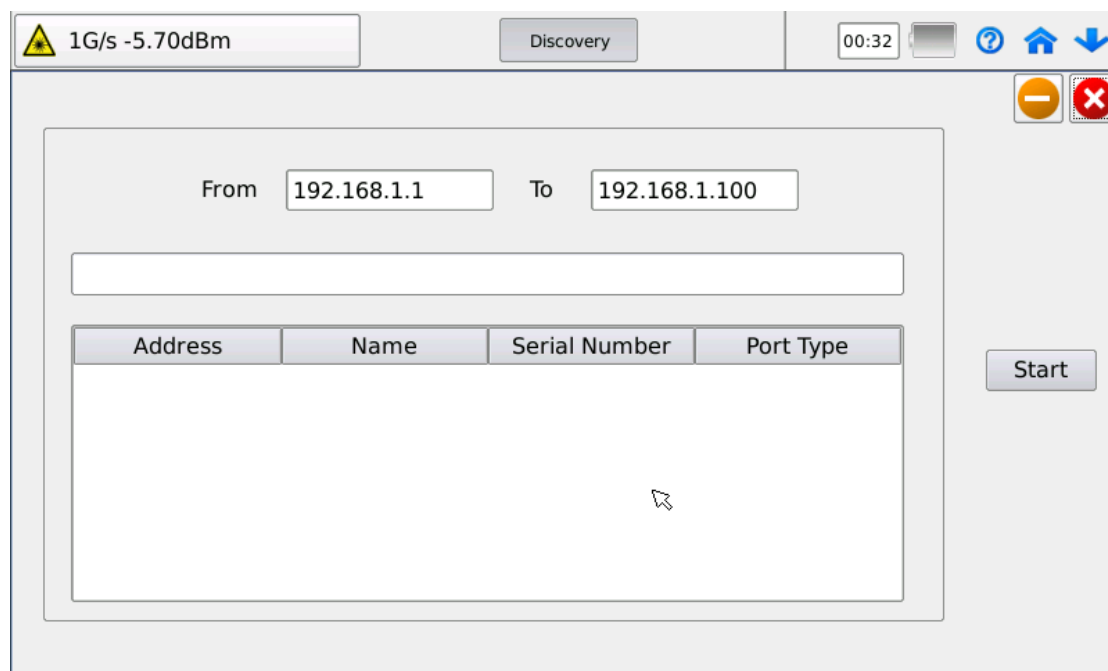
Max delay: the longest round trip time of frames received;

Min delay: the shortest round trip time of frames received

10.2 Discovery

The Discover function is used to search for a Our company[®] product at some IP section for the testing, so as to apply the Control Setting and search for far-end loopback device.

On the testing main interface, select Discover [🔍], and come into the Discover interface, as shown in the following figure:



The screenshot shows a software interface for the 'Discovery' function. At the top left, there is a status bar with a warning icon and the text '1G/s -5.70dBm'. To its right is a 'Discovery' button. Further right is a timer showing '00:32' and several navigation icons (help, home, back). Below the status bar, there are two input fields: 'From' with the value '192.168.1.1' and 'To' with the value '192.168.1.100'. Below these fields is a large empty text input area. Underneath is a table with four columns: 'Address', 'Name', 'Serial Number', and 'Port Type'. The table is currently empty. To the right of the table is a 'Start' button. The interface also features standard window controls (minimize, maximize, close) in the top right corner.

Input the IP address sections at the beginning and ending, and select Start for searching; filter out all Our company[®] products at this IP address section.

10.3 Trace Route

The trace route is used to count the number of network segments passed before the device arrives at the destination address. On the testing main interface, select the trace route [📍], and come into the interface; input the destination address and press Start for the tracing of the destination end, as shown in the following figure:

1G/s -5.70dBm

Trace Route

00:32

Trace Route


Destination: 192.168.0.2

HOP	TTL	Address
-----	-----	---------

Start

11. Guides of common problems to the instrument

11.1 Incomplete displaying information or not finding the interface closing button on the top of the interface

The closing button for testing application is located in the bottom right side, while the closing button for the system setting interface is located on the top right side of the interface. If no port information bar is received, the information on the top of some interfaces will not be displayed completely. In this case, press the icon [] on the right of tool bar to hide the port information bar

12. Warranty Information

Terms of Warranty

All Our company[®] products are warranted against defective material and workmanship for a period of one (1) year 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 Shineway Technologies Inc. free of charge.

In no case will Shineway Technologies, Inc. liabilities exceed the original purchase price of the product.

Exclusions

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

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

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

Warranty Registration

A warranty registration card is included with the original shipment of equipment. Please take a few moments to fill out the card and mail or fax it to the local Customer Service Center of Shineway Technologies, Inc. to ensure proper initiation of your warranty term and scope of your warranty.

Returning Instruments

To return instrument for reasons of yearly calibration or other, please contact the local Customer Service Center of Shineway Technologies, Inc. to obtain additional information and a RMA # (Return Materials Authorization number). And describe briefly reasons for the return of the equipment, to allow us offer you more efficient service.

NOTE

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

- Be sure to 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 around the instrument.
- Be sure to correctly fill out and return the warranty registration card, which should include the following information: company name, postal address, contact, phone number, email address and problem description.
- Be sure to seal the packing box with exclusive tape.
- Be sure to ship to your representative or the agent of the Company in a reliable way.