# MT1000A
# MU100010A
# Network Master Pro
# Operation Manual

**First Edition**

| |
|---|
| **For safety and warning information, please read this manual before attempting to use the equipment. Keep this manual with the equipment.** |

**ANRITSU CORPORATION**

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MT1000A/MU100010A
Network Master Pro
Operation Manual

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The contents of this manual may be changed without prior notice.
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# About This Manual

The documentation for MT1000A Network Master Pro applies to the instrument with the MU100010A 10Gig Multirate Module installed. This operation manual describes both the basic operation of the instrument as well as the operations available via interface options and predefined applications/tests.

**MT1000A/MU100010A Network Master Pro Operation Manual (this manual)**
Operations for the MT1000A Network Master Pro mainframe with 10G Multirate module (MU100010A) are described.

**MT1000A/MU100010A Network Master Pro Quick Reference Guide**
A printed quick user's guide that introduces the basic operation of the instrument.

**MT1000A/MU100010A Network Master Pro Command Based Remote Control Operation Manual**
Operations of the command-based Remote Control function are described.

**Manual structure**

The contents of the manual is structured in the following way:

**Chapter 1 - Introduction**

**Chapter 2 - Configuration**

**Chapter 3 - Man-Machine-Interface**

**Chapter 4 - Graphical User Interface**

**Chapter 5 - SDH/SONET/PDH/DSn Applications**

**Chapter 6 - Ethernet Application**

**Chapter 7 - OTN Applications**

**Chapter 8 - Specifications**

**Chapter 9 - Support**

Chapter 4 consists of a general introduction to the GUI. Chapters 5-7 contain descriptions of each screen, sub-screen and major dialog. The descriptions are provided in the following order:

Setup and result screens for each application. The applications are described in the same order as they appear on the application selector screen.

Ports setup screens and status information for each interface type.

Sub-screens and dialogs are described under the main screen from which they are activated/launched.

This operation manual assumes the reader has the following basic knowledge:

Ethernet communications, SDH/SONET communications

Optical communications, handling optical parts

# Table of Contents

# 1 Introduction

This chapter provides a general introduction to the instrument, and explains the symbols and conventions used in this manual.

# 1.1 Mainframe

The MT1000A Network Master Pro (hereafter called *the Network Master* and sometimes *the instrument*) is a battery-powered multipurpose telecommunications test instrument for field use. It is a tool for a wide range of applications from fast first-aid troubleshooting to comprehensive, in-depth analysis of transmission problems. The installed options enable the Network Master to be used both as a full-featured transmission line quality tester and as an advanced signaling analyzer.

Results are easily read from the large color LCD display, where the colors and graphical symbols facilitate interpretation. Together with the touch screen operation, this makes the Network Master very user-friendly in operation. Set-ups supporting particular applications may be stored in the instrument. The instrument has the following interface for data transfer and external communication: LAN interface, *Bluetooth* and three USB ports.

Fault location is greatly facilitated by the high degree of portability of the robust Network Master, allowing measurements to be taken at any suitable measuring point. The instrument is powered by a rechargeable and replaceable intelligent high-capacity Li-Ion battery. The Network Master can also be powered via an external mains adapter for long-term measurements.

## 1.2 10G Multirate Module (MU100010A)

The 10G Multirate module (MU100010A) allows the Network Master to test a large variety of interfaces and systems up to 10 Gbps, like OTN interfaces, Ethernet interfaces, SDH/SONET interfaces and PDH/DSn interfaces. The MU100010A can be configured to have two ports at all rates and interfaces. The instrument is thus ideal for both in-service and out-of-service transmission-quality measurement.

For fast troubleshooting, the Network Master displays alarms and transmission link status on LED icons in its display. The instrument's two ports permit immediate monitoring of the two sides of a line and allow comparison of simultaneously recorded results.

# 1.3 Symbols and Conventions

## 1.3.1 Symbols Used in Manual

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

**DANGER** This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

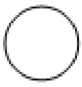
**WARNING** This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

**CAUTION** This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

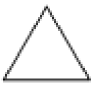
## 1.3.2 Safety Symbols Used on Equipment

The following safety symbols are used on Anritsu equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

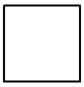
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



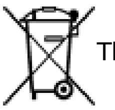
This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.



This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

A number of typographical conventions are used for easy spotting of information. Examples below are shown in grey boxes in this section only to indicate that they are 'examples'.

## 1.3.3 Notes

NOTE

*The Note symbol indicates information, procedures or recommendations that need to be followed to make correct measurements etc. Note text is written in italics to separate the information from the other text elements on a page.*

## 1.3.4 Hints

HINT

*The Hint symbol indicates information that should be treated as hints, suggestions, recommendations etc. Hint text is written in italics to separate the information from the other text elements on a page.*

### 1.3.5 Option

OPTION

*The Option symbol indicates that the information described covers an option (hardware and software) and that this option must be installed before use. Text is written in italics to separate the information from the other text elements on a page.*

# 1.4 Warnings

This section contains warnings which should be followed to avoid personal injury, product damage, as well as damage to the environment.

**WARNING**

- ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the advice in the operation manual is not followed, there is a risk of personal injury or reduced equipment performance. The alert mark shown on the left may also be used with other marks and descriptions to indicate other dangers.
- Overvoltage Category
  This equipment complies with overvoltage category II defined in IEC 61010. DO NOT connect this equipment to the power supply of overvoltage category III or IV.
- Laser radiation warning
  NEVER look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. There is a risk of injury if laser radiation enters the eye.

  The Laser Safety label is attached to the equipment for safety use as indicated in "Laser Safety" in Chapter 9.

**Repair**


- Only qualified service personnel with a knowledge of electrical fire and shock hazards should service this equipment. This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or unit covers or to disassemble internal components. In addition, there is a risk of damage to precision components.

**Calibration**


- The performance-guarantee seal verifies the integrity of the equipment. To ensure the continued integrity of the equipment, only Anritsu service personnel, or service personnel of an Anritsu sales representative, should break this seal to repair or calibrate the equipment. Be careful not to break the seal by opening the equipment or unit covers. If the performance-guarantee seal is broken by you or a third party, the performance of the equipment cannot be guaranteed.

## ⚠ WARNING

**Replacing Battery**

- When replacing the battery, use the specified battery and insert it with the correct polarity. If the wrong battery is used, or if the battery is inserted with reversed polarity, there is a risk of explosion causing severe injury or death.

**FOR CALIFORNIA USA ONLY**

This product contains a CR Coin Lithium Battery which contains Perchlorate Material - special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate.

**Battery Fluid**

- DO NOT short the battery terminals and never attempt to disassemble the battery or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak. This fluid is poisonous. DO NOT touch the battery fluid, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, rinse them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

**Battery Disposal**

- DO NOT expose batteries to heat or fire. Do not expose batteries to fire. This is dangerous and can result in explosions or fire. Heating batteries may cause them to leak or explode.

**LCD**

- This equipment uses a Liquid Crystal Display (LCD). DO NOT subject the equipment to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak. This liquid is very caustic and poisonous. DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, rinse them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

# 1.5 Cautions

## ⚠ CAUTION

**Replacing Memory Back-up Battery**

This equipment uses a Poly-carbomonofluoride lithium battery to back up the memory. This battery must be replaced by service personnel when it has reached the end of its useful life; contact the Anritsu sales section or your nearest representative.

*Note: The battery used in this equipment has a maximum useful life of 8 years. It should be replaced before this period has elapsed.*

The life of the battery will vary depending on the length of equipment usage and the operating environment.

The following conditions may be observed if the battery has expired:

- When power to the equipment is supplied, the time display may no longer match the actual time.
- Parameter and data settings may not be retained when the power to the equipment is cut.

**External Storage**

This equipment uses a USB memory as external storage media for storing data and programs.

If this media is mishandled or becomes faulty, important data may be lost. To prevent this chance occurrence, all important data and programs should be backed-up.

*Anritsu will not be held responsible for lost data.*
Pay careful attention to the following points:

- Never remove the USB memory from the equipment while it is being accessed.
- The USB memory may be damaged by static electric charges.
- Anritsu has thoroughly tested all external storage media shipped with this equipment. Users should note that external storage media not shipped with this equipment may not have been tested by Anritsu, thus Anritsu cannot guarantee the performance or suitability of such media.

**Lifetime of Parts**

The life span of certain parts used in this equipment is determined by the operating time or the power-on time. Due consideration should be given to the life spans of these parts when performing continuous operation over an extended period. The safety of the equipment cannot be guaranteed if component parts are used beyond their life spans. These parts must be replaced at the customer's expense even if within the guaranteed period described in Warranty at the end of this manual.

For details on life-span, refer to the corresponding section in this manual.

- LCD: Brightness at 50% after 40,000hrs
- Battery pack Capacity: 70% after 300 charge/discharge cycles

**Use in Residential Environment**

This equipment is designed for an industrial environment. In a residential environment, this equipment may cause radio interference in which case the user may be required to take adequate measures.

**Use in Corrosive Atmospheres**

Exposure to corrosive gases such as hydrogen sulfide, sulfurous acid, and hydrogen chloride will cause faults and failures.

Note that some organic solvents release corrosive gases.

## 1.5.1 Cautions against Computer Virus Infection

**Copying files and data**
Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.

All other required files should be transferred by means of USB media after undergoing a thorough virus check.

**Adding software**
Do not download or install software that has not been specifically recommended or licensed by Anritsu.

**Network connections**
Ensure that the network has sufficient anti-virus security protection in place.

# 1.6 Precautions

This section contains some precautions which should be followed to avoid damage or malfunction due to incorrect use, handling and transportation of the Network Master.

## 1.6.1 ESD (Electrostatic Discharge)

Modules and options for the Network Master contain electronic devices that are sensitive to ESD (Electro Static Discharge). Therefore, all ESD sensitive items are delivered from Anritsu in antistatic shielding packages.

Electrostatic discharge during installation can result in destruction or degradation of these devices. The damage may lead to equipment failure later. When you install or remove modules, it is your responsibility to control ESD. To control ESD, take the issues described below into consideration.

⚠ **CAUTION**

**Avoid build-up of electrostatic charge**

- Keep your workplace clear of any item that can generate electrostatic charges, e.g. all items that are not made of antistatic materials.

**Minimize the exposure to ESD**

- Keep ESD sensitive items in antistatic shielding packaging as long as possible.
- Do not remove ESD sensitive items from equipment or the antistatic shielding packaging unless you are connected to the equipment with a grounding wrist strap (as described later).
- Return ESD sensitive items to antistatic shielding packaging.

**Keep equipment, the ESD sensitive items and yourself at the same static potential**

- If your workplace is already prepared for handling ESD sensitive items, then follow your usual procedure. If not, you should follow the procedure below using a ground wrist strap.

1. Attach the wrist end of the wrist strap firmly around your wrist and the other end to the equipment chassis or ground plug.
2. Keep the wrist strap on while you install or remove ESD sensitive items. Do not remove the wrist strap until the ESD sensitive parts are either installed or returned to the antistatic shielding package.

## 1.6.2 Optical Surfaces

The optical interfaces - transmitter as well as receiver - are very sensitive to contamination. Be aware that contamination of the optical surfaces may result in severe loss of signal.

⚠ **CAUTION**

**To prevent contamination of the optical surfaces, mount protective caps to seal the transmitter/receiver connectors when no fiber optic cables are connected.**

**Correct functioning of the instrument can only be ensured if optical modules, supplied by Anritsu for the Network Master, are used.**

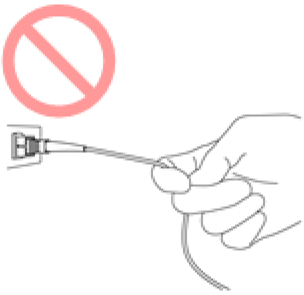
### 1.6.3 Cautions on Handling Optical Fiber Cables

Optical fiber cables may degrade in performance or be damaged if handled improperly. Note the following points when handling them.

**CAUTION**

**Do not pull the cable when removing the connector.**

Doing so may break the optical fiber inside the cable, or remove the cable sheath from the optical connector.

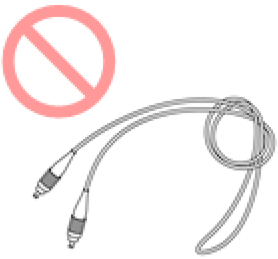


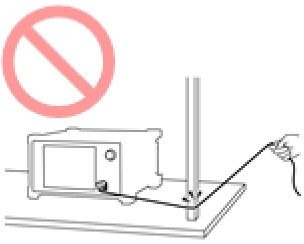
**CAUTION**

**Do not excessively bend, fold, or pinch an optical fiber cable.**

Doing so may break the optical fiber inside the cable.

Keep the bend radius of an optical fiber cable at 30 mm or more. If the radius is less, optical fiber cable loss will increase.





**CAUTION**

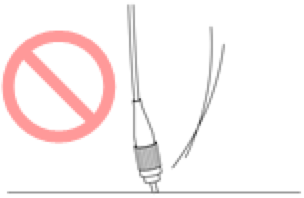
**Do not excessively pull on or twist an optical fiber cable.**

Also, do not hang anything by using a cable. Doing so may break the optical fiber inside the cable.

**CAUTION**

**Be careful not to hit the end of an optical connector against anything hard such as the floor or a desk by dropping the optical fiber cable.**

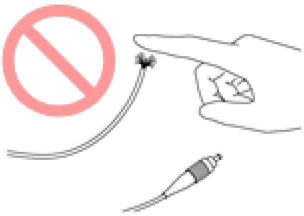
Doing so may damage the connector end and increase connection loss.



## ⚠ WARNING

**Do not touch the end of a broken optical fiber cable.**

The broken optical fiber may pierce the skin, causing injury.



## ⚠ CAUTION

**Do not disassemble optical connectors.**

Doing so may cause part to break or the performance to degrade.

### 1.6.4 Ventilation

The instrument has built-in fans, to prevent the temperature to rise inside the instrument.

## ⚠ CAUTION

**Be sure not to block the ventilation holes.**

### 1.6.5 Countries and Regions Permitting WLAN Use

Use of WLAN is restricted in some countries and regions, and illegal use may be punishable under national or local regulations. To avoid violating WLAN regulations, visit the Anritsu website to check where use is allowed.

http://www.anritsu.com/en-US/Products-Solutions/Products/MT1000A.aspx

Note that Anritsu cannot be held liable for any problem arising from WLAN use in other countries and regions.

# 2 Configuration

This chapter contains information about the included accessories and the basic configuration. You will find information about how to connect the mains adapter, about the battery used and how to charge it.

# 2.1 Delivered Accessories

The instrument is delivered in a shipment container together with various accessories depending on the order. When unpacking the first time, it is recommended to check these accessories against the list(s) below.

## 2.1.1 Standard Accessories

The following standard accessories are delivered with the instrument:

| | |
|---|---|
| J1565A | Line Cord USA |
| J1566A | Line Cord Europe |
| J1567A | Line Cord UK |
| J1568A | Line Cord Australia |
| J1594A | Line Cord Japan |
| J1596A | Line Cord Korea |
| G0309A | AC Adapter |
| G0310A | LiION Battery |
| B0690A | Softbag |
| B0692A | ESD box |
| Z1746A | Stylus |
| Z1747A | Carrying Strap |
| Z1748A | Handle |
| Z1817A | Utilities ROM |
| W3681AE | Quick Reference Guide |

## 2.1.2 Optional Accessories

One or more of the following optional accessories may be delivered with the instrument (if included in the order):

| | |
|---|---|
| B0691A | Hard case |
| G0324A | Battery Charger |
| G0325A | GPS receiver |
| J1570A | Head Set |
| W3682AE | Operation Manual |

# 2.2 Mains Power Adapter

The Network Master can be powered from the supplied AC mains adapter.

⚠ **CAUTION**

**Always use AC mains adapter delivered from Anritsu. Anritsu Part No. G0309A.**

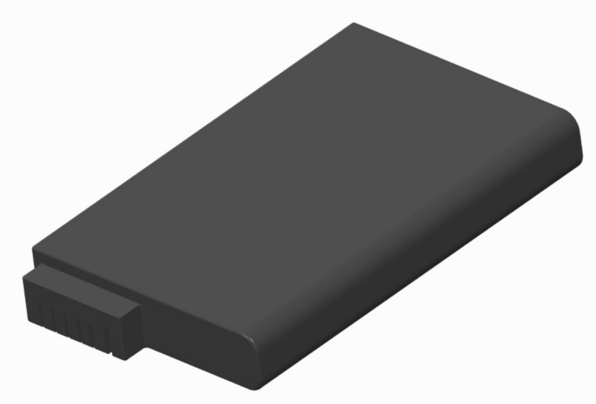
## 2.2.1 Connecting Mains Power Adapter

To connect the mains power adapter to the Network Master, follow the procedure below:

1. Insert the mains adapter's DC power plug into the socket connector marked '18V DC'. The DC input connector is located on the right-hand side of Network Master's connector panel.
2. Connect the AC plug of the mains adapter to the mains and switch on the mains wall outlet. The power button will flush during booting. Then lit on orange when charging.

## 2.3 Rechargeable Battery

The Network Master is delivered with a 10.8 V Intelligent Li-Ion rechargeable and replaceable battery. The typical operation capacity (with a fully charged battery) will be approximately 4 hours.



**⚠ CAUTION**

**Use only original batteries delivered from Anritsu, to prevent the risk of instrument damage or personal injury.**

**Battery should only be charged at room temperature.**

**Initial charging**

The battery will normally be partially or fully discharged on delivery. It is recommended to charge the battery as the first thing after delivery and unpacking. In Stand By Mode, the **ON/OFF** indicator will stop flashing when the battery is fully charged.

NOTE

*If the battery happens not to be used for a longer period of time it is recommended that it contains at least 20% capacity. Charge the battery before storage, if necessary.*

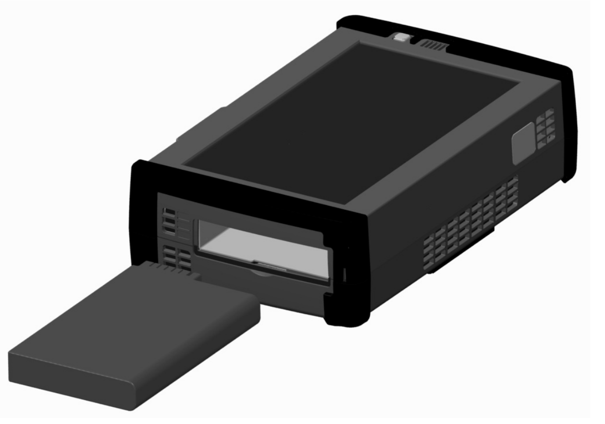
**Temperature**

When charging is in process, the temperature of the battery will increase. The intelligence of the battery will ensure that the charging takes place at the correct temperature.

### 2.3.1 Installing or Replacing Battery

To install or replace the battery in the Network Master, follow the procedure below:

1. Disconnect the mains power adapter if it is connected.
2. Switch the Network Master **OFF**.
3. Place the instrument on its back on a plain surface and turn the lock screw of the battery compartment to match the unlock mark.
4. Remove the lid of the battery compartment.
5. Pull out the battery from the compartment.



6. When installing the battery, note the direction of the battery terminals. With the instrument placed on its back - and the battery compartment in front of you - the terminals should be in the upper left corner.
7. Re-install the battery compartment door and tighten the lock screw.

## 2.3.2 Charging Battery in Fast Mode

Power is supplied from the external AC mains adapter - and the Network Master is switched **OFF** during the charging (Stand By Mode).

To charge the Network Master battery using the fast charge mode, follow the procedure below:

1. Switch the Network Master **OFF**.
2. Connect the mains adapter, as described in the "Connecting Mains Power Adapter" section.

**ON/OFF indicator**

When connected, the **ON/OFF** indicator will flash after approx. 30 seconds, indicating that charging is in progress. When the flashing stops, the charging is complete. If the battery is defective - the **ON/OFF** indicator will also light. Therefore, the best way to check the battery status is to switch on the Network Master and observe the battery information as described in the Instrument toolbar section.

## 2.3.3 Charging Battery in Normal Mode

Power is supplied from the external AC mains adapter - and the Network Master is switched **ON** during the charging.

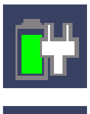
A normal charging of the battery is taking place every time the instrument is in use and connected to the mains adapter.

The battery status can be checked in the instrument toolbar (expandable icon toolbar) on the right-hand side of the screen, or in the status line if the battery indicator is displayed there. See the "Battery Status Information" section below.

## 2.3.4 Battery Status Information

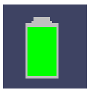
The battery icon is displayed in the status line at the bottom of the screen.

The following icons are used to indicate the current battery status:



Icon indicates that the battery is fully charged. The Network Master is using the AC adapter as power source.

Icon indicates that there is no battery in the Network Master (or the battery is malfunctioning). The Network Master is using the AC adapter as power source.

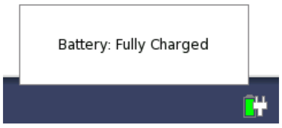


Icon indicates that the Network Master is using the battery as power source. The AC adapter is not connected.

NOTE

*There is a delay of several seconds before the battery status is updated.*

A more detailed battery status information is launched when touching the battery icon. The example in the figure below shows the status screen of a battery during charging.



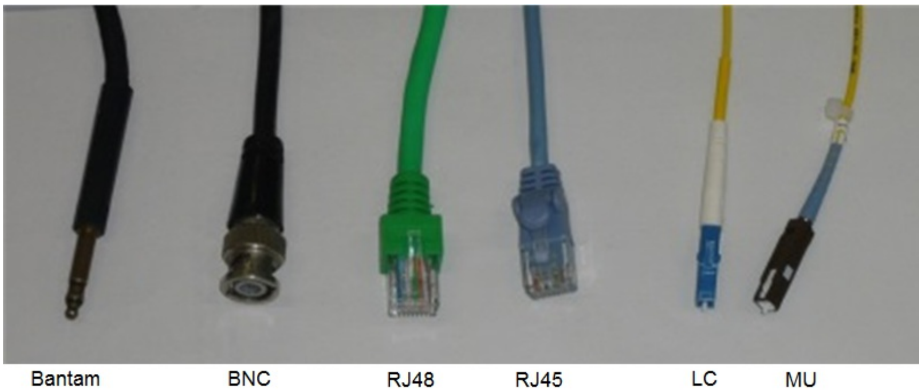

## 2.4 Measurement Cables

When connecting the Network Master to the line to be tested or monitored, it is recommended always to use shielded cables of good quality, to avoid the possibility of corrupting the measuring results. For the same reason, the AC adapter, if used, should be connected to the instrument and switched on before starting the measurement.

For connection of the Network Master to different types of equipment, different cables are available. Please contact your Anritsu representative for information.

### 2.4.1 Connecting Measurement Cables

Measurement cables are connected to the input and output connectors located on the connector panel of the instrument. Various electrical and optical connectors are available.



# 2.5 Support Stand and Carrying Strap

## 2.5.1 Support Stand

The Network Master is equipped with a support stand keeping the instrument at a convenient angle during the operation. To extract the stand: pull out the metal bar on rear of the instrument - it automatically stays in the correct position.

Be sure to open a support stand fully. If it does not so, the Network Master will be more likely to tip over. Moreover, the air flow on bottom panel will be insufficient.

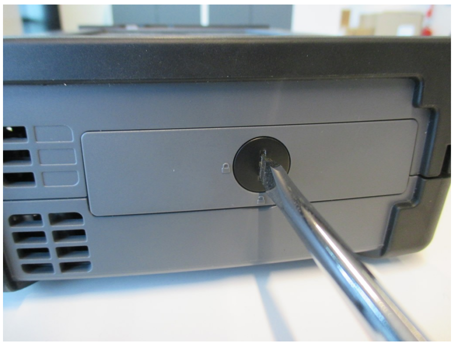
## 2.5.2 Carrying Strap and Handle

The included carrying strap and handle can easily be mounted for your convenience when transporting and/or using the Network Master.

The carrying strap is equipped with hooks for easy installation.

**How to attach carrying strap and handle**
To attach carrying strap (Z1747A) and handle (Z1748A) to MT1000A Network Master Pro, follow instructions below.

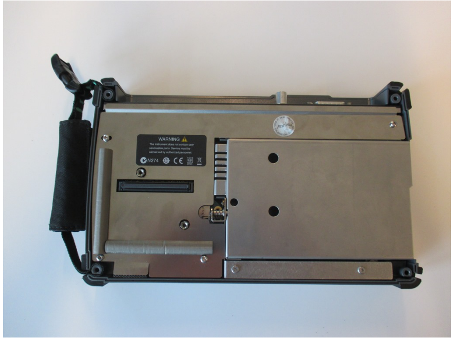
1. Use screw driver and remove the battery lid from MT1000A.

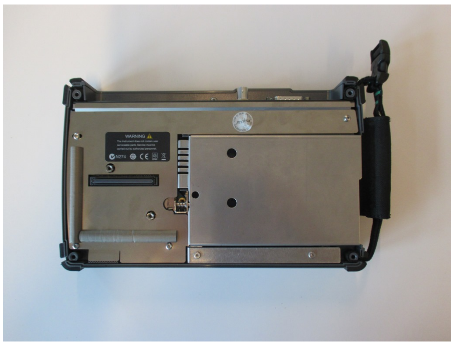


2. Remove the battery pack.

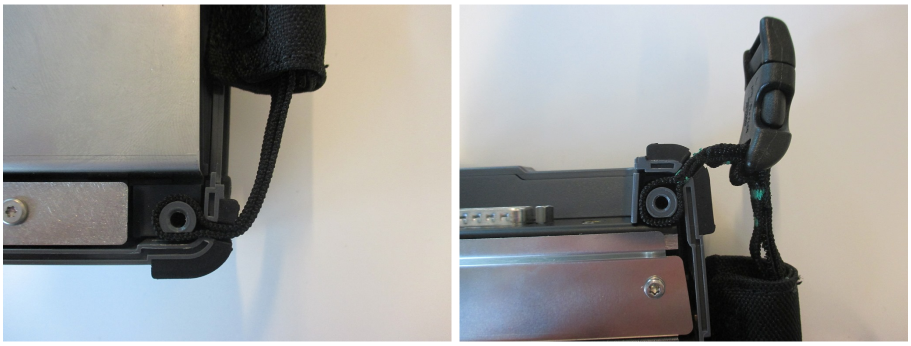
3. Loosen four screws at each corner of MU100010A.

4. Separate MT1000A and MU100010A.
5. Attach the handle on either right or left side.

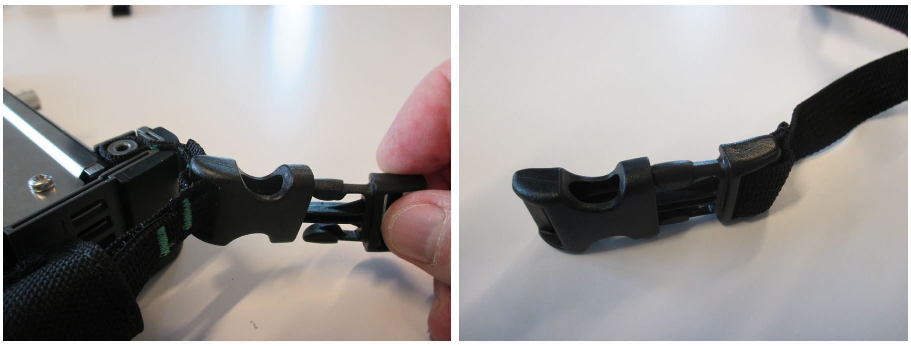




6. Detailed photos for upper and lower corner.



7. Remove the buckle cap from the handle and the carrying strap.



8. Mount the carrying strap on both upper corners.

9. Attach MT1000A and MU100010A , insert the battery pack and mount the battery lid with the reverse sequence at the beginning.



# 3 Man-Machine-Interface

Man-Machine-Interface (MMI) covers the relation between the user and the instrument - in other words: the information you get from the instrument combined with the action you add to the instrument.

The informative part is the TFT display, and the part susceptible to influence is the touch-active layer of the screen. Connections made to the input and output connectors are included in the MMI as well.

# 3.1 Touch Screen Display

The 9 inch active TFT display with WVGA resolution (800x480 pixels) is used for setups and for presentation of results (that is, for all interaction with the instrument). As the display includes touch screen functionality, it is possible to navigate and operate directly from it.

The touch screen display is constructed to be operated by the tip of your finger or by the included *Stylus* (Anritsu part No. Z1746A). The touch screen surface is made of delicate material and is easily scratched or damaged if handled incorrectly.

**⚠ CAUTION**

**Never expose the touch screen to excessive pressure as this may damage its functionality.**

**Never use sharp objects (e.g. pens, paper clips etc.) to operate the touch screen, as this may damage the surface.**

**If the touch screen breaks and liquid leaks out, DO NOT touch or ingest the liquid and avoid getting it in your eyes. The liquid may be poisonous.**

Only use a soft cloth moisturized with a mild detergent to clean the surface of the touch screen. Be sure to power off and disconnect main power adapter.

# 3.2 Key Operation

The only physical operator key (the Power button) is described in this section.

## 3.2.1 Power Button

The Power button on the front panel of the instrument is used to switch power ON and OFF. In addition, the menu used for power-off also contains a few extra options (e.g. to lock the screen).

 Gray: Power off

 Orange flashing (fast): Booting in case of AC operation

 Green flashing: Booting in case of the battery operation

 Orange flashing (slow): Charging

 Orange: Stand by

 Green: Operating

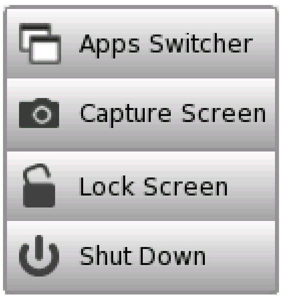
**Switching power ON**

**AC Operation**
Connect the mains power adapter to the Network Master. The Network Master flashes the power button in orange during booting. The power button lights in orange after booting.
To start your test, press the power button. The power button lights in green. After a model name is displayed, the Network Master enters Operating status and shows the Application Selector.

**Battery Operation**
Press the power button. The Network Master shows a model name and flashes the power button in green during booting.
Then, the Network Master enters Operating status and shows the Application Selector.

**Switching power OFF**

When you press the Power button, a pop-up menu containing **Shut Down** will appear.




Touch the **Shut Down** menu item and then confirm by touching **Yes** in a dialog box.

**AC Operation**

After you shut the Network Master down, the Network Master goes back to Stand by or Charging state.
The Network Master stays Stand by or Charging state until you disconnect the mains power adapter.

**Battery Operation**
After you shut the Network Master down, the power goes off.

### Forcing power OFF

If it is not possible to power down the Network Master using the power button menu, the following procedure can be used to make an emergency power down.

1. Disconnect AC adapter if it is connected.
2. Hold the Power button depressed for a couple of seconds.

NOTE *It is not recommended to force a power-off except in emergencies.*

### Additional options in power button menu

**Apps Switcher**
Shows all currently activated applications and allows you to switch among them.

**Capture Screen**
Saves a screen shot image in .PNG format. The image file will be saved in 'Internal/screens' folder or an attached USB memory stick.

**Lock Screen**
Locks or unlocks the screen.

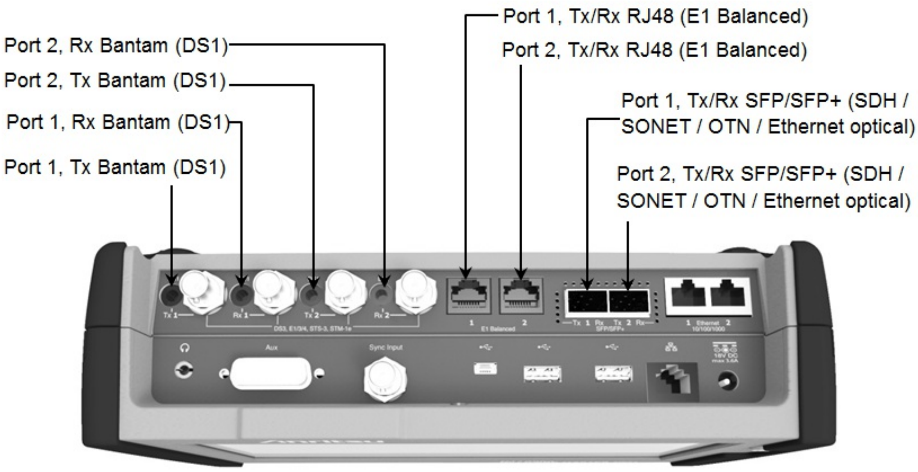
# 3.3 Connector Panel

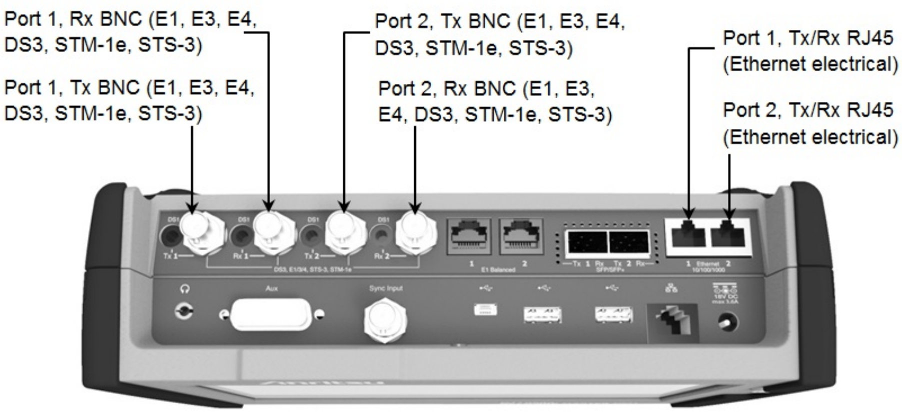
All connections (both for *test interfaces* and for *service interfaces*) are placed on the connector panel of the Network Master.

The figure below shows the connector panel of the mainframe and MU100010A.

## 3.3.1 Test Interfaces

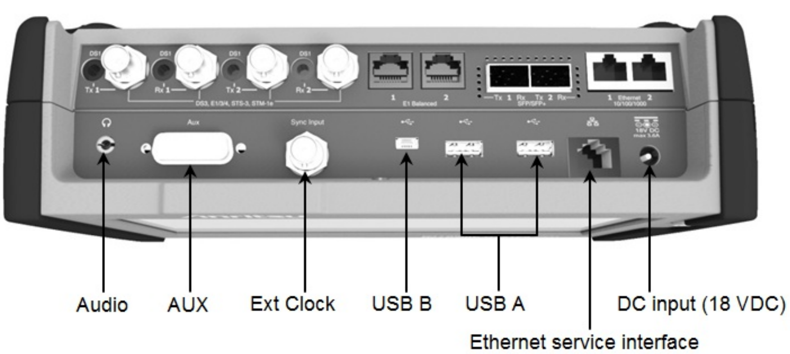
The connector panel contains the following port connectors to be used for the tests:




## 3.3.2 Service Interfaces

All connections concerning the service interfaces are also located on the connector panel:



| | |
|---|---|
| Audio | This connector is reserved for the future use. |
| AUX | The AUX connector is used for G0325A GPS Receiver. |
| Ext Clock | The Ext Clock connector is used for reference clock input. |
| USB B<br>USB A | The three USB connectors (two connectors type A and one connector type B mini) can for example be used for connection of printers with USB interface. Another convenient use of this interface is the exchange of information to and from the instrument. |
| Ethernet service interface | The Ethernet connector is used for connecting the Network Master to a Local Area Network, e.g. to remotely operate the instrument from a PC. |
| DC input (18 VDC) | The DC power connector is used for connection of 18 V DC power delivered from the AC Adapter. |

# 3.4 Command-Based Remote Control

Using command-based scripts makes the Network Master a fully automated measurement instrument.

- The Network Master remote control communication functions support the built-in Ethernet service interface.
- Software specifications are in conformity with the IEEE488.2 standard and SCPI version 1999 (Standard Commands for Programmable Instruments).

All commands are described in a separate document:

- MT1000A/MU100010A Network Master Pro, Remote Scripting, Operation Manual (M-W3708AE).


This icon indicates whether the Network Master is controlled by the command-based scripts or not.

# 3.5 External GPS Receiver

It is possible to connect an external GPS receiver (part No. G0325A) available from Anritsu. The GPS receiver is used for:

- Precise time synchronization, when making one way Frame Transfer Delay measurements as part of the Ethernet Service Activation Test.
- Clock source in an IEEE 1588v2 system
- Timing source for synchronizing Ethernet transmitters
- Reference source for Ethernet bit rate measurements


Connect The 15 pin D-sub connector to the 15 pin AUX connector on the connector panel.

## 3.5.1 Activating the GPS receiver

The GPS receiver is activated automatically if it has connected to Network Master.

## 3.5.2 Using the GPS service

One purpose of the external GPS receiver is to provide for precise one way Frame Transfer Delay measurements as part of the Ethernet Service Activation Test.

When the GPS receiver is activated and the active interface is Ethernet, the Network Master will calibrate its internal time base to the ultra precise time signal from the GPS receiver. The calibration process takes approximately 1 minute. After calibration, if the GPS receiver is disconnected (or the GPS signals are lost), the GPS system enters "Holdover" mode. In holdover mode, the accuracy of the Frame Transfer Delay measurement can be maintained for approximately 1 hour. After this time, the GPS system will enter a "Not OK" state.

When Ethernet is not the active interface, holdover mode is not applicable.

HINT

*For best accuracy, let the Network Master warm up for 5 - 10 minutes before removing the GPS receiver, and keep the surrounding temperature as constant as possible.*

# 4 Graphical User Interface

This chapter provides a general introduction to the graphical user interface (GUI). The descriptions of the screens, sub-screens and major dialog boxes related to specific technologies and applications are placed in separate chapters.

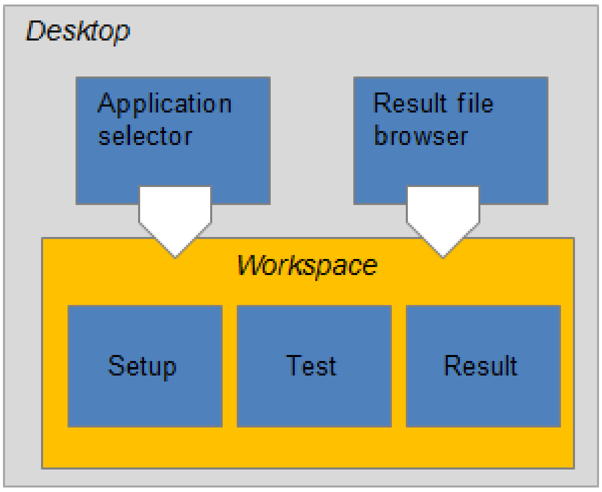
# 4.1 General Handling of the GUI

The Network Master is equipped with a touch screen display, except for the key to switch the instrument on/off. The operating principle of the graphical user interface (GUI) presented on the touch screen display is that it guides you through all setup steps required for running a specific test and then finally presents you with the test results. You can, however, also navigate back and forth between setup steps and result presentation to re-run a test with new parameter settings if required.

## 4.1.1 GUI Concept

The GUI can be split up into two functional spaces or levels: the *desktop* and the *workspace*.

- The *desktop* is the entry level which appears after the booting. It consists of the *application selector*, which allows you to start a new application, and the *result file browser*, which allows you to access previously created and stored test results.
- The *workspace* is where you work with a specific application (i.e. set up and run a test and inspect the test results). Your selection on the desktop creates the workspace and loads relevant data into it.




**Application selector**
The *application selector* loads a new application into the workspace. A new application can be either one of the standard applications provided with the instrument or a previously saved application with partial or full configuration of interface/test setup parameters.

**Result file browser**
The *result file browser* loads the results and configuration of a previous test into the workspace. This allows you to generate reports from the results and/or to rerun the test (either using the original configuration or with various configuration modifications).

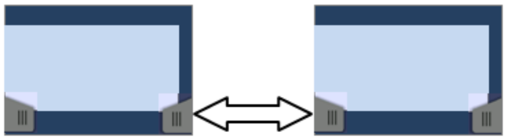
NOTE *A specific set of resources (i.e. ports) are assigned to a workspace when it is created. More than one workspace can therefore exist at the same time, each assigned to different resources.*

## 4.1.2 Navigating in the GUI

As shown in previous figure, Application selector and desktop have the relation vertically. Application selector and Result file browser have the relation horizontally. Switching screens is navigated based on horizontal and vertical relations.

### Horizontal navigation at desktop level

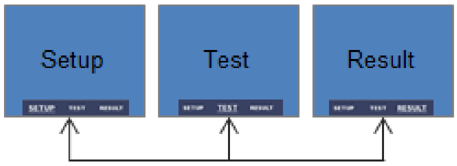
You can switch between the application selector and the result file browser by touching the tab displayed in the bottom right-hand corner and the bottom left-hand corner.



### Horizontal navigation within a workspace

In the workspace you can step through the setup by touching the navigation tabs displayed in the bottom corners of the screen. The right-hand tab brings you to the next step in the setup, while the left-hand tab allows you to take a step backwards.

Alternatively, you can use the *screen indicator* at the bottom of the screen to switch between ports setup, test setup and test result.

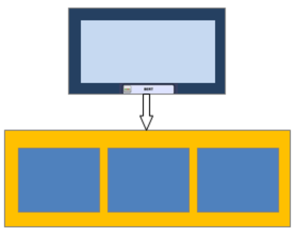



It is also possible to loop back directly to the ports setup from the test result screen if you need to rerun the test with different settings.

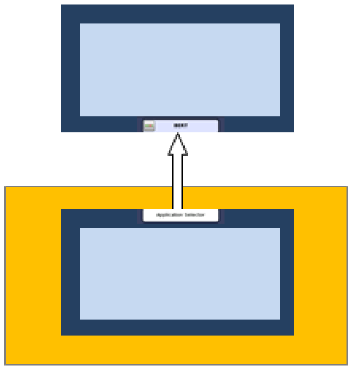
NOTE *To get from the Test Setup to the Test Result screen during a new test, you must run the test. This is done by touching the 'Start' icon in the Application toolbar, which is the expandable toolbar shown on the right-hand side of the screen. Please refer to the separate Toolbars section for information about the toolbars.*

### Vertical navigation between desktop and workspace

When an application is currently running, the application selector screen will contain a tab at the bottom which allows you to go directly to the screen last displayed in the application's workspace. Similarly, the result file browser screen will contain a tab at the bottom which brings you to the test result screen of the running application.



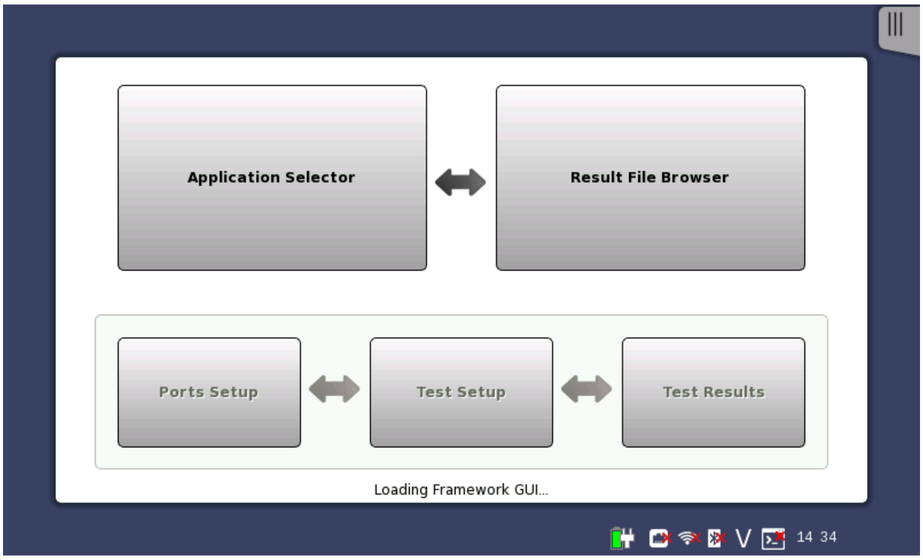
From a setup screen you can return to the application selector using the tab at the top of the screen. Test result screens contain a tab at the top which returns you to the result file browser.



### 4.1.3 Layout of the GUI Screens

**Startup Splash Screen**

The Network Master starts up with a splash screen that shows the GUI concept of desktop/workspace and the various screen types. It indicates both *application selector* and *result file browser* as entry points.




**Status icons**

There are status icons of the battery and the network connections at bottom of the screen.

When the network connection is unusable, the red cross ( ) appears on the icon.

 Battery status
Refer to "Battery Status Information".

 Link status of Ethernet service interface

 WLAN (when the option is installed.)

 Bluetooth (when the option is installed.)

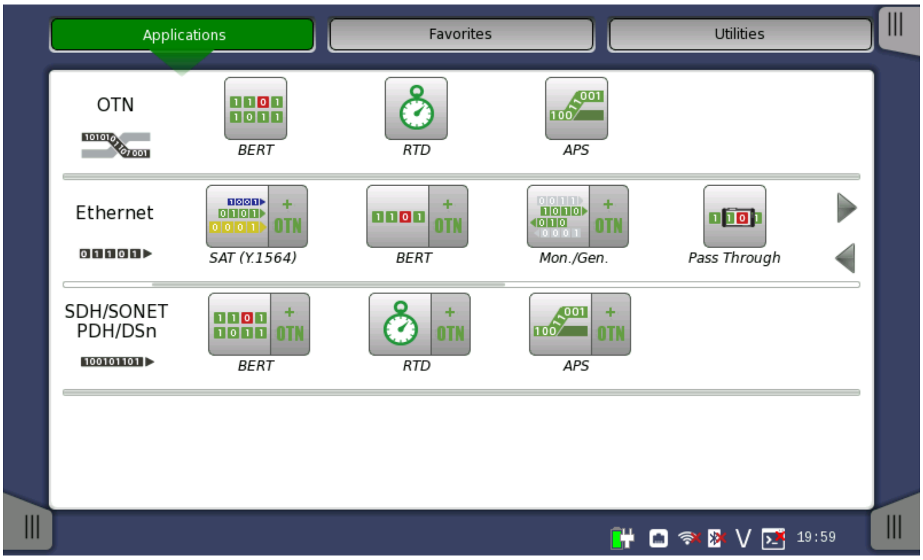
 VNC (Virtual Network Computing)

 Controlled by the remote command

**Application Selector**

The **Application Selector** screen is the main entry point after startup of the Network Master. From here you can choose which application/test to run: either one of the standard applications or a previously saved pre-configured application.

### Applications





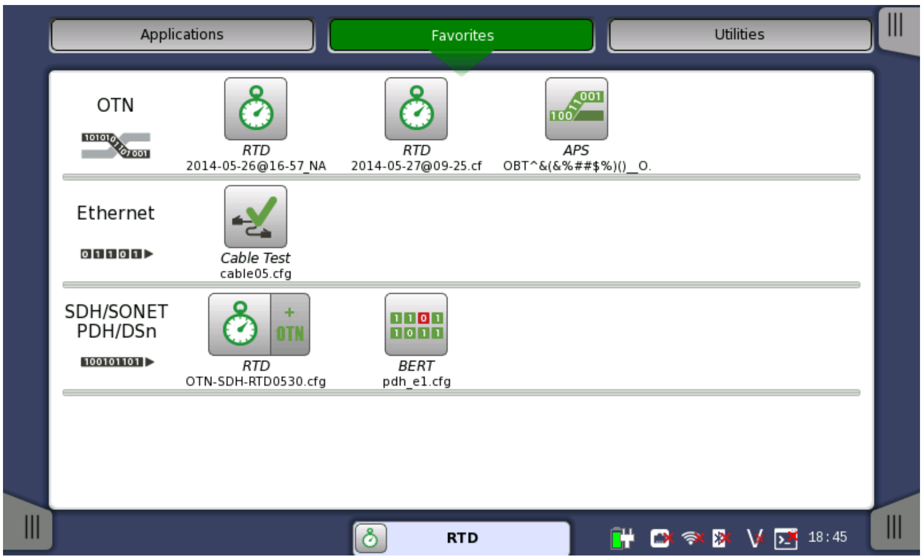
*The icon may be not displyed because icons on screen are limited up to four. You may need to scroll the row of applications to display the relevant icon.*


Touching **+ OTN** adds OTN layer for SDH/SONET or Ethernet applications.

Aside from the application buttons, the application selector screen also contains a tab for showing/hiding the Instrument toolbar and a navigation tab to the Result File Browser screen.

### Favorites

Touching **Favorites** button displays the screen below.




**Registering applications**

1. Go to Application screen by the following method.
   - Touch the **Applications** button and touch an icon to be registered.
   - Return to the workspace by touching the button at bottom.
2. Touch the Application Toolbar tab.

3. Touch the **Load Save** icon.
4. Touch the **File name** field.
5. Enter the file name using the dialog box.
6. Select **Add to Favorites** in the Save/Load dialog box.


7. Touch the **Save settings** button.

### Deleting applications

1. Hold the touching an icon in Favorites screen until a pop-up menu appears.
2. Touch **Delete Favorite**.
3. Touch **Delete** if the confirmation dialog box appears.

### Renaming the icon

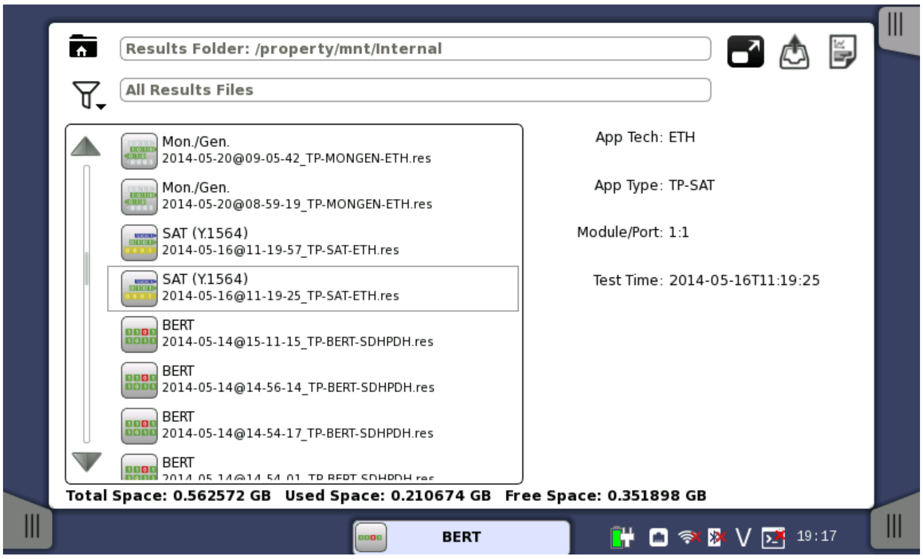
1. Hold the touching an icon in Favorites screen until a pop-up menu appears.
2. Touch **Rename Favorite**.
3. Input a new name on the opening dialog box.

## Utilities

This screen is planed for the future use.

**Result File Browser**

The **Result File Browser** screen is the other entry point after startup of the Network Master. From here you can access the results of previous tests either for creating PDF reports or for viewing the results directly, or both. Refer to "Accessing Previous Tests and Test Results".



 Browses the folder.

 Sets the filter of files.

 Loads the result and starts the application with view mode.

 Loads the result.

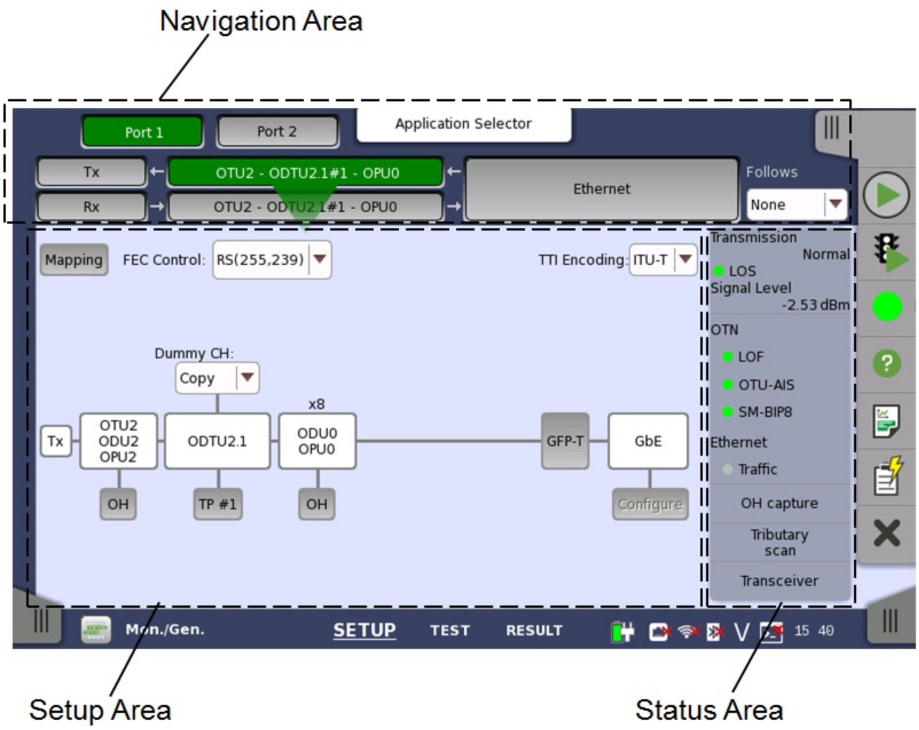
 Creating the report from the result.

In addition to the buttons for accessing and handling test results, the result file browser also contains a tab for showing/hiding the Instrument toolbar and a navigation tab to the Application Selector screen.

**Ports Setup screen**

The **Ports Setup** screen is the first screen in the workspace. It may contain one or more setup pages, with a row of buttons at the top of the screen allowing you to switch between the pages and between ports (when relevant).

It consists of several "areas":

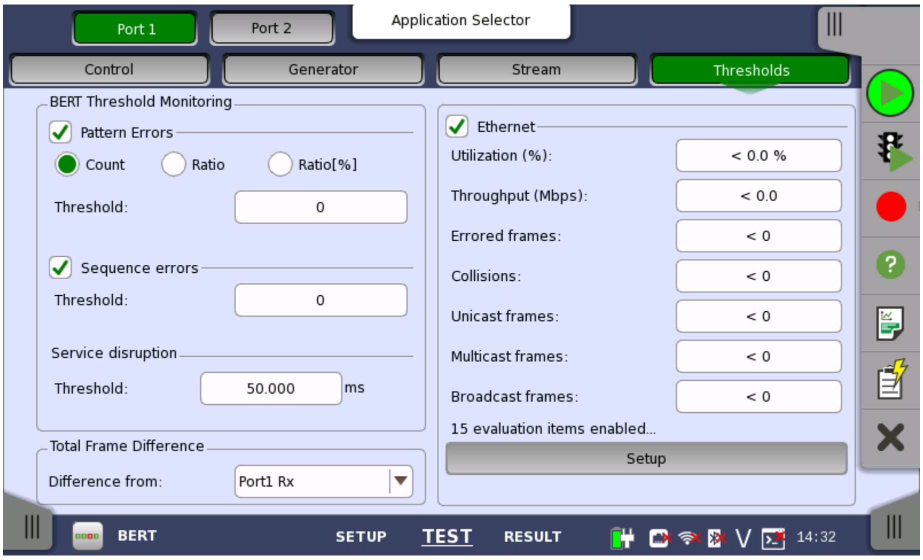



- The *navigation area* at the top of the screen contains a number of buttons representing a structure for the current interface, which allows you to select a specific port, transmitter/receiver and layer.
- The *setup area* (the main area of the screen) is where the parameters for setting up the interface are displayed. The contents of the area changes depending on what is currently selected in the navigation area.
- The *status area* (to the right of the setup area) shows status information for the currently selected port and layer. You can access more detailed status information from here by touching the status summary boxes and buttons.

It may contain one or more setup pages, with a row of navigation buttons at the top of the screen allowing you to switch between the pages and between ports (when relevant). In addition, the **Ports Setup** screen also contains the expandable Application toolbar and the navigation tabs for horizontal and vertical navigation.

**Test Setup screen**

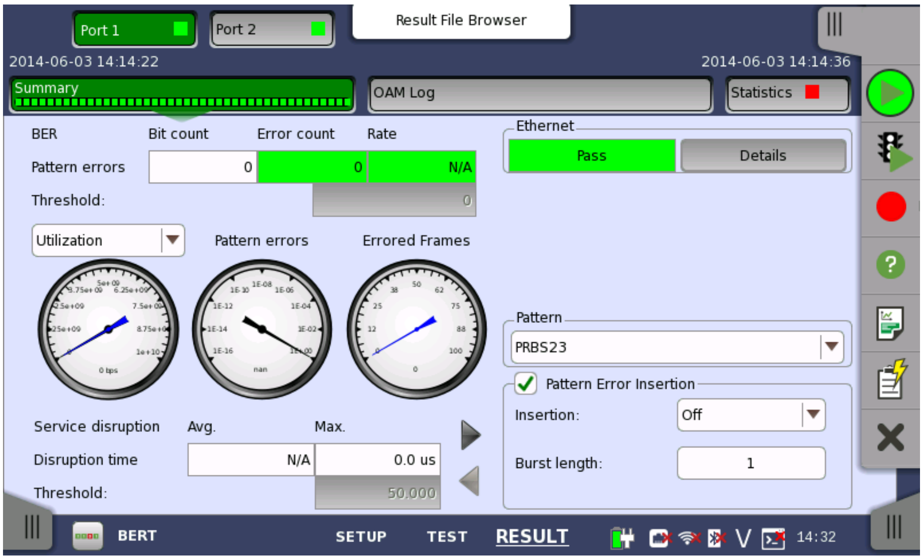
The **Test Setup** screen is the second screen in the workspace. It may contain one or more setup pages, with a row of navigation buttons at the top of the screen allowing you to switch between the pages and between ports (when relevant).




In addition to the various parameters, the **Test Setup** screen also contains the Application toolbar and the navigation tabs for horizontal and vertical navigation.

**Test Results screen**

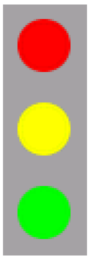
The **Test Results** screen is the last screen in the workspace. It generally contains several pages, reflecting the progress of the test. Navigation buttons at the top of the screen will allow you to switch between the pages and between ports (when relevant).




In addition to the results, whose presentation varies from application to application, the **Test results** screen also contains the Application toolbar and the navigation tabs for horizontal and vertical navigation.

## 4.1.4 Lamp Indication of Alarm/Error Status

Alarm and error status is indicated by colored Lamp icons. The following colors are used:



Red Lamp icon indicates that an alarm has appeared.

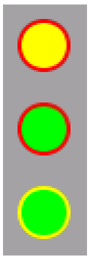
Yellow Lamp icon indicates that an error has appeared.

Green Lamp icon indicates a 'no trouble' situation.

Note that the same colors are also used for indication of status in other contexts, e.g. in the display of test results.

**Double-ringed icons with history information**

The Lamp icons are double-ringed, with the inner ring indicating the current status and the outer ring showing history information (i.e. alarms and errors in the alarm trap since the last reset/clearing of history).

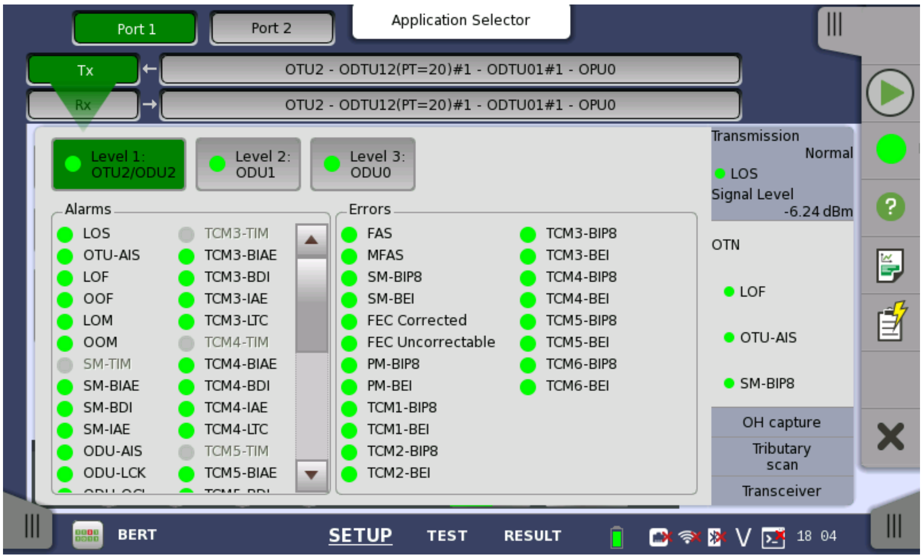


'Error' situation currently, but alarm recorded previously.

'No trouble' situation currently, but alarm recorded previously.

'No trouble' situation currently, but error recorded previously.

The example below shows the Lamp icons used in a screen displayed by selecting alarm and error status on the ports setup screen.




## 4.1.5 Keypads for Entering Text in Fields

Alphanumerical or purely numerical keypads are used to enter text in fields. By touching the field you launch the related keypad. The layout (i.e. type) of a specific keypad will depend on which type of text is required/valid for the field.

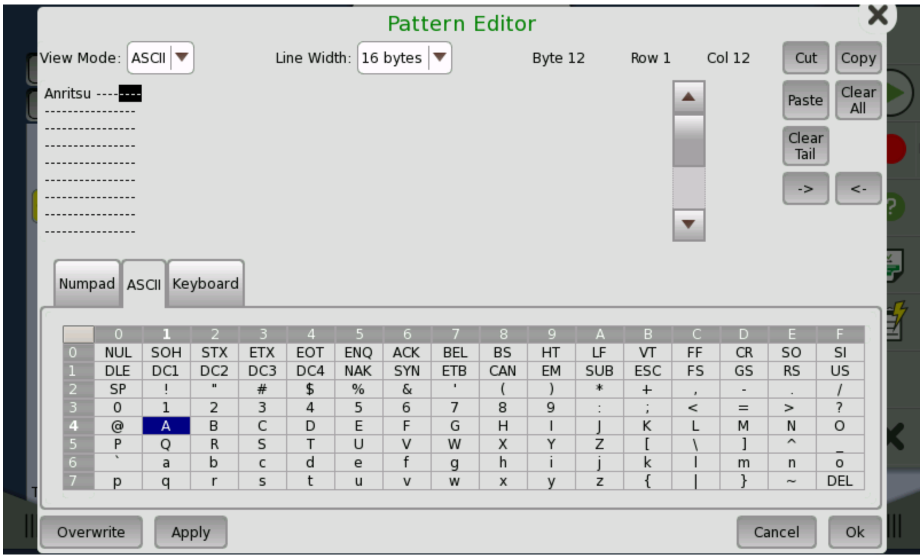

In general, a keypad consists of the character/number keys, a display field showing the current text/number entry, various editing-related keys. For number entries, the minimum and maximum values allowed are also shown. When you launch a keypad from a field, the current field value is shown in the keypad's display field.

Touch **Ok** to accept the new entry and close the keypad.

To close the keypad without accepting the change, touch **Cancel** or touch the "X" symbol in the upper right-hand corner of the keypad.

## 4.1.6 The User Pattern Editor

The 32-bits and 2048-bits user patterns are specified using the **Pattern Editor**. You can view the pattern in either Hexadecimal, Binary or ASCII format and use either a numpad, an ASCII table or a keyboard to set it up.

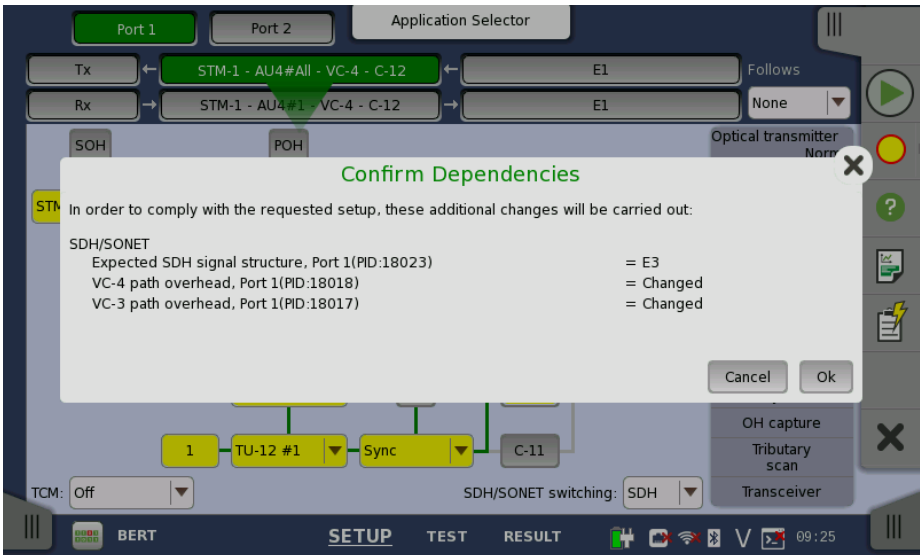



You use the numpad to edit the pattern in the *Hex* and *Bin* view modes, and use either the ASCII table or the keyboard to edit in *ASCII* view mode.

For 2048-bits user patterns, you can use the **Line Width** drop-down menu to specify how the pattern is displayed. The available values are: **2**, **4**, **8**, **16**, **32**, **64 bytes**.

### 4.1.7 Prompts to Confirm Dependencies

When a parameter change spawns changes elsewhere because of dependencies, you are prompted to accept or reject the change(s). A **Confirm Dependencies** dialog box is displayed, with information about the dependency-related changes.




You can switch whether displaying the Confirm Dependencies dialog box. Refer to Miscellaneous in "Instrument Toolbar" section.

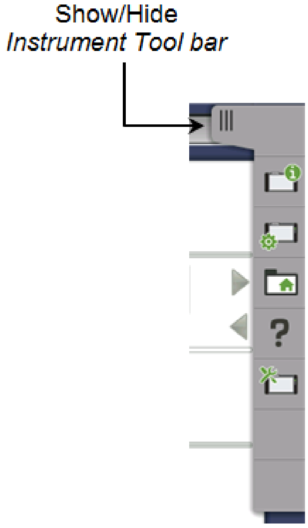
# 4.2 Toolbars

Two toolbars are available on the right-hand side of the screen: the desktop toolbar (called the *Instrument toolbar*) and the expandable workspace toolbar (called the *Application toolbar*).

- The *Instrument toolbar* contains general system functions and information (e.g. Instrument configuration, Battery time etc.). It is available directly on the screens related to the desktop, but can also be accessed on the workspace-related screens as a "sub-toolbar" inside the application toolbar.
- The *Application toolbar* contains application-related functions and information (e.g. Start/Stop test, Test progress etc.). It is available on the screens related to a specific application (i.e. all workspace-related screens), with the *Instrument toolbar* as a sub-toolbar.

## 4.2.1 Instrument Toolbar

The *Instrument toolbar* is shown in the figure below. When the toolbar is hidden, it is represented by its icon tab in the top right-hand corner of the screen.

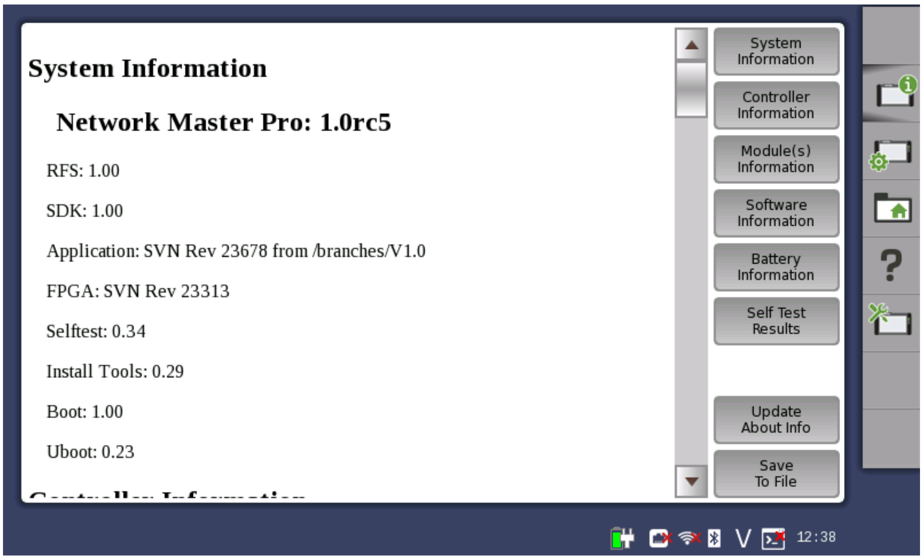



The *Instrument toolbar* contains the following functions/status:

- Instrument information
- Configuration
- File manager
- Help
- Resource monitoring

### Instrument information

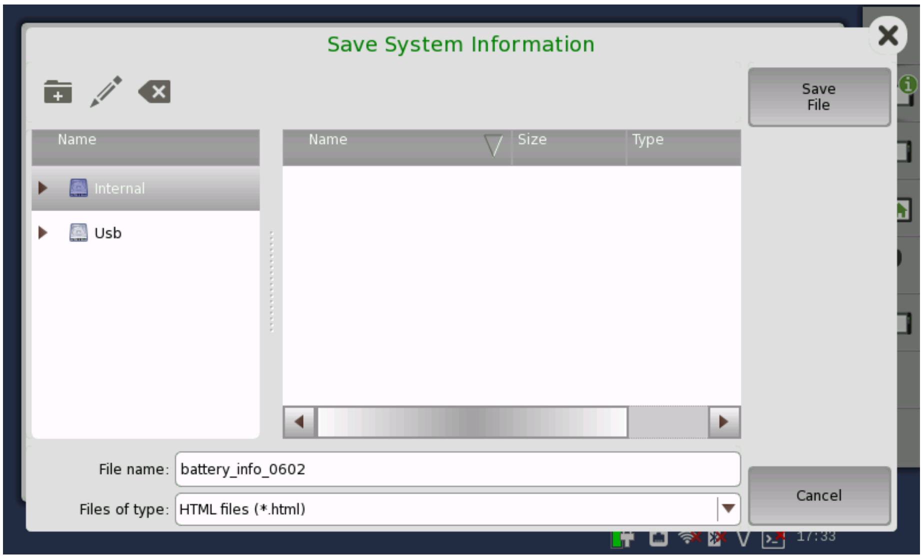
The *Information* icon launches the **System Information** screen. Touch the **Update About Info** button to generate the instrument information.




The following information is presented on the screen:

- System Information
- Controller Information
- Module(s) Information
- Software Information
- Battery Information
- Self Test Results

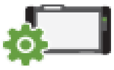
To save the instrument information in an HTML file, touch the **Save To File** button. This launches another dialog box, where you can specify file name and location. For the icons, refer to " File Manager".




NOTE

*When there are "NG"s in the self test results, try to reboot Network Master. If "NG"s remain in the self test results, contact an Anritsu Service and Sales office.*

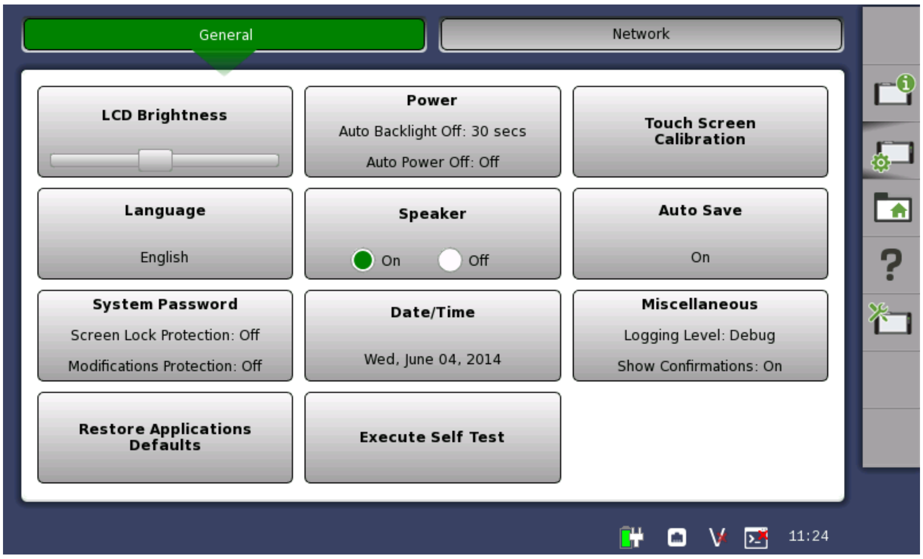
## Configuration



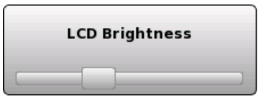
The *Configuration* icon launches the *Global Configuration* screen. From this screen it is possible to configure both the general instrument settings (such as date/time, password etc.) and various network settings.

**General**

The **General** screen contains the following configuration options:



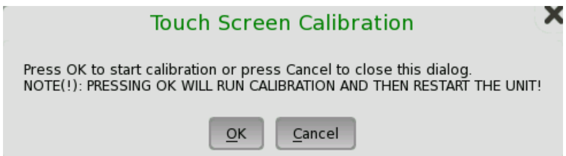

**LCD Brightness**
Allows you to change the screen brightness by using the slide bar.




**Power**
Allows you to specify auto backlight duration and auto power-off time.

NOTE *These settings are applied for the battery operation only.*

**Touch Screen Calibration**
Allows you to calibrate the touch screen. Touch **OK** in the dialog box to start the calibration.




NOTE *Save the measurement results or settings before the touch screen calibration. Network Master reboots after the touch screen calibration. The measurement data which is not saved will be lost.*

**Language**
Allows you to select another language for the instrument.

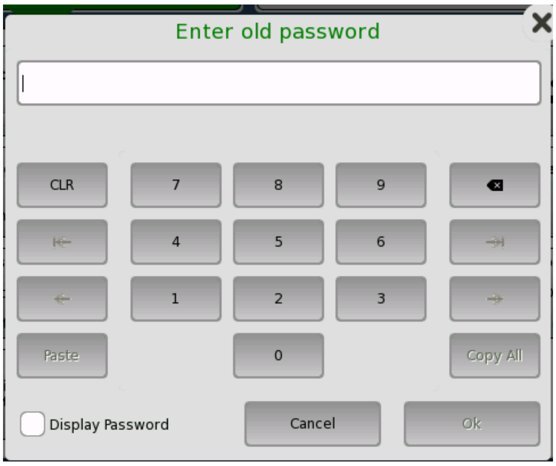
**Speaker**
Selecting the checkbox enables/disables the speaker.

**Auto Save**
Allows you to specify saving method of the measurement results.

- **Prompt**: Confirms saving results or not after a test.
- **On**: Saves results to the file automatically without notification every time a test ends.
- **None**: Does not save results. The results data are discarded if you do not save the data manually.

**System Password**
Allows you to enable/disable password protection and to specify a new password. When the password protection is enable, starting applications and the settings change of applications are protected.

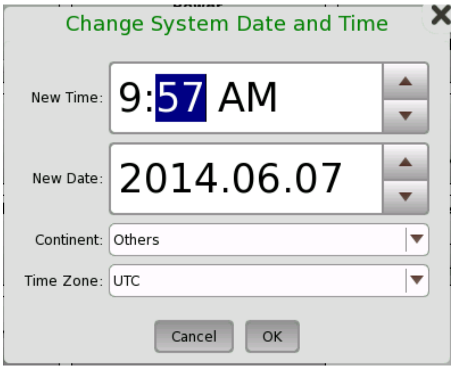

To change/set the password, select the one or more checkboxes and then touch the password buttons. A numeric keypad is displayed.




To see the numbers as you type them on the keypad, select the **Display Password** checkbox.

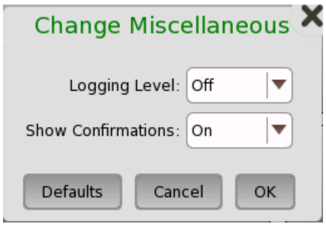
NOTE *The password is set to 0614 as factory default.*

**Date/Time**
Allows you to change the system date and time. Select a part in **New Time** or **New Date** field and touch the up/down button.




**Miscellaneous**
**Logging Level** allows you to specify the logging level. Select **Off** always. Other options are used for the service use.

**Show Confirmations** allows you to specify whether showing the prompts to confirm dependencies.




**Restore Applications Defaults**
Touching this button restores each application settings to defaults.

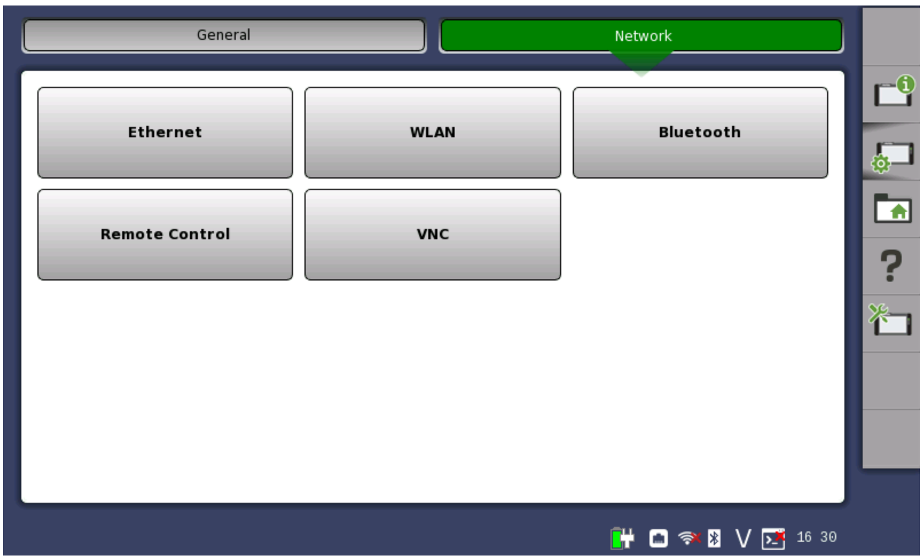
**Execute Self Test**
Touching this button starts the self test.

NOTE

*Save the measurement results or settings of the running applications before executing self test. Network Master reboots when executing self test. The measurement data which is not saved will be lost.*

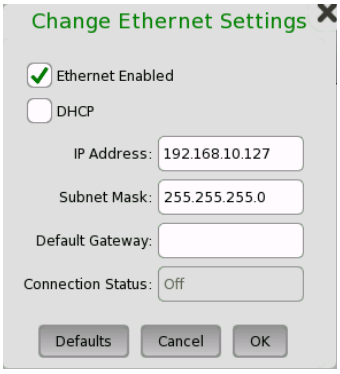
**Network**

The **Network** screen contains the following configuration options for the instrument's network connection:



**Ethernet**

Allows the instrument to be connected to the Ethernet either via dynamic addressing (*DHCP*) or via manual specification of IP address, subnet mask and default gateway. These settings are applied for the Ethernet service interface.



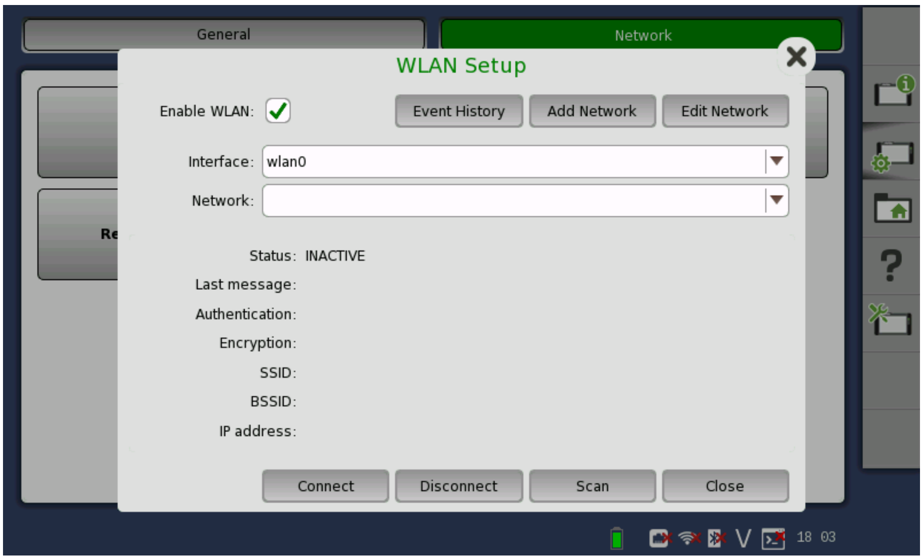

 This icon indicates the link status of the Ethernet service interface.

**WLAN**

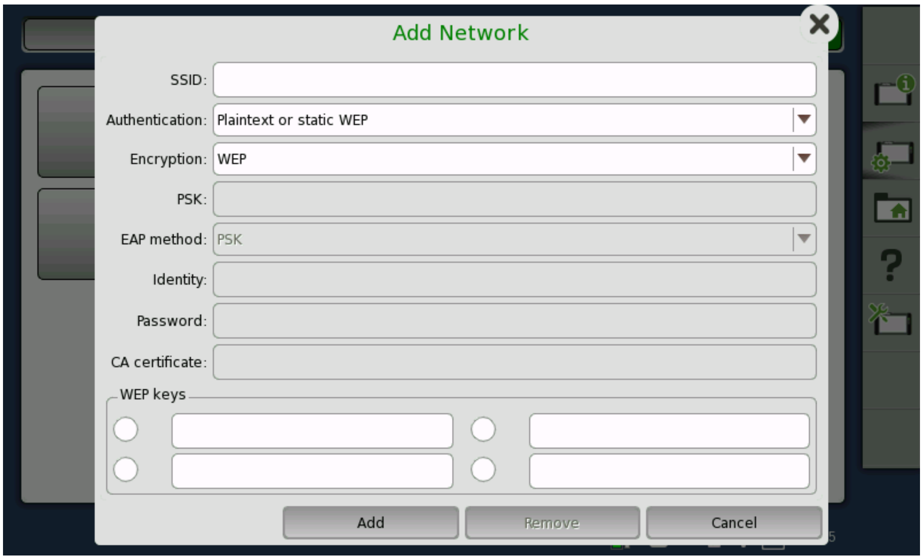
Allows the instrument to connect to a network via Wireless Local Area Network (WLAN). Note that if WLAN is enabled, the instrument cannot connect to the Ethernet via the Ethernet setting mentioned above.

OPTION

*This feature requires an option (MT1000A-003).*




1. Touch the **WLAN** button. WLAN Setup dialog box appears.
2. Touch the **Scan** button. Scan results are displayed.
3. Select the network from scan results and touch the **View** button.
4. Touch the **Add Network** button. Specify relevant items of network, touch the **Add** button.
5. Confirm that Status in WLAN Setup dialog box changes to **Connected**.



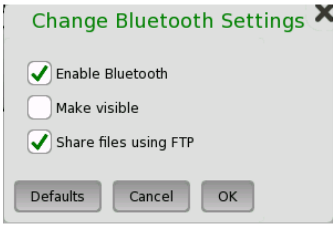

 When option is installed, this icon indicates the connection status of the WLAN.

To edit the settings of the current network, touch the **Edit Network** button.

The **Event History** button is available to diagnose the WLAN connection.

**Bluetooth**
Allows the instrument to use a Bluetooth connection.

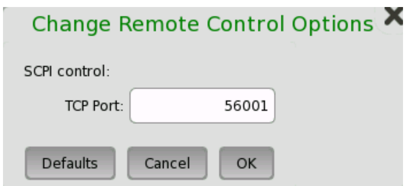
*This feature requires an option (MT1000A-003).*



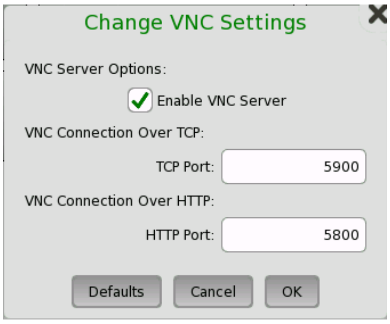

- **Enable Bluetooth**: Enables using the Bluetooth.
- **Make visible**: Allows to discover Network Master from other Bluetooth devices.
- **Share files using FTP**: Allows to share files stored in Network Master via Bluetooth. Login account and password are not required for the FTP connection. Shared folder in Network Master is "/property/mnt/internal".

 When option is installed, this icon indicates the enable or disable of the Bluetooth.

**Remote Control**
Allows you to specify a TCP port for the command-based remote control of the instrument.



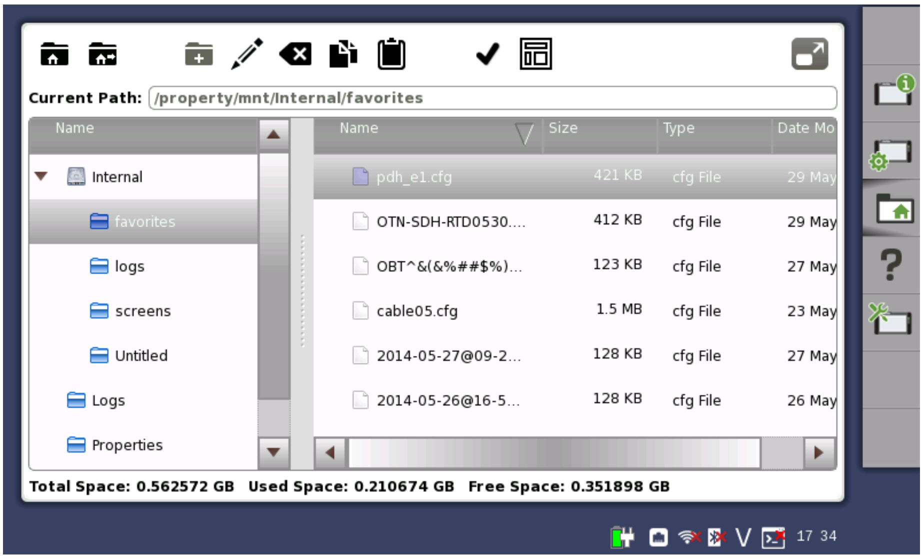

**VNC**
Allows remote control of the instrument via Virtual Network Computing (VNC).




This icon indicates the enable or disable of the VNC. Touching this icon allows switching VNC enable or disable.

## File Manager

The *File Manager* icon launches the file manager screen. From this screen it is possible to configure the instrument's internal file storage facility as well as perform all kinds of file transactions, both internally and from/to any external file storage source (USB memory stick etc.).



 Sets the current folder to the home folder.

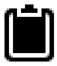
 Moves to the home folder.

 Creates a new folder.

 Edits the file name or the folder name.

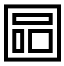
 Deletes the selected file(s) or folder(s).

 Copies the selected file(s) or folder(s).

 Pastes the file(s) or folder(s).

 Selects a file or a folder.

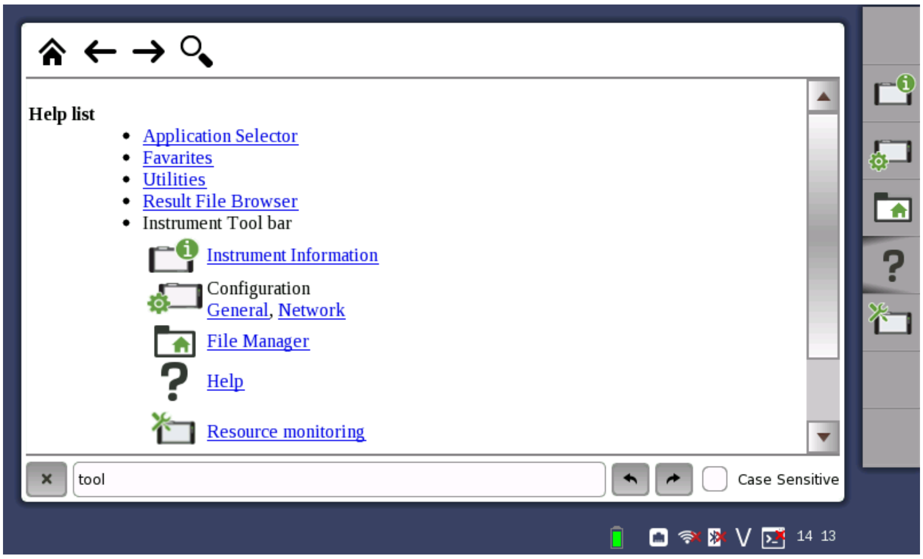
 Selects multiple files or folders.

 Switches the GUI layout.

 Shows contents of a text file.

## Help

The *Help* icon launches the help screen with context-related help. You can search for specific words or phrases in the help and also step through previously displayed help topics.



Moves to the Help list topic.

Back

Forward

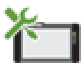
Shows/hides the search box and buttons at bottom.

Searches backward.

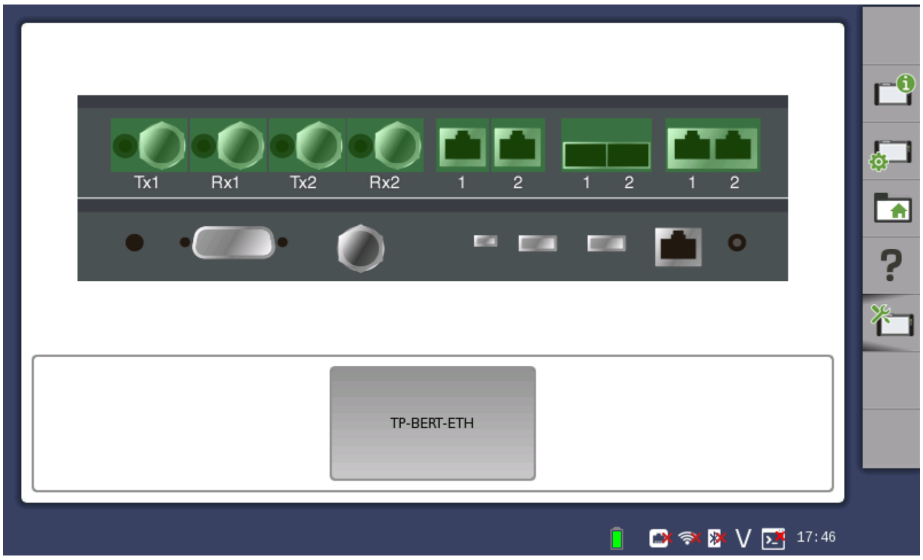
Searches forward.

When **Case Sensitive** is selected, searches distinguishing the upper case and the lower case.

### Resource monitoring

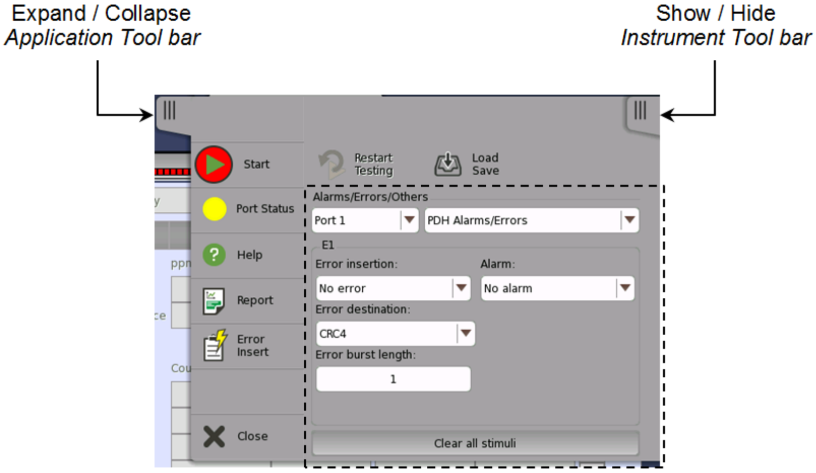


The **Resource monitoring** icon launches a screen showing which applications are currently activated and which ports on the connector panel are assigned to each of the applications.



## 4.2.2 Application Toolbar

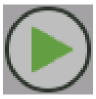
The *Application toolbar* consists of two columns plus the *Instrument toolbar*. You can expand/collapse the toolbar as shown in the figure below. The left-most column, which is always displayed, contains the most commonly used functions and status indicators.




### Left-most column

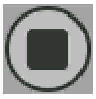
The left-most column contains the following functions and status indicators:

**Start**



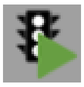
Touch the **Start** icon to start the currently selected application/test. The icon changes to the **Stop** icon shown below, which can then be used to stop the test.

**Stop**



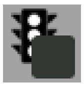
Touch the **Stop** icon to stop the currently running application/test. The back color indicates the pass/fail status. When the test has stopped, the icon changes to the **Start** icon shown above.

**Traffic Start**



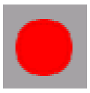
This icon appears in case of applications having traffic generation. Touch the **Traffic Start** icon to start sending traffic of all ports under test. The icon changes to the **Traffic Stop** icon shown below.

**Traffic Stop**

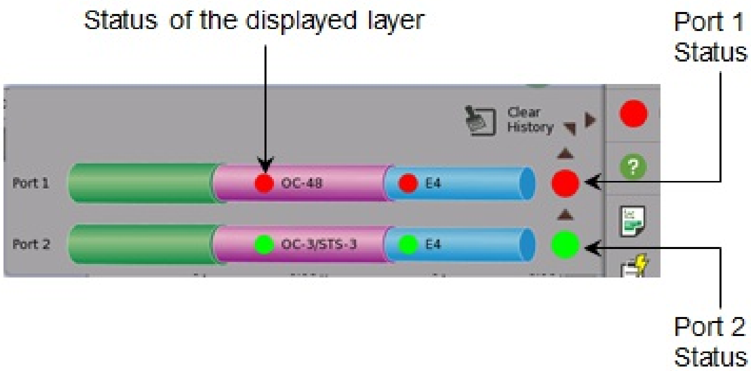


This icon appears in case of applications having traffic generation. Touch the **Traffic Stop** icon to stop the traffic of all ports under test. When the traffic has stopped, the icon changes to the **Traffic Start** icon shown above.

**Port Status**



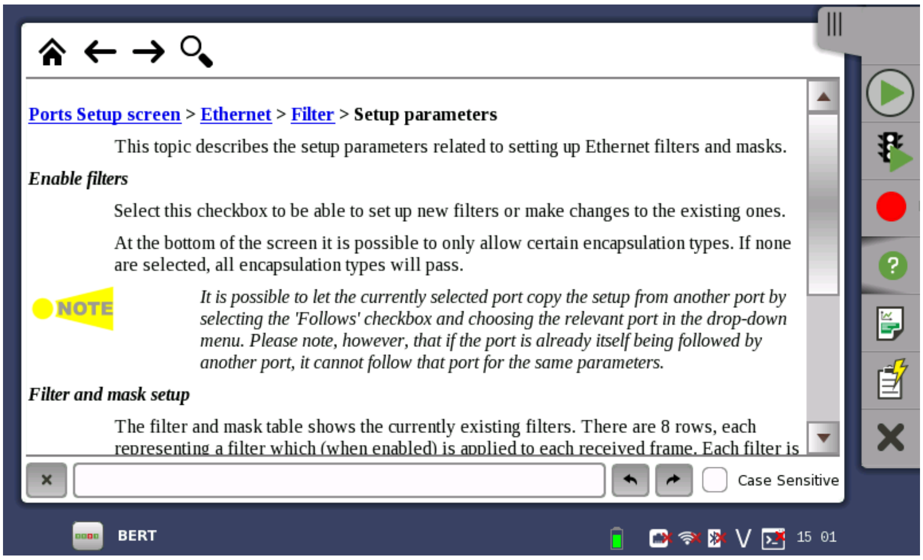
Shows the current pass/fail status of the test. *Green* means pass, *red* means fail.




Port Status is the summary of all ports under test. If fail occurs in any layer, Port Status turns in red.

**Help**

Touch this icon to access the online help for the currently displayed screen or dialog box. You can search for specific words or phrases in the help and also step through previously displayed help topics.




 Moves to the topic when touching the help icon.

 Back

 Forward

 Shows/hides the search box and buttons at bottom.

 Searches backward.

 Searches forward.

If **Case Sensitive** is selected, searches distinguishing the upper case and the lower case.

**Report**

Touch this icon to create a report.

NOTE

*Adobe® Reader® is recommended as a PDF viewer to open or print out the report.*

**Alarm/Error Insert**

Touch this icon to activate the stimulus specified in the stimuli setup available in the expanded *Application toolbar*. Only relevant if the stimulus has been set to manual insertion. The *stimuli function* is used to generate special or abnormal conditions during a test.

**Close**

Touch this icon to close the application.

## Expanded Application toolbar

The *Application toolbar* is expanded/collapsed by touching the tab placed above the left-most column. The column displayed in the expanded toolbar contains the following functions:

**Restart Testing**

Touch this icon to restart the current test.

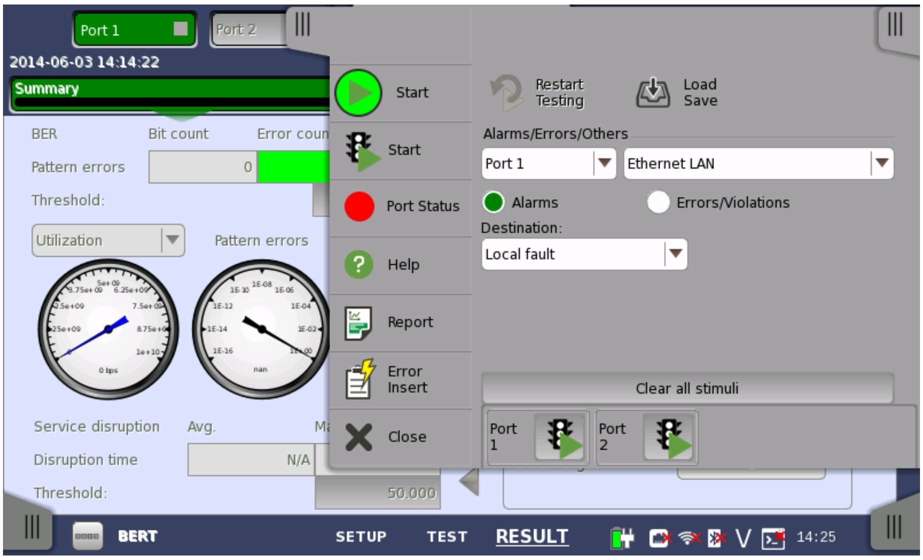
**Load Save**

Touch this icon to open Load/Save dialog box. You can load or save Setup file or Result file.

**Stimuli setup**

Various fields and buttons are available for setting up a stimulus signal to provoke a special or abnormal situation during the test. When the signal has been specified, the stimulus is sent by touching the **Alarm/Error Insert** icon ( ).

The stimulus signal is sent via the transmitter, and the received signal can simultaneously be inspected as a related status or result display. This allows to evaluate the behavior of the device under test.




The setup options vary depending on the stimulus mode (i.e. the signal type). Common functions for all stimulus modes are the port selection and stimulus type drop-down menus. Touching the **Clear all stimuli** button clears/resets the current stimulus settings.

In case of applications having traffic generation, the Traffic start button or the Traffic stop button appears for each ports.

# 4.3 Startup and Switch-off Sequences

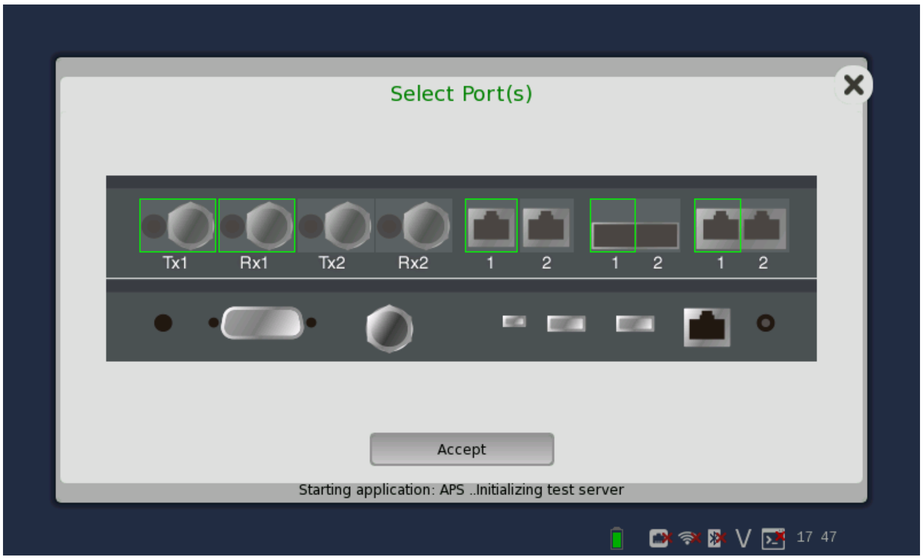
This section describes what takes place when you switch the Network Master on and off as well as when you start up and close down an application.

## 4.3.1 Instrument Startup

When you switch on the instrument, the first screen displayed is a splash screen - introducing you to the GUI concept of the *desktop/workspace* and the various screen types (see the figure in the *GUI Concept* section). Then the *Application Selector* screen is displayed.

## 4.3.2 Application Startup

When you select an icon on the *Application Selector* screen to start an application, a *workspace* is created for that application and the relevant data is loaded into it. When the loading is complete, you are prompted to select the instrument resources (i.e. ports) that will be allocated to the application/test.




After the selection of resources, the *Ports Setup* screen is displayed, with the interface type(s) relevant for the selected application.

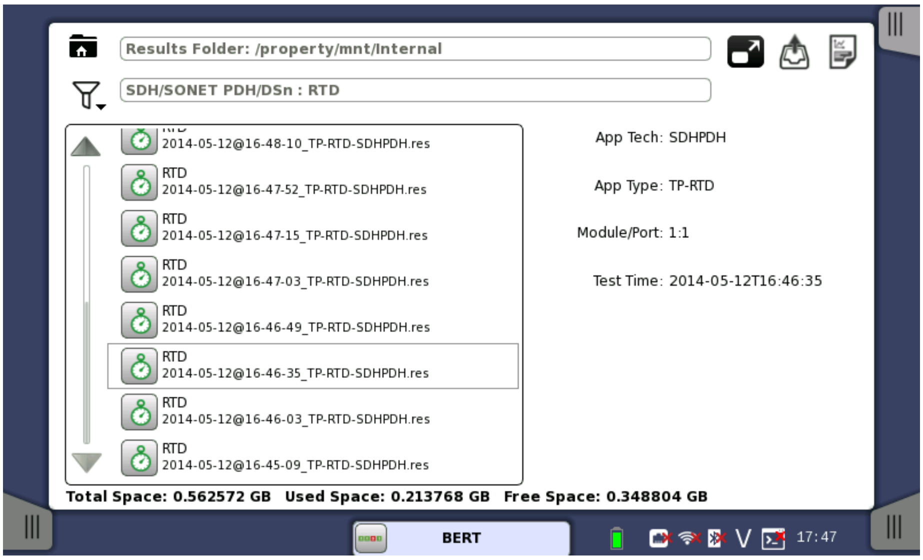
NOTE

*Some of the application icons are "double-icons", allowing you to start the application with an OTN signal layer if relevant. Be careful to touch the correct part of the icon when starting the application.*

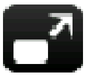
You can also start an application by selecting the result file on the *Report File Browser* screen. Refer to the next section.

## 4.3.3 Accessing Previous Tests and Test Results

When you select test result files on the *Report File Browser* screen, you can choose to either create a report from the results or to create a *workspace* containing the test setup data and its results.

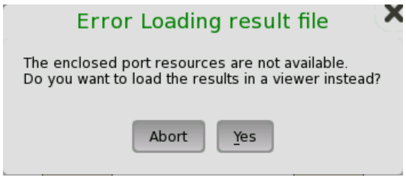


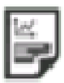

Creating a *workspace* for a previous test allows you to view the test results in the GUI and also to rerun the test if required (either with the same setup or with changed parameter settings). You are brought directly to the *Test Results* screen when you touch the **View/Load File** button, but can navigate to the other screens in the workspace from there.



When you touch the **View** button, an application starts in *Viewer* mode. In this mode, you cannot start measurement. This mode is used to view the test result.

When you touch the **Load File** button, an application starts using the setting in the file. If other applications is using ports, the following message appears. In this case, you can start the application in *Viewer* mode.



When you touch the **Create Report** button, a file manager dialog box is displayed, allowing you to name and save the report (in PDF format).

## 4.3.4 Closing an Application

When you touch the **Close** icon in the *application toolbar*, you are prompted to confirm that you really want to close the current application. If you say "Yes", the *workspace* is closed and you are returned to the *desktop* (i.e. the *Application Selector* screen). The resources previously allocated to the application are freed to be used by another application if required.

## 4.3.5 Switching Off the Instrument

When you press the Power button on the instrument, the power-off menu is displayed. The menu contains the menu item **Shut Down**, and when you select that, you are prompted to confirm that you really want to switch off the instrument completely.

If you say "Yes", the shutdown is announced, and then after a few moments the power is turned off.

NOTE

*If you have any applications still active when you switch off the instrument, these applications will be closed automatically without any configuration data and/or test results being saved.*

# 5 SDH/SONET/PDH/DSn Applications

This chapter describes the graphical user interface (i.e. screens, sub-screens and major dialogs) related to SDH/SONET/PDH/DSn applications. Sub-screens and dialogs are described under the main screen from which they are activated/launched.

The following settings and applications are available:

- SDH Setup and Status
- SONET Setup and Status
- E1 Setup and Status
- DS1/J1 Setup and Status
- E3 Setup and Status
- DS3 Setup and Status
- E4 Setup and Status
- APS
- BERT
- RTD

NOTE *You can switch between SDH and SONET using the 'SDH/SONET switching' drop-down menu on the SDH and SONET structure setup screens. 'SDH and SONET switching' also switches PDH and DSn.*

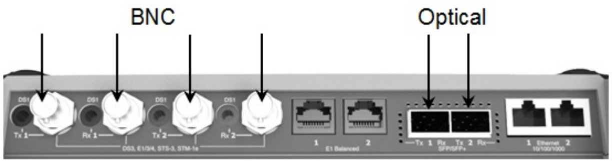
# 5.1 SDH Setup and Status

An **STM-xx** button in the navigation area of the **Ports Setup** screen gives you access to the SDH setup for the transmitter and/or receiver of the currently selected port.

Refer to SDH/SONET switching for switching to SDH.

Synchronous Digital Hierarchy (SDH) is a standardized protocol that transfers digital signals over optical fiber using lasers. At low transmission rates data can also be transferred via an electrical interface.

NOTE *The SDH interface uses the electrical BNC connectors and the optical ports.*

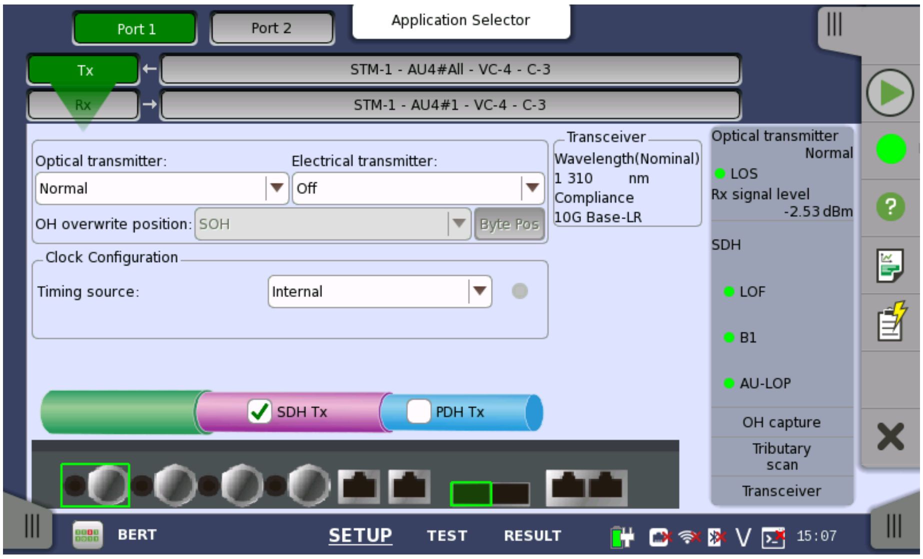



**MU100010A Connector Panel**

## 5.1.1 Transmitter Setup

### 5.1.1.1 Physical Setup

When the transmitter is set up with an SDH interface, touching the **Tx** button in the navigation area will launch the following screen. (Note that the **SDH Tx** checkbox above the connector panel illustration is selected.)




This screen allows you to enable the optical or electrical interface of the SDH transmitter. It can also be used to confirm the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Optical transmitter or Electrical transmitter**

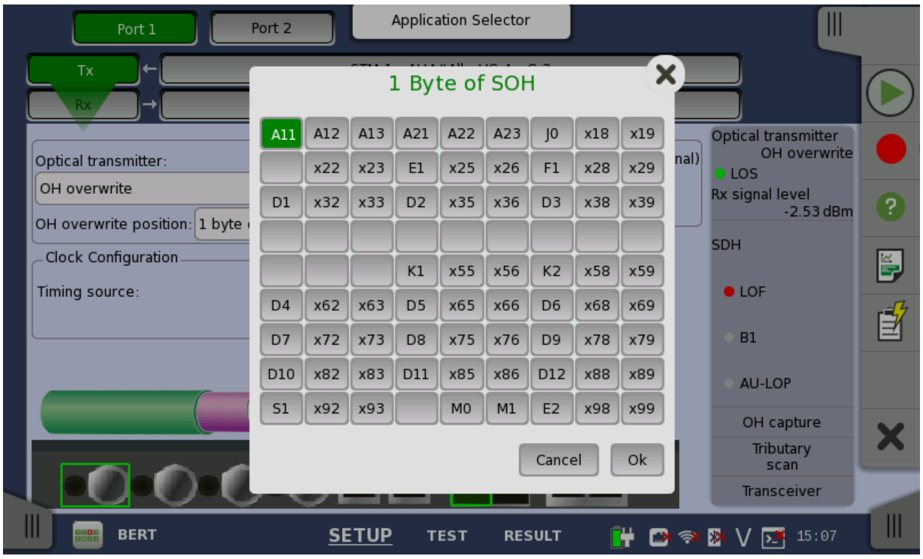
Use the **Optical transmitter** or **Electrical transmitter** drop-down menus to select to the behavior of the transmitter. Set the other type to **Off**.

**OH overwrite position**

Only enabled when the **OH overwrite** has been selected to the behavior of the transmitter. Use the drop-down menu to select the relevant overwrite position. The available values are:

- **SOH**
- **A1/A2 byte**
- **K1/K2 byte**
- **S1 byte**
- **DCC1-3 byte**
- **DCC4-12 byte**
- **J0 byte**
- **1 byte of SOH**

When '1 byte of SOH' is selected, touch the **Byte Pos** button to launch the **1 Byte of SOH** dialog box. Select the byte to overwrite in the dialog box.




**Clock Configuration**
Use the drop-down menu to select the clock source. This is fixed to **Received** when the Port Mode is set to **Through** or **OH overwrite**.

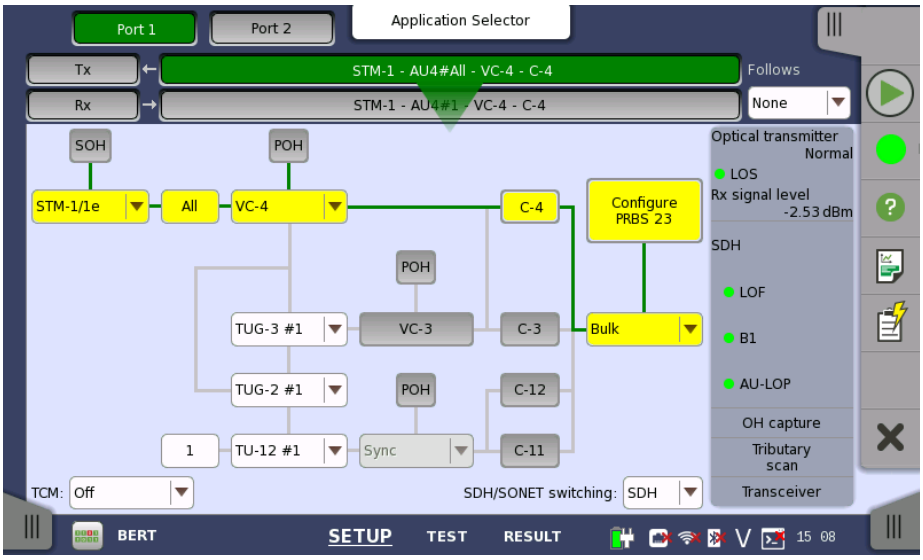
Timing Source
- **Internal**: Internal clock of the module
- **External**: The clock provided from the connector
- **Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

**Transceiver** Displays the Transceiver information when Optical transmitter is selected.

### 5.1.1.2 SDH Frame Setup

Touching the navigation area button which represents the transmitter's SDH layer will launch the following screen.




The general principle in setting up the SDH frame is to select the relevant values for the various containers in the multiplexing structure. This is done either via a drop-down menu or via a launched dialog box, by touching a drop-down menu or a button in the frame structure diagram.

Note that the currently 'active path' in the structure is highlighted. Note also that the changes you make will be reflected in the text displayed in the **STM-xx** button in the navigation area, if relevant.

**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings), touch the right-most button in the navigation area and select the **Tx1** in the drop-down menu. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

**TCM**

Select the *TCM* (Tandem Connection Monitoring). The available TCM is decided by multiplex structure. If you select other TCM, the multiplex structure on the setup area will be changed.

The possible settings are:

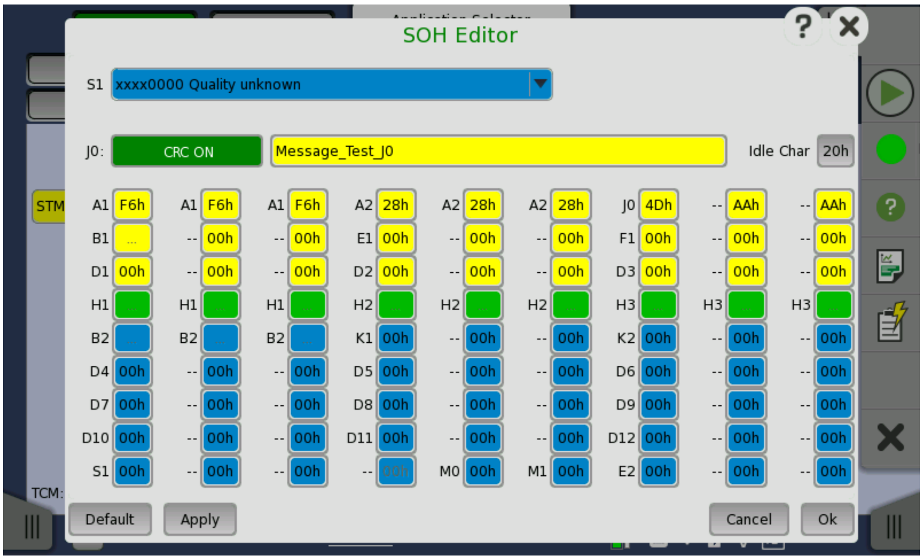
- **Off**
- **N1 (VC-4)**
- **N1 (VC-3)**
- **N2 (VC-12/11)**

**SDH/SONET switching**

Allows you to switch between SDH and SONET.

**SOH Editor**

You can configure the section overhead (SOH) in a special dialog box (**SOH Editor**), which is launched when you touch the **SOH** button.

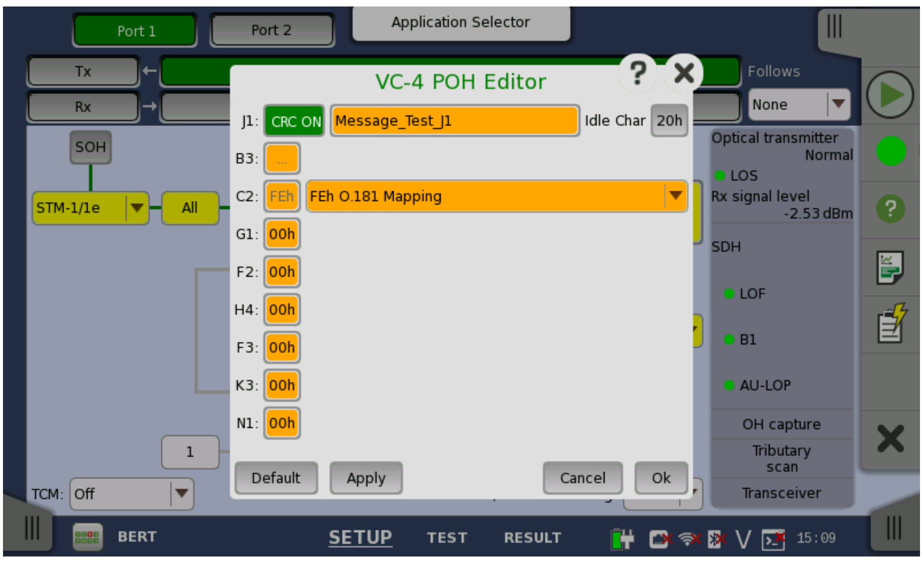



The setup principle is the same in this editor dialog as in the SDH structure. Touching a button or opening a drop-down menu will open for new editor dialog boxes, new value selections etc.

- **S1**: Synchronization status
- **J0**: Regenerator section trace
  Idle Char is an Ascii code used for the padding.
- **A1**, **A2**: Framing
  Defined A1 as F6h (1111011b), A2 as 28h (00101000b).
- **B1**: BIP-8 (bit interleaved parity) This byte cannot be set.
- **E1**, **E2**: Orderwire
  E1 is part of the RSOH, E2 is part of the MSOH.
- **F1**: User channel
- **D1-D3**: RS (regenerator section) data communication channel ($DCC_R$)
- **D4-D12**: MS (multiplex section) data communication channel ($DCC_M$)
- **B2**: BIP-N×24 These bytes cannot be set.
- **K1**, **K2**(bit 1 to bit 5): Automatic protection switching (APS) channel
- **K2**(bit 6 to bit 8): MS-RDI (multiplex section remote defect indication)
- **M0**, **M1**: MS-REI (multiplex section remote error indication)
- **H1**, **H2**, **H3**: AU-n pointer These bytes cannot be set.

**POH Editor**

Touching a **POH** button launches the **VC-x POH Editor** dialog box. The contents of the dialog box depends on which path overhead you are configuring.

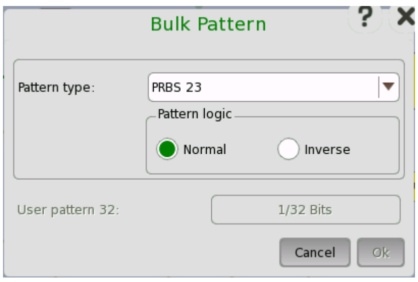


- **J1**: Path Trace
  Idle Char is an Ascii code used for the padding.
- **B3**: Path BIP-8 This byte cannot be set.
- **C2**: Signal label
- **G1**: (bit 1 to 4) REI (bit 5) RDI (bit 6 and 7) Reserved (bit 8) Spare
- **F2,F3**: Path user channels
- **H4**: Multiframe indicator
- **K3**: (bit 1 to 4) Automatic protection switching (APS) channels (bit 5 and 6) Spare (bit 7 and 8) Data link
- **N1**: Network operator byte


- **J2**: Path Trace
  Idle Char is an Ascii code used for the padding.
- **V5**: (bit 1 and 2) BIP-2 (bit 3) REI (bit 4) RFI (bit 5 to 7) Signal label (bit 8) RDI
- **N2**: Network operator byte
- **K4**: (bit 1) Extended signal label (bit 2) Low order virtual concatenation (bit 3 and 4) Automatic protection switching (APS) channels (bit 5 to 7) Reserved (bit 8) Data link

**Bulk Pattern**

To set up the bulk pattern, touch the **Configure xxxxx** button to launch the **Bulk Pattern** dialog box.




**Pattern type**
Select a predefined pattern or define a user pattern.

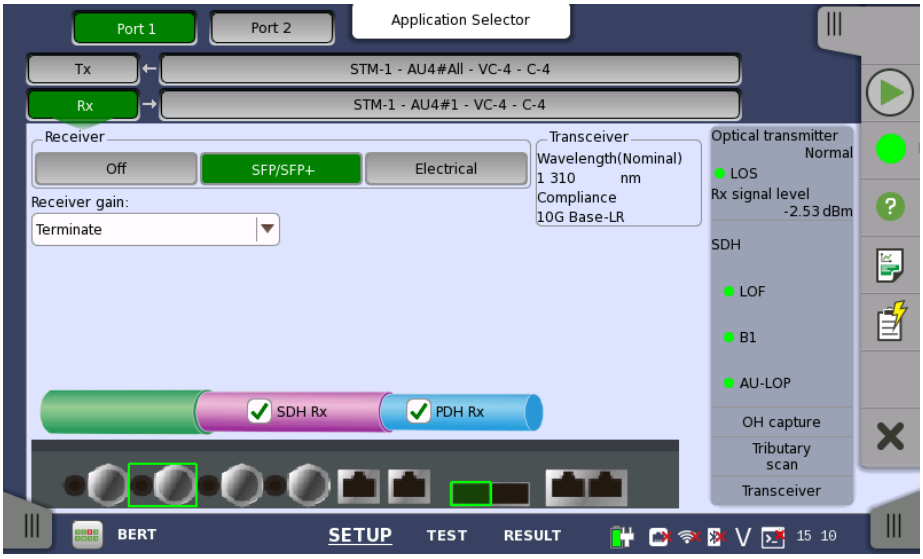
- **User [32] bit**, **User [2048] bit**: 32 bits or 2048 bits length pattern.
  The field which shows bit length is enabled. Touch the field to launch the dialog box to define the bit pattern. Refer to The User Pattern Editor.
- **PRBS9** to **PRBS31**: Pseudo-random bit sequence. The number indicates the bit length of sequence.
  For example, bit length of PRBS9 is $2^9$-1=511.
  **Pattern logic** is enabled.
- **All 0's**, **All 1's**: All bits are 0, all bits are 1.
- **Alternating 1:1**, **Alternating 1:3**, **Alternating 1:7**: Bit pattern such as

"010101...", "100010001000...", "1000000010000000...".
- **2 in 8**: Bit pattern such as "01000010010000100100010...".

## 5.1.2 Receiver Setup

### 5.1.2.1 Physical Setup

When the receiver is set up with an SDH interface, touching the **Rx** button in the navigation area will launch the following screen. (Note that the **SDH Rx** checkbox above the connector panel illustration is selected.)




This screen allows you to make the physical setup of the receiver in SDH mode. It can also be used to confirm the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Receiver** Touch the button corresponding to the relevant interface type.

- **Off**: No interface
- **SFP/SFP+**: Optical interface
- **Electrical**: Electrical interface (BNC connector)

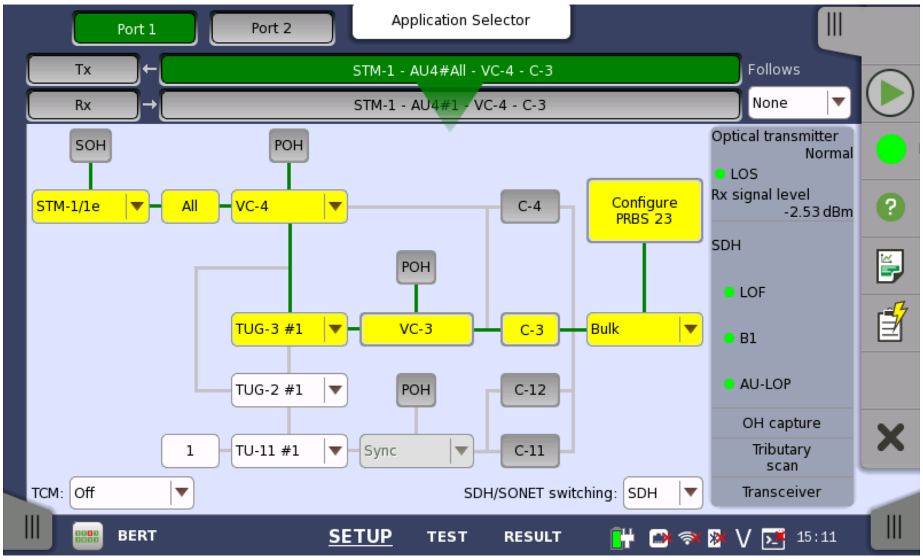
**Receiver gain** Only relevant for electrical receivers. Select the attenuation and impedance mode from the drop-down menu.

- **Terminate**: Up to 12 dB cable attenuation, nominal impedance
- **Monitor**: 20 dB linear attenuation and up to 12 dB cable attenuation, nominal impedance.

**Transceiver** Displays the Transceiver information when Optical Transmitter is selected.

### 5.1.2.2 SDH Frame Setup

Touching the navigation area button which represents the receiver's SDH layer will launch the following screen.




The manner of setting up the SDH interface of receiver is the same as that of transmitter. Refer to SDH Frame Setup in "Transmitter Setup".

**Follows** To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the right-most button in the navigation area and select the relevant value in the drop-down menu. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**TCM** Select the *TCM* (Tandem Connection Monitoring). The available TCM is decided by multiplex structure. If you select other TCM, the multiplex structure on the setup area will be changed.

The possible settings are:

**Off**
**N1 (VC-4)**
**N1 (VC-3)**
**N2 (VC-12/11)**

**SDH/SONET switching** Allows you to switch between SDH and SONET.

## 5.1.3 Status Information

This section describes the status information available for the SDH layer in the status area of the **Ports Setup** screen.

### 5.1.3.1 Status Summary

The status summary displayed for the SDH layer consists of the following information:

**Physical Status** The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status** The middle part of the status area gives you access to alarm and error information for the selected interface. The status is indicated by the lamp color.

A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

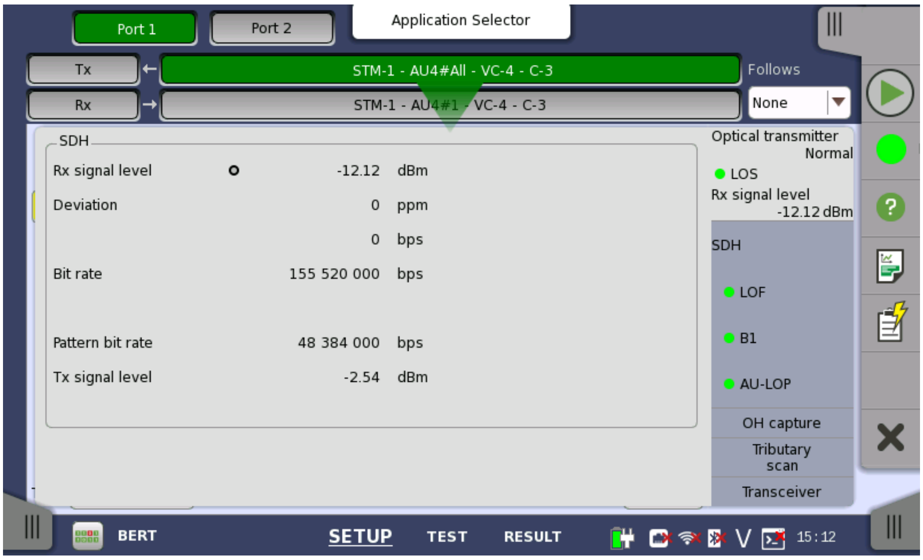
**Capture/Monitor Status**

At the bottom of the status area are below buttons that give you access to various capture/monitor information. By touching a button, you can launch the corresponding information display.

- **OH capture**
- **Tributary scan**
- **Transceiver**

### 5.1.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen launches the dialog box shown below.




This dialog box presents detailed information about the current physical status of the received signal at the STM-1/4/16/64 optical/electrical interface.

The physical status information consists of the following parameters.

NOTE

*When Receiver is set to OFF, 'N/A's are displayed.*

**Rx signal level**

- Signal Level (Optical) shows the optical signal level in dBm.
- Signal Level (Electrical) shows the electrical signal level in dB.

'N/A' is displayed when input level is too low to detect the signal level. The lamp indicates LOS status.

**Deviation**
This field shows the deviation from the relevant nominal bit rate:

- STM-1/1e: 155 520 000 bps
- STM-4: 622 080 000 bps
- STM-16: 2 488 320 000 bps
- STM-64: 9 953 280 000 bps

**Bit rate**
The current bit rate is shown (in bps).

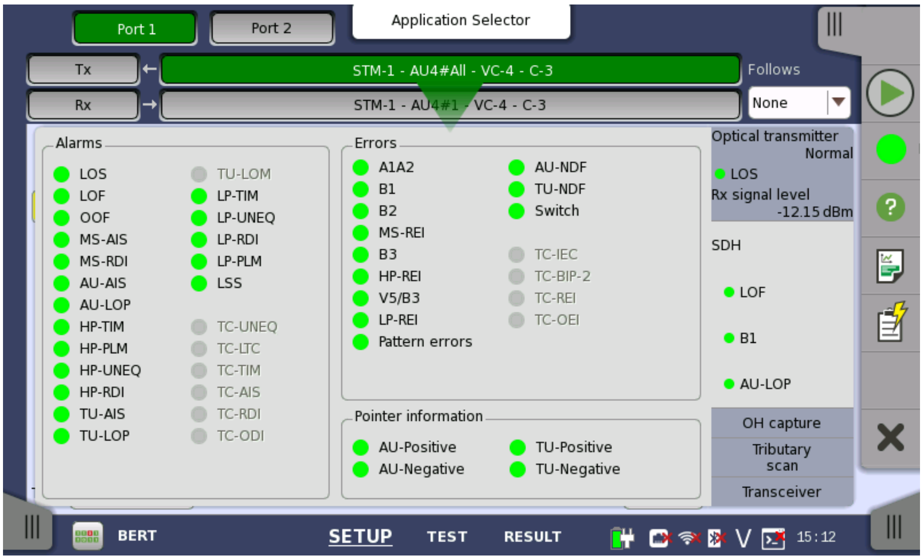
**Pattern bit rate**
This field shows the effective bit rate of the patterns received (that is, the number of pattern bits received per second).

**Tx signal level**

When optical is selected, this field shows the output power the SFP module. When electrical is selected, 'N/A' is displayed.

### 5.1.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen allows you to launch the display shown below.




This screen contains detailed alarm and error information related to the SDH interface. Status is indicated by the use of colored Lamp icons.

Alarms

- **LOS**: Loss of Signal
- **LOF**: Loss of Frame
- **OOF**: Out of Frame
- **MS-AIS**: Multiplex Section Alarm Indication Signal
- **MS-RDI**: Multiplex Section Remote Defect Indication
- **AU-AIS**: Administrative Unit Alarm Indication Signal
- **AU-LOP**: Administrative Unit Loss of pointer
- **HP-TIM**: High order Path Trace Identifier Mismatch
- **HP-PLM**: High order Path Payload Mismatch
- **HP-UNEQ**: High order Path UNEQuipped
- **HP-RDI**: High order Path Remote Defect Indication
- **TU-AIS**: Tributary Unit Alarm Indication Signal
- **TU-LOP**: Tributary Unit Loss of pointer
- **TU-LOM**: Tributary Unit Loss of Multiframe
- **LP-TIM**: Low order Path Trace Identifier Mismatch
- **LP-UNEQ**: Low order Path UNEQuipped
- **LP-RDI**: Low order Path Remote Defect Indication
- **LP-PLM**: Low order Path Payload Mismatch
- **LSS**: Loss of Sequence Synchronization
- **TC-UNEQ**: Tandem Connection UNEQuipped
- **TC-LTC**: Tandem Connection Loss of Tandem Connection
- **TC-TIM**: Tandem Connection Trace Identifier Mismatch
- **TC-AIS**: Tandem Connection Alarm Indication Signal
- **TC-RDI**: Tandem Connection Remote Defect Indication
- **TC-ODI**: Tandem Connection Outgoing Defect Indication

Errors

- **A1A2**: Bytes used for the frame synchronization
- **B1**: The byte of BIP-8 (Bit Interleaved Parity-8)
- **B2**: The bytes of BIP-N×24 (Bit Interleaved Parity N×24)
- **MS-REI**: Multiplex Section Remote Error Indication
- **B3**: The byte of BIP-8 (Bit Interleaved Parity-8)

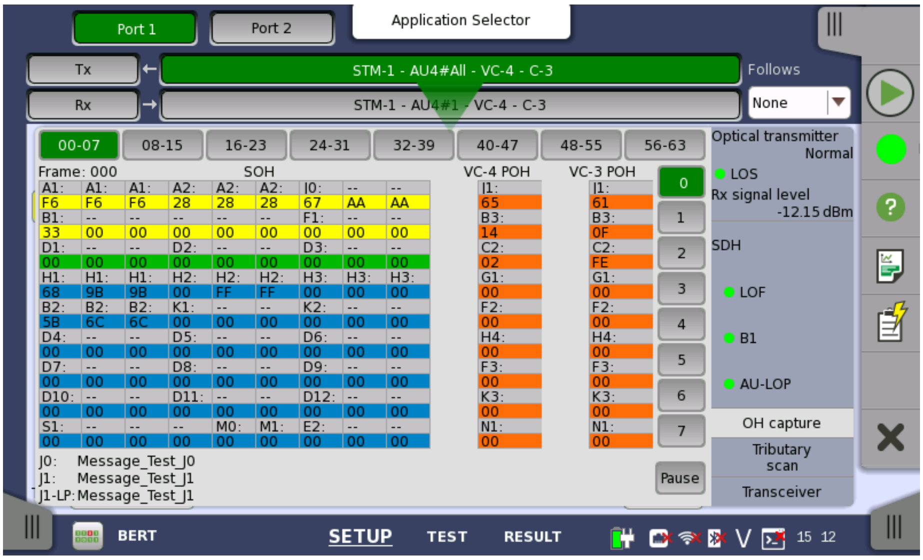
- **HP-REI** : High order Path Remote Error Indication
- **V5/B3**: BIP-2 of VC-12/VC-11 or BIP-8 of Low order VC3
- **LP-REI**: Low order Path Remote Error Indication
- **Pattern errors**: Bit error detected in the payload
- **AU-NDF**: Administrative Unit New Data Flag
- **TU-NDF**: Tributary Unit New Data Flag
- **Switch**: APS switching occurred
- **TC-IEC**: Tandem Connection Incoming Error Count
- **TC-BIP-2**: Tandem Connection Bit Interleaved Parity-2
- **TC-REI**: Tandem Connection Remote Error Indication
- **TC-OEI**: Tandem Connection Outgoing Error Indication

Pointer Information

- **AU-Positive**: Administrative Unit Positive stuffing
- **AU-Negative**: Administrative Unit Negative stuffing
- **TU-Positive**: Tributary Unit Positive stuffing
- **TU-Negative**: Tributary Unit Negative stuffing

### 5.1.3.4 OH capture

Touching the **OH capture** button in the status area of the **Ports Setup** screen launches the screen shown below.




This screen shows SDH capture status information for one frame at a time. Touch the frame selection buttons to select which frame to display.

**Refreshing information**

Refresh once

When touch the **Pause** button, the **Update** button is showed at left side of the **Pause** one and information is not updated. Touching the **Update** button will refresh the dialog information once.

Refresh continuously

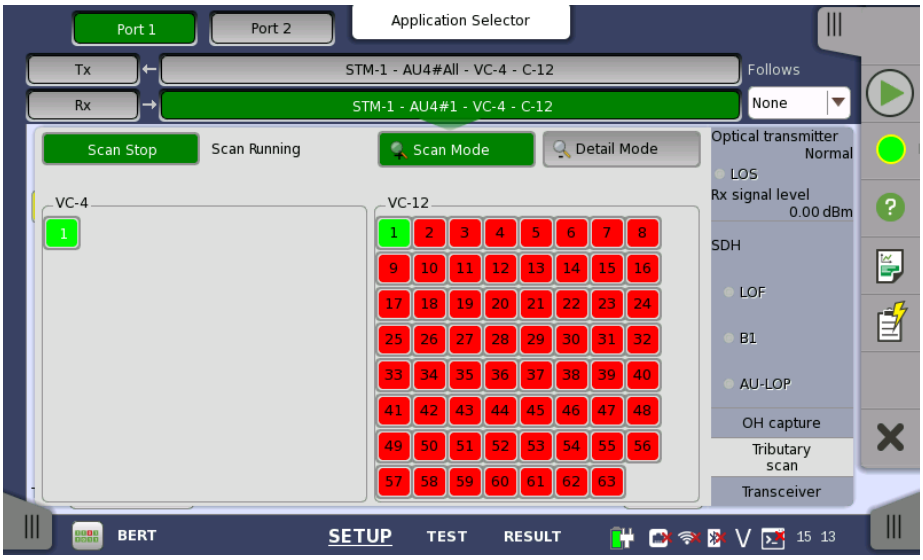
When the dialog is open and touch the **Pause** button at refresh once mode, information is updated continuously.

**Displaying detailed information**

Detailed overhead byte information can be accessed by touching a specific byte. This will launch a separate dialog containing a description of and details about the selected byte.


### 5.1.3.5 Tributary scan

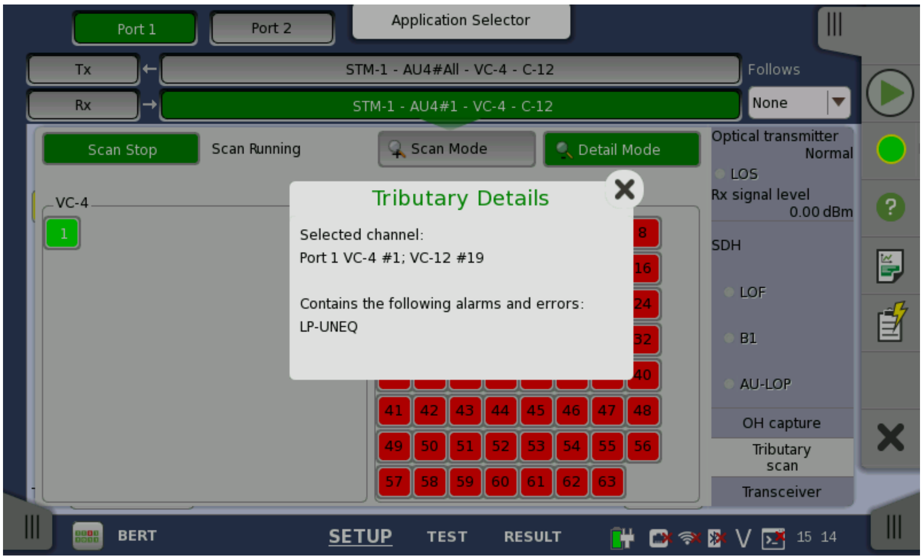
Touching the **Tributary scan** button in the status area of the **Ports Setup** screen displays the status shown below.




This screen allows to measure the alarms and errors of all VC-containers in the High order or the Low order at the same time. Note that the Low order scan is performed against the High order channel which you have selected.

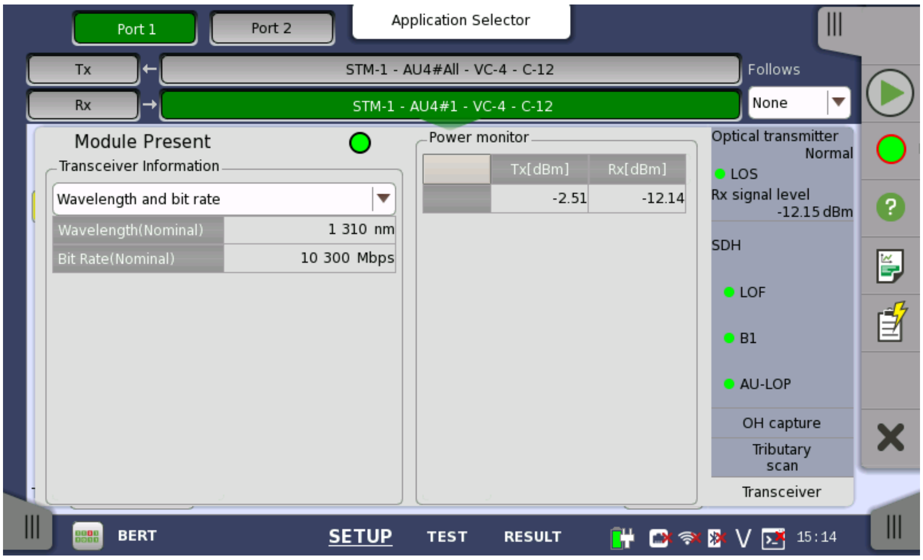
**Scanning** This button appears when the Low order channel exists. In Scan Mode, touch the **Scan Start** button to start the scanning. To stop the scanning touch the **Scan Stop** button (same button, which toggles between the two functions).

**Details** To view detailed information for a specific channel, touch the **Detail Mode** button and then touch the channel number.




### 5.1.3.6 Transceiver

Touching the **Transceiver** button in the status area of the **Ports Setup** screen launches the dialog shown below.




This dialog box presents status information about the optical transceiver.

**Module Present**

**Green** indicates that optical transceiver presents.

**Transceiver Information**

Select the information from pull down menu.

- **Wavelength and bit rate** shows the nominal wavelength and bit rate.
- **Compliance** shows the available standards.
- **Vendor information** shows the data stored in the optical transceiver.

**Power monitor**

The transmitting optical power is displayed in left column. Unit of the optical power is dBm.

The received optical power is displayed in right column. Unit of the optical power is dBm.

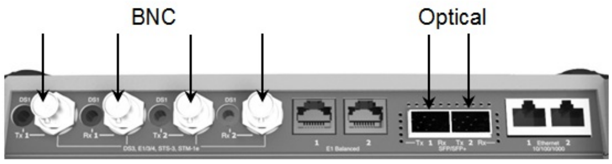
# 5.2 SONET Setup and Status

An **OC-xx/STS-xx** button in the navigation area of the **Ports Setup** screen gives you access to the SONET setup for the transmitter and/or receiver of the currently selected port.

Refer to SDH/SONET switching for switching to SONET.

Synchronous Optical Networking (SONET) refers to a standardized protocol that transfers digital signals over optical fiber using lasers. At low transmission rates data can also be transferred via an electrical interface.

NOTE *The SONET interface uses the electrical BNC connectors and the optical ports.*

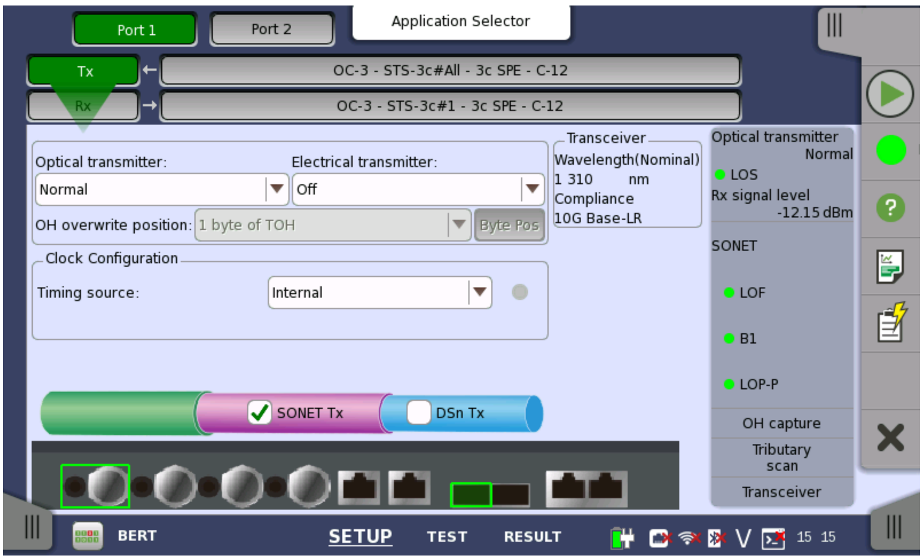



**MU100010A Connector Panel**

## 5.2.1 Transmitter Setup

### 5.2.1.1 Physical Setup

When the transmitter is set up with a SONET interface, selecting the **Tx** button in the navigation area will launch the following screen. (Note that the **SONET Tx** checkbox above the connector panel illustration is selected.)




This screen allows you to enable the optical or electrical interface of the SONET transmitter. It can also be used to inspect the current status of the selected port.

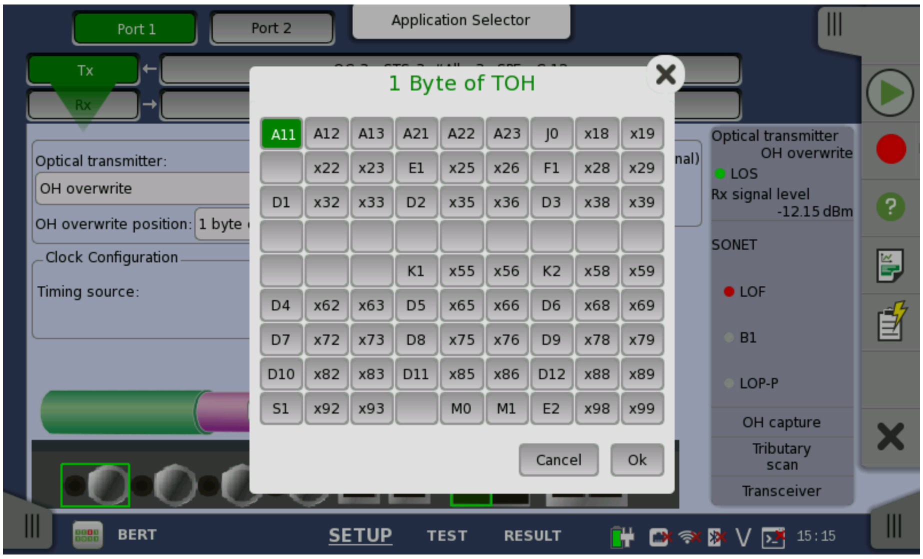
The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Optical transmitter or Electrical transmitter**
Use the **Optical transmitter** or **Electrical transmitter** drop-down menus to select to the behavior of the transmitter. Set the other type to **Off**.

**OH overwrite position**
Only enabled when the **OH overwrite** has been selected to the behavior of the transmitter. Use the drop-down menu to select the relevant overwrite position. The available values are:

- **TOH**
- **A1/A2 byte**
- **K1/K2 byte**
- **S1 byte**
- **DCC1-3 byte**
- **DCC4-12 byte**
- **J0 byte**
- **1 byte of TOH**

When '1 byte of TOH' is selected, touch the **Byte Pos** button to launch the **1 Byte of TOH** dialog box. Select the relevant byte in the dialog.




**Clock Configuration**
Use the drop-down menu to select the clock source. This is fixed to **Received** when the Port Mode is set to **Through** or **OH overwrite**.

Timing Source

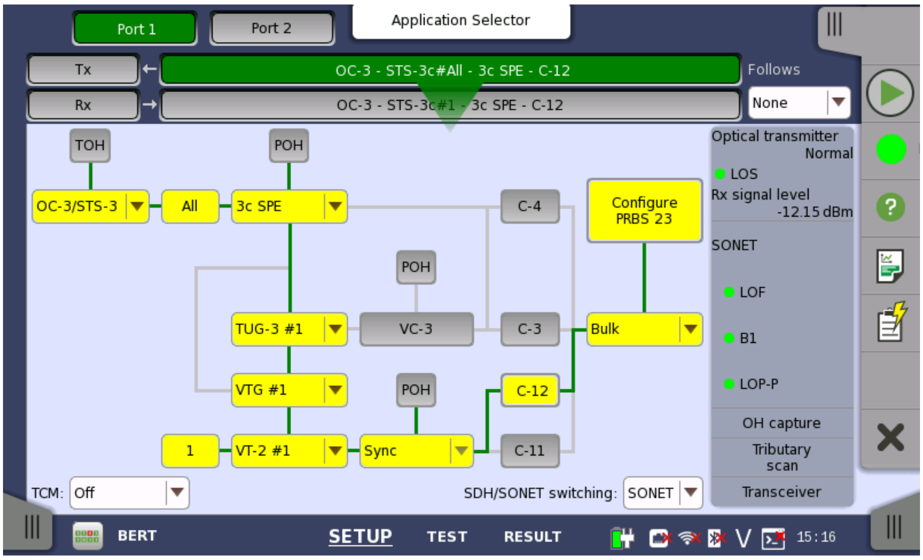
**Internal**: Internal clock of the module
**External**: The clock provided from the connector
**Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

**Transceiver** Displays the Transceiver information when Optical Transmitter is selected.

### 5.2.1.2 SONET Frame Setup

Touching the navigation area button which represents the transmitter's SONET layer will launch the following screen.




The general principle in setting up the SONET frame is to select the relevant values for the various containers in the multiplexing structure. This is done either via a drop-down menu or via a launched dialog box, by touching a drop-down menu or a button in the frame structure diagram.

Note that the currently 'active path' in the structure is highlighted. Note also that the changes you make will be reflected in the text displayed in the SONET button in the navigation area, if relevant.

**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings), touch the right-most button in the navigation area and select the **Tx1** in the drop-down menu. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

**TCM**

Select the *TCM* (Tandem Connection Monitoring). The available TCM is decided by multiplex structure. If you select other TCM, the multiplex structure on the setup area will be changed.

The possible settings are:

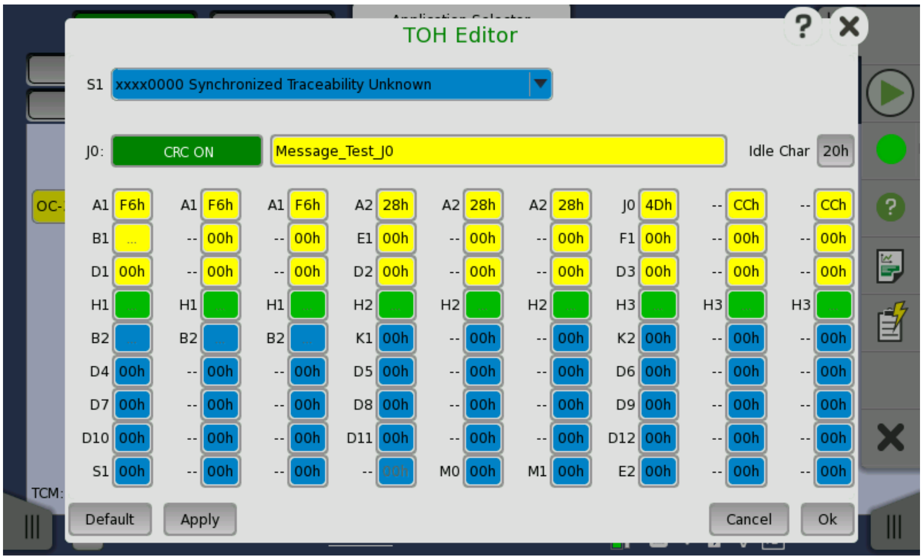
- **Off**
- **Z5 (STS-3c)**
- **Z5 (STS-1)**
- **Z6 (VT-2/1.5)**

**SDH/SONET switching**

Allows you to switch between SDH and SONET.

**TOH Editor**

You can configure transport overhead (TOH) in a special dialog box (**TOH Editor**), which is launched when you touch the **TOH** button.

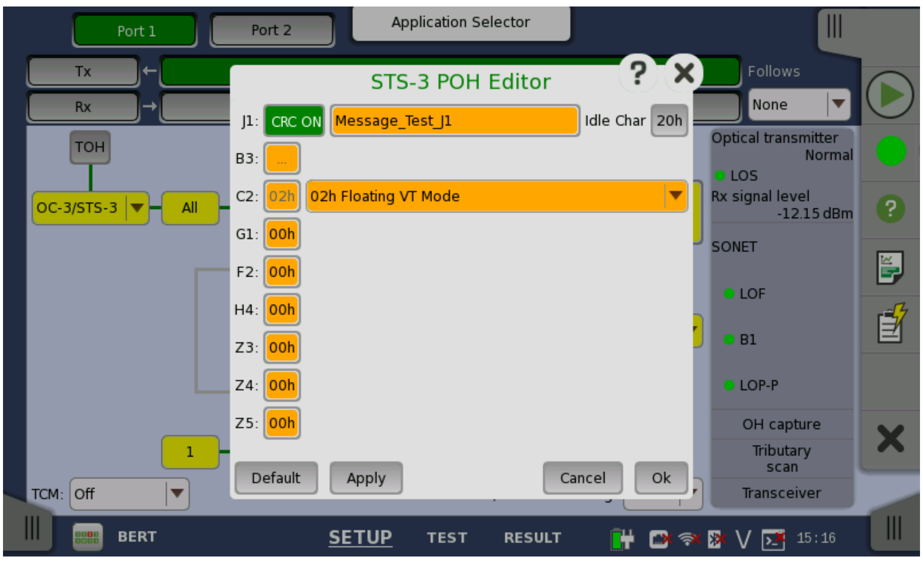



The setup principle is the same in this editor dialog box as in the SONET structure. Touching a button or opening a drop-down menu will open for new editor dialog boxes, new value selections etc.

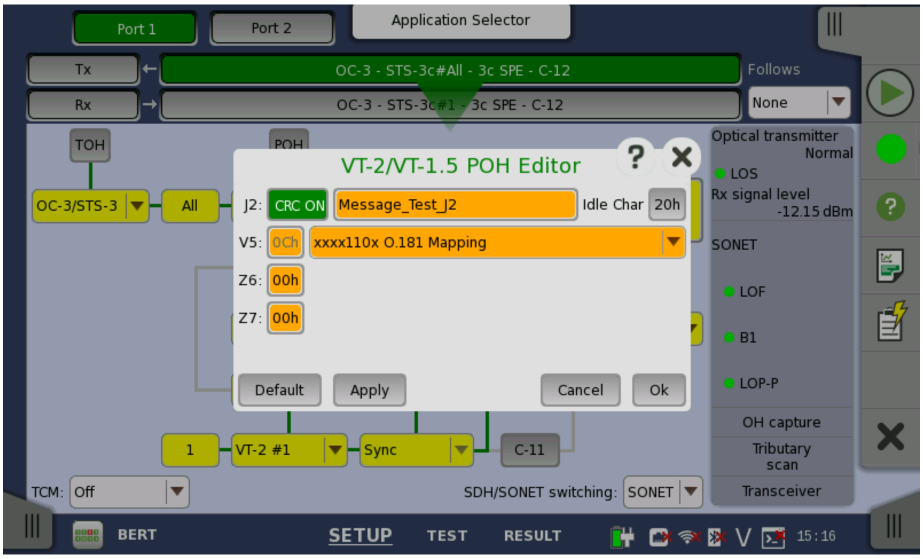
- **S1**: Synchronization status
- **J0**: Regenerator section trace
  Idle Char is an Ascii code used for the padding.
- **A1**, **A2**: Framing
  Defined A1 as F6h (1111011b), A2 as 28h (00101000b).
- **B1**: BIP-8 (bit interleaved parity) This byte cannot be set.
- **E1**, **E2**: Orderwire
  E1 is part of the Section Overhead, E2 is part of the Line Overhead.
- **F1**: User channel
- **D1-D3**: Section data communication channel ($DCC_R$)
- **D4-D12**: Line data communication channel ($DCC_M$)
- **B2**: BIP-N×24 These bytes cannot be set.
- **K1**, **K2**(bit 1 to bit 5): Automatic protection switching (APS) channel
- **K2**(bit 6 to bit 8): RDI-L (Line remote defect indication)
- **M0**, **M1**: REI-L (Line remote error indication)
- **H1**, **H2**, **H3**:STS pointer These bytes cannot be set.

**POH Editor**

Touching a **POH** button launches the **STS-x POH Editor** or **VT-2/VT1.5 POH Editor** dialog box. The contents of the dialog depends on which path overhead you are configuring.



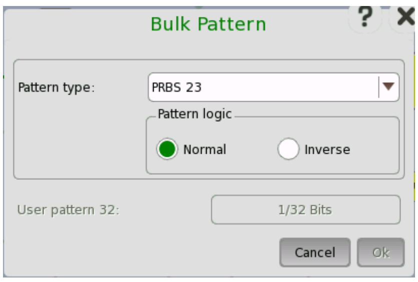
- **J1**: Path Trace
  Idle Char is an Ascii code used for the padding.
- **B3**: Path BIP-8 This byte cannot be set.
- **C2**: Signal label
- **G1**: (bit 1 to 4) REI (bit 5) RDI (bit 6 and 7) Reserved (bit 8) Spare
- **F2,Z3**: Path user channels
- **H4**: Multiframe indicator
- **Z4**: (bit 1 to 4) Automatic protection switching (APS) channels (bit 5 and 6) Spare (bit 7 and 8) Data link
- **Z5**: Network operator byte




- **J2**: Path Trace
  Idle Char is an Ascii code used for the padding.
- **V5**: (bit 1 and 2) BIP-2 (bit 3) REI (bit 4) RFI (bit 5 to 7) Signal label (bit 8) RDI
- **Z6**: Network operator byte
- **Z7**: (bit 1) Extended signal label (bit 2) Low order virtual concatenation (bit 3 and 4) Automatic protection switching (APS) channels (bit 5 to 7) Reserved (bit 8) Data link

**Bulk Pattern**

To set up the bulk pattern, touch the **Configure xxxxx** button to launch the **Bulk Pattern** dialog box.




**Pattern type**
Select a predefined pattern or define a user pattern.

- **User [32] bit**, **User [2048] bit**: 32 bits or 2048 bits length pattern. The field which shows bit length is enabled. Touch the field to launch the dialog box to define the bit pattern. Refer to The User Pattern Editor.
- **PRBS9** to **PRBS31**: Pseudo-random bit sequence. The number indicates the bit length of sequence.

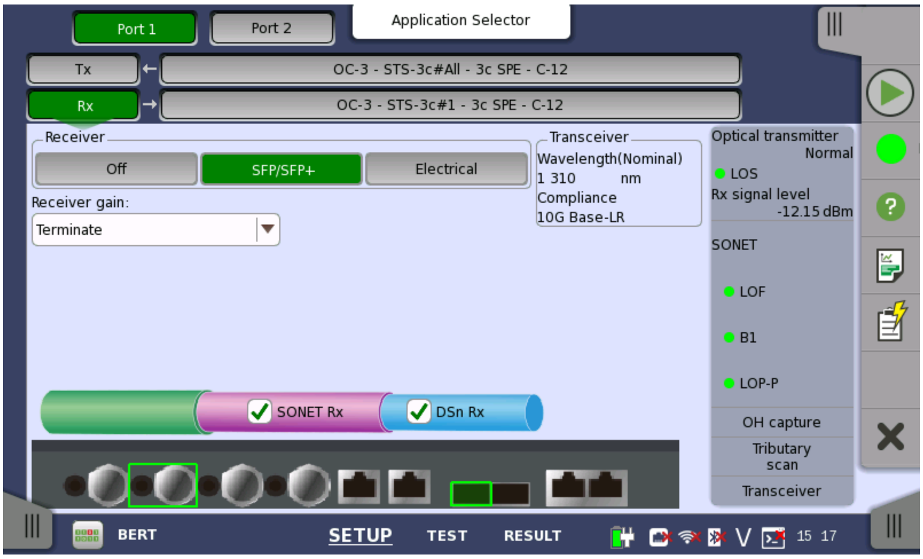
  For example, bit length of PRBS9 is $2^9$-1=511.
  **Pattern logic** is enabled.
- **All 0's**, **All 1's**: All bits are 0, all bits are 1.
- **Alternating 1:1**, **Alternating 1:3**, **Alternating 1:7**: Bit pattern such as

"010101...", "100010001000...", "1000000010000000...".
- **2 in 8**: Bit pattern such as "0100001001000010010000010...".

## 5.2.2 Receiver Setup

### 5.2.2.1 Physical Setup

When the receiver is set up with a SONET interface, touching the **Rx** button in the navigation area will launch the following screen. (Note that the **SONET Rx** checkbox above the connector panel illustration is selected.)




This screen allows you to make the physical setup of the receiver in SONET mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Receiver**

Touch the button corresponding to the relevant interface type.

- **Off**: No interface
- **SFP/SFP+**: Optical interface
- **Electrical**: Electrical interface (BNC connector)

**Receiver gain**

Only relevant for electrical receivers. Select the attenuation and impedance mode from the drop-down menu.

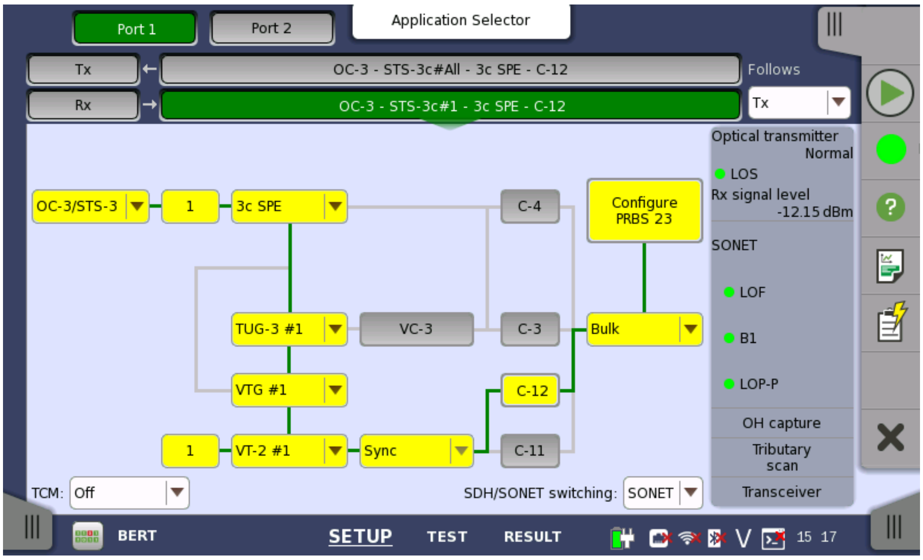
- **Terminate**: Up to 12.7 dB cable attenuation, nominal impedance
- **Monitor**: 20 dB linear attenuation and up to 12 dB cable attenuation, nominal impedance.

**Transceiver**

Displays the Transceiver information when Optical transmitter is selected.

### 5.2.2.2 SONET Frame Setup

Touching the navigation area button which represents the receiver's SONET layer will launch the following screen.




The manner of setting up the SONET interface of receiver is the same as that of transmitter. Refer to *SONET Frame Setup*.

**Follows**

To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the right-most button in the navigation area and select the relevant value in the drop-down menu. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**TCM**

Select the *TCM* (Tandem Connection Monitoring). The available TCM is decided by multiplex structure. If you select other TCM, the multiplex structure on the setup area will be changed.

The possible settings are:

**Off**
**Z5 (STS-3c)**
**Z5 (STS-1)**
**Z6 (VT-2/1.5)**

**SDH/SONET switching**

Allows you to switch between SDH and SONET.

## 5.2.3 Status Information

This section describes the status information available for the SONET layer in the status area of the **Ports Setup** screen.

### 5.2.3.1 Status Summary

The status summary displayed for the SONET layer consists of the following information:

**Physical Status**

The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status**

The middle part of the status area gives you access to alarm and error information for the selected interface. The status is indicated by the lamp color.

A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

**Capture/Monitor Status**

At the bottom of the status area are below buttons that give you access to various capture/monitor information. By touching a button, you can launch the corresponding information display.

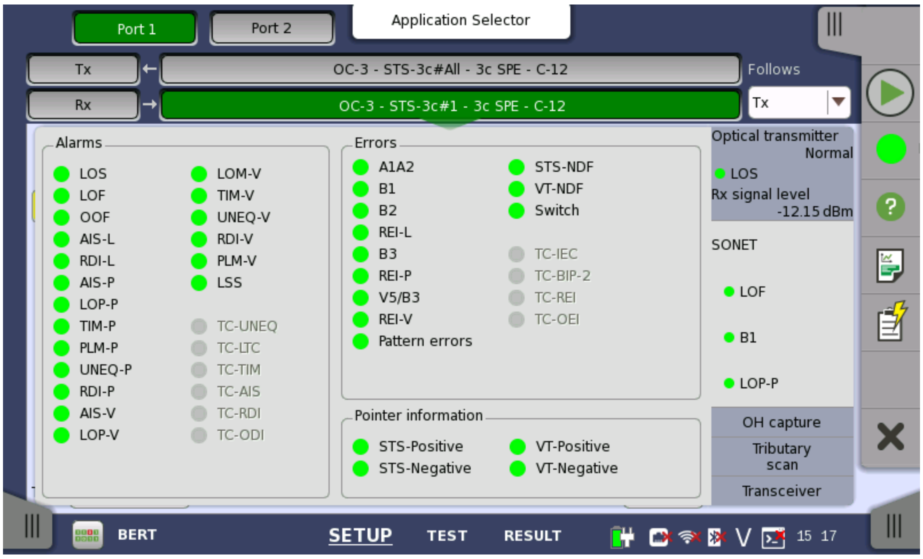
- **OH capture**
- **Tributary scan**
- **Transceiver**

### 5.2.3.2 Physical Details

Refer to Physical Details in "SDH Setup and Status".

### 5.2.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen allows you to launch the dialog box shown below.




This dialog box contains detailed alarm and error information related to the SONET interface. Status is indicated by the use of colored Lamp icons.

Alarms

- **LOS**: Loss of Signal
- **LOF**: Loss of Frame
- **OOF**: Out of Frame
- **AIS-L**: Line Alarm Indication Signal
- **RDI-L**: Line Remote Defect Indication
- **AIS-P**: Path Alarm Indication Signal
- **LOP-P**: Path Loss of pointer
- **TIM-P**: Path Trace Identifier Mismatch
- **PLM-P**: Path Payload Mismatch
- **UNIQ-P**: Path UNEQuipped
- **RDI-P**: Path Remote Defect Indication
- **AIS-V**: VT-Path Alarm Indication Signal
- **LOP-V**: VT-Path Loss of pointer
- **LOM-V**: VT-Path Loss of Multiframe
- **TIM-V**: VT-Path Trace Identifier Mismatch
- **UNIQ-V**: VT-Path UNEQuipped
- **RDI-V**: VT-Path Remote Defect Indication
- **PLM-V**: VT-Path Payload Mismatch
- **LSS**: Loss of Sequence Synchronization
- **TC-UNEQ**: Tandem Connection UNEQuipped
- **TC-LTC**: Tandem Connection Loss of Tandem Connection
- **TC-TIM**: Tandem Connection Trace Identifier Mismatch
- **TC-AIS**: Tandem Connection Alarm Indication Signal

- **TC-RDI**: Tandem Connection Remote Defect Indication
- **TC-ODI**: Tandem Connection Outgoing Defect Indication

Errors

- **A1A2**: Bytes used for the frame synchronization
- **B1**: The byte of BIP-8 (Bit Interleaved Parity-8)
- **B2**: The bytes of 24 parity bits
- **REI-L**: Line Remote Error Indication
- **B3**: The byte of BIP-8 (Bit Interleaved Parity-8)
- **REI-P** : Path Remote Error Indication
- **V5/B3**: BIP-2 of VT-2/VT-1.5 or BIP-8 of Low order VC-3
- **REI-V**: VT-Path Remote Error Indication
- **Pattern errors**: Bit error detected in the payload
- **STS-NDF**: Path New Data Flag
- **VT-NDF**: VT-Path New Data Flag
- **Switch** : APS switching occurred
- **TC-IEC**: Tandem Connection Incoming Error Count
- **TC-BIP-2**: Tandem Connection Bit Interleaved Parity-2
- **TC-REI**: Tandem Connection Remote Error Indication
- **TC-OEI** :Tandem Connection Outgoing Error Indication

Pointer information

- **STS-Positive**: Synchronous Transport Signal Positive stuffing
- **STS-Negative**: Synchronous Transport Signal Negative stuffing
- **VT-Positive**: Virtual Tributary Positive stuffing
- **VT-Negative**: Virtual Tributary Negative stuffing

### 5.2.3.4 OH Capture

Refer to OH Capture in "SDH Setup and Status".

### 5.2.3.5 Tributary Scan

Refer to Tributary Scan in "SDH Setup and Status".

### 5.2.3.6 Transceiver

Refer to Transceiver in "SDH Setup and Status".

# 5.3 E1 Setup and Status

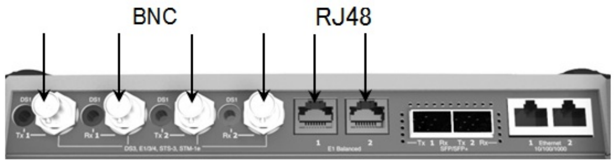
*E1* represents the 2 Mbit/s PDH layer. The **Ports Setup** screen gives you access to the PDH layer setup for the transmitter and/or receiver of the currently selected port.

Plesiochronous Digital Hierarchy (PDH) refers to the technology originally used in telecommunications networks to transport data over digital transport equipment such as fiber optic systems.

E1 allows transmission of data streams that are nominally running at the same rate, however allowing for some variation in the speed around a nominal rate (+/-125 ppm variation around 2 Mbit/s).

NOTE

*The E1 interface uses the electrical BNC connectors (unbalanced) or the electrical RJ48 connectors (balanced).*

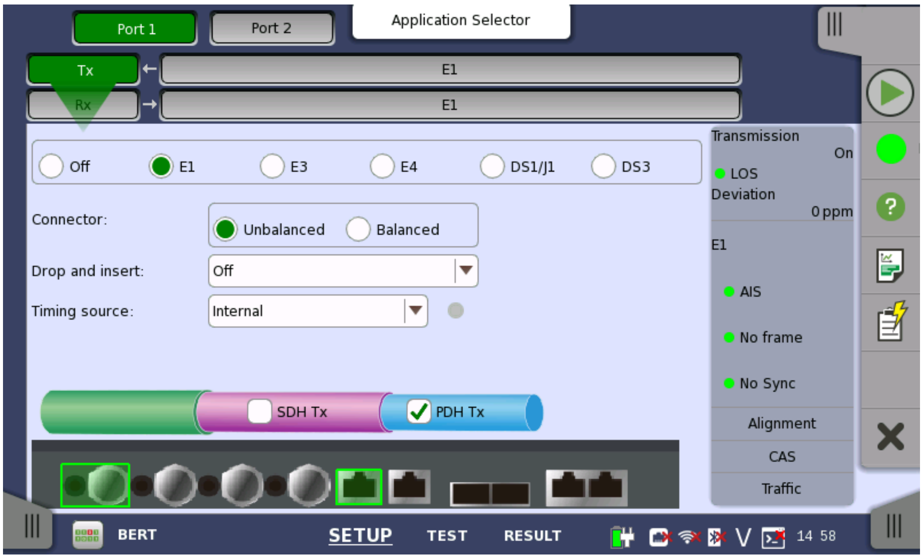



**MU100010A Connector Panel**

## 5.3.1 Transmitter Setup

### 5.3.1.1 Physical Setup

When the transmitter is set up with only an E1 interface, touching the **Tx** button in the navigation area will launch the following screen.




Switching between PDH Tx and DSn Tx is done in the SDH/SONET transmitter setup screen.

1. Select **SDH Tx** or **SONET Tx** checkbox.
2. Touch **STM-xx**, **STS-xx**, or **OC-xx** button in the navigation area.
3. Use drop down menu at right bottom to switch SDH or SONET. Selecting the SDH displays **PDH Tx** on **Tx** screen. Selecting the SONET displays **DSn Tx** on **Tx** screen.
4. Touch **Tx** button in the navigation area.
5. Select **PDH Tx** or **DSn Tx** checkbox.
6. Clear **SDH Tx** or **SONET Tx** checkbox.
7. Touch **E1** radio button. Touching **Off** radio button disables the transmitter.

This screen allows you to make the physical setup of the PDH transmitter in E1 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Connector**

Select the type of the input/output connectors of the instrument. Choose **Unbalanced** to link to the corresponding unbalanced connector, or choose **Balanced** to link to the corresponding balanced connector. A balanced output goes to the RJ48 connector.

**Drop and insert**

Select the source for the transmitter. The whole contents of *Port 1* and *Port 2* can be selected as a source. **Off** is identical to normal transmitter mode.

**Timing Source**

Select the clock source.

**Internal**: Internal clock of the module
**External**: The clock provided from the Ext Clock connector
**Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

### 5.3.1.2 E1 Signal Setup

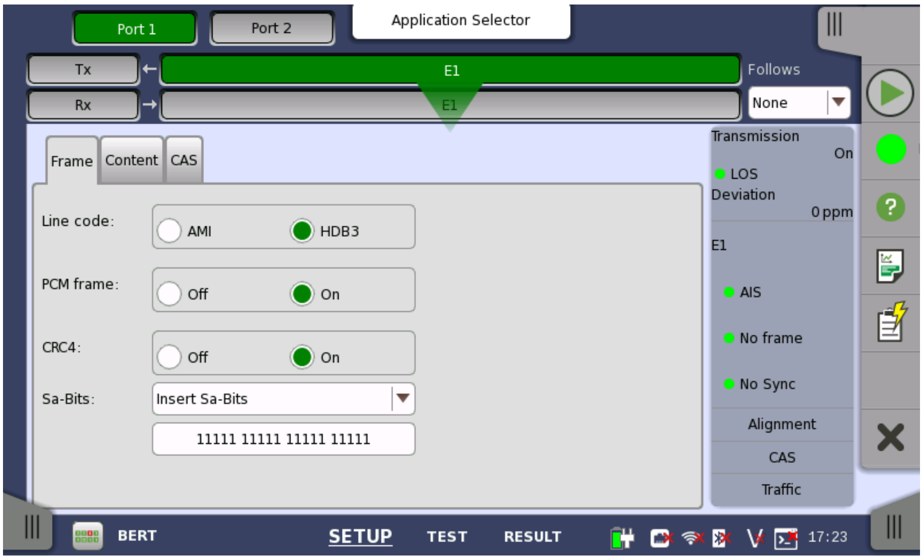
Touching the navigation area button which represents the transmitter's E1 layer will display the screen.

**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings) when using Port 1 and Port 2, touch the drop-down menu in the navigation area and select the **Tx1**. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

#### Frame tab page

The **Frame** tab page contains the following parameters:




**Line code**
Use the **Line code** radio buttons to select transmission line code **HDB3** or **AMI**.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) insertion of PCM frame in the transmitted signal.

*When PCM frame is set to Off, many of the following transmitter parameters are insignificant.*

**CRC4**

Use the **CRC4** radio buttons to enable (**On**) or disable (**Off**) CRC4 in the transmitted signal contained in the PCM Frame.

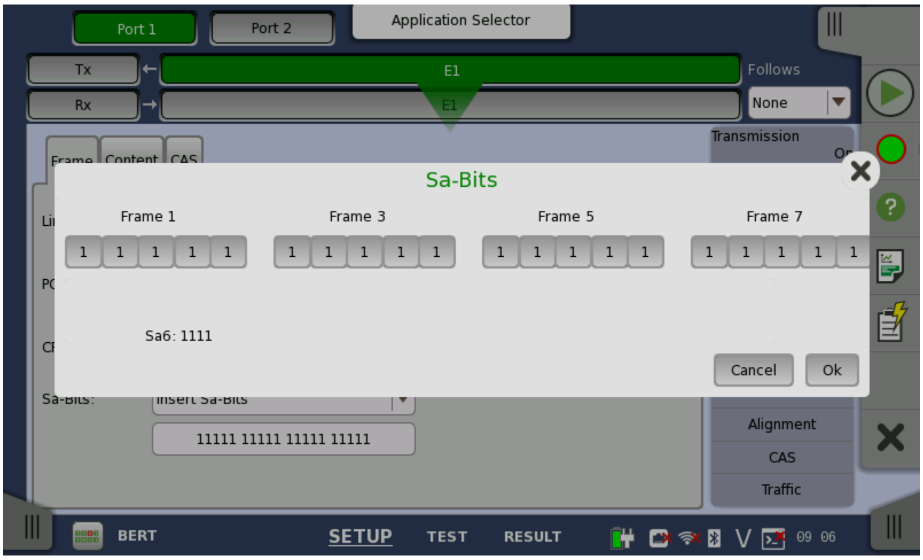
*If you are uncertain whether the CRC4 should be selected or not, it is recommended to enable the CRC4.*

*If **Drop and Insert** of the total contents of a receiver is selected and the signal contains CRC4, it is possible to either Bypass or Insert Sa-Bits.*

**Sa-Bits**

Use the drop-down menu above the setup field to select whether or not to **Insert Sa-Bits** or **Bypass Sa-Bits** (this is only relevant when **Drop and insert** is set to **On**).

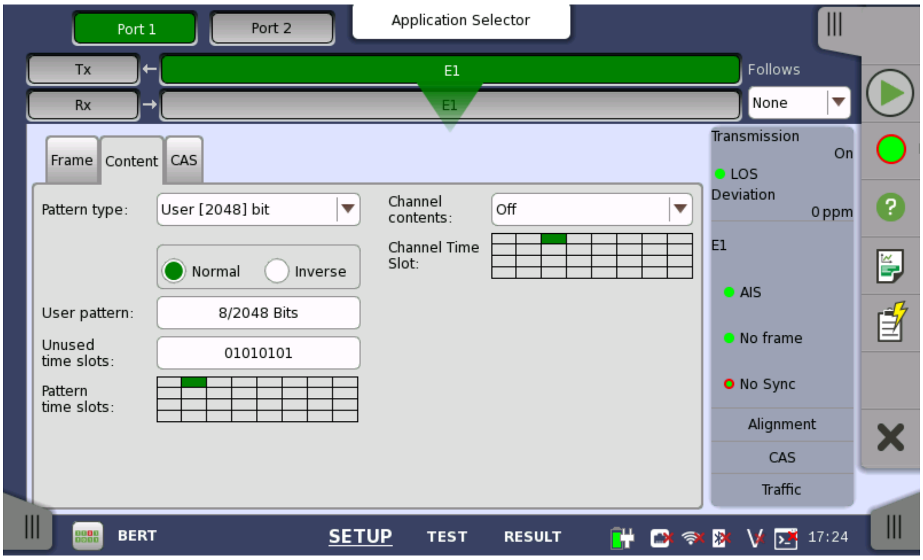
You can set the Sa-Bits value of the non-FAS words in the transmitted signal when containing PCM Frame/CRC4. Touch the **Sa-Bits** setup field to open the setup dialog box.




In **Sa-Bits** dialog box, change the individual Sa-bits by touching on the relevant bit keys - this will toggle the bit key's binary value from logic 1 to 0 or vice versa. Touch **Ok** to accept the changes and close the dialog.

## Content tab page

The **Content** tab page contains the following parameters:




**Pattern type**
Select the pattern to be inserted in the transmitted signal.

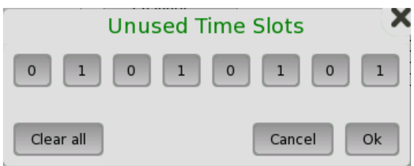
- **Off**: Does not insert the pattern.
- **User [32] bit**, **User [2048] bit**: 32 bits or 2048 bits length pattern.
- **PRBS 6** to **PRBS 23**: Pseudo-random bit sequence. The number indicates the bit length of sequence.
  For example, bit length of PRBS 9 is $2^9$-1=511.
  **Pattern Logic** is enabled.
- **QRSS 11**, **QRSS 20**: Quasi-random signal source.
  The bit length of QRSS 11 is 2047, the length of QRSS 20 is 1 048 575.
- **Fox Pattern** 'THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 1234567890' in Ascii code
- **Fox (CMA3000)** The 'fox pattern' using for the combined test with CMA3000 (the previous model of Network Master)
- **All 0's**, **All 1's**: All bits are 0, all bits are 1.
- **Alternating 1:1**: Bit pattern such as "010101..."
- **Alternating 1:3**: Bit pattern such as "100010001000..."
- **Alternating 1:7**: Bit pattern such as "1000000010000000..."
- **Alternating 3:24**: A repeating 24-bit sequence that contains three ones, fifteen consecutive zeros and 12.5% average ones density.

You can select 'Normal' or 'Inverse' pattern type.

**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

**Unused time slots**
Touch the **Unused time slots** field and use the launched dialog box to define the unused time slots.



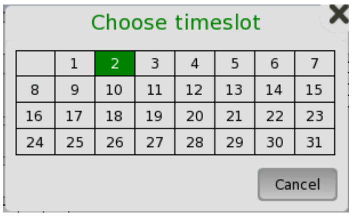
In the **Unused time slots** dialog box, change the individual bits by touching on the relevant bit keys - this will toggle the bit key's binary value from logic 1 to 0 or vice versa. Touch **Ok** to accept the changes and close the dialog box.

**Pattern time slots**
Touch the **Pattern time slot** graphics and use the dialog box to select the timeslots in which the Pattern will be inserted. Set and clear timeslots as relevant.


**Channel contents**
Use the **Channel contents** drop-down menu to select the signal transmitting into the timeslot:

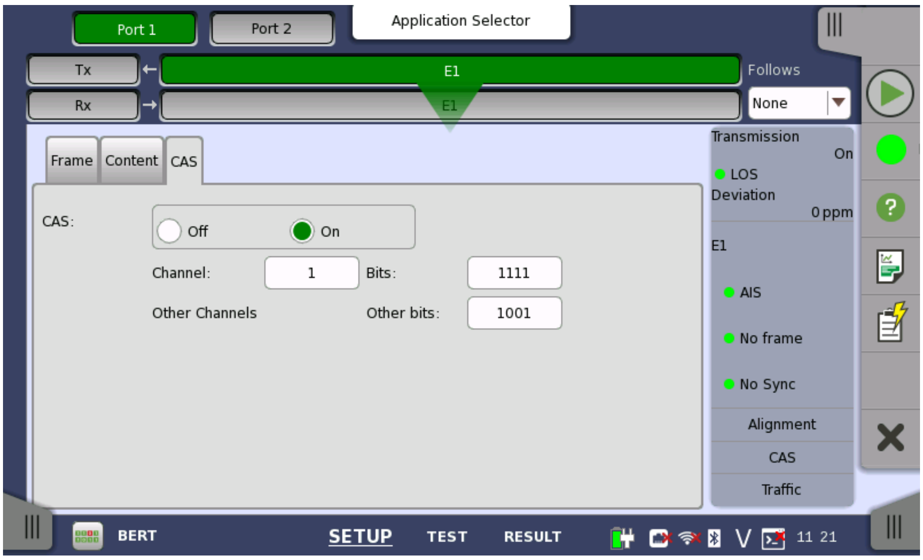
- **Off**: No channel content is selected.
- **Transparent**: Received content in same channel time slot is used. 'Drop and insert' on Tx screen will be switched to On.

**Channel Time Slot**
Touch the **Channel Time Slot** graphics and use the dialog box to select the timeslot to insert the Audio signal.




## CAS tab page

The **CAS** tab page contains the following parameters:



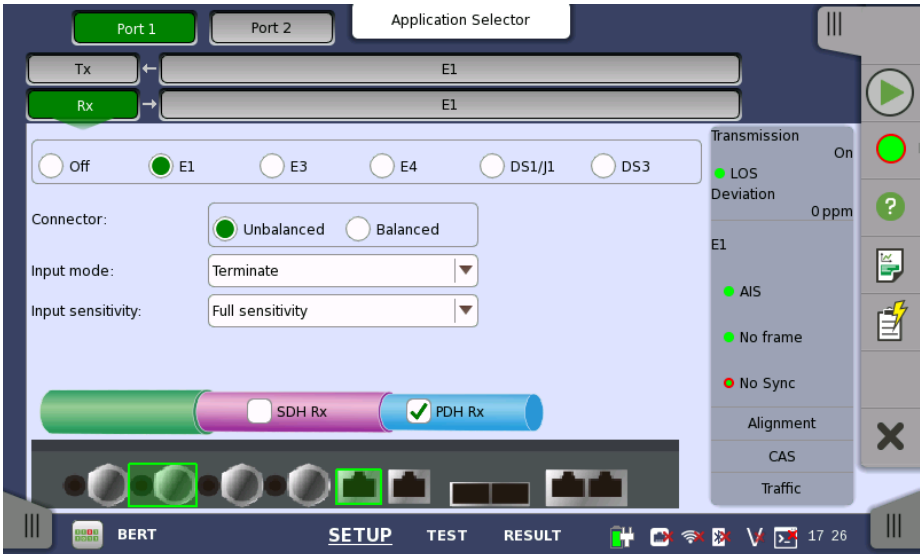

**CAS**
Use the **CAS** radio buttons to enable (**On**) or disable (**Off**) the insertion of a CAS signaling multiframe into time slot 30 of the transmitted signal.

Touch the **Channel**, **Bits** and **Other bits** fields to define the contents of a selectable CAS channel as well as the remaining channels.

## 5.3.2 Receiver Setup

### 5.3.2.1 Physical Setup

When the receiver is set up with only an E1 interface, selecting the **Rx** button in the navigation area will launch the following screen.




Switching between PDH Rx and DSn Rx is done in the SDH/SONET receiver setup screen.

1. Select **SDH Rx** or **SONET Rx** checkbox.
2. Touch **STM-xx**, **STS-xx**, or **OC-xx** button in the navigation area.
3. Use drop down menu at right bottom to switch SDH or SONET. Selecting the SDH displays **PDH Rx** on **Rx** screen. Selecting the SONET displays **DSn Rx** on **Rx** screen.
4. Touch **Rx** button in the navigation area.
5. Select **PDH Rx** or **DSn Rx** checkbox.
6. Clear **SDH Rx** or **SONET Rx** checkbox.
7. Touch **E1** radio button. Touching **Off** radio button disables the receiver.

This screen allows you to make the physical setup of the PDH receiver in E1 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Connector**

Select the physical type of the relevant output connectors located on the back panel of the instrument. Choose **Unbalanced** to link to the corresponding unbalanced connector, or choose **Balanced** to link to the corresponding balanced connector. A balanced input is taken from RJ48 connector.

**Input mode**

Select the mode of input.

**Terminate**

Used when the instrument is used as a tester and the receiver is the only device connected to the line. The input impedance is nominal.

**Bridged**

Used when the receiver is connected directly in parallel to a line carrying live traffic. Please observe that this way of connecting may disturb the monitored line - connection through a protected monitor point, as well as using the input mode **Monitor**, is recommended instead.

**Monitor**

Used when connecting to protected monitoring points. The input impedance is nominal.

**Input sensitivity** Set the sensitivity of the input. The available options are:

**Full sensitivity**
Signal levels down to the maximum sensitivity on the instrument are accepted.

**-20 dB**
Input signal attenuated by -20 dB or more relative to the nominal level will be considered Loss Of Signal.

**-33 dB**
Input signal attenuated by -33 dB or more relative to the nominal level will be considered Loss Of Signal.

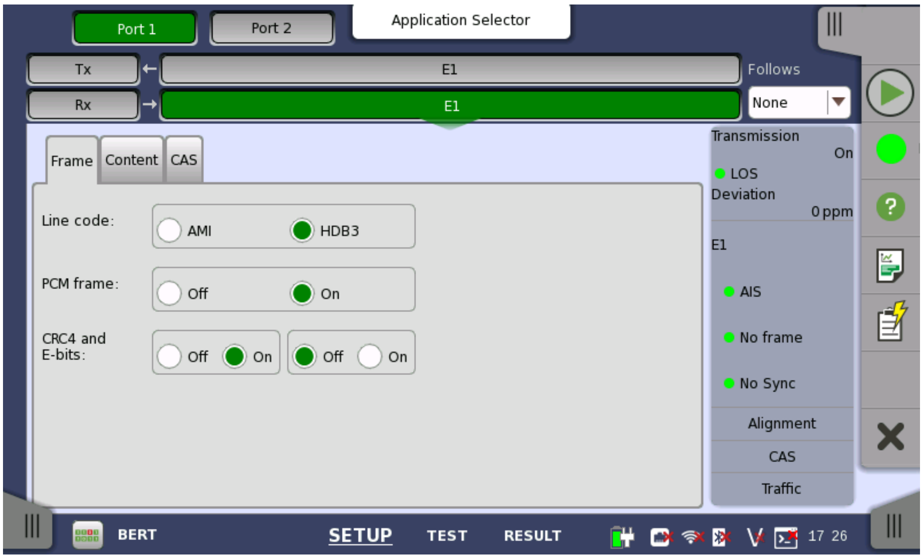
### 5.3.2.2 E1 Signal Setup

Touching the navigation area button which represents the receiver's E1 layer will display the screen.

**Follows** To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the drop-down menu in the navigation area and select the relevant value. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

#### Frame tab page

The **Frame** tab page contains the following parameters:




**Line code**
Use the **Line code** radio buttons to select transmission line code **HDB3** or **AMI**.

HINT *For normal 2 Mbps systems choose HDB3. AMI is for special applications only.*

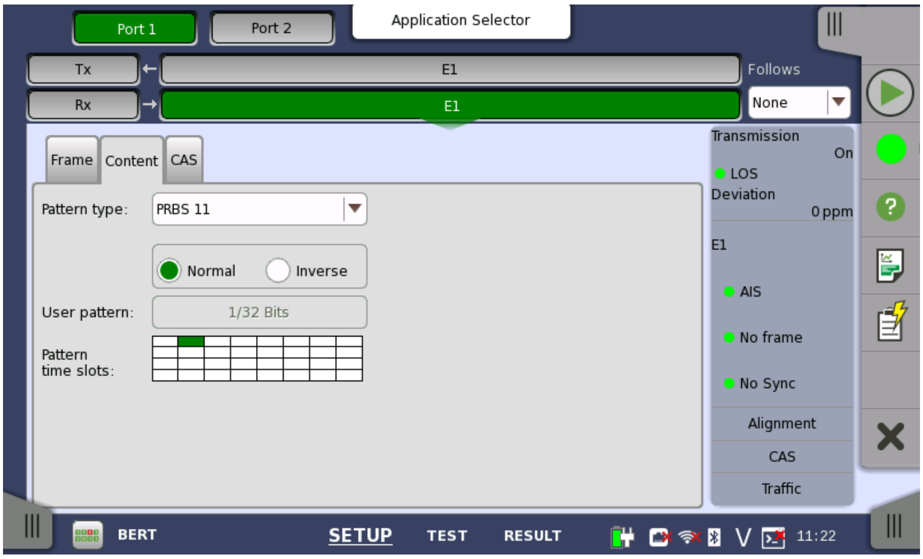
**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) the status of the PCM frame.

**CRC4 and E-bits**
Use the **CRC4 and E-bits** radio buttons to enable (**On**) or disable (**Off**) the corresponding bit in the received signal. Use buttons in left frame for setting CRC4. Use buttons in right frame for setting E-Bit.

*If it is uncertain whether the **CRC4 and E-bits** are supported in the monitor signal, it is recommended to select the **Off** mode.*

## Content tab page

The **Content** tab page contains the following parameters:




### Pattern type

Select the requested pattern. Refer to Pattern type in "Transmitter Setup".

*For testing of data rates from 64 kbps to 2 Mbps in a 2 Mbps line, ITU-T O.150 recommends PBRS 11 to be used. For testing at the 2 Mbps rate, PRBS 15 is recommended in ITU-T O.150.*

Select 'Normal' or 'Inverse' pattern type.

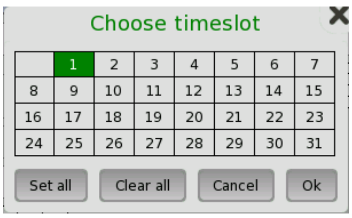
### User pattern

User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

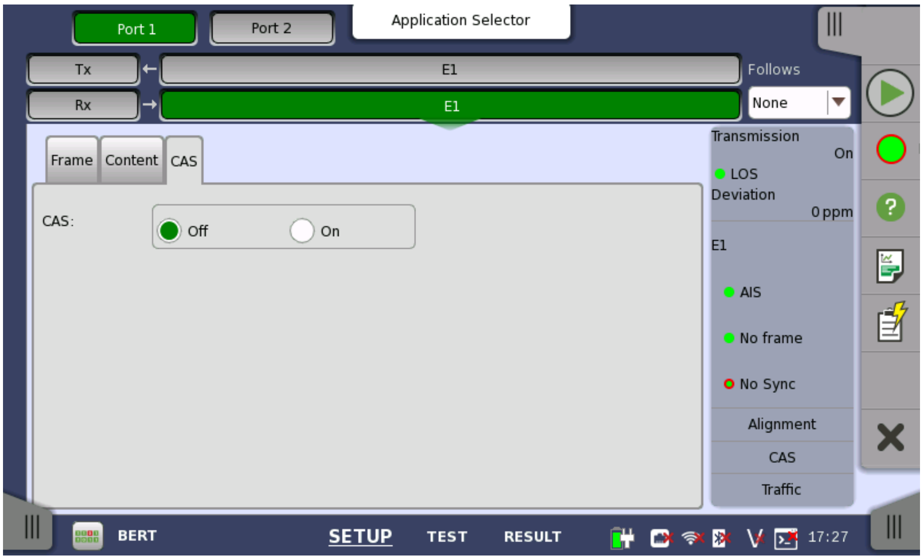
### Pattern time slots

Touch the **Pattern time slots** graphics and use the launched dialog box to select the timeslot which will receive the Channel Content signal. Set and clear timeslots as relevant.




## CAS tab page

The **CAS** tab page contains the following parameters:




**CAS**
Use the **CAS** radio buttons to enable (**On**) or disable (**Off**) the reception of a CAS signaling multiframe in time slot 16 of the received signal.

## 5.3.3 Status Information

This section describes the status information available for the E1 layer in the status area of the **Ports Setup** screen.

### 5.3.3.1 Status Summary

The status summary displayed for the E1 layer consists of the following information:

**Physical Status**
The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status**
The middle part of the status area gives you access to alarm and error information for the selected interface. The current status is indicated by the lamp color.

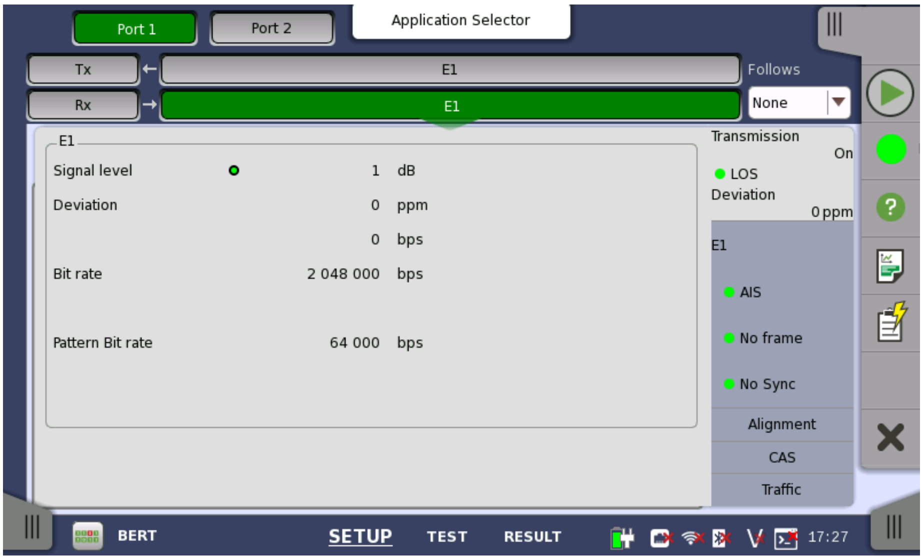
A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

**Monitor Buttons**
At the bottom of the status area are below buttons that give you access to various monitor information. By touching a button, you can launch the corresponding information display.

- **Alignment**
- **CAS**
- **Traffic**

### 5.3.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the received signal at the 2 Mbps E1 layer.

The physical status information consists of the following parameters.

**Signal level**
The Signal Level indicators show the attenuations (in dB) of the currently received signals compared to a nominal signal.

The nature of the levels depend on the Input Level setup for each receiver (Terminate or Monitor):

- In Terminate mode, the attenuation is assumed to be caused by a cable.
- In Monitor mode, linear attenuation is assumed.

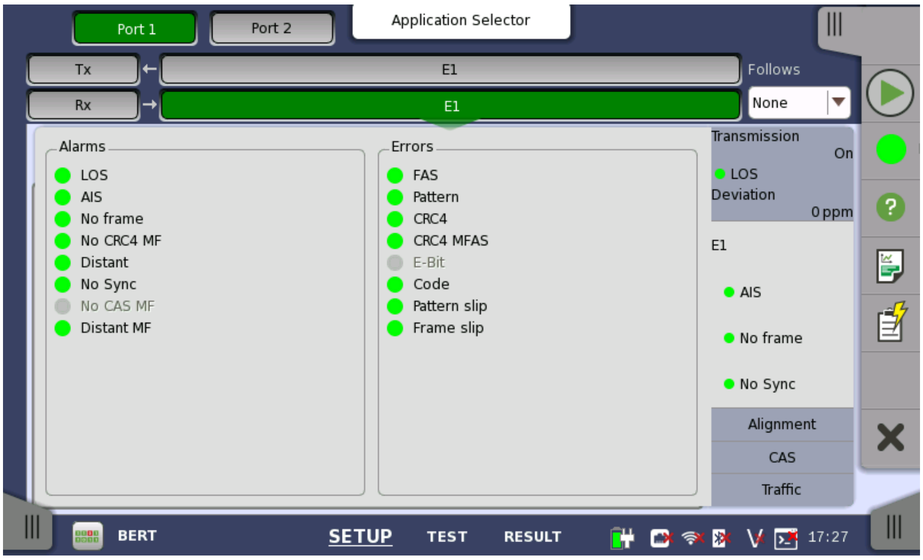
**Deviation**
The deviation from the nominal bit rate is shown for each receiver in both ppm and bps. The nominal bit rate is 2 048 000 bps.

**Bit rate**
The actual bit rate of each receiver is shown (in bps).

**Pattern Bit rate**
This field shows the effective bit rate of the patterns received (that is, the number of pattern bits received per second).

### 5.3.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen contains detailed alarm and error information related to the E1 interface. Status is indicated by the use of colored Lamp icons.

Alarms

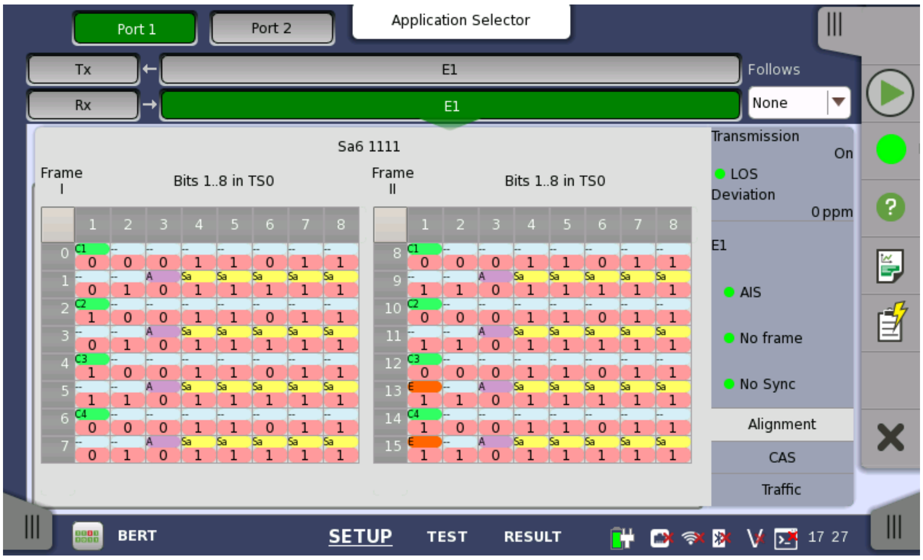
- **LOS**: Loss of Signal
- **AIS**: Alarm Indication Signal
- **No frame**: No Frame
- **No CRC4 MF**: No Cyclic Redundancy Check 4 Multi Frames
- **Distant**: Distant
- **No Sync**: No Synchronization
- **No CAS MF**: No Channel-Associated Signaling Multi Frames
- **Distant MF**: Distant Multi Frames

Errors

- **FAS**: Frame Alignment Signal
- **Pattern**: Pattern
- **CRC4**: Cyclic Redundancy Check 4
- **CRC4 MFAS**: Cyclic Redundancy Check 4 Multiplex Frame Alignment Signal
- **E-Bit**: E-Bit Error
- **Code** : Code
- **Pattern slip** : Pattern slip
- **Frame slip** : Frame slip

### 5.3.3.4 Alignment

Touching the **Alignment** button in the status area of the **Ports Setup** screen displays the status shown below.



This screen provides information on the frame alignment when available. The frame alignment information includes the 16 first FAS/NFAS words of the CRC4 multiframe.

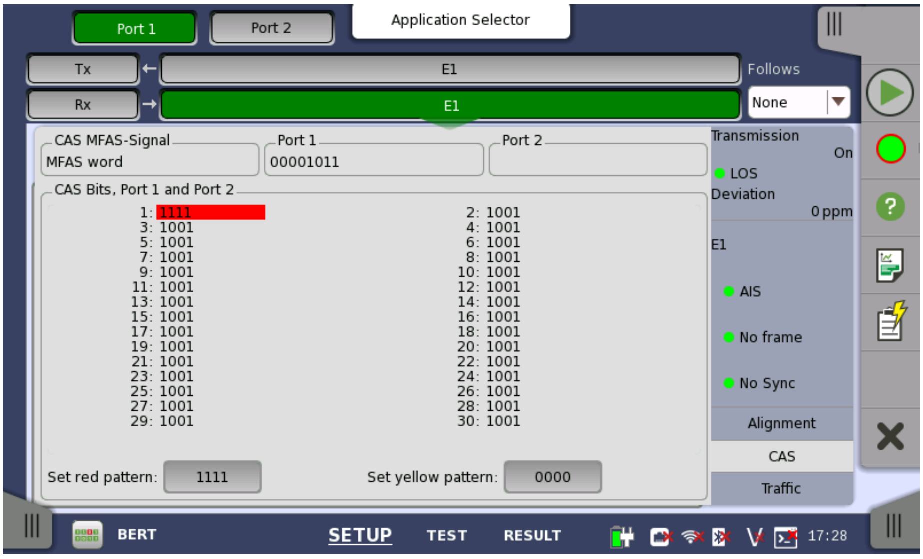
If multiframe is not available, the frame information will show 16 FAS/NFAS words in sequence.

The following color indicators are used:

- Green: Cyclic Redundancy Check bits
- Orange: Bits used to indicate received faulty sub-multiframes
- Purple: Remote alarm indication
- Yellow: Spare bits reserved for national use.

### 5.3.3.5 CAS

Touching the **CAS** button in the status area of the **Ports Setup** screen displays the status shown below.



This screen gives information on the CAS (Channel Associated Signaling) signaling when available. It displays the state of the four signaling bits in both directions for all 30 channels. Activity is indicated with bold characters.

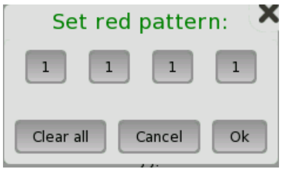
**CAS MFAS-Signal**
This field shows the status of the CAS MFAS-Signal.

**Port1, Port2**
This field shows the MFAS bits.

**CAS Bits, Port1 and Port2**
This table shows the status of the CAS Bits in the two ports.

**Use of colors**

For easy recognition of special bit combinations, coloring is available. Use the **Set red pattern** and **Set yellow pattern** buttons to launch the respective setup dialog boxes.

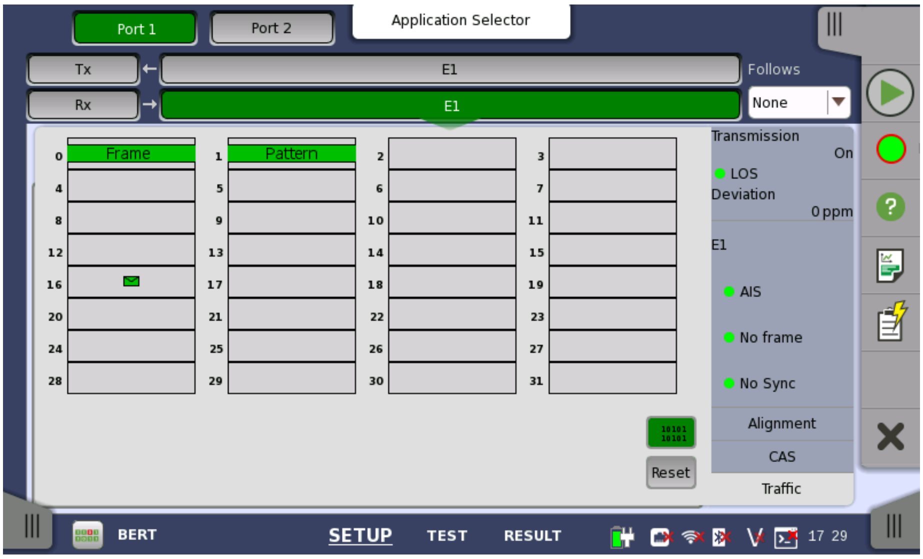



The color pattern consists of four binary digits. The minimum and the maximum acceptable value is 0000 and 1111, respectively. Touch the digit buttons to set the relevant value and then touch **Ok**.

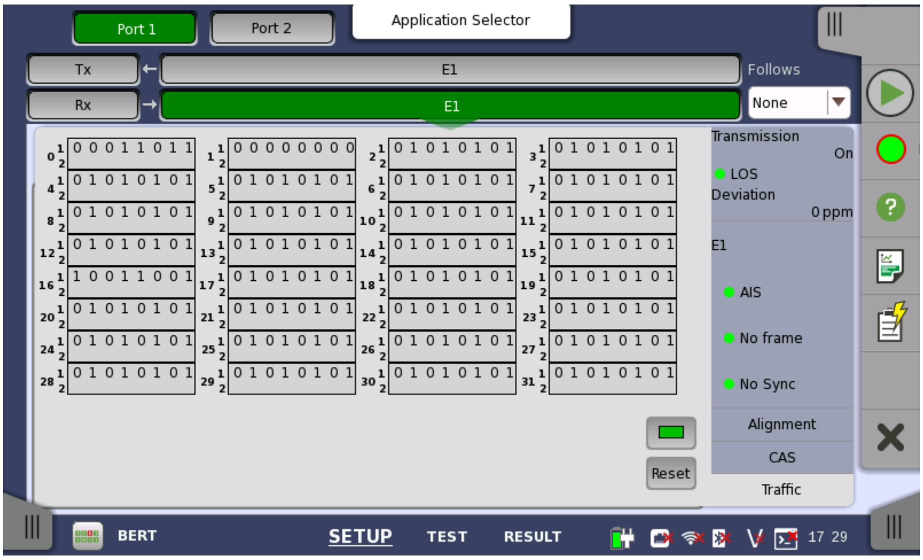
To clear the whole word e.g. to make the line ready for new digit settings, touch the **Clear all** button.

### 5.3.3.6 Traffic

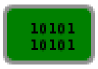
Touching the **Traffic** button in the status area of the **Ports Setup** screen displays the status shown below.



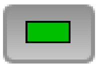

This screen shows the activity of the speech channels represented on the 2 Mbps line. You can switch between a traffic display and a view of the time slot content.

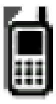



The busy / idle status of channel is displayed.



Touching this button will convert the table to display time slot content.


Touching this button will convert the graphic to display traffic.

| Icon | PCM description |
|---|---|
|  | Flags detected in currently selected signaling channel |
|  | Channel activity |

Touching **Reset** button will clear icons.

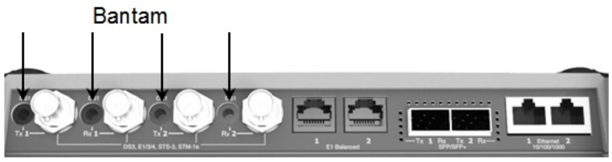
# 5.4 DS1/J1 Setup and Status

*DS1/J1* represents the 1.544 Mbit/s PDH layer. The **Ports Setup** screen gives you access to the PDH layer setup for the transmitter and/or receiver of the currently selected port.

DS1/J1 allows transmission of data streams that are nominally running at the same rate, however allowing for some variation in the speed around a nominal rate (+/-125 ppm variation around 1.544 Mbit/s).

NOTE

*The DS1/J1 interface uses the electrical Bantam connectors.*

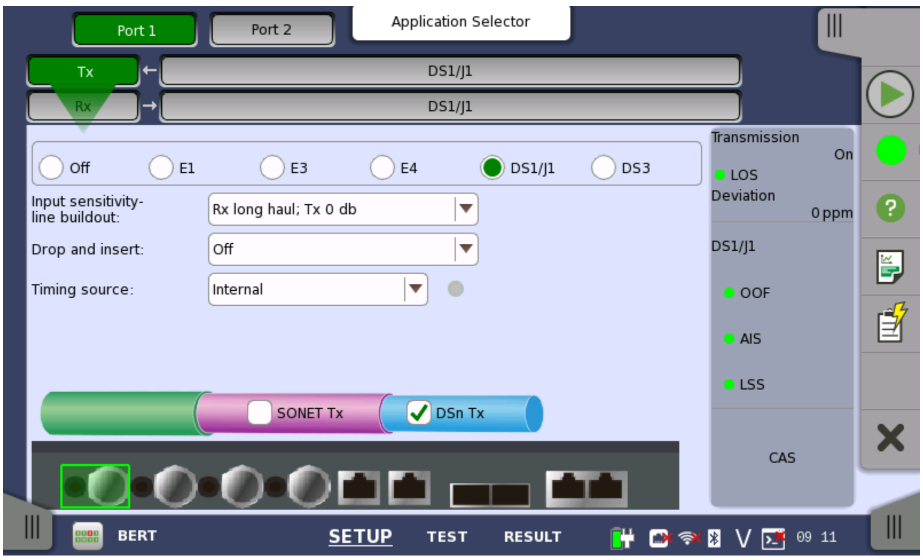



**MU100010A Connector Panel**

## 5.4.1 Transmitter Setup

### 5.4.1.1 Physical Setup

When the transmitter is set up with only a DS1/J1 interface, touching the **Tx** button in the navigation area will launch the following screen.




For the switching method between PDH Tx and DSn Tx, refer to Physical Setup in "E1 Setup and Status". Touching **Off** radio button disables the transmitter.

This screen allows you to make the physical setup of the PDH transmitter in DS1/J1 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

The output signal goes to the corresponding Bantam connector.

**Input sensitivity - line buildout**

Select the line build-out. The available values are:

- **Rx short haul; Tx 1-133 ft**
- **Rx short haul; Tx 133-266 ft**
- **Rx short haul; Tx 266-399 ft**

- **Rx short haul; Tx 399-533 ft**
- **Rx short haul; Tx 533-655 ft**
- **Rx gain mode (Monitor)**
- **Rx long haul; Tx 0 db**
- **Rx long haul; Tx -7.5 db**
- **Rx long haul; Tx -15 db**
- **Rx long haul; Tx -22.5 db**

**Drop and insert** Select the source for the transmitter. The whole contents of *Port 1* and *Port 2* can be selected as a source. **Off** is identical to normal transmitter mode.

**Timing source** Select the clock source.

**Internal**: Internal clock of the module
**External**: The clock provided from the Ext Clock connector
**Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

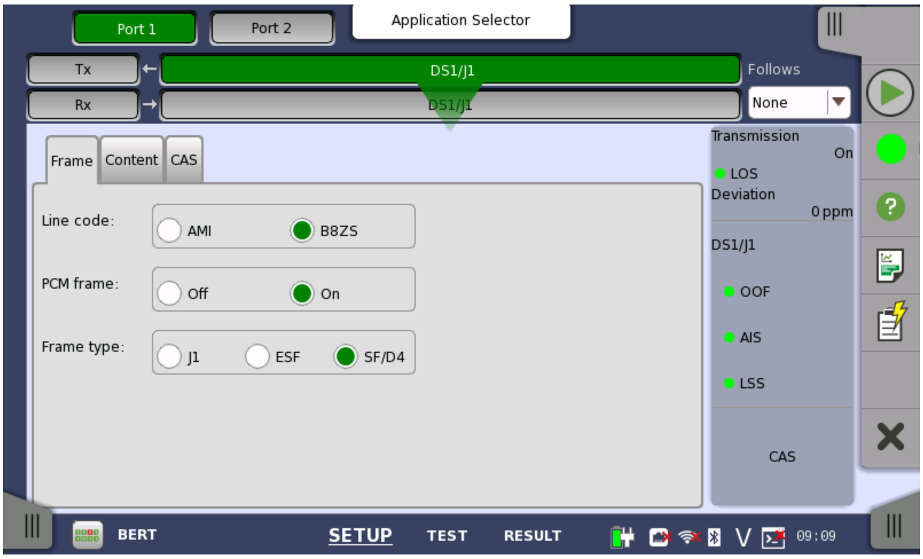
### 5.4.1.2 DS1/J1 Signal Setup

Touching the navigation area button which represents the transmitter's DS1/J1 layer will display the screen.

**Follows** To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings) when using Port 1 and Port 2, touch the drop-down menu in the navigation area and select the **Tx1**. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

#### Frame tab page

The **Frame** tab page contains the following parameters:




**Line code**
Use the **Line code** radio buttons to select transmission line code **AMI** or **B8ZS**.

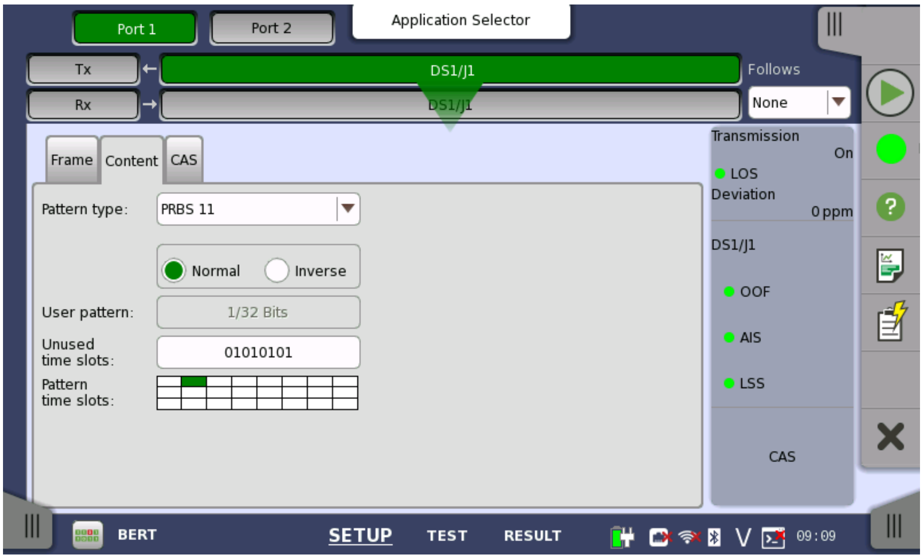
**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) insertion of PCM frame in the transmitted signal.

NOTE *When PCM frame is set to Off, many of the following transmitter parameters are insignificant.*

**Frame type**
Use the **Frame type** radio buttons to select the relevant frame type: **J1**, **ESF** or **SF/D4**.

## Content tab page

The **Content** tab page contains the following parameters:




**Pattern type**
Select the pattern to be inserted in the transmitted signal. Refer to [Pattern type](#) in "E1 Setup and Status". Available patterns are:

- **Off**
- **User [32] bit**, **User [2048] bit**
- **PRBS 9** to **PRBS 31**
- **QRSS 20**
- **Fox Pattern**, **Fox (CMA3000)**
- **All 0's**, **All 1's**
- **Alternating 1:1**, **Alternating 1:3**, **Alternating 1:7**, **Alternating 3:24**

Touch 'Normal' or 'Inverse' pattern type.

**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

**Unused time slots**
Touch the **Unused time slots** button and use the dialog box to define the unused time slots.

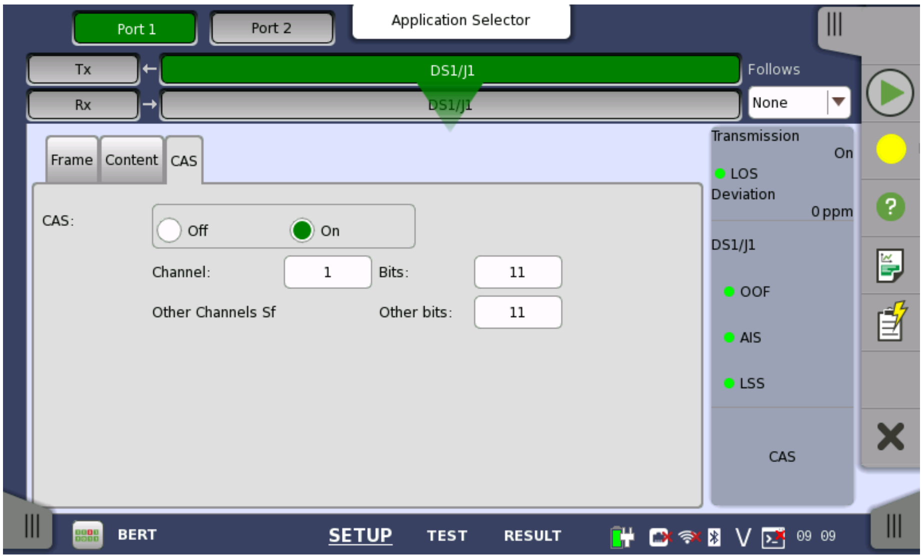

In the **Unused Time Slots** dialog box, change the individual bits by touching on the relevant bit keys - this will toggle the bit key's binary value from logic 1 to 0 or vice versa. Touch **Ok** to accept the changes and close the dialog box.

**Pattern time slots**

Touch the **Pattern time slots** graphics and use the dialog box to select the timeslots in which the pattern will be inserted. Set and clear timeslots as relevant.


## CAS tab page

The **CAS** tab page contains the following parameters:




**CAS**

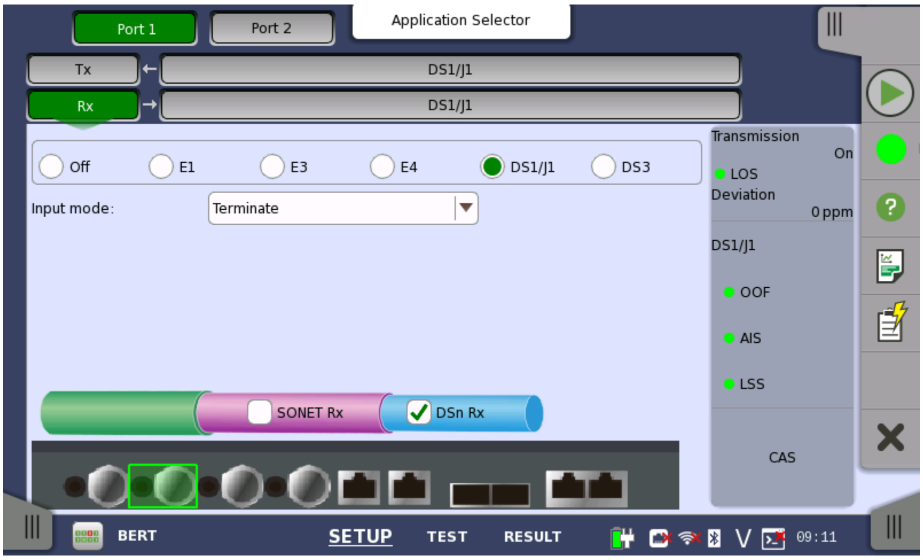
Use the **CAS** radio buttons to enable (**On**) or disable (**Off**) the insertion of a CAS signaling.

Touch the **Channel**, **Bits** and **Other bits** fields to define the contents of a selectable CAS channel as well as the remaining channels.

## 5.4.2 Receiver Setup

### 5.4.2.1 Physical Setup

When the receiver is set up with only a DS1/J1 interface, touching the **Rx** button in the navigation area will launch the following screen.




For the switching method between PDH Rx and DSn Rx, refer to Physical Setup in "E1 Setup and Status". Touch **DS1/J1** radio button. Touching **Off** radio button disables the receiver.

This screen allows you to make the physical setup of the PDH receiver in DS1/J1 mode. It can also be used to inspect the current status of the selected port.

The input signal is taken form the corresponding Bantam connector.

**Input mode** Select the mode of input.

**Terminate**
Used when the instrument is used as a tester and the receiver is the only device connected to the line. The input impedance is nominal.

**Bridged**
Used when the receiver is connected directly in parallel to a line carrying live traffic. Please observe that this way of connecting may disturb the monitored line - connection through a protected monitor point, as well as using the input mode **Monitor**, is recommended instead.

**Monitor**
Used when connecting to protected monitoring points. The input impedance is nominal.

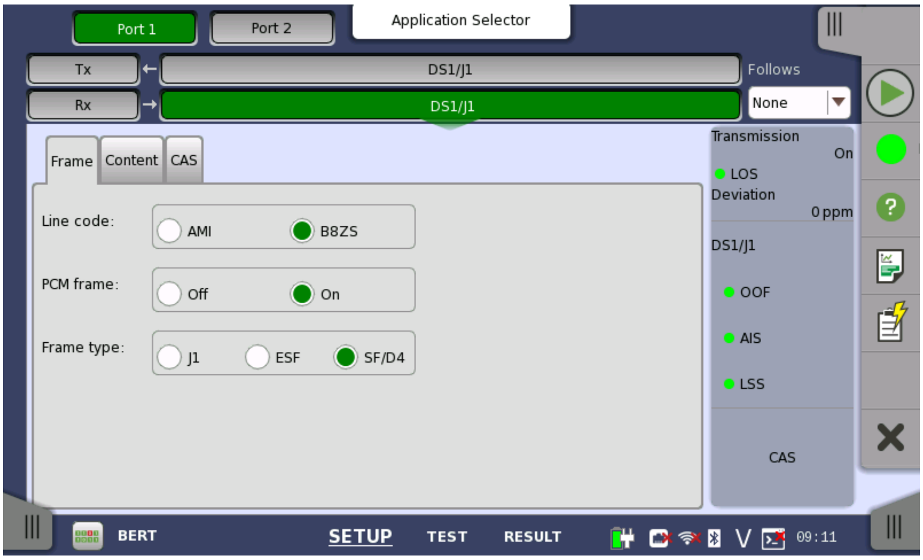
### 5.4.2.2 DS1/J1 Signal Setup

Touching the navigation area button which represents the receiver's DS1/J1 layer will display the screen.

**Follows** To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the drop-down menu in the navigation area and select the relevant value. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**Frame tab page**

The **Frame** tab page contains the following parameters:




**Line code**
Use the **Line code** radio buttons to select transmission line code AMI or B8ZS.

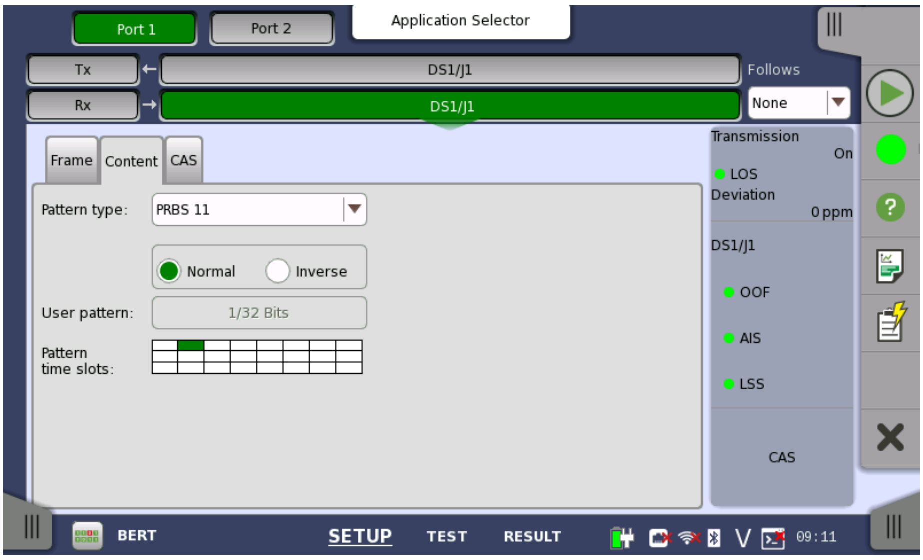
HINT *For normal 1.544 Mbps systems choose **B8ZS**. **AMI** is for special applications only.*

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) the status of the PCM frame.

**Frame type**
Select the relevant frame type: **J1**, **ESF** or **SF/D4**.

## Content tab page

The **Content** tab page contains the following parameters:




**Pattern type**
Select the requested pattern. Available patterns are same as the transmitter setup. Refer to Pattern type in "E1 Setup and Status".

Touch 'Normal' or 'Inverse' pattern type.

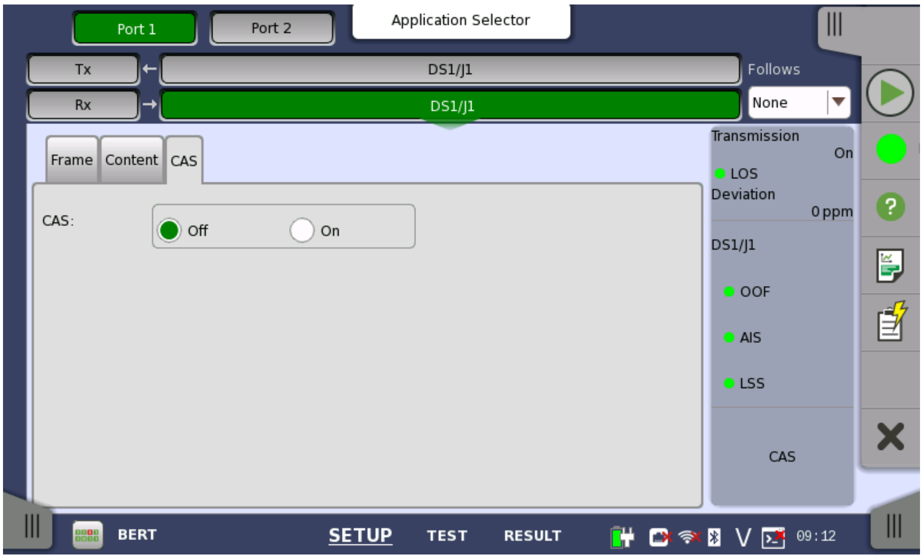
**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

**Pattern time slots**
Touch the **Pattern time slots** graphics and use the launched dialog box to select the timeslot which will receive the Channel Content signal. Set and clear timeslots as relevant.

### CAS tab page

The **CAS** tab page contains the following parameters:




**CAS**
Use the **CAS** radio buttons to enable (**On**) or disable (**Off**) the reception of a CAS signaling.

## 5.4.3 Status Information

This section describes the status information available for the DS1/J1 layer in the status area of the **Ports Setup** screen.

### 5.4.3.1 Status Summary

The status summary displayed for the DS1/J1 layer consists of the following information:

**Physical Status** The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status** The middle part of the status area gives you access to alarm and error information for the selected interface. The curent status is indicated by the lamp color.

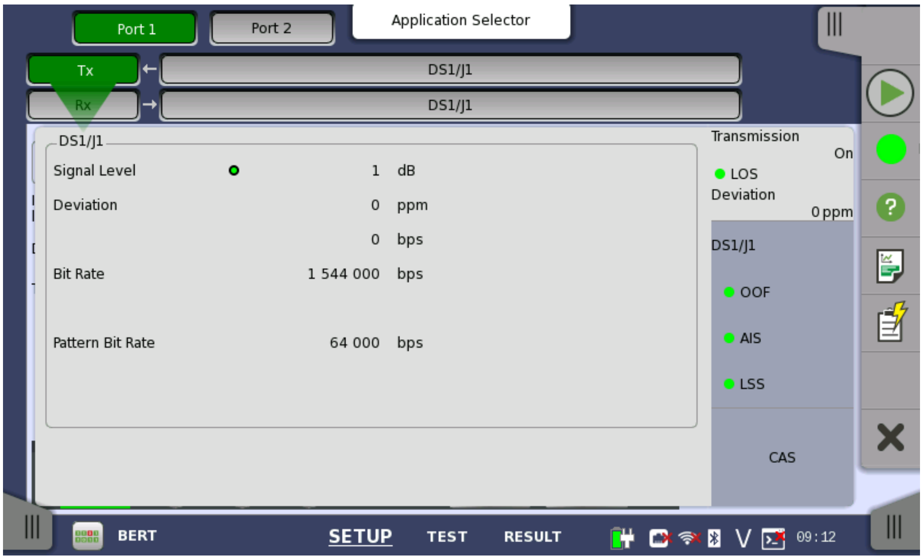
A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

**Monitor Buttons** At the bottom of the status area are below buttons that give you access to various monitor information. By touching a button, you can launch the corresponding information display.

- **CAS**

### 5.4.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the received signal at the 1.5 Mbps DS1/J1 layer.

The physical status information consists of the following parameters.

**Signal Level**
The Signal Level indicators show the attenuations (in dB) of the currently received signals compared to a nominal signal.

The nature of the levels depend on the Input Level setup for each receiver (Terminate or Monitor):

- In Terminate mode, the attenuation is assumed to be caused by a cable.
- In Monitor mode, linear attenuation is assumed.

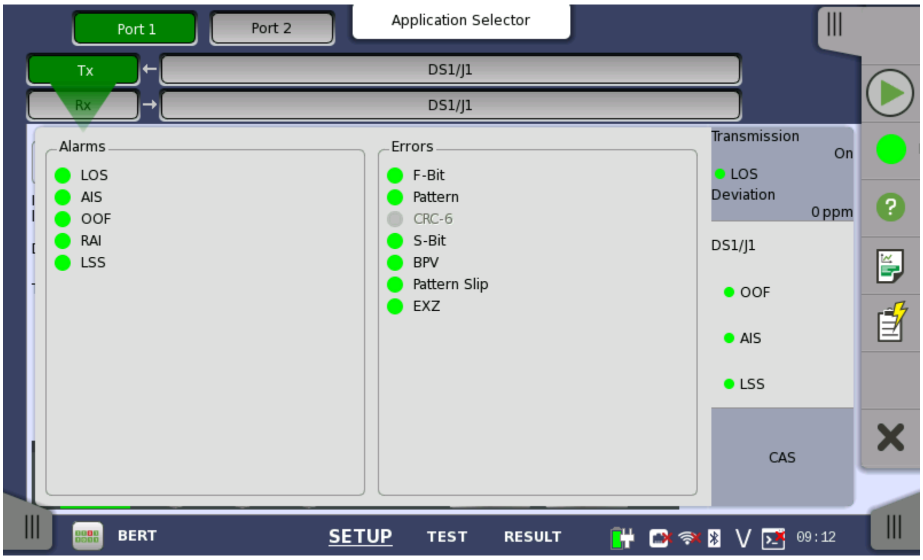
**Deviation**
The deviation from the nominal bit rate is shown for each receiver in both ppm and bps. The nominal bit rate is 1 544 000 bps.

**Bit Rate**
The actual bit rate of each receiver is shown (in bps).

**Pattern Bit Rate**
This field shows the effective bit rate of the patterns received (that is, the number of pattern bits received per second).

### 5.4.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen contains detailed alarm and error information related to the DS1/J1 interface. Status is indicated by the use of colored Lamp icons.

Alarms

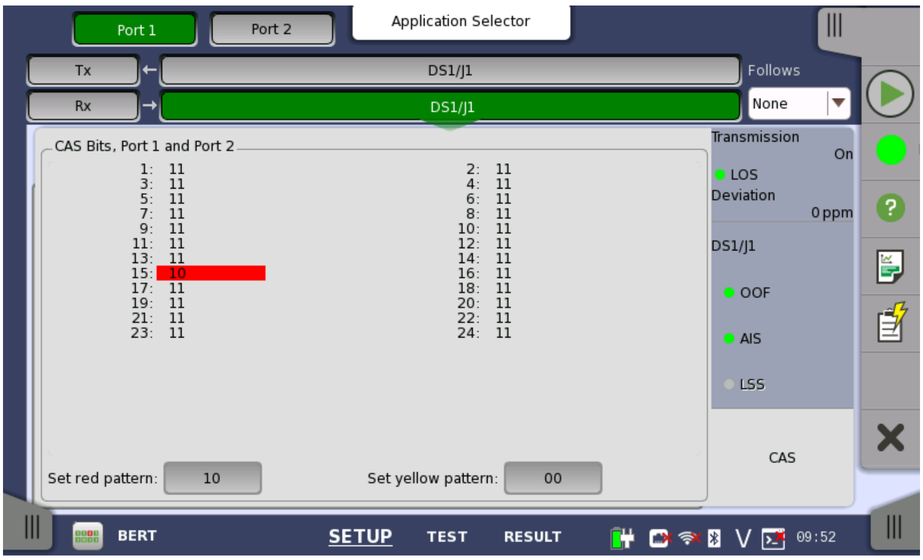
- **LOS**: Loss of Signal
- **AIS**: Alarm Indication Signal
- **OOF**: Out of Frame
- **RAI**: Remote Alarm Indication
- **LSS**: Link Status Signal

Errors

- **F-Bit**: F-Bit Error
- **Pattern**: Pattern
- **CRC-6**: Cyclic Redundancy Check 6
- **S-Bit**: S-Bit Error
- **BPV**: Bipolar Violation
- **Pattern Slip**: Pattern slips
- **EXZ** : Excessive zeros

### 5.4.3.4 CAS

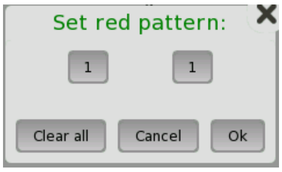
Touching the **CAS** button in the status area of the **Ports Setup** screen launches the status shown below.



This screen gives information on the CAS (Channel Associated Signaling) signaling when available. It displays the state of the two signaling bits in both directions for all 24 channels. Activity is indicated with bold characters.

**Use of colors**

For easy recognition of special bit combinations, coloring is available. Use the **Set red pattern** and **Set yellow pattern** buttons to launch the respective setup dialog boxes.




The color pattern consists of four binary digits for ESF/J1 frame. For SF/D4 frame, it consists of two binary digits. The minimum acceptable value is 00 or 0000, and the maximum acceptable value is 11 or 1111. Touch the digit buttons to set the relevant value and then touch **Ok**.

To clear the whole word e.g. to make the line ready for new digit settings, touch the **Clear all** button.

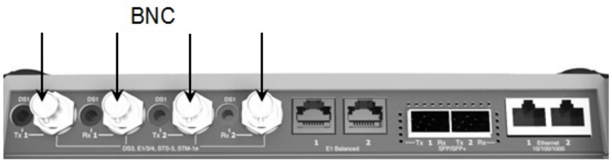
# 5.5 E3 Setup and Status

*E3* represents the 34.368 Mbit/s PDH layer. The **[Ports Setup]** screen gives you access to the PDH layer setup for the transmitter and/or receiver of the currently selected port.

E3 allows transmission of data streams that are nominally running at the same rate, however allowing for some variation in the speed around a nominal rate (+/-125 ppm variation around 34.368 Mbit/s).

NOTE

*The E3 interface uses the electrical BNC connectors.*

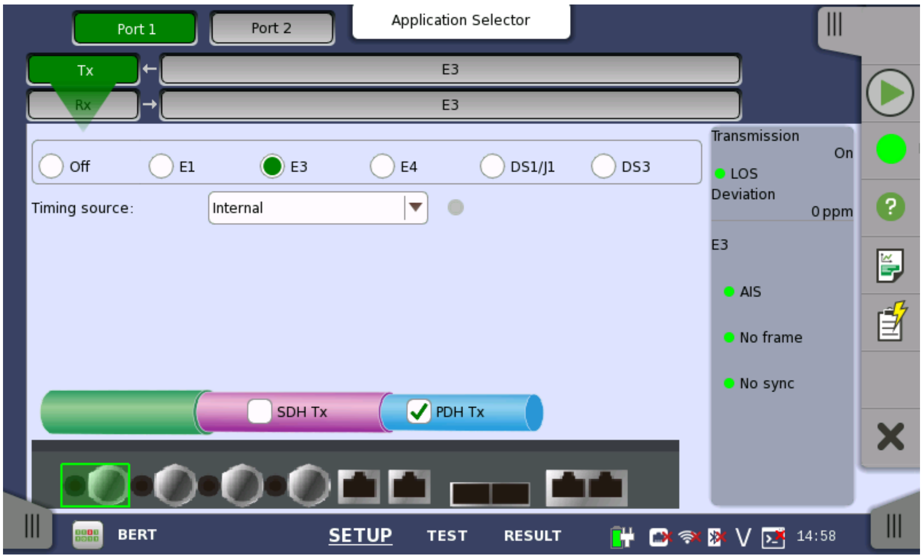



**MU100010A Connector Panel**

## 5.5.1 Transmitter Setup

### 5.5.1.1 Physical Setup

When the transmitter is set up with only an E3 interface, selecting the **Tx** button in the navigation area will launch the following screen.




For the switching method between PDH Tx and DSn Tx, refer to [Physical Setup] in "E1 Setup and Status". Touch **E3** radio button. Touching **Off** radio button disables the transmitter.

This screen allows you to make the physical setup of the PDH transmitter in E3 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

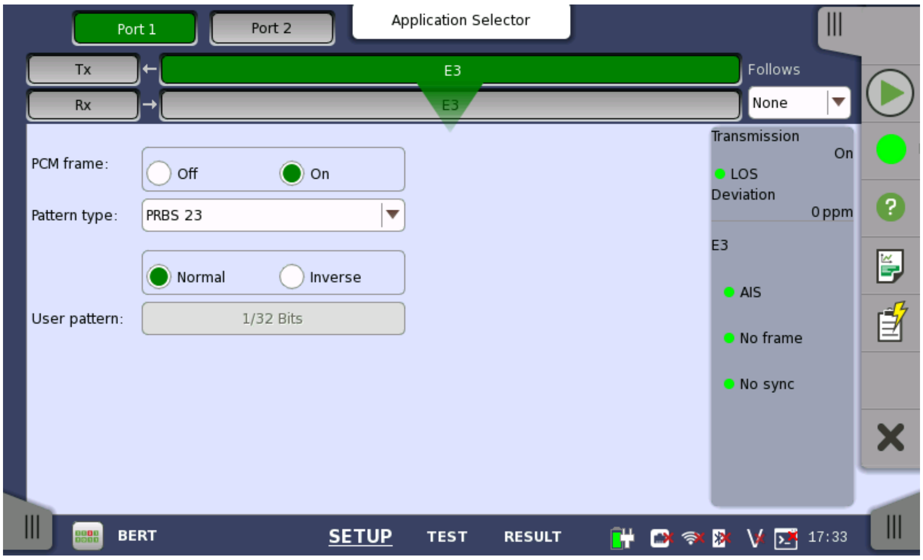
**Timing source** Select the clock source.

**Internal**: Internal clock of the module
**External**: The clock provided from the Ext Clock connector
**Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

### 5.5.1.2 E3 Signal Setup

Touching the navigation area button which represents the transmitter's E3 layer will display the screen shown below.




**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings) when using Port 1 and Port 2, touch the drop-down menu in the navigation area and select the **Tx1**. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) insertion of PCM frame in the transmitted signal.

**Pattern type**
Select the pattern to be inserted in the transmitted signal. Available patterns are same as the transmitter setup. Refer to Pattern type in "E1 Setup and Status". Available patterns are:

- **Off**
- **User [32] bit**, **User [2048] bit**
- **PRBS 9** to **PRBS 23**
- **Fox Pattern**, **Fox (CMA3000)**
- **All 0's**, **All 1's**
- **Alternating 1:1**, **Alternating 1:3**, **Alternating 1:7**, **Alternating 3:24**

Touch 'Normal' or 'Inverse' pattern type.

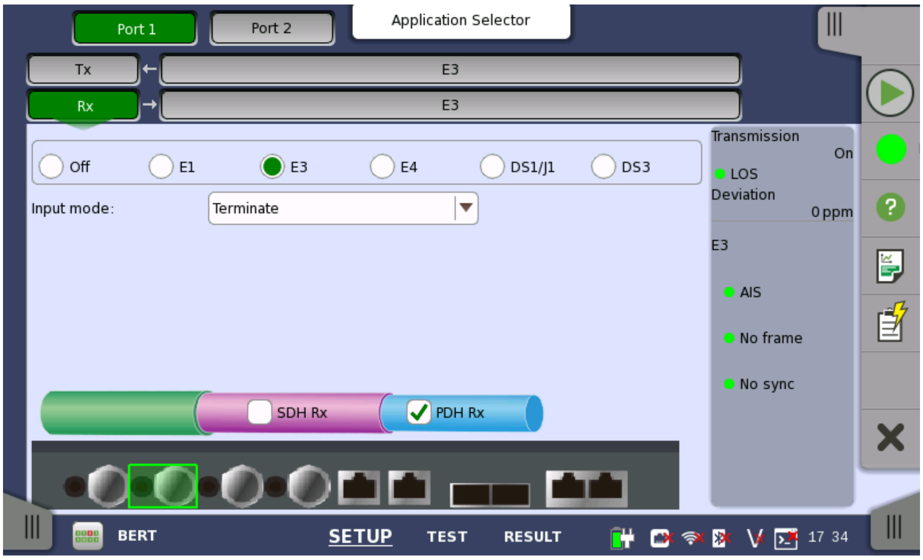
**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

## 5.5.2 Receiver Setup

### 5.5.2.1 Physical Setup

When the receiver is set up with only an E3 interface, selecting the **Rx** button in the navigation area will launch the following screen.




For the switching method between PDH Rx and DSn Rx, refer to Physical Setup in "E1 Setup and Status". Touch **E3** radio button. Touching **Off** radio button disables the receiver.

This screen allows you to make the physical setup of the PDH receiver in E3 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

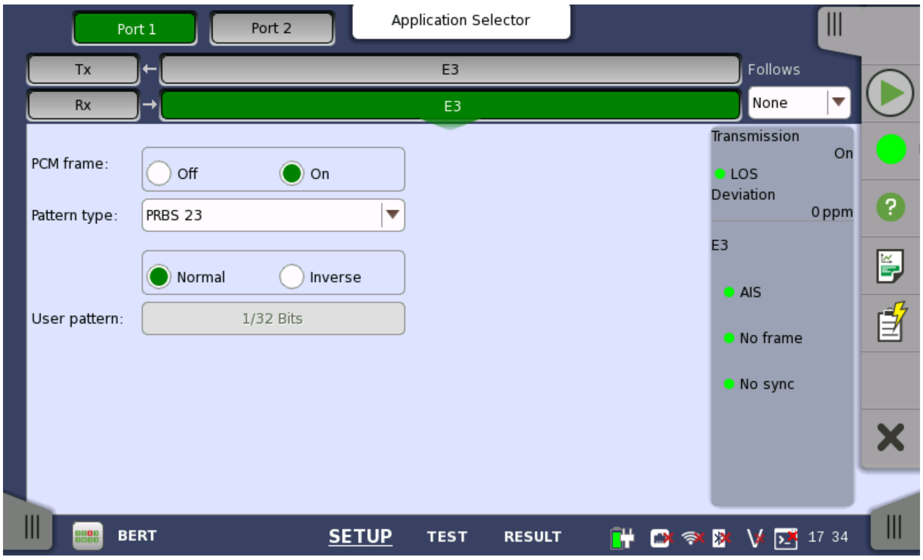
**Input mode** Select the mode of input.

**Terminate**
Used when the instrument is used as a tester and the receiver is the only device connected to the line. The input impedance is nominal.

**Monitor**
Used when connecting to protected monitoring points. The input impedance is nominal.

### 5.5.2.2 E3 Signal Setup

Touching the navigation area button which represents the receiver's E3 layer will display the screen shown below.




**Follows** To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the drop-down menu in the navigation area and select the relevant value. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) the status of the PCM frame.

**Pattern type**
Select the requested pattern. Available patterns are same as the transmitter setup. Refer to Pattern type in "E1 Setup and Status".

Touch 'Normal' or 'Inverse' pattern type.

**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

## 5.5.3 Status Information

This section describes the status information available for the E3 layer in the status area of the **Ports Setup** screen.

### 5.5.3.1 Status Summary

The status summary displayed for the E3 layer consists of the following information:

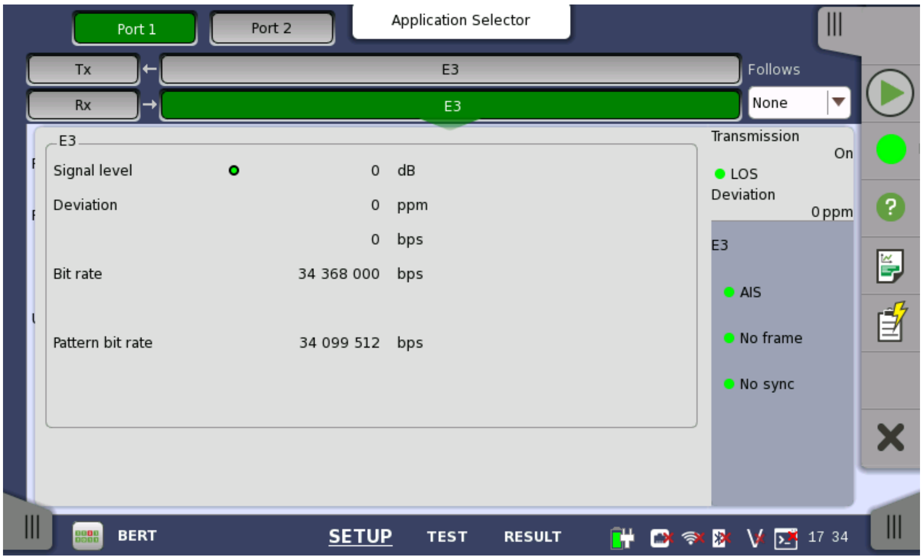
**Physical Status** The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status** The middle part of the status area gives you access to alarm and error information for the selected interface. The curent status is indicated by the lamp color.

that contains all alarms/errors.

### 5.5.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the received signal at the E3 layer.

The physical status information consists of the following parameters.

**Signal level**
The Signal level indicators show the attenuations (in dB) of the currently received signals compared to a nominal signal.

The nature of the levels depend on the Input Level setup for each receiver (Terminate or Monitor):

- In Terminate mode, the attenuation is assumed to be caused by a cable.
- In Monitor mode, linear attenuation is assumed.

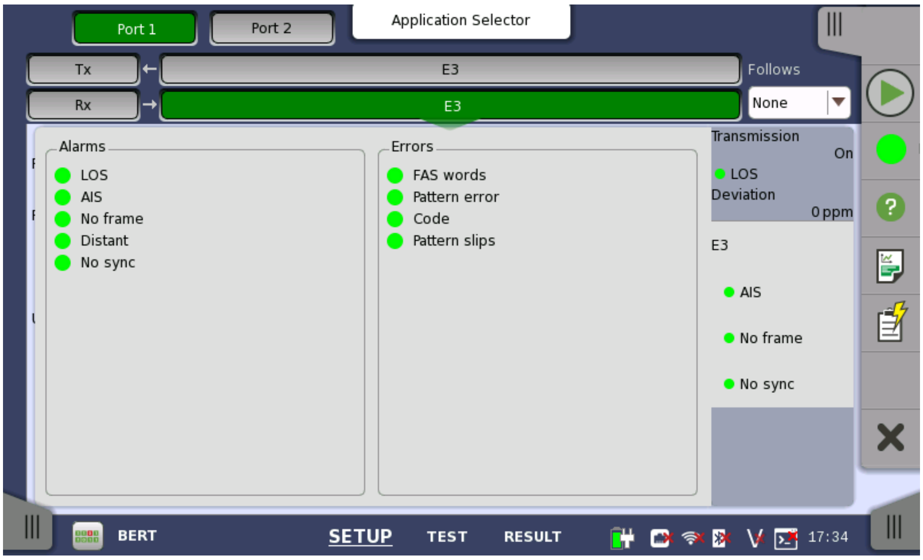
**Deviation**
The deviation from the nominal bit rate is shown for each receiver in both ppm and bps. The nominal bit rate is 34 368 000 bps.

**Bit rate**
The actual bit rate of each receiver is shown (in bps).

**Pattern bit rate**
This field shows the effective bit rate of the patterns received (that is, the number of pattern bits received per second).

### 5.5.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen contains detailed alarm and error information related to the E3 interface. Status is indicated by the use of colored Lamp icons.

Alarms

- **LOS**: Loss of Signal
- **AIS**: Alarm Indication Signal
- **No frame**: No frame
- **Distant**: Distant
- **No sync**: No synchronization

Errors

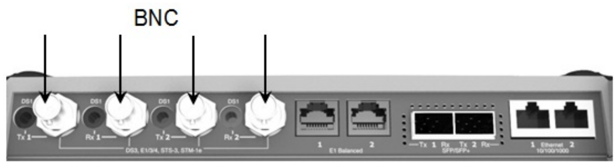
- **FAS words**: Frame Alignment Signal words
- **Pattern error**: Pattern error
- **Code** : Code
- **Pattern slips** : Pattern slips

# 5.6 DS3 Setup and Status

*DS3* represents the 44.736 Mbit/s PDH layer. The **Ports Setup** screen gives you access to the PDH layer setup for the transmitter and/or receiver of the currently selected port.

DS3 allows transmission of data streams that are nominally running at the same rate, however allowing for some variation in the speed around a nominal rate (+/-125 ppm variation around 44.736 Mbit/s).

NOTE *The DS3 interface uses the electrical BNC connectors.*

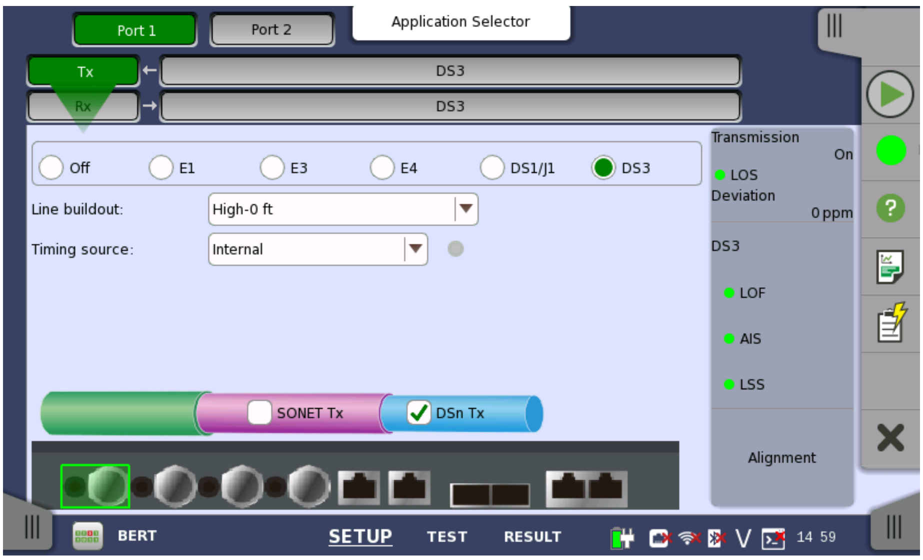



**MU100010A Connector Panel**

## 5.6.1 Transmitter Setup

### 5.6.1.1 Physical Setup

When the transmitter is set up with only a DS3 interface, selecting the **Tx** button in the navigation area will launch the following screen.




For the switching method between PDH Tx and DSn Tx, refer to Physical Setup in "E1 Setup and Status". Touch **DS3** radio button. Touching **Off** radio button disables the transmitter.

This screen allows you to make the physical setup of the PDH transmitter in DS3 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Line buildout** Select the line build-out. The available values are:

- **High-0 ft**
- **DSX-450 ft**

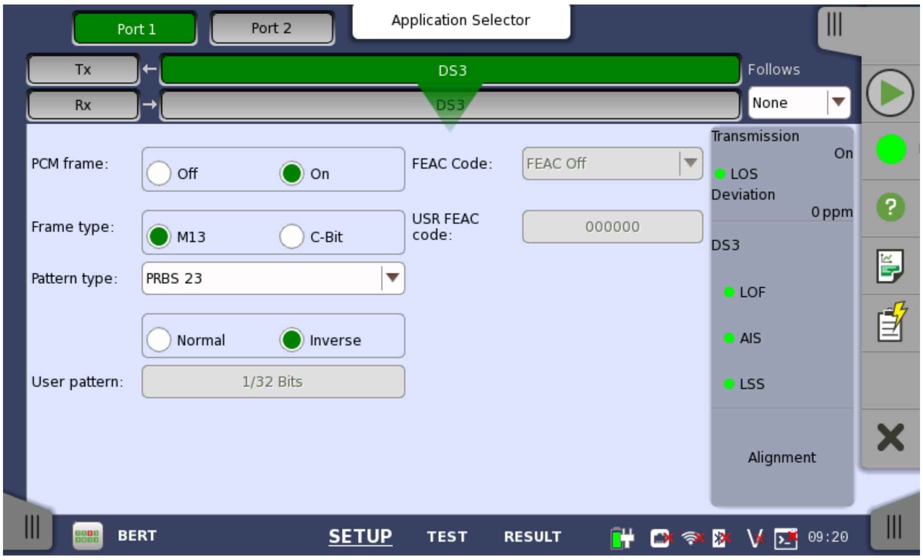
**Timing source** Select the clock source.

**Internal**: Internal clock of the module
**External**: The clock provided from the Ext Clock connector
**Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

### 5.6.1.2 DS3 Signal Setup

Touching the navigation area button which represents the transmitter's DS3 layer will display the screen shown below.




**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings) when using Port 1 and Port 2, touch the drop-down menu in the navigation area and select the **Tx1**. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) insertion of PCM frame in the transmitted signal.

**Frame type**
Use the **Frame type** radio buttons to specify either an **M13** frame or a **C-Bit** frame.

**Pattern type**
Select the pattern to be inserted in the transmitted signal. Refer to Pattern type in "E1 Setup and Status". Available patterns are:

- **Off**
- **User [32] bit**, **User [2048] bit**
- **PRBS 9** to **PRBS 31**
- **QRSS 20**
- **Fox Pattern**, **Fox (CMA3000)**
- **All 0's**, **All 1's**
- **Alternating 1:1**, **Alternating 1:3**, **Alternating 1:7**, **Alternating 3:24**

Touch 'Normal' or 'Inverse' pattern type.

**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

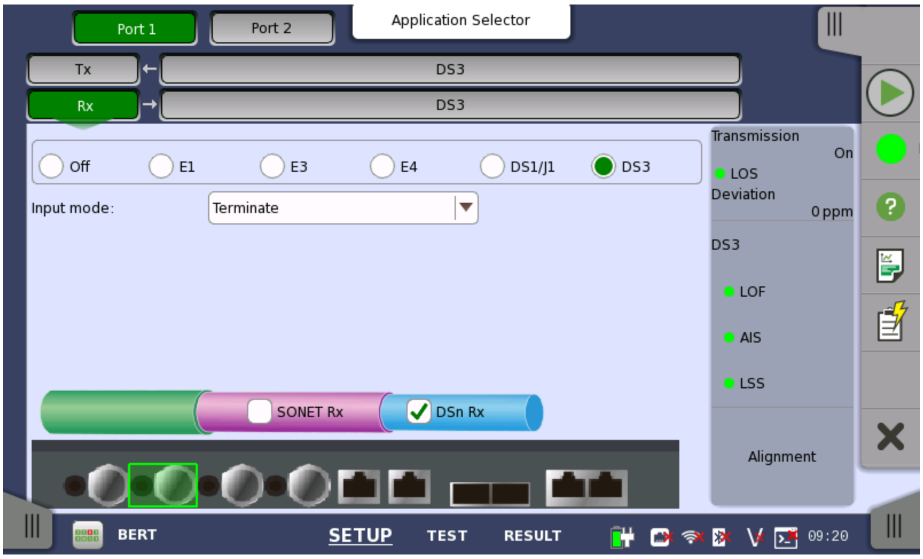
**FEAC Code**
When 'Frame type' is set to **C-Bit**, allows you to specify the FEAC (Far-End Alarm and Control) channel code.

**USR FEAC code**
When 'FEAC Code' is set to **User**, touch the **USR FEAC code** button and use the launched dialog box to define the FEAC code.

## 5.6.2 Receiver Setup

### 5.6.2.1 Physical Setup

When the receiver is set up with only a DS3 interface, selecting the **Rx** button in the navigation area will launch the following screen.




For the switching method between PDH Rx and DSn Rx, refer to Physical Setup in "E1 Setup and Status". Touch **DS3** radio button. Touching **Off** radio button disables the receiver.

This screen allows you to make the physical setup of the PDH receiver in DS3 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

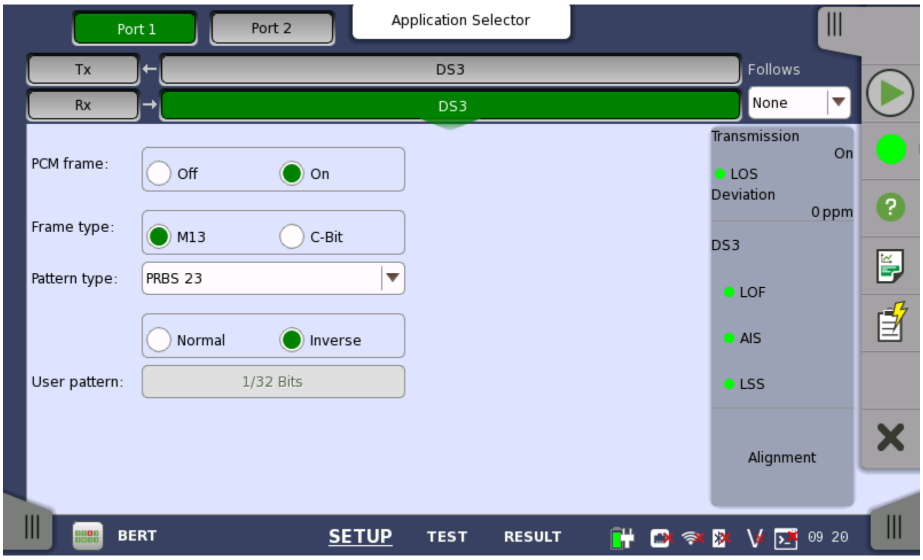
**Input mode** Select the mode of input.

**Terminate**
Used when the instrument is used as a tester and the receiver is the only device connected to the line. The input impedance is nominal.

**Monitor**
Used when connecting to protected monitoring points. The input impedance is nominal.

### 5.6.2.2 DS3 Signal Setup

Touching the navigation area button which represents the receiver's DS3 layer will display the screen shown below.




**Follows**

To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the drop-down menu in the navigation area and select the relevant value. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) the status of the PCM frame.

**Frame type**
Use the **Frame type** radio buttons to specify either an **M13** frame or a **C-Bit** frame.

**Pattern type**
Select the requested pattern. Available patterns are same as the transmitter setup. Refer to Pattern type in "E1 Setup and Status".

Touch 'Normal' or 'Inverse' pattern type.

**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

## 5.6.3 Status Information

This section describes the status information available for the DS3 layer in the status area of the **Ports Setup** screen.

### 5.6.3.1 Status Summary

The status summary displayed for the DS3 layer consists of the following information:

**Physical Status**

The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status**

The middle part of the status area gives you access to alarm and error information for the selected interface. The curent status is indicated by the lamp color.

A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

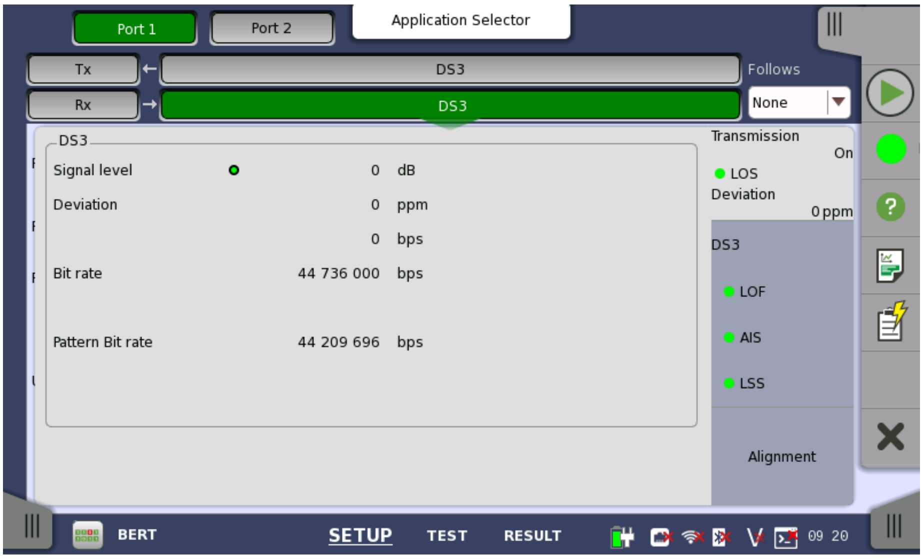
**Monitor Button**

At the bottom of the status area are a number of buttons that give you access to various capture/monitor information. By touching a button, you can launch the corresponding information dialog.

- **Alignment**

### 5.6.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the received signal at the DS3 layer.

The physical status information consists of the following parameters.

**Signal level**
The Signal level indicators show the attenuations (in dB) of the currently received signals compared to a nominal signal.

The nature of the levels depend on the Input Level setup for each receiver (Terminate or Monitor):

- In Terminate mode, the attenuation is assumed to be caused by a cable.
- In Monitor mode, linear attenuation is assumed.

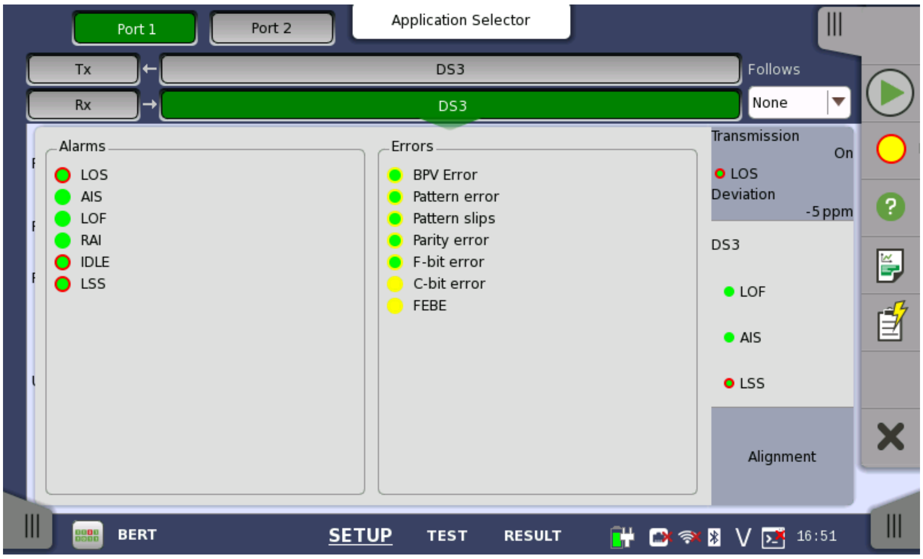
**Deviation**
The deviation from the nominal bit rate is shown for each receiver in both ppm and bps. The nominal bit rate is 44 736 000 bps.

**Bit rate**
The actual bit rate of each receiver is shown (in bps).

**Pattern Bit rate**
This field shows the effective bit rate of the patterns received (that is, the number of pattern bits received per second).

### 5.6.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen allows you to launch the screen shown below.




This dialog box contains detailed alarm and error information related to the DS3 interface. Status is indicated by the use of colored Lamp icons.

Alarms

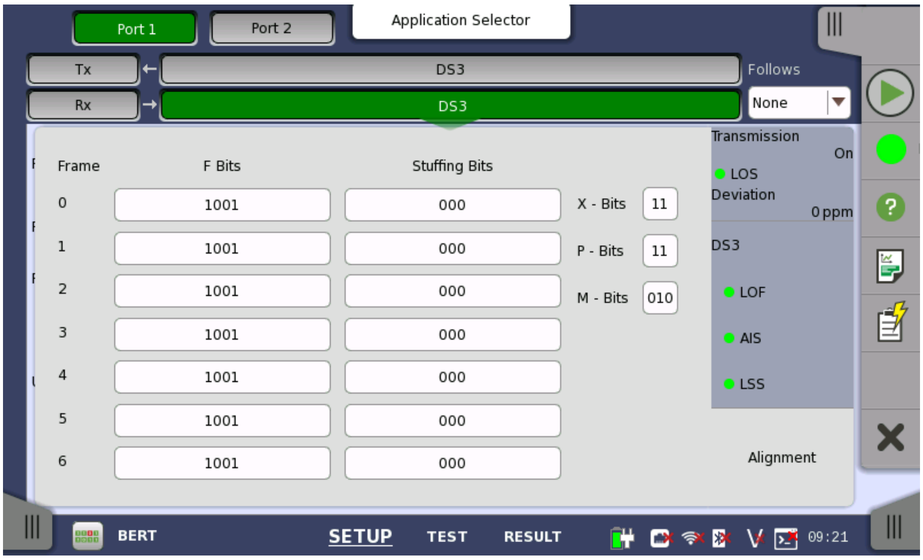
- **LOS**: Loss of Signal
- **AIS**: Alarm Indication Signal
- **LOF**: Loss of Frame
- **RAI**: Remote Alarm Indication
- **IDLE**: Idle Signal
- **LSS**: Link Status Signal

Errors

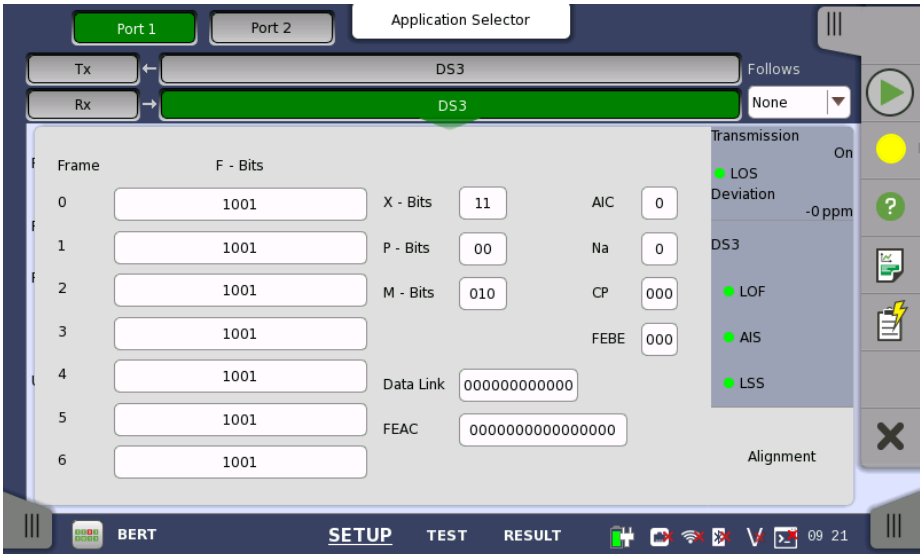
- **BPV Error**: Bipolar Violation error
- **Pattern error**: Pattern error
- **Pattern slips**:Pattern slips
- **Parity error**: Parity error
- **F-bit error**: F-bit error
- **C-bit error**: C-bit error
- **FEBE**: Far End Block Error

### 5.6.3.4 Alignment

Touching the **Alignment** button in the status area of the **Ports Setup** screen displays the status shown below.




**Alignment status when the frame type is M13**




**Alignment status when the frame type is C-bit**

This screen provides information on the frame alignment when available. The frame alignment information includes the below bits contained in seven multiframe.

- F-Bits: Framing bits
- Stuffing Bits: Bit stuffing control bits
- X-Bits: Message bits
- P-Bits: Parity bits
- M-Bits: Multiframing bits
- AIC: Application Identification Channel
- Na: Reserved Network Application bit
- CP: C-bit Parity
- FEBE: Far-End Block Error
- Data Link: Data links for application
- FEAC: Far-End Alarm and Control Channel

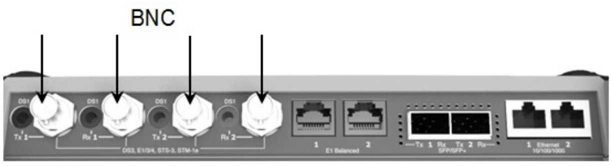
# 5.7 E4 Setup and Status

*E4* represents the 139.264 Mbit/s PDH layer. The **Ports Setup** screen gives you access to the PDH layer setup for the transmitter and/or receiver of the currently selected port.

E4 allows transmission of data streams that are nominally running at the same rate, however allowing for some variation in the speed around a nominal rate (+/-125 ppm variation around 139.264 Mbit/s).

NOTE

*The E4 interface uses the electrical BNC connectors.*

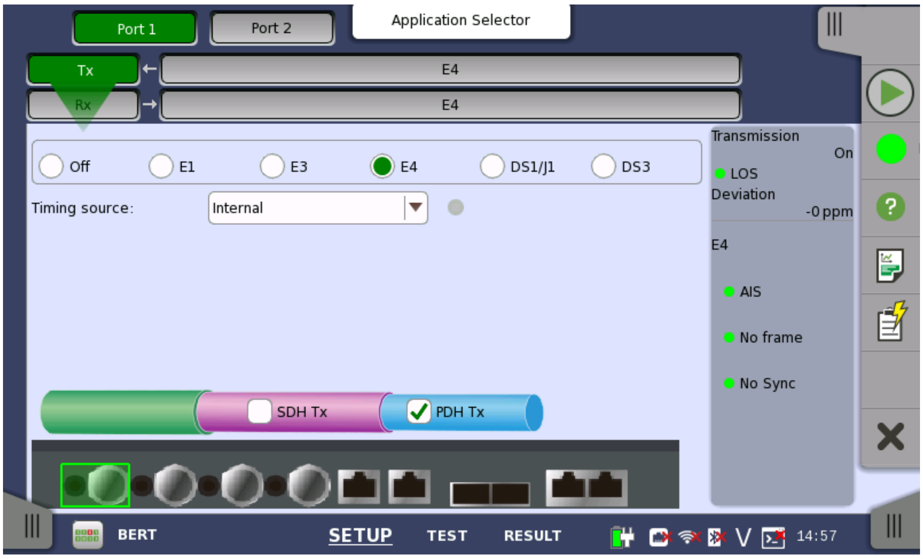



**MU100010A Connector Panel**

## 5.7.1 Transmitter Setup

### 5.7.1.1 Physical Setup

When the transmitter is set up with only an E4 interface, selecting the **Tx** button in the navigation area will launch the following screen.




For the switching method between PDH Tx and DSn Tx, refer to Physical Setup in "E1 Setup and Status". Touch **E4** radio button. Touching **Off** radio button disables the transmitter.

This screen allows you to make the physical setup of the PDH transmitter in E4 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

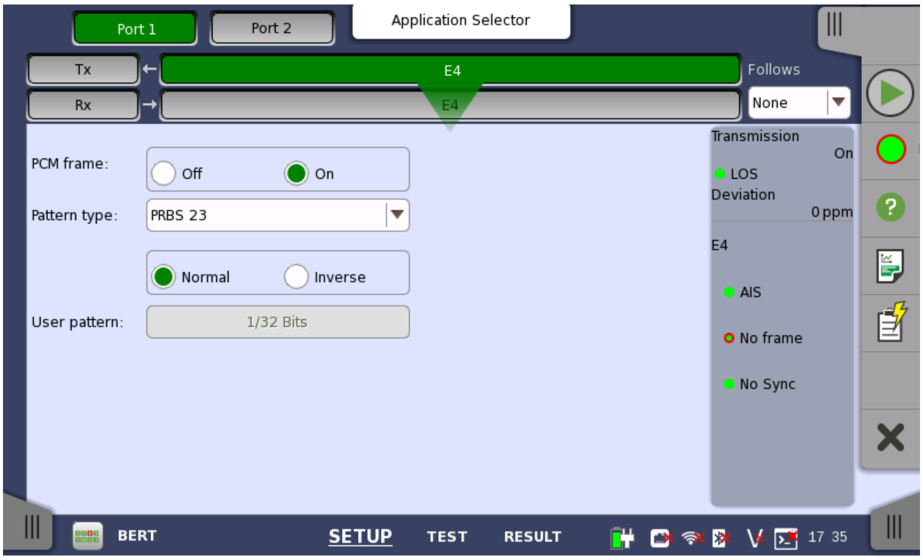
**Timing source** Select the clock source.

**Internal**: Internal clock of the module
**External**: The clock provided from the Ext Clock connector
**Received**: The clock generated from the received signal

When **External** or **Received** is set, the right hand lamp indicates whether clock is detected or not.

#### 5.7.1.2 E4 Signal Setup

Touching the navigation area button which represents the transmitter's E4 layer will display the screen shown below.




**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings) when using Port 1 and Port 2, touch the drop-down menu in the navigation area and select the **Tx1**. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) insertion of PCM frame in the transmitted signal.

**Pattern type**
Select the pattern to be inserted in the transmitted signal. Refer to Pattern type in "E1 Setup and Status". Available patterns are:

- **Off**
- **User [32] bit**, **User [2048] bit**
- **PRBS 9** to **PRBS 31**
- **QRSS 20**
- **All 0's**, **All 1's**
- **Alternating 1:1**, **Alternating 1:3**, **Alternating 1:7**, **Alternating 3:24**

Touch 'Normal' or 'Inverse' pattern type.

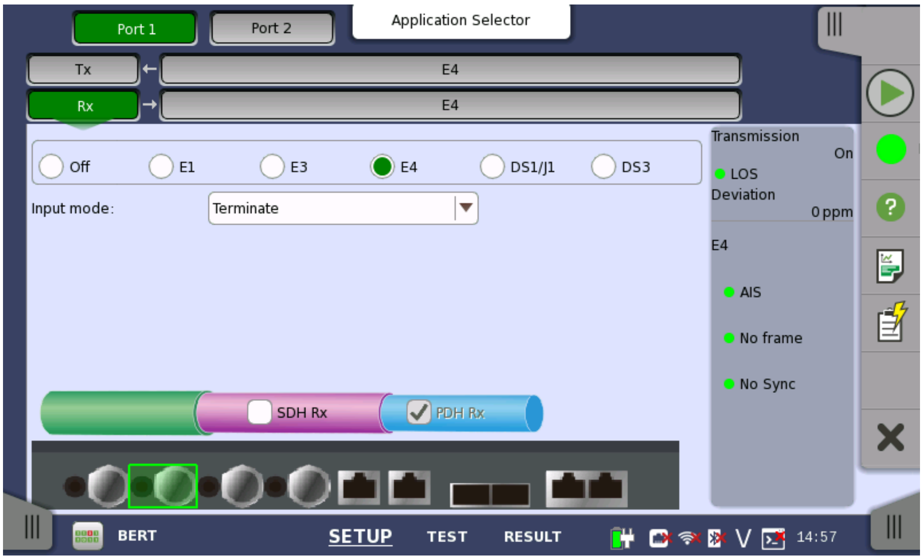
**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

### 5.7.2 Receiver Setup

#### 5.7.2.1 Physical Setup

When the receiver is set up with only an E4 interface, selecting the **Rx** button in the navigation area will launch the following screen.




For the switching method between PDH Rx and DSn Rx, refer to Physical Setup in "E1 Setup and Status". Touch **E4** radio button. Touching **Off** radio button disables the receiver.

This screen allows you to make the physical setup of the PDH receiver in E4 mode. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

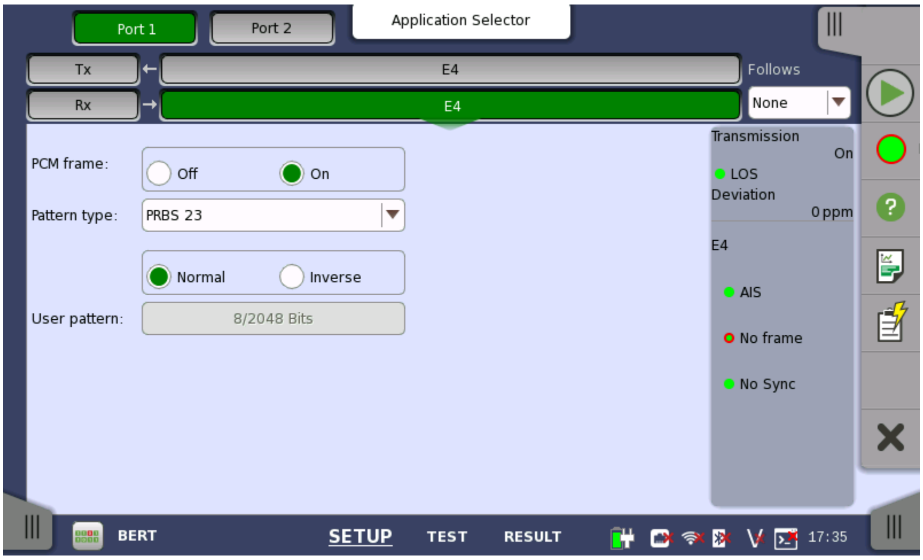
**Input mode** Select the mode of input.

**Terminate**
Used when the instrument is used as a tester and the receiver is the only device connected to the line. The input impedance is nominal.

**Monitor**
Used when connecting to protected monitoring points. The input impedance is nominal.

### 5.7.2.2 E4 Signal Setup

Touching the navigation area button which represents the receiver's E4 layer will display the screen shown below.



To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the drop-down menu in the navigation area and select the relevant value. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**PCM frame**
Use the **PCM frame** radio buttons to enable (**On**) or disable (**Off**) the status of the PCM frame.

**Pattern type**
Select the pattern to be inserted in the transmitted signal. Available patterns are same as the transmitter setup. Refer to Pattern type in "E1 Setup and Status".

Touch 'Normal' or 'Inverse' pattern type.

**User pattern**
User pattern field is enabled if Pattern type is set to **User [32] bit** or **User [2084] bit**. Touch the **User pattern** field and use the launched **Pattern Editor** dialog box to define the user pattern. Depending on the selected pattern type, different user pattern setup options will be available.

The length can be any length from 1 bit to 32 bits or from 1 bit to 2048 bits.

## 5.7.3 Status Information

This section describes the status information available for the E4 layer in the status area of the **Ports Setup** screen.

### 5.7.3.1 Status Summary

The status summary displayed for the E4 layer consists of the following information:

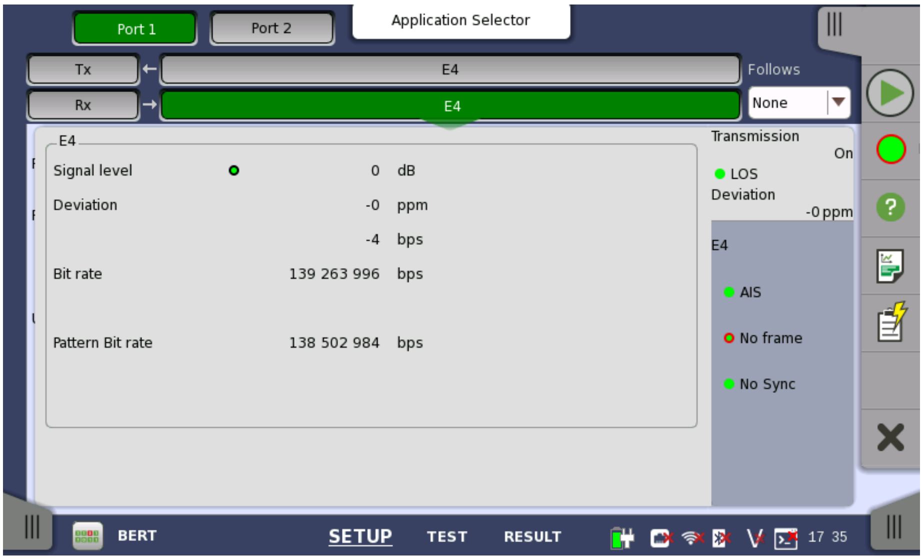
**Physical Status** The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status** The middle part of the status area gives you access to alarm and error information for the selected interface. The curent status is indicated by the lamp color.

A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

### 5.7.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the received signal at the E4 layer.

The physical status information consists of the following parameters:

**Signal level**
The Signal level indicators show the attenuations (in dB) of the currently received signals compared to a nominal signal.

The nature of the levels depend on the Input Level setup for each receiver (Terminate or Monitor):

- In Terminate mode, the attenuation is assumed to be caused by a cable.
- In Monitor mode, linear attenuation is assumed.

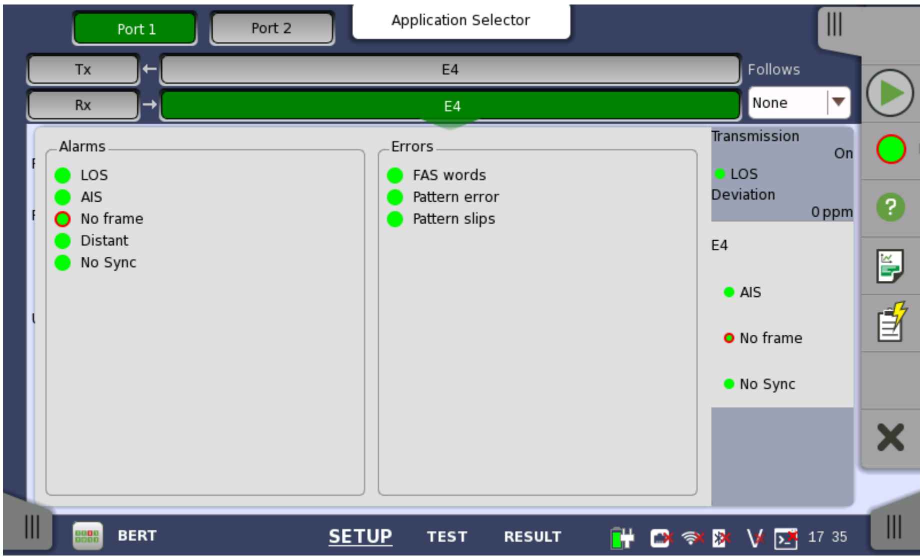
**Deviation**
The deviation from the nominal bit rate is shown for each receiver in both ppm and bps. The nominal bit rate is 139 264 000 bps.

**Bit rate**
The actual bit rate of each receiver is shown (in bps).

**Pattern Bit rate**
This field shows the effective bit rate of the patterns received (that is, the number of pattern bits received per second).

### 5.7.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen contains detailed alarm and error information related to the E4 interface. Status is indicated by the use of colored Lamp icons.

Alarms

- **LOS**: Loss of Signal
- **AIS**: Alarm Indication Signal
- **No frame**: No frame
- **Distant**: Distant
- **No Sync**: No synchronization

Errors

- **FAS words**: Frame Alignment Signal words
- **Pattern error**: Pattern error
- **Pattern slips**: Pattern slips

# 5.8 APS

The Automatic Protection Switching (APS) test described in this section is applicable for SDH/SONET/PDH/DSn interfaces.

For APS test of OTN interface, refer to APS in "OTN Application".

On SDH/SONET
K1,K2 protocol decoding is performed, as well as measurement of average and maximum duration of a specified reference event (alarm/error).

On PDH/DSn
The average and maximum duration of a specified reference event is measured, as is the number of events that have occurred.

## 5.8.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to each interface type are described in separate sections:

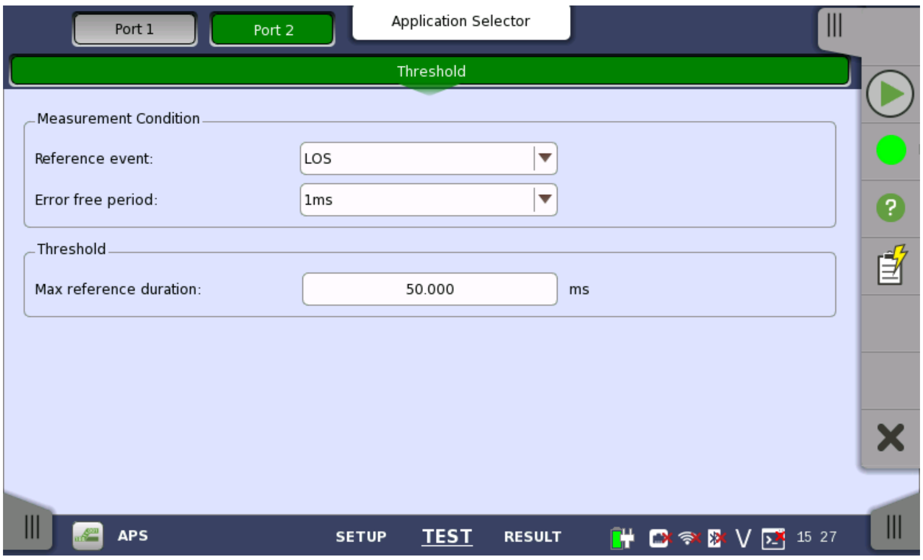
- SDH Setup and Status
- SONET Setup and Status
- E1 Setup and Status
- DS1/J1 Setup and Status
- E3 Setup and Status
- DS3 Setup and Status
- E4 Setup and Status
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 5.8.2 Test Setup

### 5.8.2.1 Threshold

Touching the **Threshold** button in the navigation area displays the following screen.




This screen contains the parameters for setting up the threshold values for alarms/errors and Pass/Fail status.

**Measurement Condition**

**Reference event**
Use the drop-down menu(s) to select the relevant event (**LOS**, **LOF**, **OOF** etc.).

**Error free period**
Appears when SDH or SONET layer is present.
If a reference event is not generated within the time of this cycle, end the switching time measurement.

**Threshold**

**Max reference duration**
Allows you to specify the maximum duration of the selected reference event(s). Valid values are from **0.000 ms** to **10000.000 ms** for SDH/SONET and **0.000 ms** to **4000.000 ms** for PDH.

NOTE

*The setup of the protection and the requests used in an 'APS' test on SDH or SONET layer is done on the Test Results > Details screen.*

## 5.8.3 Test Results

### 5.8.3.1 Summary

Touching the **Summary** button in the navigation area will display the screen shown below.

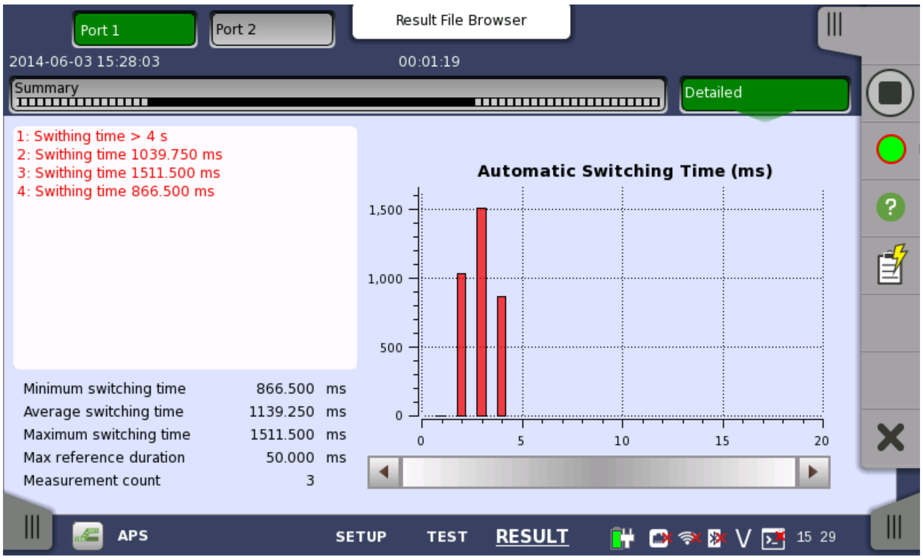

This screen presents a summary of the results of the APS test.

For each port the following information is displayed:

- Reference event
- Average switching time
- Max. time
- Max reference duration

### 5.8.3.2 Details for APS

Touching the **Detailed** button will display the screen shown below.




This screen shows the duration of all reference events, both in a list and in a graphic representation. This screen contains the summary field displayed below the list.

**Summary field** Consists of the minimum, maximum, and average automatic switching times in milliseconds, the specified Max. reference duration value, the number of measurements.

**List-form information** Presents the automatic switching times in list-form.

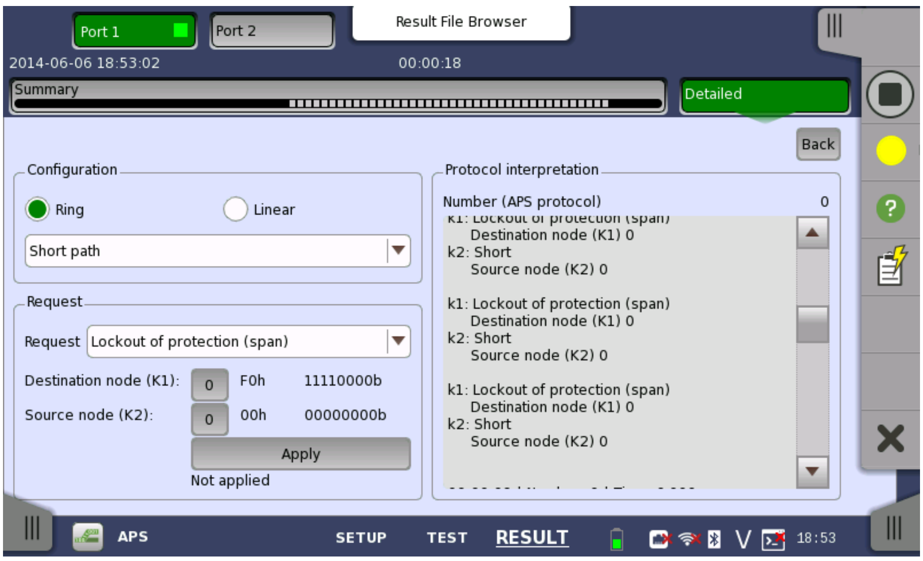
**Graphical presentation** The graphical presentation consists of a bar diagram of the automatic switching times. Results may be affected by unexpected alarms/errors.

**Protocol interpretation** Shows the screen displaying the Protocol interpretation.

**NOTE** *Protection interpolation button appears when SDH or SONET layer is present.*

### 5.8.3.3 Protocol interpretation

Touching the **Protocol interpretation** button on the **Detailed** screen will display the following screen.



This screen shows a protocol interpretation for the selected port (i.e. detailed decoding information about K1 and K2 during the test). It also contains a set of parameters that allow you configure the requests used in the test.

**Configuration**

Select the configuration from below.

- **Ring**: MS shared protection ring / BLSR (Bidirectional line switched ring)
- **Linear**: Linear VC trail protection / UPSR (Unidirectional path switched ring)

- **Short path**, **Long path**: Type of substitute path for Ring protection.
- **1+1 architecture**, **1:n architecture**: Type of the architecture for Liner protection.

**Request**

**Request**
Use the drop-down menu to select the relevant request type (**Forced switch**, **Signal fail** etc.).

**Destination node / Source channel (K1)**
Touch the field to set the channel number of the K1 byte (bits 5-8). Possible values are **0** to **15**.

**Source node / Bridged channel (K2)**
Touch the field to set the channel number of the K2 byte (bits 1-4). Possible values are **0** to **15**.

**Apply**
Touch the **Apply** button to apply the specified APS request to the SDH/SONET transmitter.

# 5.9 BERT

The Bit Error Rate Test (BERT) described in this section is applicable for SDH/SONET/PDH/DSn interfaces.

For BERT of OTN interface, refer to BERT in "OTN Application".

As the name implies, the bit error rate is defined as the rate at which errors occur in a string of transmitted bits:

BER = number of bit errors / total number of bits received

NOTE

*The interface specification on the Ports Setup screen determines whether the current application is SDH, SONET, PDH and/or DSn BERT.*

## 5.9.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to each interface type are described in separate sections:

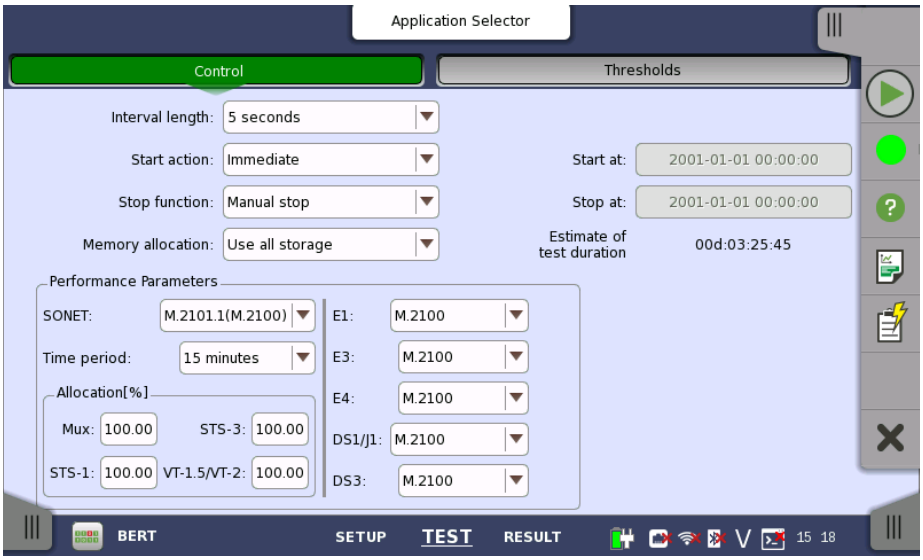
- SDH Setup and Status
- SONET Setup and Status
- E1 Setup and Status
- DS1/J1 Setup and Status
- E3 Setup and Status
- DS3 Setup and Status
- E4 Setup and Status
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 5.9.2 Test Setup

### 5.9.2.1 Control

When you go to the test setup of the SDH/SONET/PDH/DSn BERT application, the following screen is displayed.




This screen contains the parameters that are generally required in a BERT test setup.

**Interval length**
Allows you to specify the length of the measurement intervals.

**Start action**
Allows you to specify when the measurement is started.

- If **Immediate** is selected, the measurement starts when you touch the **Start** button.
- Selecting **Start at** will enable a delayed start. The start time for a delayed start can be specified in the adjacent **Start at** field.

**Stop function**
Allows you to specify when the measurement ends. Select the relevant option from the drop-down menu:

- If **Manual stop** is selected, the measurement will stop immediately when the **Stop** button is touched.
- Selecting **Stop at** will enable the adjacent field, in which you can specify the stop time.
- Selecting **Duration** will allow you to specify a duration time in the adjacent field.

**Memory allocation**
Allows you to specify how the measurement will be stored in the Network Master's memory. Select the relevant option from the drop-down menu:

- **Use all storage**: When Network Master's memory became full with measured data, the whole measurement is stopped.
- **Continuous**: When Network Master's memory became full with measured data, the oldest records in that memory will be overwritten.

**Estimate of test duration**
Contains an estimation of the time (in days, hours, minutes and seconds) before the whole memory will be filled out by the test. During an ongoing measurement, the estimate will be recalculated periodically.

**Performance Parameters**

The titles of ITU-T Recommendation are below.

- **G.821** Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an Integrated Services Digital Network
- **G.826** End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections
- **G.828** Error performance parameters and objectives for international, constant bit-rate synchronous digital paths
- **G.829** Error performance events for SDH multiplex and regenerator sections
- **G.8201** Error performance parameters and objectives for multi-operator international paths within the Optical Transport Network (OTN)
- **M.2100** Performance limits for bringing-into-service and maintenance of international multi-operator PDH paths and connections
- **M.2101.1** Performance limits for bringing-into-service and maintenance of international SDH paths and multiplex sections
- **M.2401** Error performance limits and procedures for bringing-into-service and maintenance of multi-operator international paths and sections within an optical transport network
- **M.2110** Bringing into service international multi-operator paths, sections and transmission systems

## OTN-related

This item appears if 'BERT on OTN' is running.

**OTN**
G.8201, M.2401 (M.2110)

**Time period**
15 minutes, 1 hour, 2 hours, 24 hours, 7 days

**Allocation**
Touching the **Setup** button launches the dialog box. Refer to Performance Parameters in "OTN Application" .

**SDH/SONET-related**

**SDH/SONET**
G.826, G.828+G.829, M.2101.1(M.2100)

**Time period**
15 minutes, 1 hour, 2 hours, 24 hours, 7 days

**Allocation [%]**
0.00 to 100.00%

**PDH/DSn-related**

**E1**
G.821, G.826, M.2100, G.821 (expired)

**E3**
G.826, M.2100

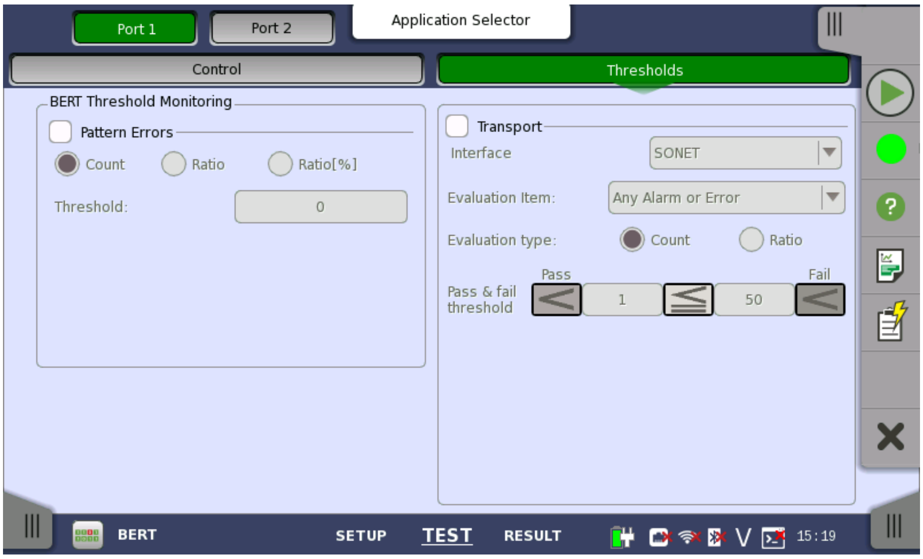
**E4**
G.826, M.2100

**DS1/J1**
G.821, G.826, M.2100, G.821 (expired)

**DS3**
G.826, M.2100

### 5.9.2.2 Thresholds

Touching the **Thresholds** button in the navigation area displays the following screen.




This screen contains the parameters for setting up the various threshold values (i.e. limits) for errors and Pass/Fail status that are used during the monitoring.

**Pattern Errors**

Allows you to enable monitoring of pattern errors (i.e. bit errors) and to set up a threshold value for the bit error ratio.

Choose whether the threshold is specified as an absolute value or a percentage, using the **Count**, **Ratio** and **Ratio [%]** radio buttons, and then specify the value in the **Threshold** field.

**Transport**

Select the checkbox to enable the transport-related parameters.

**Interface**
Select the item to evaluate from **OTN**, **SDH**, **SONET**, **E4**, **E3**, **E1**, **DS3** or **DS1/J1**.

**Evaluation item**
Select the item to evaluate. If selecting other than **Any Alarm or Error**, another menu appears.

**Evaluation type**
Select the relevant type.

**Pass & fail threshold**
Touch the left-hand number to set the lower limit for "Warning". Touch the right-hand number to set the lower limit for "Fail". The lower limit of "Fail" must be equal to or greater than the lower limit of "Warning" (defining a "Within limits" range in between them).

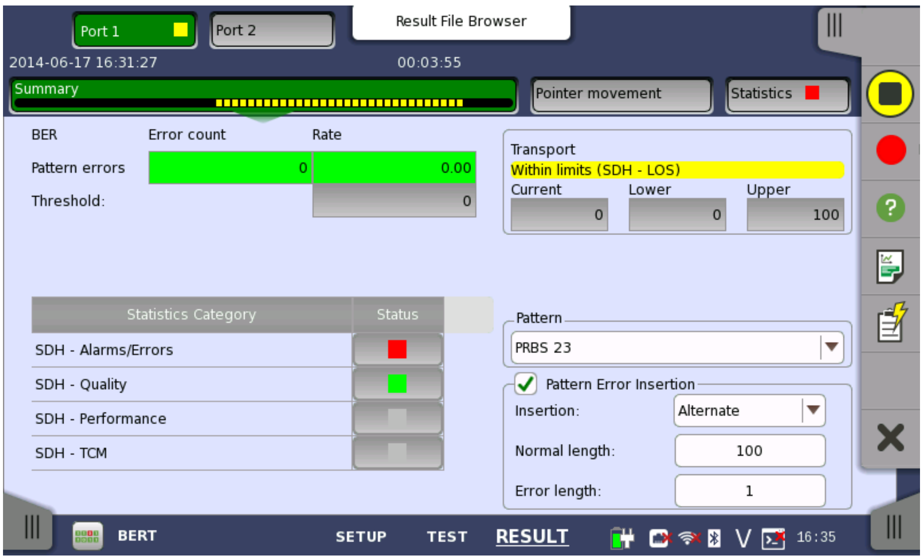
NOTE

*Thresholds can only be set/modified while no measurement is running, as they are active during a measurement.*

## 5.9.3 Test Results

### 5.9.3.1 Summary

When you go to the test results of the SDH/SONET/PDH/DSn BERT application, the following screen is displayed.




This screen contains a summary of OTN/SDH/SONET/PDH/DSn BERT results.

**Statistics Category**

The lamp icon in Status column shows the Pass or Fail results for each category. Touching the Status column displays the statistics results.

**Transport**

Displays the results of Transport test. This result appears if 'Transport' checkbox is selected in Test Setup screen.

**Pattern**

Select the pattern.

**Pattern Error Insertion**

Select the checkbox to enable the pattern error insertion.

**Insertion**
Select the timing of the error insertion from the drop-down menu.

- **Off**: Stops the error insertion.
- **Manual**
- **1E-04** to **1E-10**
- **Alternate**

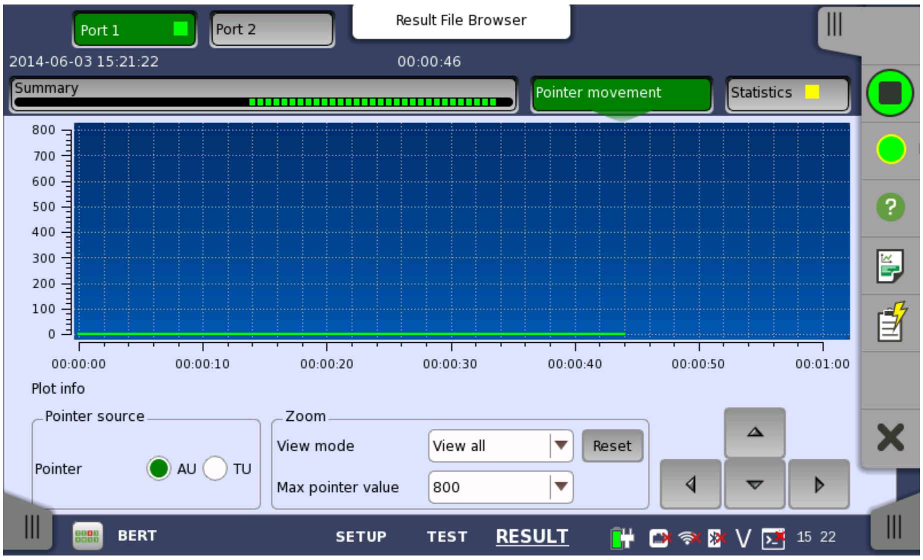
**Burst length**
If 'Insertion' is set to **Manual**, touch the button and set the burst length to insert.

**Normal length**
If 'Insertion' is set to **Alternate**, touch the button and set the normal length.

**Error length**
If 'Insertion' is set to **Alternate**, touch the button and set the error length.

### 5.9.3.2 Pointer Movement

Touching the **Pointer Movement** button in the navigation area displays the screen shown below.




This screen presents a detailed analysis of pointer movements in the monitored signal. The results are displayed as a graph, showing the positions of a specific pointer over time.

Using the graph area itself and the controls displayed below the graph, you can specify which pointer's data is displayed as well as zoom in on specific details of the graph.

HINT *In general, you use direct touch-manipulation of the graph area to zoom in and use the controls to zoom out.*

**Pointer source**

**Pointer**
Select the radio button corresponding to the pointer whose movements you want to monitor.

**Zoom**

To zoom in, select a zoom area directly in the graph area by drawing a rectangle with a finger or the stylus (delivered with the instrument).

When releasing the finger or stylus, the graph area zooms in to show the selected part of the graph.

To zoom out, use the view settings below the graph:

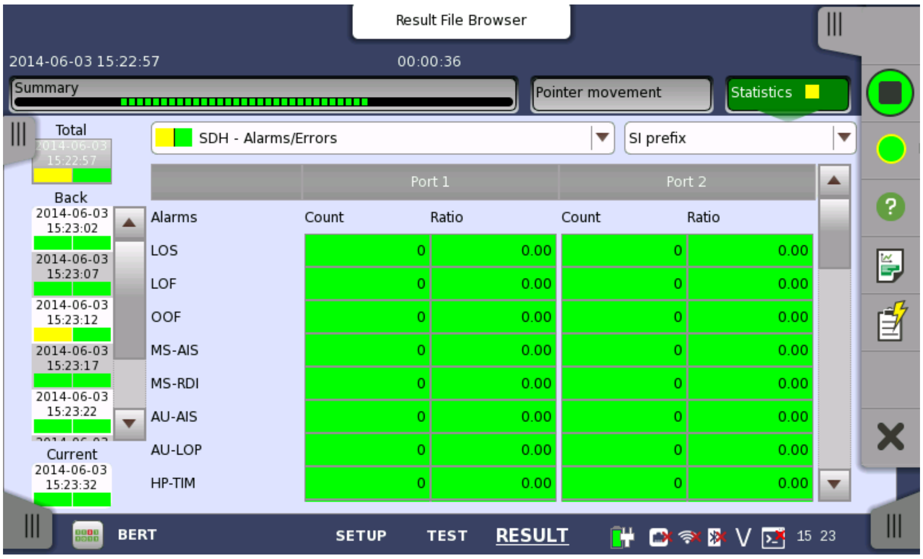
**View mode**
Used to set the x-scaling for the graph. The possible settings are:

- **Last 24H** to **Last 5m**: Shows a sliding graph area with max. width of 24 hours to 5 minutes.
- **View all**: Shows a graph area with a width as the duration of the test.
- **Custom**: This is automatically selected when the graph area is touch-manipulated.

**Max pointer value**
Used to set the y-scaling of the view. The maximum amplitude of the plot always originates from the zero line.

### 5.9.3.3 Statistics

Touching the **Statistics** button in the navigation area displays the screen shown below.




This screen presents a detailed analysis of the test results. You can choose to view either the total results from measurement start or the results of a specific interval during the test. You can also zoom in on a specific result item. The results can be displayed either in table (list) form or as a graph.

**Selecting which results to view**

**Selecting the interval time**

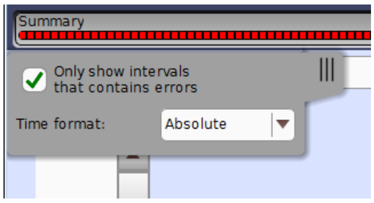
Touch the **Total** button to switch the total values measured in all interval times. The start time of measurement is displayed on the button.

Touching the button in left side **Back** field shows the measured values in the interval time. The end time of the interval is displayed on the button.

**Current** button is displayed at left bottom when the measurement is running. Touching the **Current** button shows the measured values in the current interval time.

The slide-out panel on the left-hand side of the screen contains the following functions:

- Only show intervals that contains errors
- Time format




NOTE

*If you have stopped measurement during the interval time, the measurement results of current interval are discarded. The log of current interval is not displayed in* ***Back*** *field.*
In this case, result data are re-calculated excluding the data of current interval when the measurement is stopped. This causes that "Count" and "Ratio" displayed after the measurement will be different from that of during measurement.
The sum of interval time (multiplied interval time by the number of back logs) may not match the differential time between displayed time at left top and right top after the measurement.

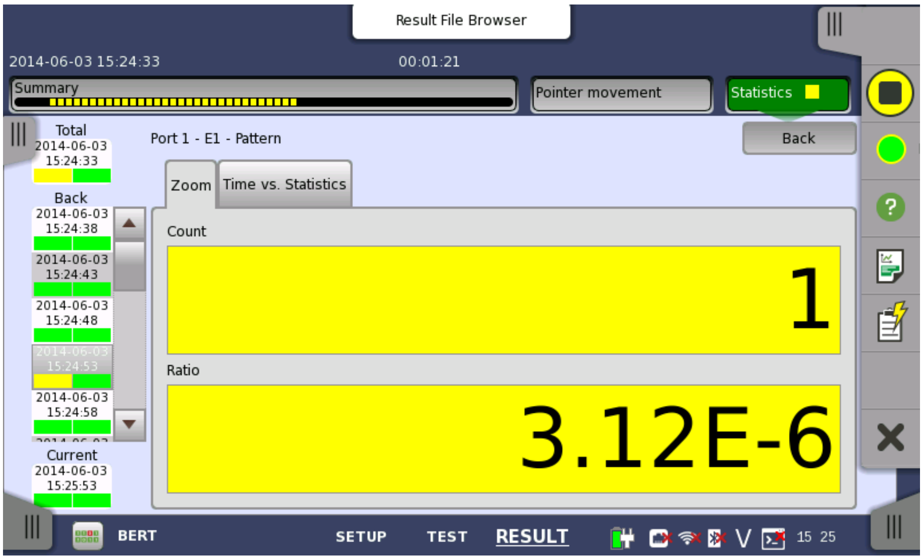
**Selecting type of results**

Open the middle drop-down menu in the top row of buttons to select which results you want displayed on the screen.

- **OTN**
  - **Alarms/Errors**
  - **Performance**
- **SDH**
  - **Alarms/Errors**
  - **Quality**
  - **Performance**
  - **TCM**
- **SONET**
  - **Alarms/Errors**
  - **Quality**
  - **Performance**
  - **TCM**
- **E1**
  - **Alarms/Errors**
  - **Performance**
- **E3**
  - **Alarms/Errors**
  - **Performance**
- **E4**
  - **Alarms/Errors**
  - **Performance**
- **DS1/J1**
  - **Alarms/Errors**
  - **Performance**
- **DS3**
  - **Alarms/Errors**
  - **Performance**

**Studying a specific result**

Touch a specific cell in a result table to zoom in on the corresponding result item. The **Count** and **Ratio** fields are displayed on a **Zoom** tab page. A **Time vs. Statistics** tab page is also available. Touch the **Back** button to return to the statistics screen.




## Selecting how results are displayed

**Selecting notation**

Select the required notation for the results from the notation drop-down menu.

- **Unformatted** - e.g. 71892
- **SI prefix** - e.g. 71.892 k (k means "kilo")
- **Engineering** - e.g. 71.892E3
- **Scientific** - e.g. 7.1892E4

## Results

Results are displayed according to your choice. OTN appears when 'BERT on OTN' is running.

OTN Alarms/Errors
  Refer to Results in "OTN Application"
OTN Performance
  Refer to Results in "OTN Application"
SDH Alarms/Errors
  **Alarms**
  **Errors**
SDH Quality
  **Frequency**
  **MUX**
  **AU VC-4/3**
  **TU VC-3**
  **TU VC-12/11**
  **Bulk**
  **AU Pointer**
  **TU Pointer**
  **Justification** *1
SDH Performance
  **MUX**
  **AU VC-4/3**
  **TU VC-3**
  **TU VC-12/11**
SDH TCM
  **Alarms**
  **Errors**
SONET Alarms/Errors
  **Alarms**
  **Errors**
SONET Quality
  **Frequency**
  **MUX**

- **STS-3c/1**
- **TU VC-3**
- **VT-2/1.5**
- **Bulk**
- **STS Pointer**
- **VT Pointer**
- **Justification** *1

SONET Performance
- **MUX**
- **STS-3c/1**
- **TU VC-3**
- **VT-2/1.5**

SONET TCM
- **Alarms**
- **Errors**

E1 Alarms/Errors
- **Alarms**
- **Errors**

E1 Performance Results
- **FAS errors**
- **Pattern errors**
- **CRC4 errors**
- **E-Bit errors***2

E3 Alarms/Errors
- **Alarms**
- **Errors**

E3 Performance
- **FAS errors**
- **Pattern errors**

E4 Alarms/Errors
- **Alarms**
- **Errors**

E4 Performance
- **FAS errors**
- **Pattern errors**

DS1/J1 Alarms/Errors
- **Alarms**
- **Errors**

DS1/J1 Performance
- **FAS errors**
- **Pattern errors**
- **CRC-6 errors**

DS3 Alarms/Errors
- **Alarms**
- **Errors**

DS3 Performance
- **FAS errors**
- **Pattern errors**

*1: **Justification** appears when 'PDH Rx' or 'DSn Rx' is selected.
*2: **E-Bit errors** appears when 'E-bit' is set to On in Frame tab of E1 receiver.
*3: **CRC6 errors** appears when 'ESP' or 'J1' is selected.

# 5.10 RTD

The Round-Trip Delay (RTD) test measures the time that the data which is transmitted by the transmitter returns to the receiver.

The RTD test described in this section is applicable for SDH/SONET/PDH/DSn interfaces.

For RTD test of OTN interface, refer to RTD in "OTN Application".

## 5.10.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to each interface type are described in separate sections:

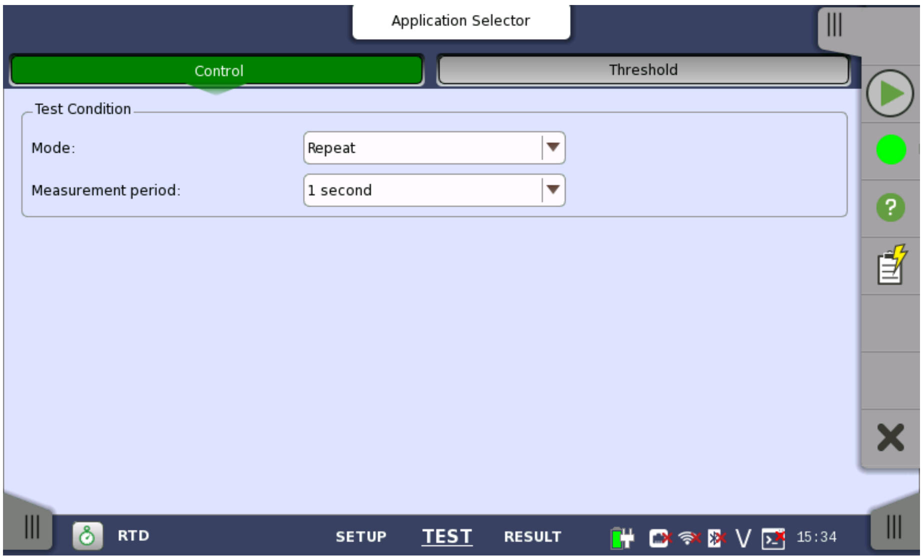
- SDH Setup and Status
- SONET Setup and Status
- E1 Setup and Status
- DS1/J1 Setup and Status
- E3 Setup and Status
- DS3 Setup and Status
- E4 Setup and Status
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 5.10.2 Test Setup

### 5.10.2.1 Control

When you go to the test setup of the RTD application, the following screen is displayed.




This screen allows you to configure the RTD test conditions for the currently selected port(s).

**Test Condition**

Allows you to define the test duration in one of two ways:

**Mode**

- **Single** - Used to perform RTD test once.

- **Repeat** - Used when a *persistent RTD test* is needed.

**Measurement period**
Select the measurement period from **0.5 seconds** to **10 seconds**.

### 5.10.2.2 Threshold

Touching the **Threshold** button in the navigation area displays the following items.

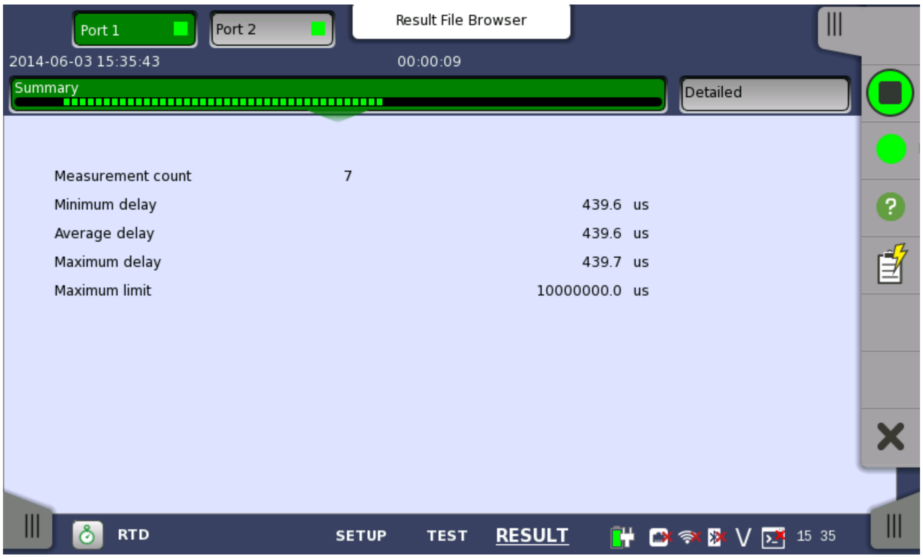
**Threshold**

**Maximum limit**
Allows you to specify a threshold value of RTD in micro seconds (µs).

## 5.10.3 Test Results

### 5.10.3.1 Summary

Touching the **Summary** button in the navigation area will display the screen shown below.

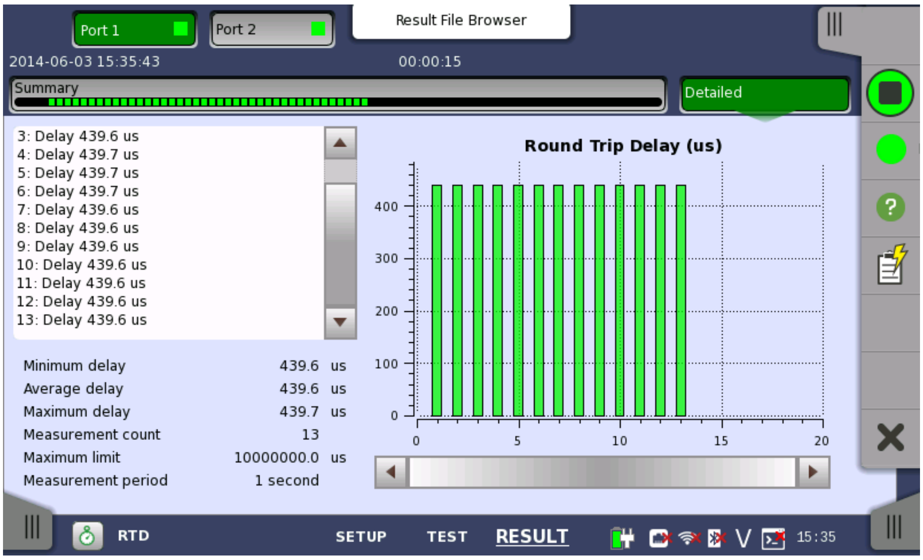



This screen presents a summary of the RTD test results, for all of the ports included in the test. For each port, the information consists of:

- Measurement count
- Minimum, average, and maximum round-trip delay times in micro seconds
- Threshold value

### 5.10.3.2 Detailed

Touching the **Detailed** button in the navigation area will display the screen shown below.




Buttons for selecting the relevant port are displayed at the top of the screen, with a color indication of the pass/fail status of the test.

This screen presents the detailed results of an RTD test. The result is shown in both list-form and in a graphical presentation. This screen contains the summary field displayed below the list.

**Summary field**

Consists of the minimum, average, and maximum round-trip delay times in microseconds, the number of measurements, the specified threshold value and measurement period.

**List-form information**

Presents the results of an RTD test in list-form.

**Graphical presentation**

The graphical presentation consists of a bar diagram of the round-trip delay times.

# 6 Ethernet Applications

This chapter describes the graphical user interface (i.e. screens, sub-screens and major dialogs) related to Ethernet applications. Sub-screens and dialogs are described under the main screen from which they are activated/launched.

The following setting and applications are available:

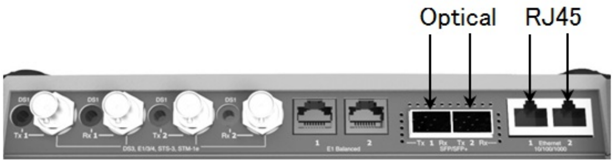
- Ethernet Setup and Status
- BERT
- Cable
- Mon/Gen
- Pass Through
- Ping
- Reflector
- RFC 2544
- SAT 1564
- Traceroute

# 6.1 Ethernet Setup and Status

*Ethernet* is globally used for data communication. Ethernet transmits variable length frames up to 1500 bytes in length, each containing a header with the source and destination addresses and a trailer that contains error correction data.

When setting an Ethernet application on OTN, in the navigation area of the **Ports Setup** screen, the Ethernet layer may initially be shown as a single **Ethernet** button which will change into a row of buttons when you touch it. Each button represents an aspect of Ethernet port setup and gives you access to the related setup options.

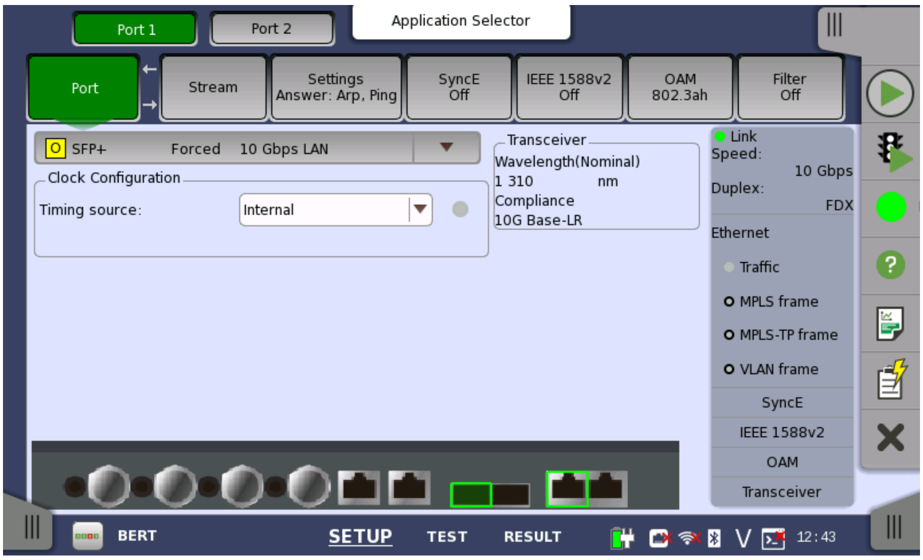
**Note:** The Ethernet interface uses the Electrical RJ45 connectors or the optical ports.




**MU100010A Connector Panel**

## 6.1.1 Physical Port Setup

When the port is set up with an Ethernet interface, touching the **Port** button in the navigation area will display the following screen.



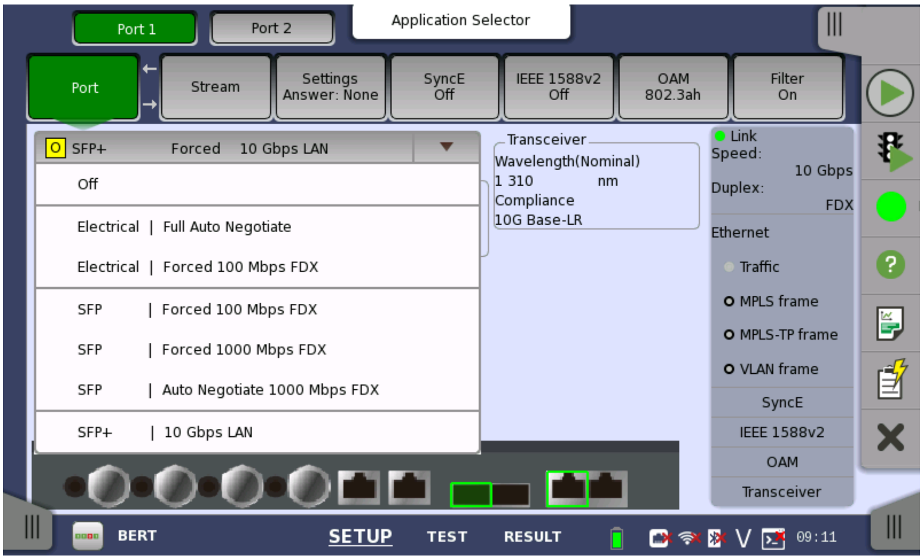

This screen allows you to specify the physical port configuration of the currently selected Ethernet port. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

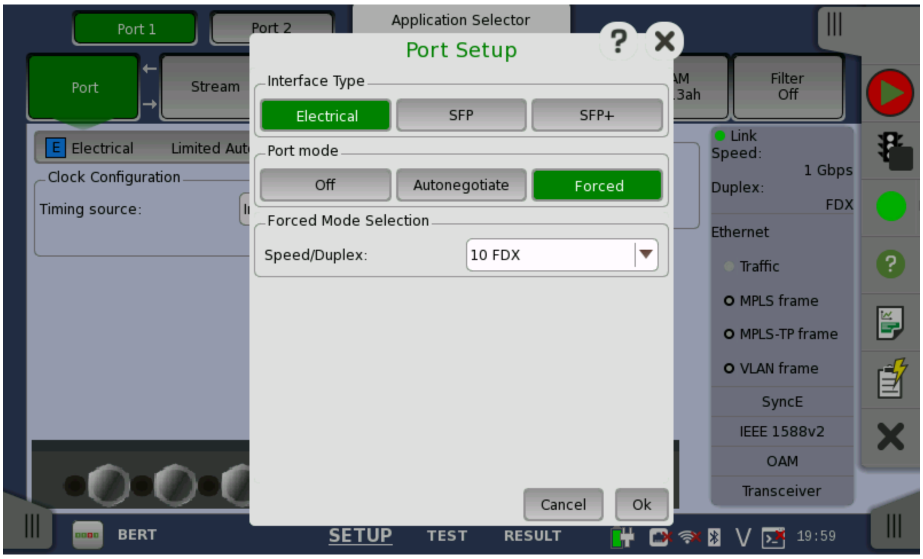
### 6.1.1.1 Port configuration parameters

**Port definition**

You can use either a 'quick mode' or a 'detailed mode' to set up the port. Touching the long button at the top of the setup area will launch the Port Setup dialog box. Touching the arrow to the right of the button will open the *quick setup menu*.




The quick setup menu contains a number of predefined port configurations (e.g. **Electrical | Forced 100 Mbps FDX**). The detailed mode dialog allows you to specify the configuration yourself.




The detailed mode (**Port Setup**) dialog box is described in a separate section below.

**Timing**

**Timing source**
Select a source to synchronize all Ethernet transmitters to.

The possible sources are:

- **Internal**
- **External**
- **GPS**
- **Received**
- **IEEE 1588v2**

**Received** appears when the interface type is set to **SFP** or **SFP+**.

**Transceiver**

Displays the Transceiver information.

### 6.1.1.2 Port Setup (detailed mode)

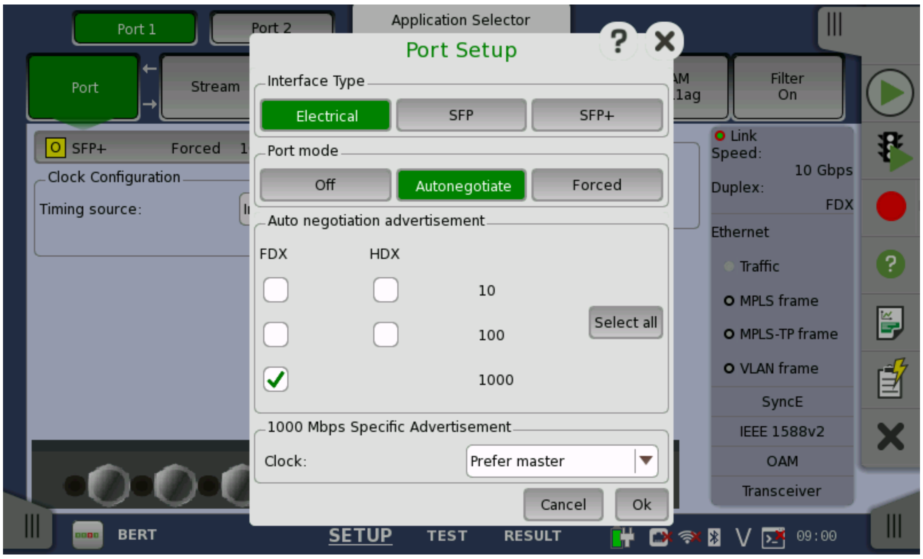
The contents of the dialog box (i.e. which parameters are displayed) depends on your combined choice of *interface type* and *port mode*.

**Port Mode = Off**

Selecting the **Off** port mode will shut down the Ethernet port and stop the physical link.

**Electrical + Autonegotiate**

Selecting the **Autonegotiate** port mode with interface type specified as **Electrical** will display the following parameters:




**Auto Negotiation Advertisement**
Allows you to set the speed and duplex capabilities that are advertised to the link partner.

- **FDX** can be set to **10**, **100** and **1000**.
- **HDX** can be set to **10** and **100**.

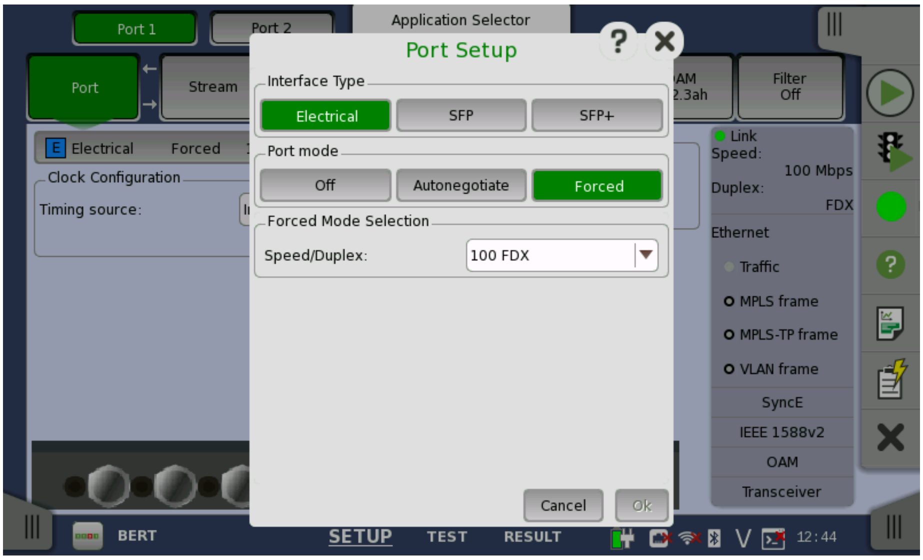
Using the **Select all** will automatically set check marks in every checkbox.

**1000 Mbps Specific Advertisement**
Open the **Clock** drop-down menu to select one of the following settings:

**Prefer master**, **Prefer slave**, **Master**, or **Slave**.

**Electrical + Forced**

Selecting the **Forced** port mode with interface type specified as **Electrical** will display the following parameters:



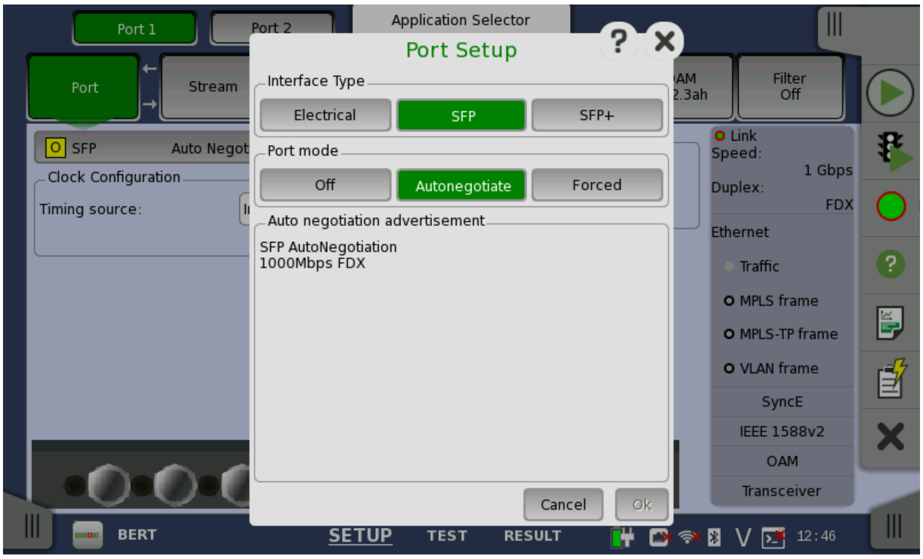

**Forced Mode Selection**
Allows you to select the forced mode speed and duplex capabilities. Available choices are:

**10 HDX**, **10 FDX**, **100 HDX**, and **100 FDX**

**NOTE** *When autonegotiating with a port that is forced (i.e. not using autonegotiation), the duplex for the port that is using autonegotiation will automatically be set to Half Duplex (HDX) and the speed to the speed used by the forced port. It is thus possible to have a duplex mismatch without knowing it.*

**SFP + Autonegotiate**

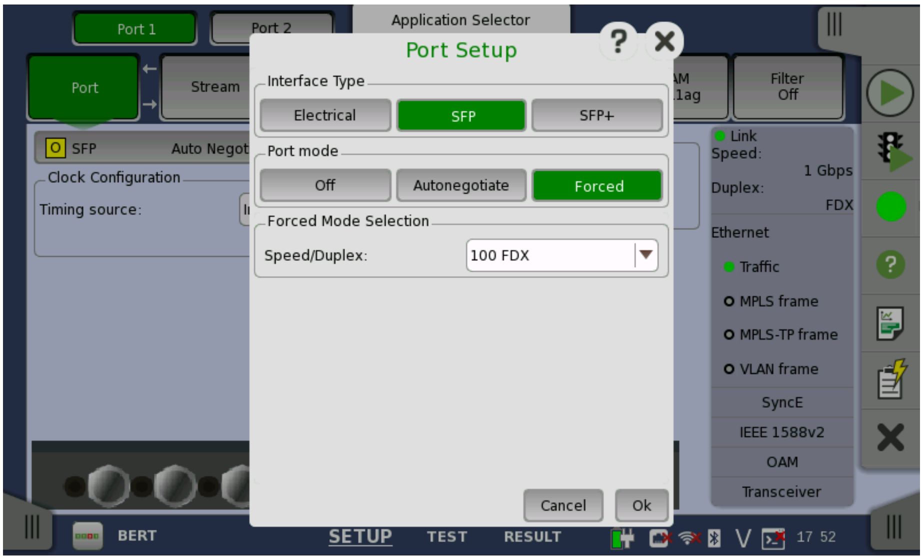
Selecting the **Autonegotiate** port mode with interface type specified as **SFP** will display the following parameters:




The negotiated speed appears.

**SFP + Forced**

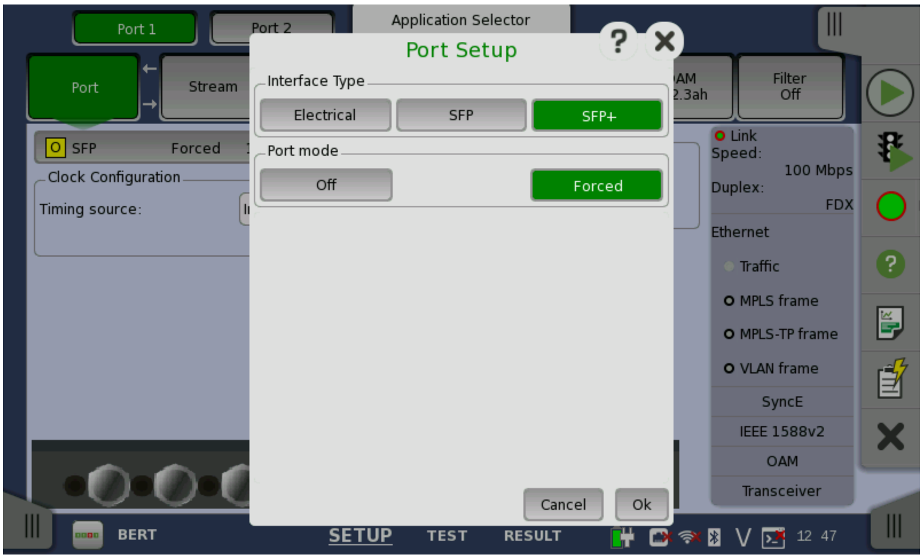
Selecting the **Forced** port mode with interface type specified as **SFP** will display the following parameters:




Allows you to select the forced mode speed. Available choices are:

**100 FDX**, **1000 FDX**

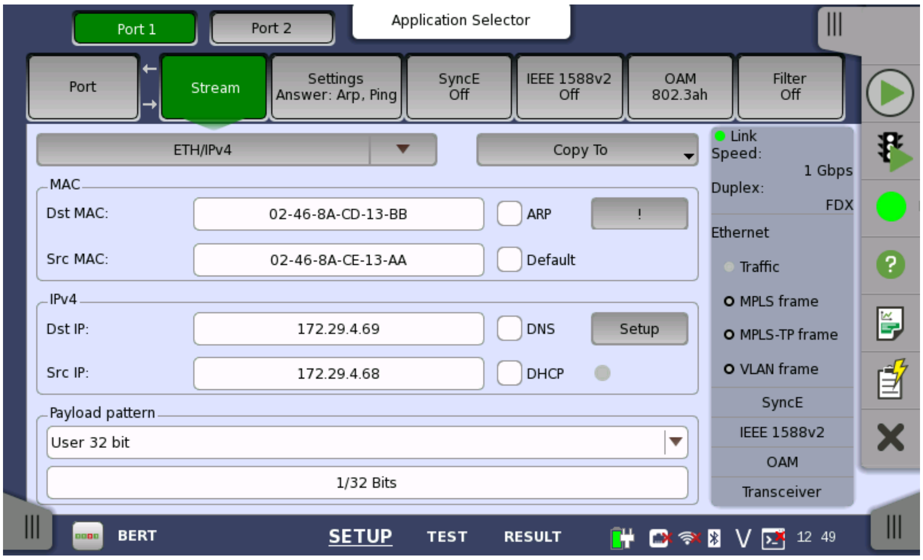
**SFP+ + Forced** When running 10G only **Forced** mode is available. The following parameters are displayed:




## 6.1.2 Ethernet Frame Setup

### 6.1.2.1 Stream

Touching the **Stream** button in the navigation area will display a screen like the one shown below.



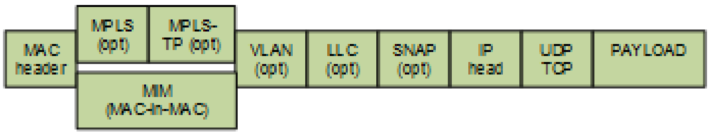

This screen contains the setup of the Ethernet frame content transmitted by the Network Master. The exact layout depends on the current selection of layers (i.e. the various encapsulation and protocol headers composing the Ethernet frame). Including a layer will display its specifically related configuration options.

**NOTE**

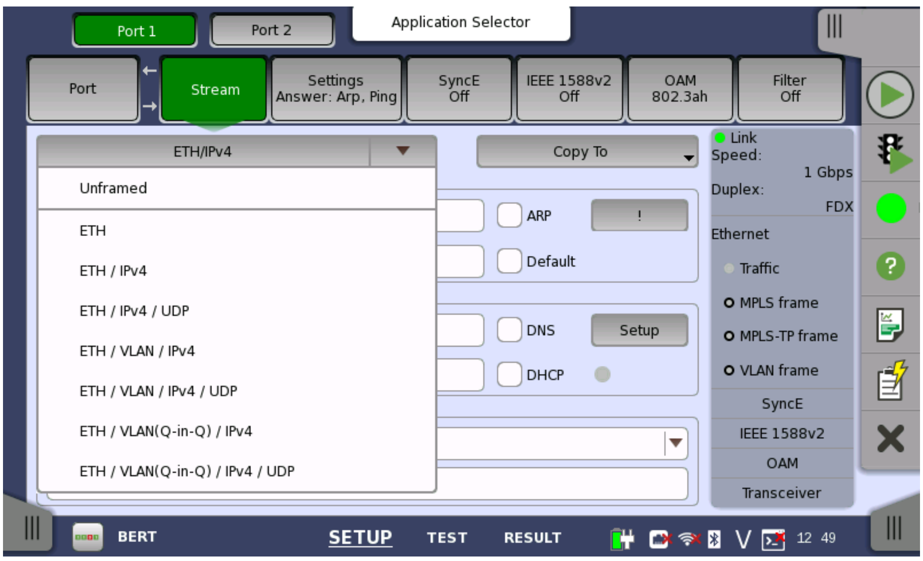
*Only the most important (i.e. most frequently used) configuration parameters are displayed here for each specified layer. To access all parameters, launch the frame composition 'Stream Setup' dialog box accessible via the button in the top left-hand part of the screen.*

## Composing the Ethernet frame

The following headers/layers are available for the frame configuration:




You can use either a 'quick' mode or a 'detailed' mode to set up the selection of headers/layers. Touching the button at the top of the setup area will launch the *detailed mode* dialog box (the Stream Setup dialog box ). Touching the arrow to the right of the button will open the *quick selection menu*.



The quick selection menu contains a number of predefined frame configurations (e.g. **ETH/VLAN/IPv4**). The detailed mode dialog box allows you to specify the frame configuration yourself and also provides you with access to all configuration parameters available for the individual layers.

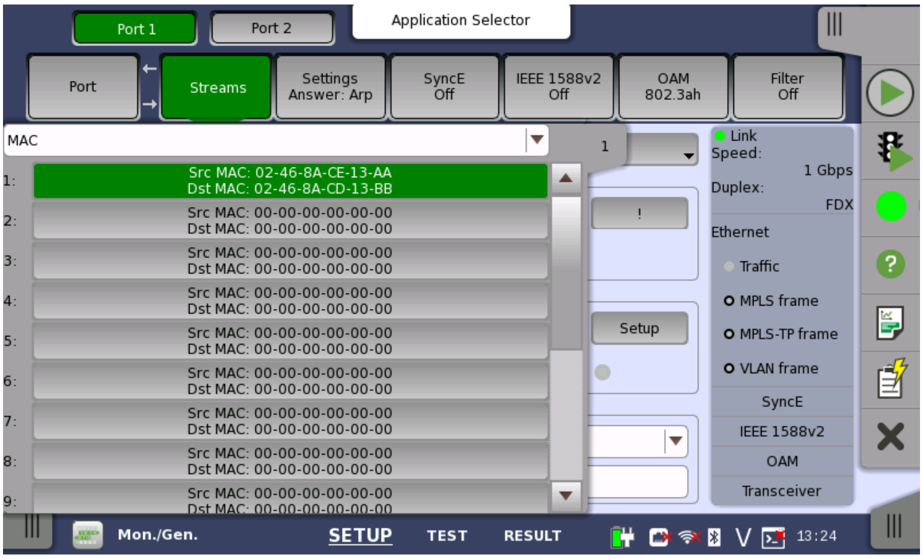
The detailed mode (**Stream Setup**) dialog box is described in detail below.

## Follow another port


It is possible to let the Port 2 copy the setup from Port 1 by touching the **Follow** button. This button appears when the Port 1 settings can be copy to Port 2.

## Multistreams

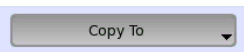
When the Multistream is active, the screen contains a **Stream** slide-out, which allows you to select the relevant stream to view/configure. The name of the slide-out control indicates which stream is currently being displayed.




At the top of the slide-out list you can switch between MAC, IP, and VLAN information as stream identification.

**Copy frame content to other stream(s)**

This feature allows you to copy the frame content of the stream that you are currently configuring to all streams in another port or to a single stream.

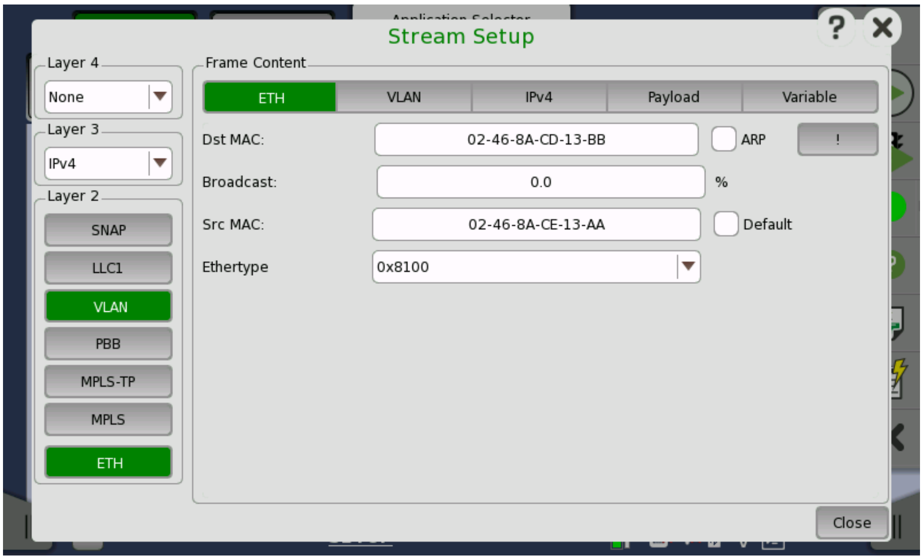



Touching the **Copy To** button opens a drop-down menu from which you can select the relevant port and **All** or a specific stream.

## Stream Setup (detailed mode dialog box)

This dialog box provides you with the advanced options for configuring the Ethernet frame content for a specific stream. Use the buttons at the bottom to select the stream.

The buttons on the left-hand side of the dialog box allow you to select the relevant layers. The current selection is shown at the top of the **Frame Content** area. Touching one of the layer buttons in the **Frame Content** area will display the setup parameters for that layer.




The layer buttons are arranged in order from bottom to top and from left to right. The TCP/UDP protocols are the uppermost layer and Ethernet the lowermost as depicted below compared to the OSI model.

| # | OSI layer name | Protocol |
|---|---|---|
| 4 | Transport | TCP, UDP |
| 3 | Network | IPv4[1], IPv6[1], ICMP[2], ARP |
| 2 | Data Link | IEEE 802.2 LLC Type 1/ LLC1 + SNAP[1], VLAN[1], PBB, MPLS-TP, MPLS, Ethernet[1] |
| 1 | Physical | Electrical / SFP / SFP+, 10 Mbps / 100 Mbps / 1000 Mbps / 10 Gbps, FDX / HDX |
| [1] Protocols can be excluded and the content changed.<br>[2] ICMP appears in case of Ping application. | | |

NOTE *Encapsulation affects the Ping and RFC2544/Router Latency test, i.e. Ping replies will only be sent if the Ping request contains the same encapsulation as the one selected.*

Touching **Close** will save your current settings and close the dialog. The settings done in dialog box will be reflected on the ports setup screen.

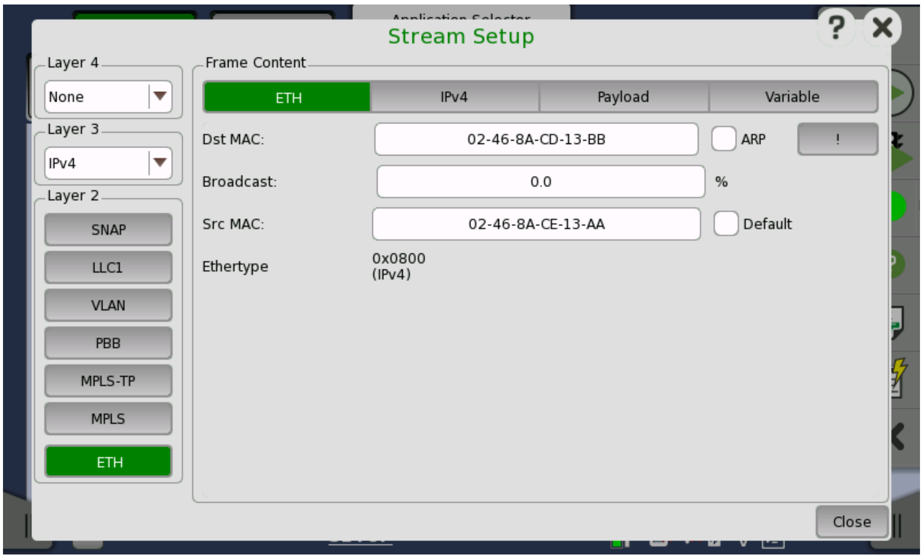
### Layer configuration parameters

The settings related to each layer are described in detail below. The following layer buttons are available:

- ETH (MAC header)
- MPLS-TP
- MPLS
- PBB
- VLAN
- LLC1
- SNAP
- IPv4

- IPv6
- UDP
- TCP
- Payload
- Variable

**ETH** Touching the **ETH** layer button displays the parameters available for the Ethernet header.




The Ethernet (MAC) header contains MAC addresses and Ethertype.

**Dst MAC**
The *Destination MAC address* can either be specified manually, or be decided based on an ARP lookup when IPv4 is set to Layer 3. To enable ARP, select the **ARP** checkbox to the right of the **Dst MAC** field.

The **!** button is an *instant ARP* button which when touched will perform an ARP lookup immediately, instead of waiting until the transmitter starts.

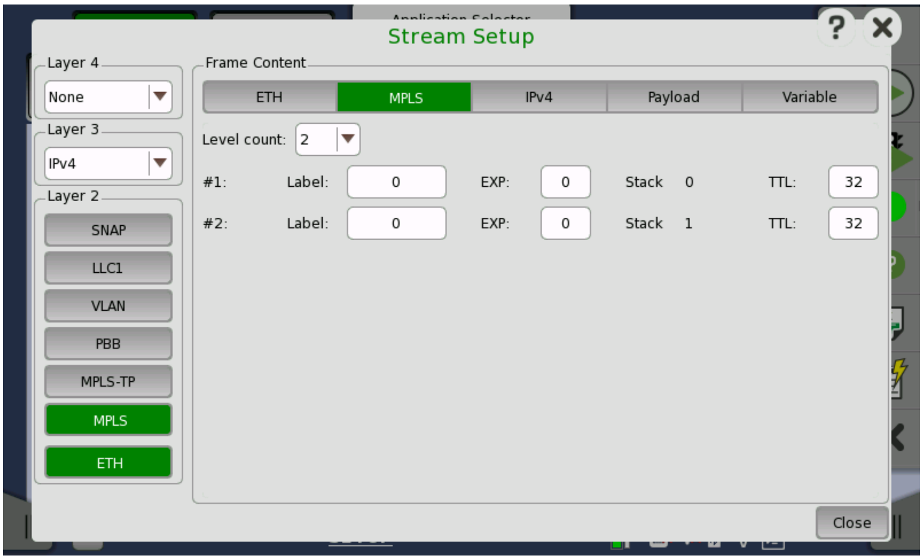
**Broadcast**
The *Broadcast Share* control is used to set the ratio between Unicast and Broadcast frames transmitting.

**Src MAC**
The *Source MAC address* can be specified manually, but the instrument comes with a default unique MAC address for each port.

If the **Default** checkbox is selected, the default unique MAC address is used.

**Ethertype**
When **IPv4** or **IPv6** is set to Layer 3, the Ethertype is automatically defined, based on the next protocol element. When **None** is set to Layer 3, it can be set between 0x05DD to 0xFFFF.

**MPLS** Touching the **MPLS** layer button displays the parameters available for the MPLS protocol layer.




**Level count**
Up to eight levels of MPLS fields can be inserted in the frame. The number of MPLS fields is selected through the **Level count** drop-down menu, and each level is set up individually.

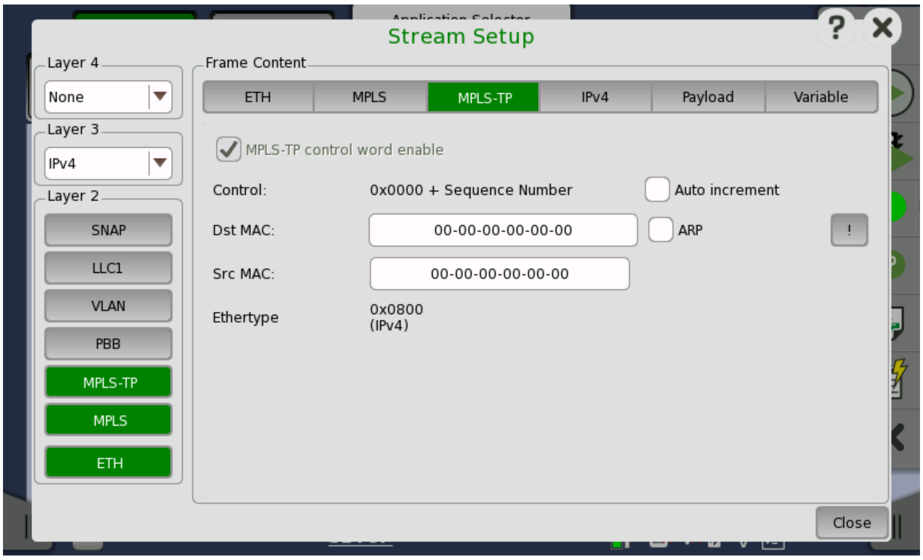
**Label**
Allows you to set up a denoting of the MPLS.

**EXP**
Allows you to set up the 3 bit value EXP (Experimental - used in MPLS to support differentiated services (priority)).

**TTL**
Allows you to set up the 8 bit value TTL (Time To Live).

**MPLS-TP**

Touching the **MPLS-TP** layer button displays the parameters available for the *MPLS-TP* protocol layer.




When MPLS-TP is active, a control word can be inserted in the frame.

NOTE

*When MPLS-TP is active the **ARP** button will be moved away from the primary Ethernet field.*

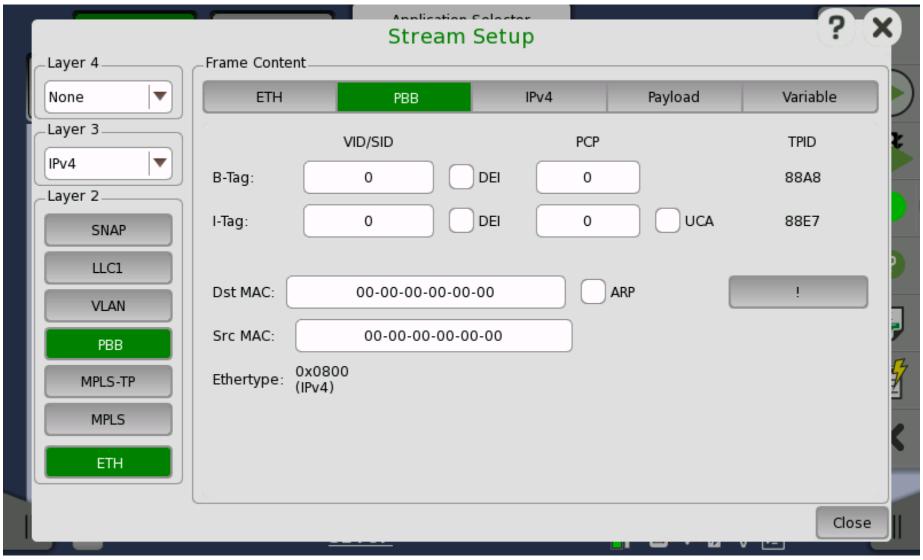
**Auto increment**

Selecting the **Auto increment** checkbox makes the sequence number in the RFC4448 control word increment automatically instead of being fixed to zero.

The remaining fields are described under the ETH layer.

**PBB**

Touching the *PBB* layer button displays the parameters available for the Provider Backbone Bridges (*MAC-in-MAC*) header.




**B-Tag**
Allows you to set a VLAN Identifier (**VID**), a Drop Eligible Indicator (**DEI**) and a Priority Code Point (**PCP**).
Displays a Tag Protocol Identifier (**TPID**).

**I-Tag**
Allows you to set a VLAN Identifier (**VID**), a Drop Eligible Indicator (**DEI**), a Priority Code Point (**PCP**) and a User Customer Address (**UCA**).
Displays a Tag Protocol Identifier (**TPID**).

**Dst MAC**
The *MAC-in-MAC destination address* can either be specified manually, or be decided based on an ARP lookup. To enable ARP, select the **ARP** checkbox to the right of the **Dst MAC** field.

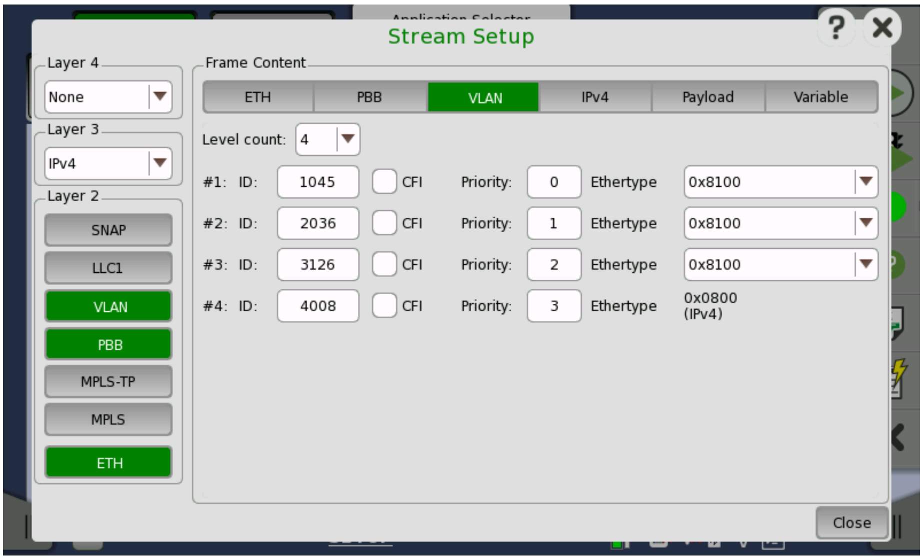
The **!** button is an *instant ARP* button which when touched will perform an ARP lookup immediately, instead of waiting until the transmitter starts.

**Src MAC**
Allows you to specify the *MAC-in-MAC source address*.

**Ethertype**
Shows the type automatically depending on layer configuration. If the value is selectable, select the value by touching the field.

**VLAN**

Touching the **VLAN** layer button displays the parameters available for the *Virtual LAN* protocol layer.




Virtual LAN (VLAN) is used to create independent logical networks within a physical network. When enabled, it adds a 16 bit IEEE 802.1Q field and a 16 bit Ethertype field to the header. The 802.1Q is separated into 3 parts.

NOTE *VLAN affects the Ping and RFC2544/Router Latency test, i.e. when VLAN is enabled, only frames with VLAN tag will be accepted. Furthermore, Ping replies will only be sent if the Ping request contains the same VLAN ID as the one selected.*

**Level count**

Up to eight levels of VLAN can be inserted in the frame. The number of VLAN fields is selected through the **Level count** drop-down menu, and each level is set up individually.

**ID**

Touching the **ID** (VLAN ID) button launches a setup dialog box from which it is possible to set up a denoting of the virtual LAN.

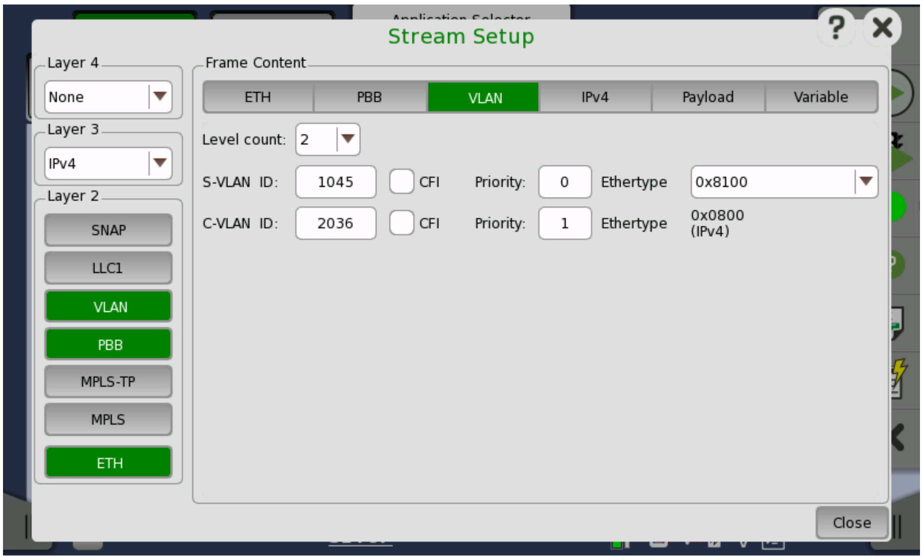
**CFI**

Selecting the **CFI** checkbox sets a 1-bit flag denoting whether MAC addresses inside the frame are in canonical format.

**Priority**

It is possible to set up the priority level of each frame.

NOTE *When the VLAN level count is 2, the two VLAN levels will be designated S-VLAN and C-VLAN. S-VLAN is short for Service provider VLAN and C-VLAN is short for Customer VLAN.*

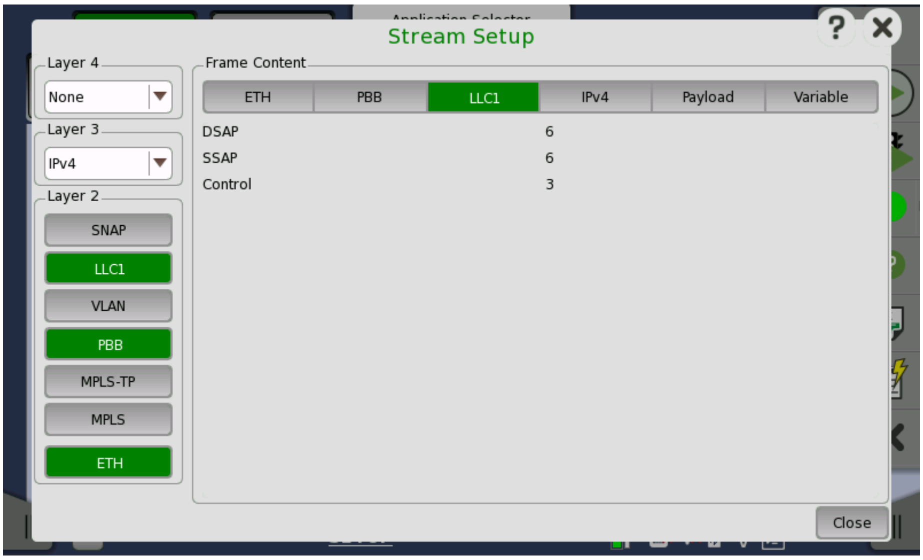



**Ethertype**
When the Level count is more than one, select the type from **0x8100**, **0x88A8**, **0x9100** or **0x9200**.

When **IPv4** or **IPv6** is set to Layer 3, the Ethertype of highest level is automatically defined, based on the next protocol element. When **None** is set to Layer 3, it can be set between 0x05DD to 0xFFFF.

**LLC1**

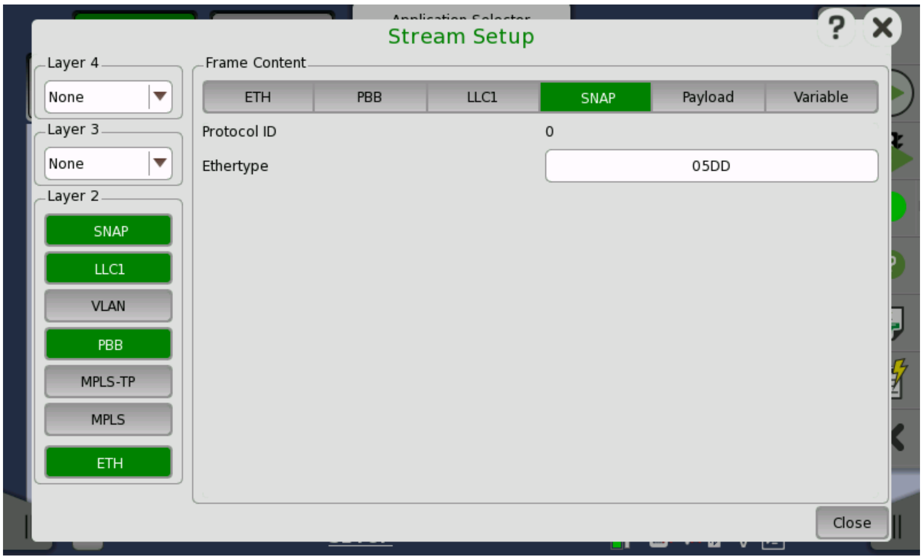
Touching the **LLC1** layer button displays the parameters available for the *Logical Link Control* protocol layer.




The **DSAP**, **SSAP** and **Control** fields are set automatically, based on the upper protocol layer.

**SNAP**

Touching the **SNAP** layer button displays the parameters available for the *SubNetwork Access Protocol* protocol layer.



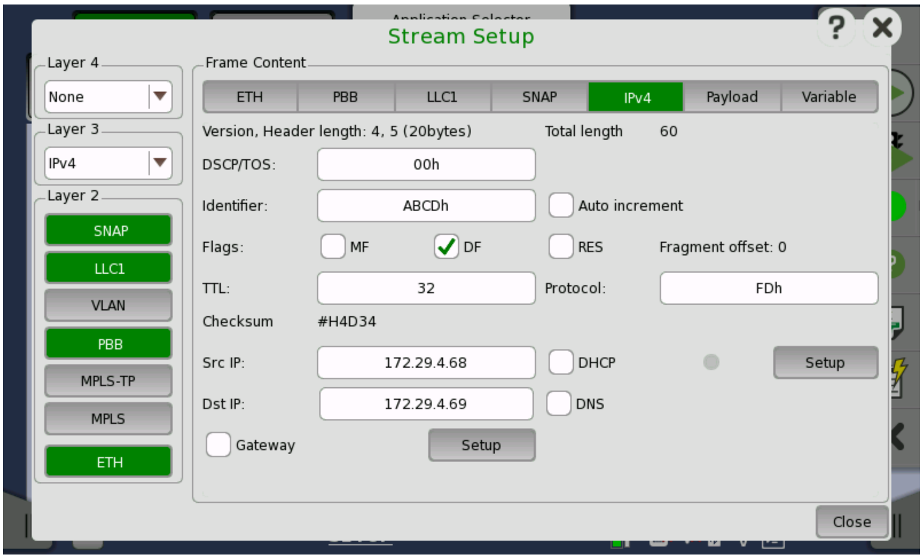

The **Protocol ID** is fixed to **0**, and the **Ethertype** field depends on the upper protocol layer.

NOTE

*'SNAP' is not possible without 'LLC1'.*

**IPv4**

Touching the **IPv4** layer button displays the parameters available for the *Internet Protocol version 4* layer.




**Version, Header length**
Shows Version and Header length in the IPv4 header.

**Total length**
Shows Total length in the IPv4 header.

**DSCP/TOS**
When changing the **DSCP/TOS** (Differentiated Service Code Point/Type of Service) setting it is possible to define some handling characteristics of the datagram, originally defined in RFC 791. Other uses of the **DSCP/TOS** setting are VoIP, DiffServ and ECN.

**Identifier**

The *Identifier* is mainly used for uniquely identifying fragments of an IP datagram. When the **Auto increment** checkbox is selected, the Identifier will be different for each sent frame.

**Flags, Fragment Offset**

- If the **MF** (More Fragments) flag is set: When a packet is fragmented, all fragments have the MF flag set except the last fragment.
- If the **DF** (Don't Fragment) flag is set: When fragmentation is required to route the packet then the packet will be dropped.
- **RES** (Reserved) must be zero (i.e. not set).

**TTL**
*TTL* (Time To Live) defines the number of 'hops' a datagram can do before it no longer is forwarded.

**Protocol**
The **Protocol** field defines the upper/next layer protocol encapsulated in the IP datagram. Typical values in hex are: *1 = ICMP*, *6 = TCP* etc.

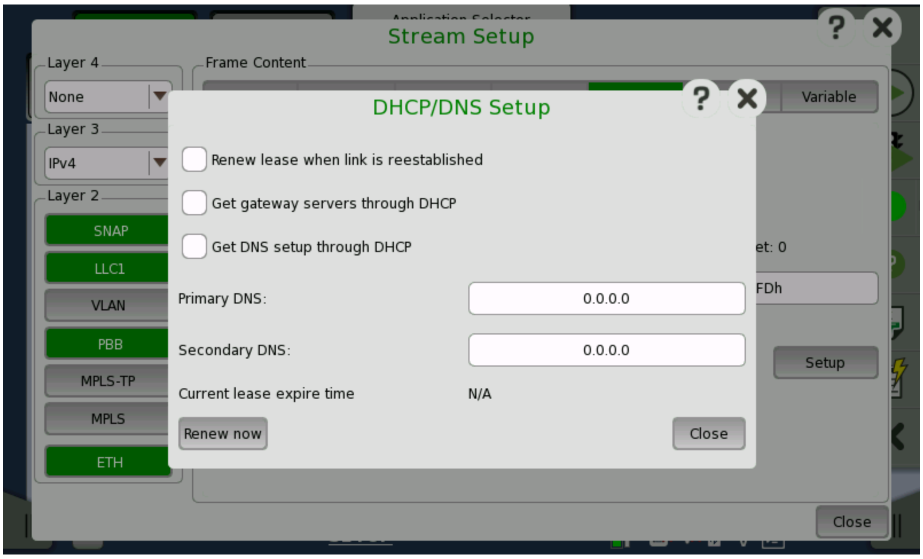
**Src IP/Dst IP**
*Source IP address* and *Destination IP address* can be entered using the format: *255.255.255.255*.

NOTE *When Multistream traffic is sent from one port to another, make sure that the source address on one port is the same as the destination address on the other port for each of the active streams. This applies both if the two ports are in one instrument and if they are in two different instruments.*

Selecting the **DHCP** checkbox located next to the **Src IP** field will enable the Dynamic Host Configuration Protocol function.

Selecting the **DNS** checkbox located next to the **Dst IP** field changes the field name to **Hostname**, allowing you to specify the domain name server.

Touching the **Setup** button next to the virtual Lamp in the **Src IP** line will open the **DHCP/DNS Setup** dialog box.

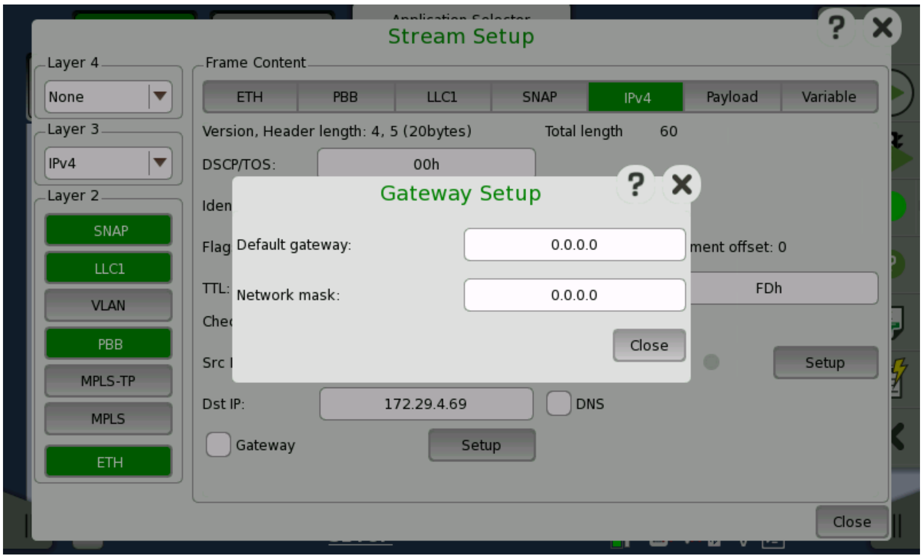



- Selecting the **Renew lease when link is reestablished** checkbox enables the function that automatically renews the lease when the link is reestablished.
- Selecting the **Get gateway servers through DHCP** checkbox enables the function that automatically assigns the gateway.
- Selecting the **Get DNS setup through DHCP** checkbox enables the function that automatically assigns the DNS server.

- **Primary DNS** and **Secondary DNS** allow you to define these IPv4 addresses for the specific stream.
- When allocating IP addresses using DHCP, it is 'leased' for a certain period of time defined by the network. The time when the lease expires is indicated as *Current lease expire time*.
- Touching the **Renew now** button will renew the allocation of the IP address.
- Touching the **Close** button closes the dialog box.

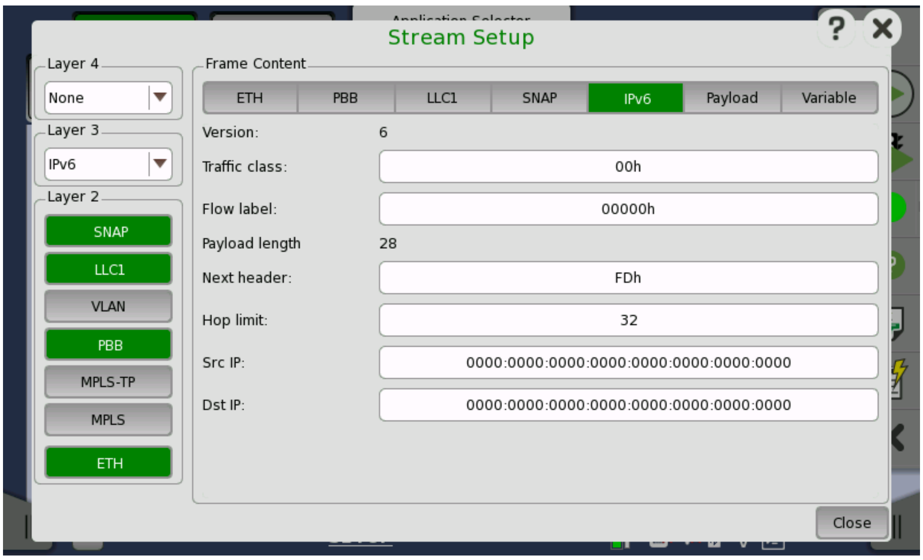
**Gateway/Network mask**
Select the **Gateway** checkbox to enable the use of a gateway. When gateway is enabled and the gateway/source address mask falls outside the network mask, an ARP lookup for the gateway IP address will be made. The resulting MAC address is used as destination. Gateway is usually used with ARP enabled as well.

Touching the **Setup** button next to the **Gateway** checkbox will open the **Gateway Setup** dialog box, in which you can set up the default gateway and/or the network mask.




**IPv6**

Touching the **IPv6** layer button displays the parameters available for the *Internet Protocol version 6* layer.



**Version**
Shows Version in the IPv6 header.

**Traffic class**
**Traffic class** is similar to IPv4's **DSCP/TOS** and is used for the class and priority. This is defined in RFC 2474.

**Flow label**
The *Flow label* indicates that the datagram belongs to a specific sequence of traffic between a source and destination. The default value is **0**.

**Payload length**
Shows Payload length in the IPv6 header.

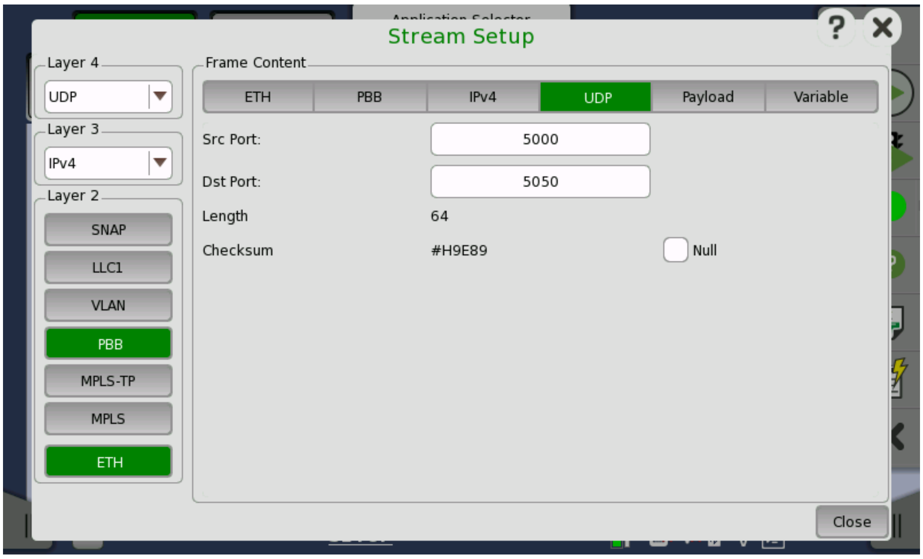
**Next header**
The *next header* indicates the upper/next layer protocol encapsulated in the IP datagram. Typical values in hex are: *1 = ICMP*, *6 = TCP* etc.

**Hop limit**
The *hop limit* defines the number of 'hops' a datagram can do before it no longer is forwarded.

**Src IP/Dst IP**
*Source IP address* and *Destination IP address* can be entered using the format *xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx* (32 Hex values).

**UDP**

Touching the **UDP** layer button displays the parameters available for the *User Datagram Protocol* layer.




*User Datagram Protocol* is a core protocol of the Internet protocol suite. The UDP provides a minimal and simple interface between a network layer below and a session layer or application above. This protocol does not guarantee reliable and in-order delivery from sender to receiver.

**Src Port**
*Source port* identifies the sending port and should be assumed to be the port to reply to if needed. If not used, then it should be zero.

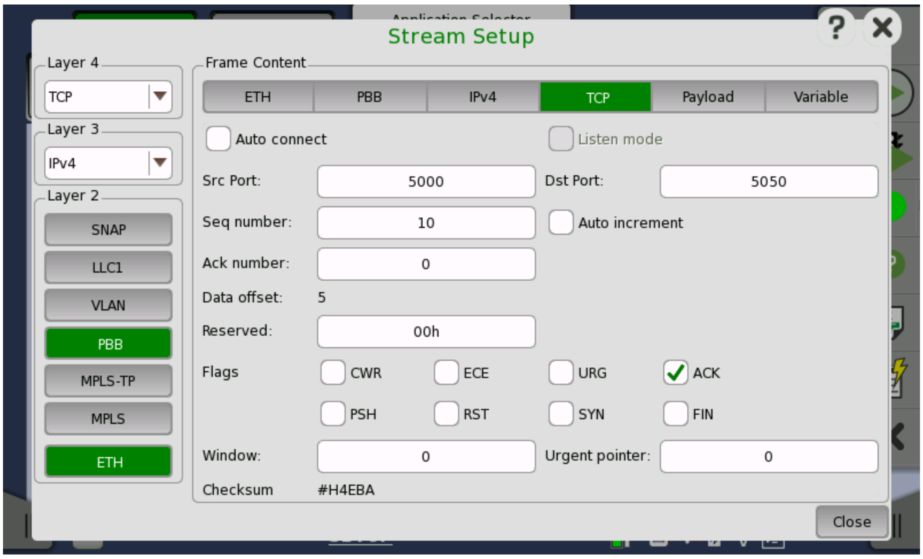
**Dst Port**
*Destination port* identifies the destination port and is required.

**Length**
Shows the packet length in bytes.

**Checksum**
Optionally, the Checksum may be forced to zero, by selecting the **Null** checkbox.

**TCP**

Touching the **TCP** layer button displays the parameters available for the *Transmission Control Protocol* layer.




*Transmission Control Protocol* is a core protocol of the Internet protocol suite. It is the intermediate layer between the Internet Protocol below it and the application above it. This protocol guarantees reliable and in-order delivery from sender to receiver.

The Network Master supports sending frames that resemble TCP frames, but the traffic transmitted will not constitute a real TCP stream, as no handshake is performed.

**Auto connect**
By enabling *Automatic TCP connect* it is possible to force the transmitter to establish a TCP connection before the actual traffic frames are sent. This makes it possible to pass a firewall/nat router from the inner side.

**Listen mode**
When *Listen mode* is enabled, the transmitter will await an external TCP connection before the actual traffic frames are sent. This makes it possible to pass a firewall/nat router from the other side (Remark: you must have something establishing the TCP connection from the inner side e.g. Network Master). In this mode the peers MAC, IP, and Port are taken from the incoming TCP connection.

**Src Port**
*Source port* identifies the sending port.

**Dst Port**
*Destination port* identifies the receiving port.

**Seq number**

- If the **SYN** flag is present, this is the initial sequence number and the first data byte is the sequence number plus 1.
- If the **SYN** flag is not present then the first data byte is the sequence number.

The **Auto increment** checkbox may be selected in order for the Sequence number to follow the number of data bytes sent (Remark: the first data byte will be number zero in this mode, and not the number entered into the **Seq number** field).

**Ack number**
If the **ACK** flag is set then the value of this field is the sequence number that the sender of the acknowledgment expects next.

**Data offset**
*Data offset* specifies the size of the TCP header in 32-bit words. This is set automatically.

**Reserved**
Reserved for future use and should be set to zero.

**Flags**
Contains 8 bit flags (control bits). The flags may be programmed individually, however when *Automatic TCP connect* is enabled, most of the flags are controlled by the TCP state engine.

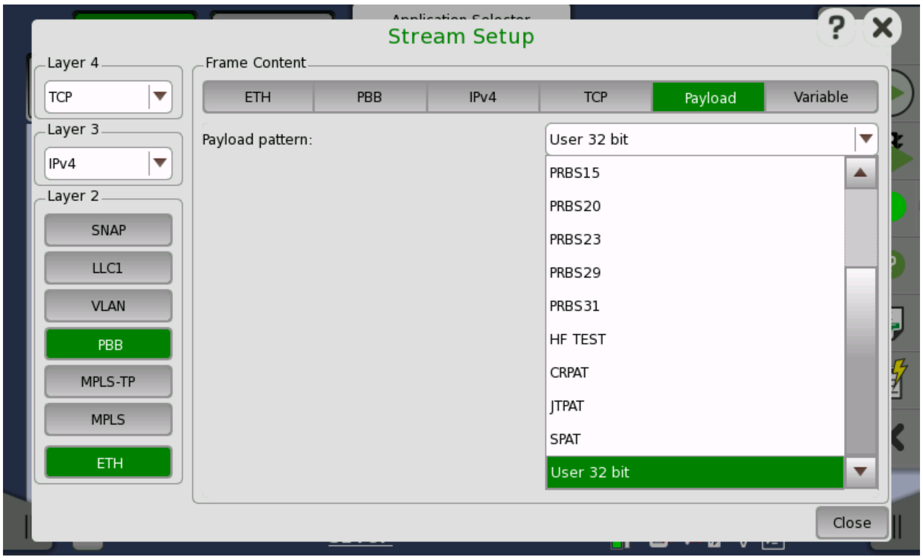
**Window**
Specifies the size of the *sliding window* (i.e. the maximum receiver buffer). The *window* defines the number of bytes that may be sent before waiting for an acknowledgement from the receiver.

**Checksum**
The 16-bit checksum field is used for error-checking of the header and data.

**Urgent pointer**
If the **URG** flag is set then this 16-bit field is an offset from the sequence number indicating the last urgent data byte.

**Payload**

The *Payload* layer allows you to set the pattern of the Payload of the transmitted frames.




Open the **Pattern** drop-down menu to select the relevant pattern.

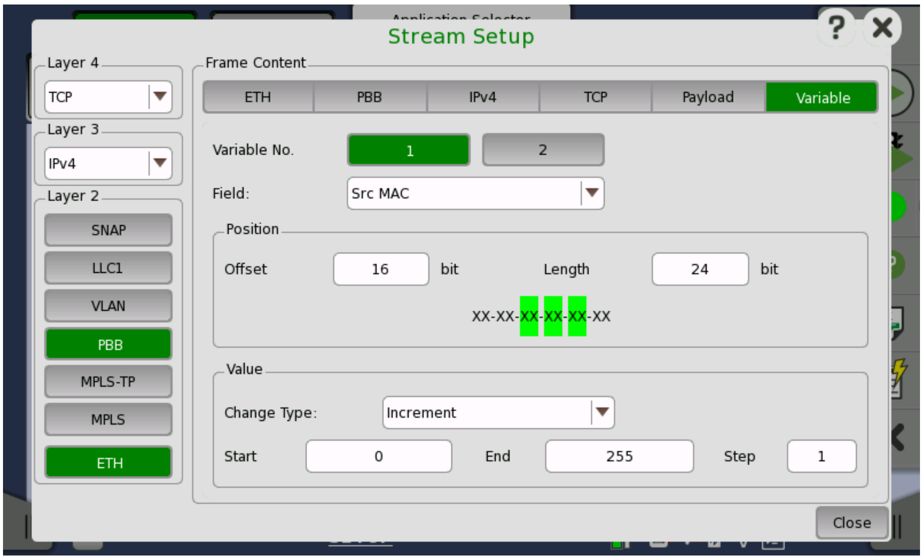
- **FOX**
- **5555**
- **PRBS9** to **PRBS31**
- **HF TEST**
- **CRPAT**
- **JTPAT**
- **SPAT**

- **User 32 bit**

If you select the **User 32 bit** pattern, a button appears with which you can open the **Pattern Editor** dialog box.

**Variable**

The *Variable* allows you to set variables in the transmitted frames.




**Variable No.**
Select which of the two variables you want to define.

**Field**
Use the drop-down menu to select the type of field. Note that the contents of the drop-down list depends on which protocol layers are currently chosen for the Ethernet frame.

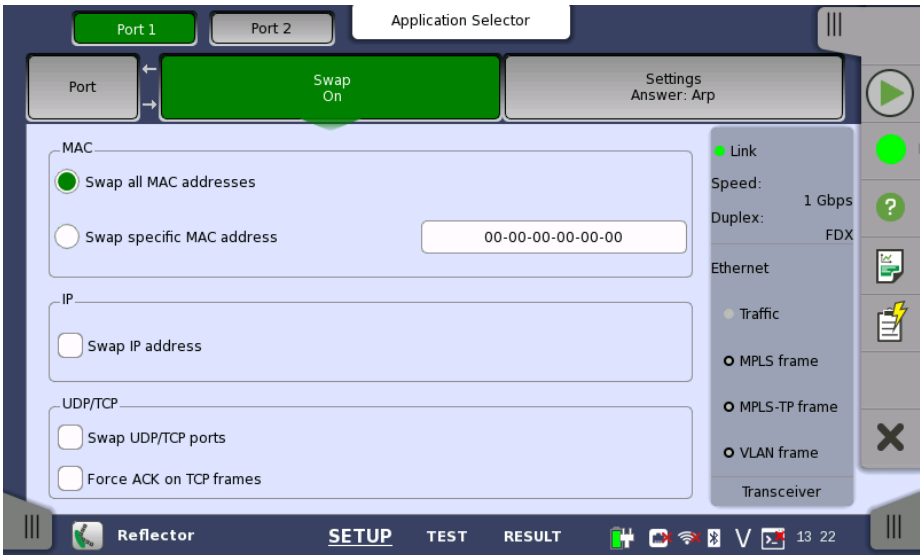
**Position**
Allows you to specify a bit position and bit length for the variable by **Offset** and **Length** field. The position of a variable is shown in green. XX means eight bits.

**Value**
Use the **Change Type** drop-down menu to specify how the variable will change: **Increment**, **Decrement** or **Random**.

Specify **Start** and **End** values for the variable, as well as the number of **Steps**.

### 6.1.2.2 Swap

Touching the **Swap** button in the navigation area displays the following screen. **Swap** button appears in Reflector application.



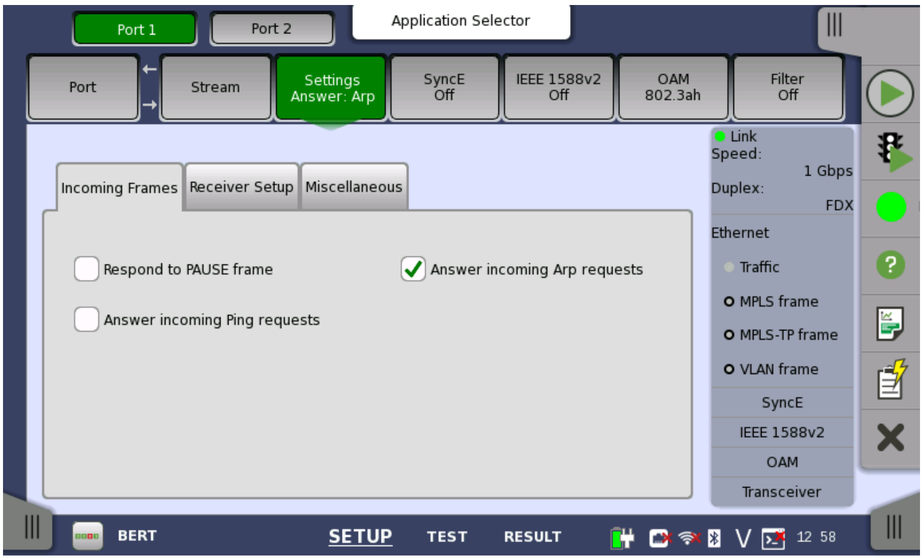

This screen is where you configure the traffic loop by specifying how addresses and/or ports are to be swapped and reflected.

Selecting **Swap all MAC addresses** will transmit/reflect all received frames with their MAC addresses swapped. Use **Swap specific MAC address** to swap and reflect only the frames with a specific MAC address.

The IP addresses and UDP/TCP ports may also be swapped inside the reflected frames. Additionally, the ACK flag may be forced set inside reflected TCP frames.

### 6.1.2.3 Settings

Touching the **Settings** button in the navigation area will display the screen shown below.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen allows you to specify how the Network Master handles incoming frames on the currently selected Ethernet port. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Incoming Frames**

**Respond to PAUSE frame**
Selecting this checkbox will force the transmitter to pause for a short period of time if a pause frame (defined in IEEE 802.3x) is received, e.g. in case of congestion of the foreign receiver.

**Answer incoming Arp requests**
When this function is *enabled*, the Network Master will reply to incoming ARP requests, using the Source MAC and IP addresses in sending out replies.

Note that when using the Ping application, this setting is ignored, and replies will always be sent - also from the passive port.

**Answer incoming Ping requests**
When this function is *enabled*, the Network Master will reply to ping requests, using the Source MAC and IP addresses in the replies.

Note that when using the Ping application, this setting is ignored, and replies will always be sent - also from the passive port.

## Receiver Setup

**Expected preamble length**
Allows you to specify the preamble length that the receiver should consider as 'normal' that is, non-erroneous). The default setting is **8** bytes. The range is from **3** to **15** bytes.

**Ignore preamble violations**
Select this checkbox if you want to ignore preamble violations.

**IFG lower threshold**
Allows you to specify the minimum allowed receiver interframe gap. The default setting is **12** bytes. The range is from **8** to **15** bytes.

**Filter IFG violations caused by master/slave clock synchronization**
Applies only to Gigabit mode, where the IFG will not be constant, which leads to a larger number of IFG violated frames than expected. Select this function to hide those violations.

**Jumbo frame size upper limit**
Allows you to specify the size of the Jumbo frames (that is, Ethernet frames longer than 1518 that are not counted as oversized/erroneous). The default setting is **9018** bytes. The range is from **1519** to **16000** bytes.

NOTE

*It is possible to let the currently selected port copy the setup from another port by selecting the 'Follows' checkbox and choosing the relevant port in the drop-down menu. Please note, however, that if the port is already itself being followed by another port, it cannot follow that port for the same parameters.*

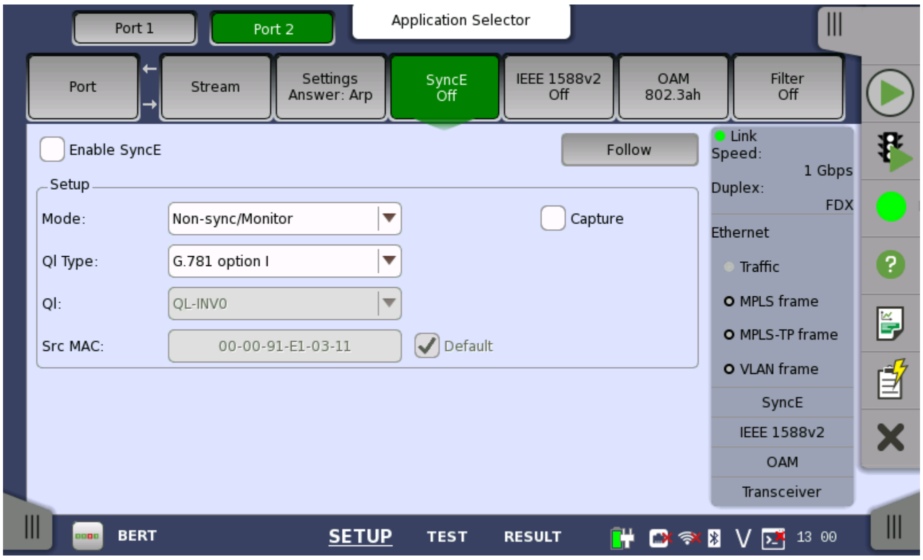
## Miscellaneous

**Allow changes to interface setup while a test is running**
Select this checkbox if you want to be able to make changes to the interface setup during a measurement.

**Compatible pattern with CMA3000**
Select this checkbox if you want the PRBS pattern for CMA3000 compatibility. (CMA3000 is the previous model of Network Master Pro.)

### 6.1.2.4 SyncE

Touching the **SyncE** button in the navigation area will display the screen shown below.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen allows you to configure the setup parameters related to Synchronous Ethernet. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Enable SyncE**
Select this checkbox to enable statistics of the quality level reported in the received ESMC (Ethernet Synchronization Messaging Channel) messages and the generation of Sync Alarm when such messages are missing.

NOTE

*Due to the properties of 10 Mbps Ethernet, the transfer of SyncE timing cannot be guaranteed at this rate.*

**Setup**

**Mode**

- **Non-sync/Monitor**: Does not transmit an ESMC message.
- **Synchronous**: Forces the quality levels specified in *QL* to be transmitted in an ESMC message every second.

**Ql Type**
Allows you to select a protocol/option. This changes the textual representation of the quality levels on the result- and status pages.

**Ql**
Allows you to specify the quality level to be indicated in the transmitted Ethernet signal.

Combination of Ql Type and Ql

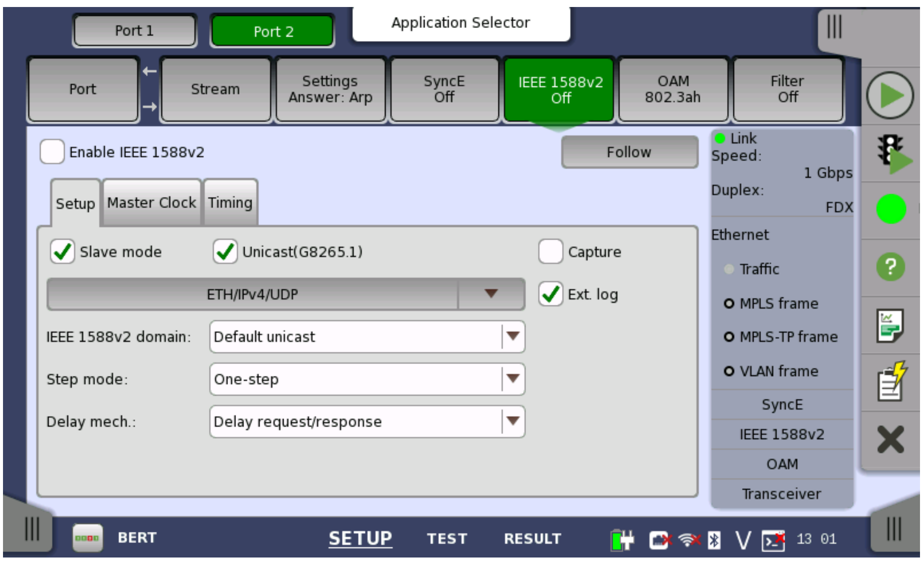
| G.781 option I | G.781 option II | G.781 option III | G.8264 |
|---|---|---|---|
| QL-INV0 | QL-STU | QL-UNK | QL-INV0 |
| QL-INV1 | QL-PRS | QL-INV1 | QL-INV1 |
| QL-PRC | QL-INV2 | QL-INV2 | QL-INV2 |
| QL-INV3 | QL-INV3 | QL-INV3 | QL-INV3 |
| QL-SSU-A | QL-TNC | QL-INV4 | QL-INV4 |
| QL-INV5 | QL-INV5 | QL-INV5 | QL-INV5 |
| QL-INV6 | QL-INV6 | QL-INV6 | QL-INV6 |
| QL-INV7 | QL-ST2 | QL-INV7 | QL-INV7 |
| QL-SSU-B | QL-INV8 | QL-INV8 | QL-INV8 |
| QL-INV9 | QL-INV9 | QL-INV9 | QL-INV9 |
| QL-INV10 | QL-ST3 | QL-INV10 | QL-EEC2 |
| QL-SEC | QL-INV11 | QL-SEC | QL-EEC1 |
| QL-INV12 | QL-SMC | QL-INV12 | QL-INV12 |
| QL-INV13 | QL-ST3E | QL-INV13 | QL-INV13 |
| QL-INV14 | QL-PROV | QL-INV14 | QL-INV14 |
| QL-DNU | QL-DUS | QL-INV15 | QL-INV15 |

**Src MAC**
Allows you to specify the MAC address to be used in ESMC messages. You can either use the **Default** checkbox to force an instrument-specific default value, or touch the address field to enter an address yourself.

**Capture**
Selecting this checkbox enables recording of ESMC messages.

### 6.1.2.5 IEEE 1588v2

Touching the **IEEE 1588v2** button in the navigation area will display the screen shown below.
**Follow** button appears when the Port 1 settings can be copy to Port 2.



This screen allows you to configure the IEEE 1588 clock (based on the IEEE 1588 Precision Time Protocol (PTP), which is used to distribute absolute time across the Ethernet network). An IEEE 1588 clock can act either as a timing master or as a slave. The screen also contains information about the current status of the selected port.

The clock may be set up in either normal or unicast mode. In unicast mode the clock must be explicitly told whether it is a master or a slave, and the clock must never change away from this setup automatically.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

The setup area of this screen contains the following groupings of parameters, placed on separate tab pages:

- General setup parameters
- Master clock specific parameters
- Timing-specific parameters

**Enable IEEE 1588v2**
Select this checkbox to start the clock. The settings of the **Slave mode** and **Unicast** checkboxes below will determine whether the clock runs as a slave or will become the grandmaster clock.

NOTE

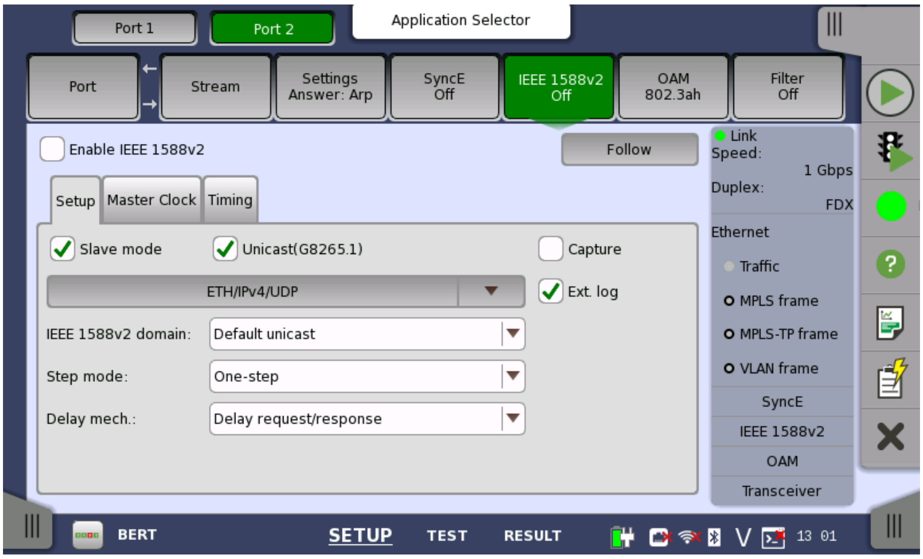
*When the Network Master becomes a grandmaster, and if the internal clock is selected (or if the GPS is not available), the IEEE 1588 clock is set from the Network Master's internal time (offset by the selected UTC offset). This action only takes place when the clock is restarted (e.g. disable/enable the clock will force this).*

NOTE

*When the Network Master is grandmaster in unicast mode, only one slave will be accepted at a time. Other slaves are just ignored.*

## Setup tab page

The **Setup** tab page contains the general setup parameters for IEEE 1588v2.




**Slave mode**
Used to specify that the port can only act as a slave clock. Used in both multicast (normal) and unicast mode.

**Unicast(G.8265.1)**

Used to enable the unicast profile. For domains 0 to 3 static unicast is enabled. For domains 4 to 23 the Telecom Profile (ITU-T G.8265.1 IEEE 1588 v2 profile for telecommunication) is used.

NOTE *If Slave mode is checked, the clock will always run as a slave in both normal and unicast mode. If Slave mode is not checked in normal mode, the best master clock algorithm is run and the result of this will determine if the Network Master can become a grandmaster clock. In unicast mode, if the Slave mode is not checked, the Network Master will become a grandmaster clock.*

**Capture**
Used to capture the packets concerning IEEE 1588 v2 protocol. The captured packet data are saved to file with extension "pcap".

**Ext. Log**
Used to record the external log. If you select this, the **IEEE1588v2 Log** button appears in the navigation area of Test Result.

**IEEE 1588v2 domain**
Allows you to select between some predefined domains. Depending on other settings different Multicast / unicast MAC and IP destination address will be used. For multicast domains from 0 to 3 may be used, and for unicast domains 4 to 23 may be used.

NOTE *In multicast mode please review the attributes in the timing section when changing the domain. Otherwise the best master algorithm may fail for all IEEE 1588v2 clocks in the domain.*

**Step mode**
Allows you to choose between the two step modes: **One-step** and **Two-step**.

- **One-step**: The transmitted timestamp of a frame is inserted into the frame itself.
- **Two-step**: The timestamp is sent in a follow-up message.

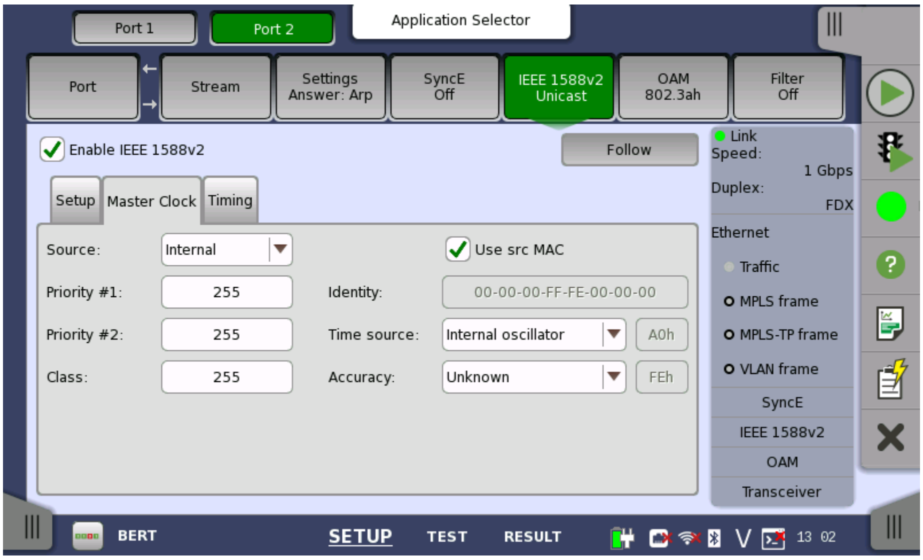
**Delay mech.**
Allows you to choose which mechanism to use for calculating the mean path delay: **Delay request/response** or **Peer delay**.

**Transport protocol**

You can set up the transport protocol(s) for PTP messages either by selecting one of the predefined configurations from the *quick selection menu* (e.g. **ETH/VLAN/IPv4/UDP**) or by configuring the protocols via the *detailed mode* dialog box. Touching the protocol button will launch the *detailed mode* dialog box (the IEEE 1588v2 Protocol dialog box). Touching the arrow to the right of the button will open the *quick selection menu*.

### Master Clock tab page

The **Master Clock** tab page contains the parameters related to the clock-specific setup. Note that it is not enabled if the port is set in Slave Mode.




**Source**
Allows you to specify where the time of the clock should come from.

- **Internal** (Current instrument time)
- **GPS** (Requires external GPS Sensor)

**Priority #1/#2**
Allows you to specify the priority 1 and priority 2 values. Acceptable values are between **0** and **255**.

**Class**
Allows you to specify the clock class. Acceptable values are between **0** and **255**.

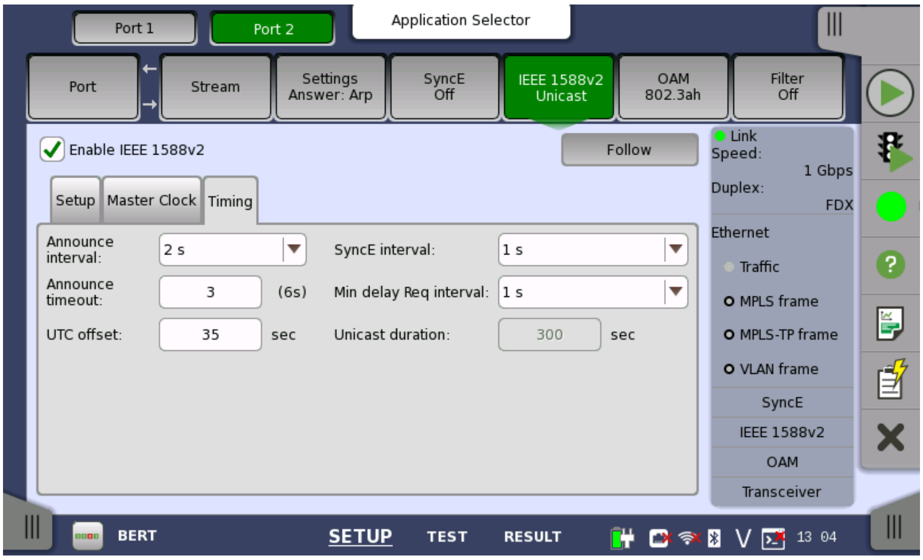
**Identity**
Allows you to specify the 64 bit clock identity. You can either use the Source MAC to generate the identity (by selecting the **Use src MAC** checkbox) or you can type the identity yourself (using the address field).

**Time source**
Either choose one of the predefined time sources in the drop-down menu, or select **User defined** and enter a value manually. Acceptable values are between **0x00** and **0xFF**.

**Accuracy**
Either choose one of the predefined accuracies in the drop-down menu, or select **User defined** and enter a value manually. Acceptable values are between **0x00** and **0xFF**.

## Timing tab page

The **Timing** tab page contains the timing-specific parameters.




*In multicast mode it is important that all IEEE 1588v2 clocks in the same domain uses the same announce interval and announce timeout values. Otherwise the best master algorithm may fail. Synch interval and minimum delay request interval should also match the domain.*

**Announce interval**
Allows you to specify the interval between transmitted announce messages. Available values are between **1/8 s** and **32 s**.

**Announce timeout**
Allows you to specify the number of missed announce intervals before announce timeout. Acceptable values are between **2** and **255**.

**Sync interval**
Allows you to specify the interval between transmitted sync messages. Available values are between **1/128 s** and **32 s**.

**Min delay Req. interval**
Allows you to specify the minimum interval between transmitted delay request messages. Available values are between **1/16 s** and **32 s**.

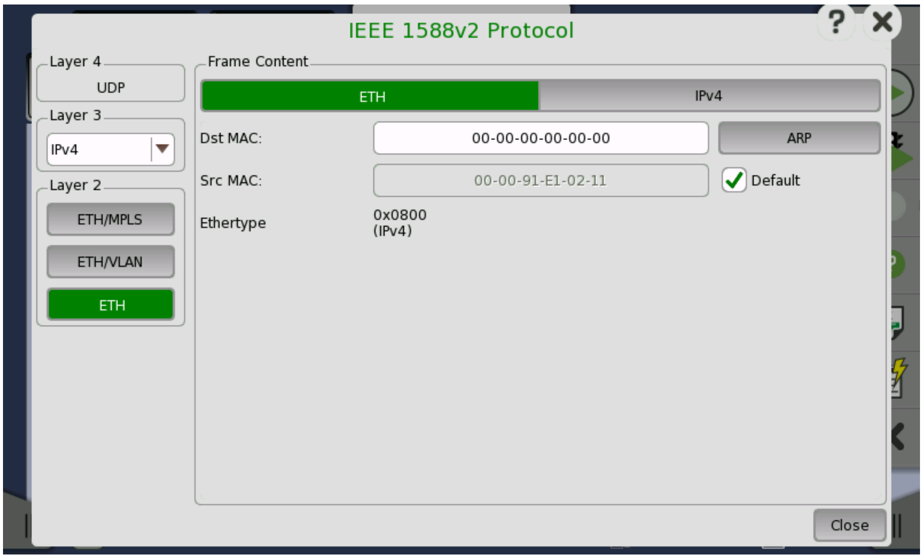
**Unicast duration**
In unicast slave mode you ask a master to emit announce, sync and delay response messages for some time. This setting is enabled when IEEE 1588v2 domain is set to **Default unicast** or **5** to **23**. After this period the master forgets everything about your request. The Unicast Duration is this period in seconds. Legal values are from **60** to **1000** seconds. A Network Master unicast slave will renew the request 10 seconds before timeout.

**UTC offset**
Defines the offset between the internal clock or UTC and TAI. This value is used when converting the internal time or a GPS based UTC time to TAI based time, which is used in an IEEE 1588 clock. The correct UTC/TAI offset value changes when leap seconds are applied to the UTC time. When the internal clock is used as reference, this offset should also include a correction of the time zone and daylight saving time.

*It is possible to let the Port 2 copy the setup from Port 1 by touching the 'Follows' button. This button appears when you can copy the Port 1 settings to Port 2.*

**Transport Protocol**

The **IEEE 1588v2 Protocol** dialog box is launched by touching the protocol button on the *Setup* tab page. The dialog box allows you to configure the protocols in *detailed mode*.




In the **IEEE 1588v2 Protocol** dialog box the buttons on the left-hand side allow you to select the relevant layers. The current selection is shown at the top of the **Frame Content** area. Touching one of the layer buttons in the **Frame Content** area will display the setup parameters for that layer.

The following layers and parameters are available:

**ETH layer**
When **None** is set to the Layer 3, you can set **Src MAC** only.

- **Dst MAC** - Type in the destination MAC address to be used with all PTP unicast frames. Use the **ARP** button to solve any MAC setup in connection with IPv4.
- **Src MAC** - Type in the source MAC address to be used with all PTP frames. Select **Default** to use the default MAC that comes with the Ethernet port.
- **Ethertype** - Ethernet type is user-selectable only in case of VLAN use.

**VLAN layer**
Select the number of levels using **Level count** drop down menu.

For each level select **ID**, **CFI**, **Priority**, and **Ethertype**.

**MPLS layer**
Select the number of levels using **Level count** drop down menu.

For each level select **Label**, **EXP**, and **TTL**. **Stack** displays the stack bit.

**IPv4 layer**

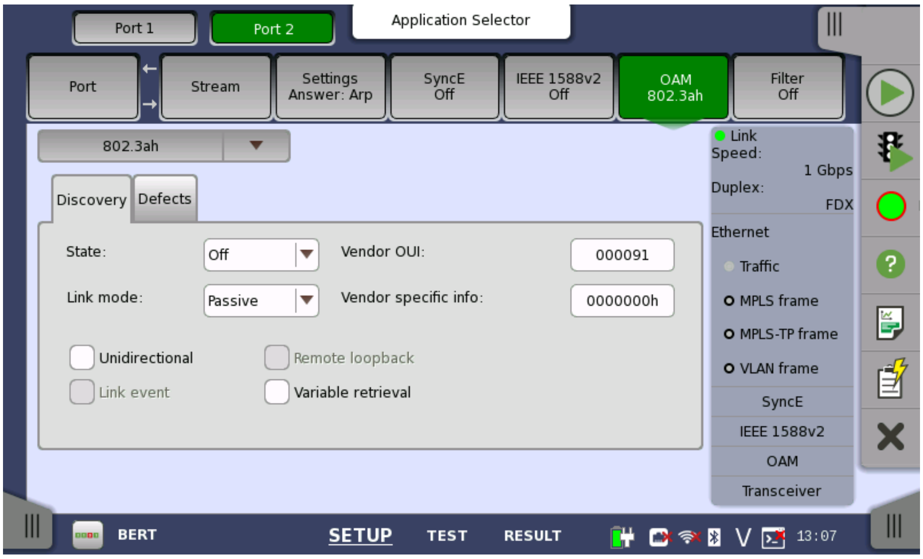
- **Src IP** - Type in the IPv4 source address.
- **Dst IP** - In unicast mode type in the IPv4 destination address.
- **DSCP(PTP events message)** and **DSCP(PTP other message)** - Set the DSCP value to be used for transmitted PTP event frames and a value for all other PTP frames. Acceptable values are between 0x00 and 0x3F.

**IPv6 layer**

- **Src IP** - Type in the IPv6 source address.
- **Dst IP** - In unicast mode type in the IPv6 destination address.
- **Multicast scope** - Select one of the predefined IPv6 multicast scope values or choose **User defined** to manually enter a value. Acceptable values are between 0x0 and 0xF.

### 6.1.2.6 OAM

Touching the **OAM** button in the navigation area will display the screen shown below.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




OAM (Operation, Administration and Management) is a group of management functions that provides system or network fault indication, performance monitoring, security management, diagnostic functions, configuration and user provisioning.

This screen allows you to configure the OAM application (i.e. the OAM functions). It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

The setup parameters are grouped according to protocol. Use the **Protocol** drop-down menu to select the relevant protocol.

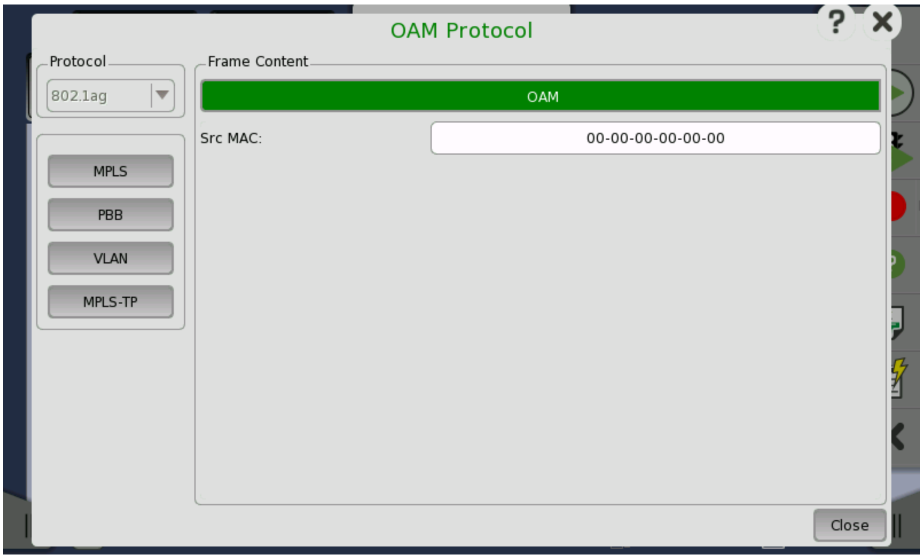
NOTE

*To change to a different protocol, the state of the current protocol must be set to 'Off'.*

- 802.3ah protocol - Applies to the connectivity of point-to-point connections across one hop.
- 802.1ag protocol - Applies to the connectivity of bridges and paths that pass through bridges. Handles both multipoint connections and point-to-point connections.
- Y.1731 protocol - An extension to the 802.1ag standard and relies upon the 802.1ag protocol for transport. Applies to both multipoint and point-to-point connections.

In addition, the 802.1ag and Y.1731 protocol screens contain a special Discovery setup.

**OAM Protocol**




In the **OAM Protocol** dialog box the buttons on the left-hand side allow you to select the relevant layers. The current selection is shown at the top of the **Frame Content** area. Touching one of the layer buttons in the **Frame Content** area will display the setup parameters for that layer.

The following layers and parameters are available:

**OAM layer**
**Src MAC** -The MAC address of the source that sends the OAM Protocol Data Units, which is a unicast address.

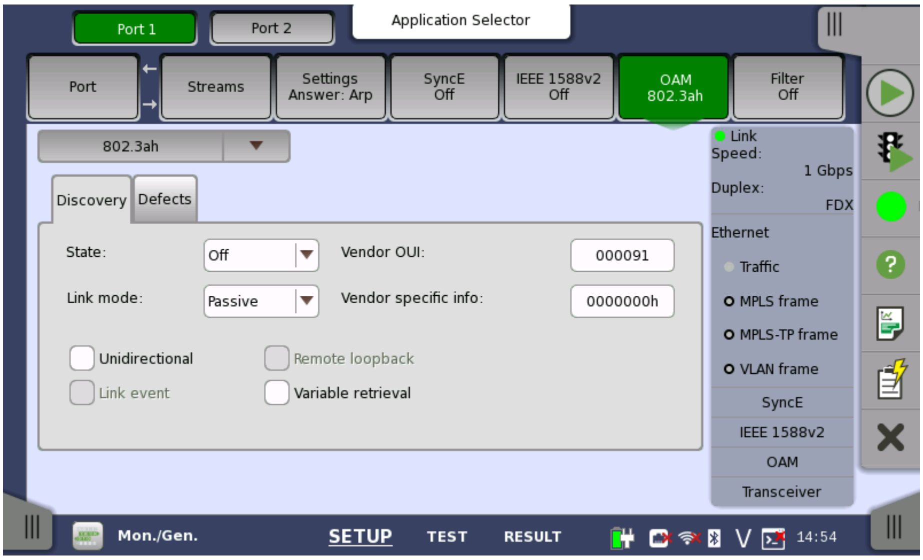
**PBB layer**
Refer to PBB in "Stream" subsection.

**VLAN layer**
Refer to VLAN in "Stream" subsection.

**MPLS, MPLS-TP layer**
Refer to MPLS in "Stream" subsection.

**802.3ah protocol setup**

Selecting the **802.3ah** protocol will display the screen shown below.




## Discovery tab page

The **Discovery** tab page contains the following parameters:

**State**
Allows you to set the state of the protocol to either **On** or **Off**. Note that when **State** is set to **On**, the *Link mode*, *Vendor OUI* and *Vendor specific info* parameters are disabled.

**Link mode**
Allows you to set the DTEs to **Active** or **Passive** mode. *Active* DTEs initiate the exchange of information, while *passive* DTEs react to the initiation by the remote DTE. Note that active DTEs operate in a limited respect if the remote OAM entity is in passive mode.

**Vendor OUI**
Allows you to specify the 24-bit Organizationally Unique Identifier of the vendor. Touch the field to launch an editor dialog box.

**Vendor specific info**
Allows you to specify a 28-bit identifier that may be used to differentiate a vendor's product models/versions. Touch the field to launch an editor dialog box.

**Unidirectional**
Select this checkbox to make the device operate in unidirectional transmission mode.

**Link event**
This setting is reserved for future use and cannot be set.

**Remote loopback**
This setting is reserved for future use and cannot be set.

**Variable retrieval**
Select this checkbox to make the DTE support sending Variable Response OAMPDUs.

### Defects tab page

The **Defects** tab page allows you to enable/disable local defects.

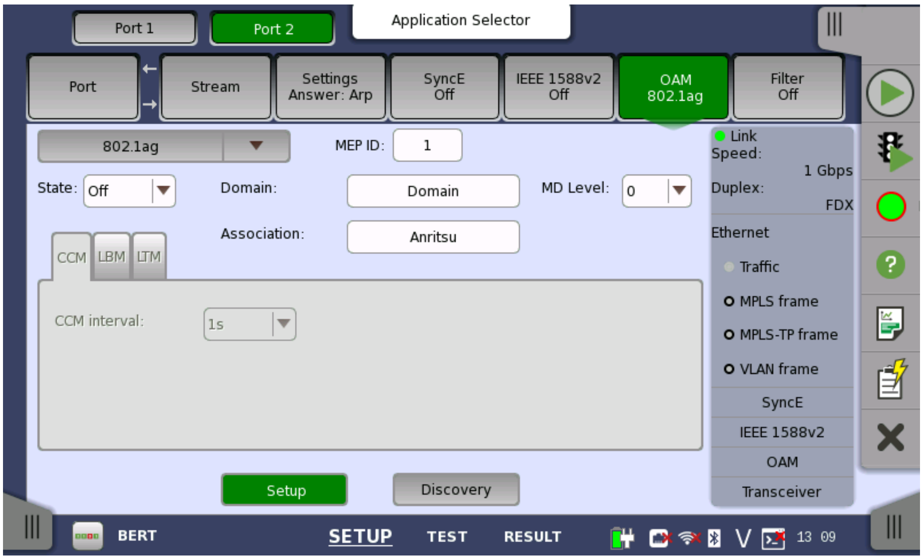
**Link fault**
Select this checkbox to enable a message if the PHY determines that a fault has occurred on the receive direction of the local DTE.

**Dying gasp**
Select this checkbox to enable a message if an unrecoverable local failure condition has occurred.

**Critical event**
Select this checkbox to enable a message if an unspecified critical event has occurred.

**802.1ag protocol setup**

Selecting the **802.1ag** protocol will display the screen shown below.




The screen contains two views: the default Setup view and the Discovery view. Use the **Setup** and **Discovery** buttons at the bottom of the screen to switch between the two views.

The Setup view is described below. The Discovery view is described in a separate section.

## General parameters

**State**
Allows you to set the state of the protocol to either **On** or **Off**. Note that when **State** is set to **On**, the other general parameters are disabled, but the tab pages and their contents are enabled.

**MEP ID**
Allows you to specify the Local Maintenance Point ID, which will identify the unit in the MA.

**Domain**
Allows you to identify the network or part of the network for which faults in connectivity are managed.

**MD Level**
Use the drop-down menu to specify the level at which the MEP exists.

**Association**
Allows you to specify the Main Association Identifier.

## CCM tab page

The **CCM** tab page contains the following parameter:

**CCM interval**
Use the drop-down menu to specify the frequency at which CCMs are transmitted and expected to be received.

## LBM tab page

The **LBM** tab page contains the following parameters:

**Optional TLV**
Use the drop-down menu to select a TLV type, if relevant. The possible types are: **Data TLV** and **Test TLV**. If you select one of the TLV types, fields for specifying the length and value will appear.

**Length**
Only available if a Data or Test TLV type has been selected. Allows you to specify the length of the TLV.

**Value**
Only available if a Data or Test TLV type has been selected. Allows you to specify the value of the TLV. Note that for the Data TLV type, this field is an entry field where you open an editor and type the value; for the Test TLV type, it is a drop-down menu.

## LTM tab page

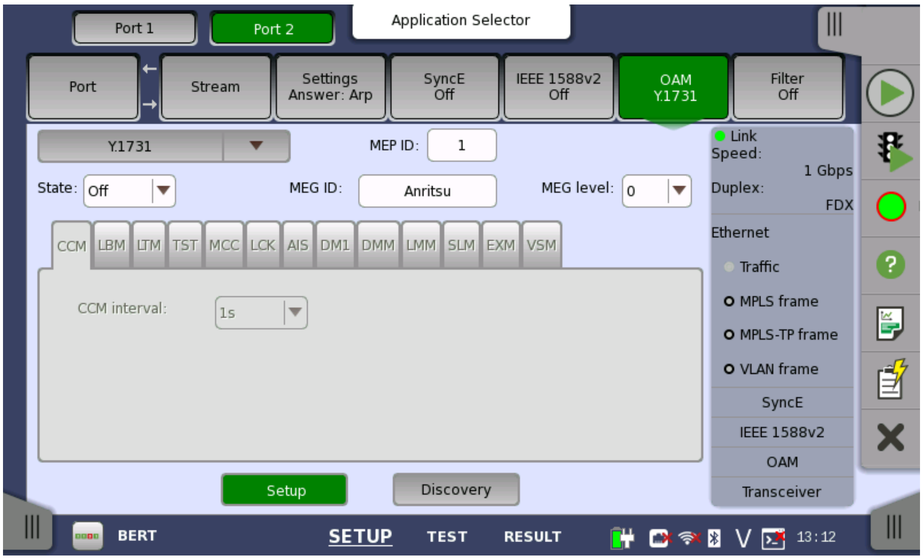
The **LTM** tab page contains the following parameters:

**TTL**
Allows you to specify a TTL value. Used to indicate whether or not an LTM should be terminated by the receiver.

**Trans ID**
Allows you to specify the transaction number for the LTM.

**Y.1731 protocol setup**

Selecting the **Y.1731** protocol will display the screen shown below.




The screen contains two views: the default Setup view and the Discovery view. Use the **Setup** and **Discovery** buttons at the bottom of the screen to switch between the two views.

The Setup view is described below. The Discovery view is described in a separate section.

## General parameters

**State**
Allows you to set the state of the protocol to either **On** or **Off**. Note that when **State** is set to **On**, the other general parameters are disabled, but the tab pages and their contents are enabled.

**MEP ID**
Allows you to specify the Local Maintenance Point ID, which will identify the unit in the MEG.

**MEG ID**
Allows you to identify the MEG to which the MEP belongs.

**MEG level**
Use the drop-down menu to specify the MEG level at which the MEP exists.

### CCM tab page

The **CCM** tab page contains the following parameter:

**CCM interval**
Use the drop-down menu to specify the frequency at which CCMs are transmitted and expected to be received.

### LBM tab page

The **LBM** tab page contains the following parameters:

**Optional TLV**
Use the drop-down menu to select a TLV type, if relevant. The possible types are: **Data TLV** and **Test TLV**. If you select one of the TLV types, fields for specifying the ID will appear.

**Length**
Only available if a Data or Test TLV type has been selected. Allows you to specify the length of the TLV.

**Value**
Only available if a Data or Test TLV type has been selected. Allows you to specify the value of the TLV. Note that for the Data TLV type, this field is an entry field where you open an editor and type the value; for the Test TLV type, it is a drop-down menu.

### LTM tab page

The **LTM** tab page contains the following parameters:

**TTL**
Allows you to specify a TTL value. Used to indicate whether or not an LTM should be terminated by the receiver.

**Trans ID**
Allows you to specify the transaction number for the LTM.

### TST tab page

The **TST** tab page contains the following parameters:

**Frames to send**
Allows you to specify the number of frames to be transmitted.

**Rate**
Use the drop-down menu to select the rate at which frames are transmitted.

**Optional TLV**
Use the drop-down menu to select the **Test TLV** type, if relevant. Fields for specifying the length and value will then appear.

**Length**
Only available if the Test TLV type has been selected. Allows you to specify the length of the TLV.

**Value**
Only available if the Test TLV type has been selected. Use the drop-down menu to select the value of the TLV.

### MCC tab page

The **MCC** tab page contains the following parameters:

**OUI**
Allows you to specify the Organizationally Unique Identifier for the organization defining a specific format and meaning of ETH-MCC.

**Data**
Allows you to specify any required additional information. The type of information depends on the specific application of ETH-MCC.

### LCK tab page

The **LCK** tab page contains the following parameters:

**Client MEG level**
Allows you to specify the MEG level of the client MEG.

**LCK rate**
Use the drop-down list to select the rate of the LCK frames being transmitted.

### AIS tab page

The **AIS** tab page contains the following parameters:

**Client MEG level**
Allows you to specify the MEG level of the client MEG.

**AIS rate**
Use the drop-down menu to select the rate of the AIS frames being transmitted.

### DM1 tab page

The **DM1** tab page contains the following parameters:

**Type**
Use the drop-down menu to select the relevant operation type (**On-demand operation** or **Proactive operation**). The same DM1 frame format can be used for both.

**Rate**
Use the drop-down menu to select the rate at which DM1 frames are transmitted.

**Frames to send**
Allows you to specify the number of frames to transmit.

**Optional TLV**
Use the drop-down menu to select a TLV type, if relevant. The possible types are: **Data TLV** and **Test TLV**. If you select one of the TLV types, fields for specifying the ID will appear.

**Length**
Only available if a Data TLV type has been selected. Allows you to specify the length of the TLV.

**Value**
Only available if a Data TLV type has been selected. Allows you to specify the value of the TLV. Note that for the Data TLV type, this field is an entry field where you open an editor and type the value.

**ID**
Only available if a Test TLV type has been selected. Allows you to specify the value of the ID.

### DMM tab page

The **DMM** tab page contains the following parameters:

**Type**
Use the drop-down menu to select the relevant operation type (**On-demand operation** or **Proactive operation**).

**Rate**
Use the drop-down menu to select the rate at which DMM frames are transmitted.

**Frames to send**
Allows you to specify the number of frames to transmit.

**Delay threshold**
Allows you to specify a delay threshold that is used when a DMM test is active. If the delay meets or exceeds that threshold, the user is alerted.

**Optional TLV**
Use the drop-down menu to select a TLV type, if relevant. The possible types are: **Data TLV** and **Test TLV**. If you select one of the TLV types, fields for specifying the ID will appear.

**Length**
Only available if a Data TLV type has been selected. Allows you to specify the length of the TLV.

**Value**
Only available if a Data TLV type has been selected. Allows you to specify the value of the TLV. Note that for the Data TLV type, this field is an entry field where you open an editor and type the value.

**ID**
Only available if a Test TLV type has been selected. Allows you to specify the value of the ID.

### LMM tab page

The **LMM** tab page contains the following parameters:

**Rate**
Use the drop-down menu to select the rate at which LMM frames are transmitted.

**Frames to send**
Allows you to specify the number of frames to transmit.

**Loss threshold**
Allows you to specify a loss threshold that is used when an LMM test is active. If the loss ratio meets or exceeds that threshold, the user is alerted.

### SLM tab page

The **SLM** tab page contains the following parameters:

**Rate**
Use the drop-down menu to select the rate at which SLM frames are transmitted.

**Frames to send**
Allows you to specify the number of frames to transmit.

**Loss threshold**
Allows you to specify a loss threshold that is used when an SLM test is active. If the loss ratio meets or exceeds that threshold, the user is alerted.

### EXM tab page

The **EXM** tab page contains the following parameter:

**Data**
Allows you to specify a string which you can send in a message to other remote maintenance points.

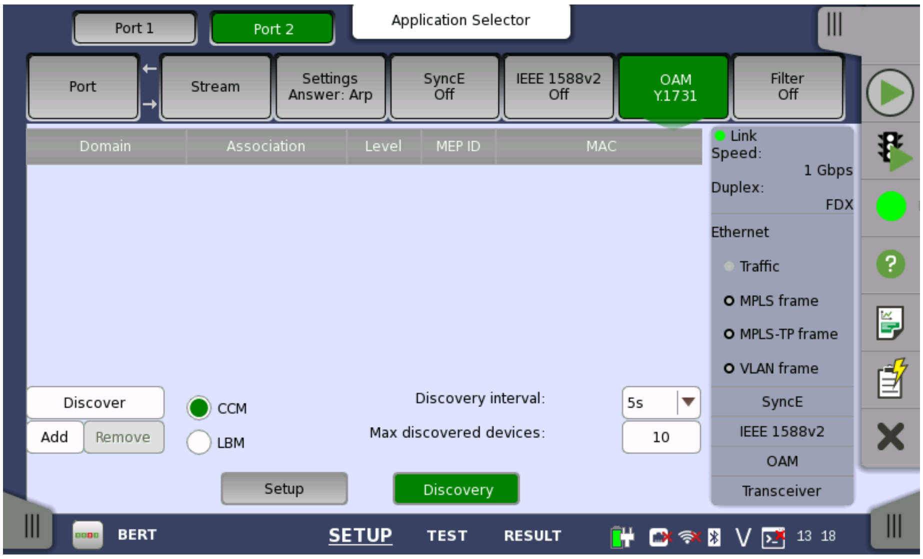
### VSM tab page

The **VSM** tab page contains the following parameter:

**Data**
Allows you to specify a string which you can send in a message to other remote maintenance points.

### Discovery view (802.1ag/Y.1731 protocols)

Touching the **Discovery** button available for the 802.1ag or Y.1731 protocol will display the screen shown below.




The contents of the Discovery view screen is the same for both protocols. The screen contains the following parameters:

**CCM/LBM**
Select the radio button for the relevant method of discovery.

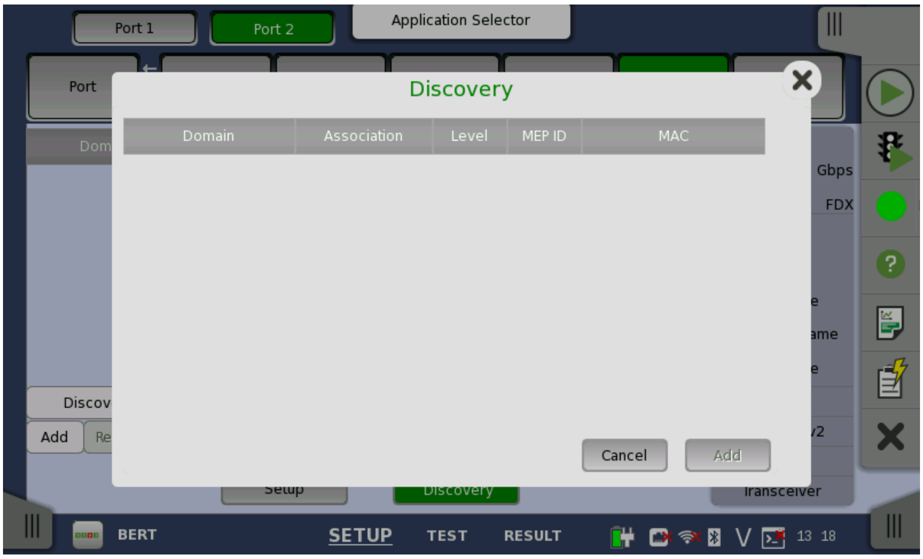
- **CCM** - Passive method. Discover Remote Maintenance points by looking at incoming CCM frames. This is the preferred method of discovery and the default selection.
- **LBM** - Active method. Discover other devices by sending out a multicast loopback message and discover the devices' MAC addresses.

**Discovery interval**
Use the drop-down menu to specify the time period during which to wait and discover messages.

**Max discovered devices**
Allows you to specify the maximum number of devices that will be discovered.

**Discovering devices**

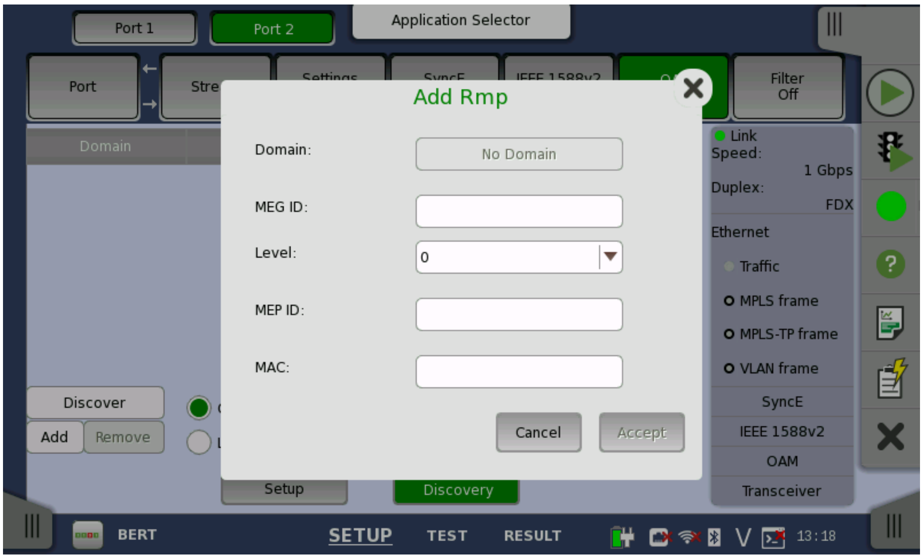
To discover devices, touch the **Discover** button on the left side of the screen. This will display the **Discovery** dialog box.




Devices will appear in the dialog's list as they are discovered. Select the device in the list and touch the **Add** button in the dialog box. The device is added to the list displayed on the Discovery view screen.

**Adding devices manually**

To add devices manually, touch the **Add** button on the left side of the Discovery view screen. This will launch the **Add Rmp** dialog box where you can enter identification data for a specific remote device.




The **Add Rmp** dialog contains the following parameters:

**Domain**
Allows you to specify the MD to which the MEP belongs. You can set the domain when 802.1ag is selected.

**MEG ID**
Allows you to specify the MEG to which the MEP belongs.

**Level**
Use the drop-down menu to select the MD level at which the MEP exists.

**MEP ID**

Allows you to specify the Maintenance Point ID that the unit will be known as in the MA. Note that this is the only required parameter.

**MAC**
Allows you to specify the MAC address of the remote unit.

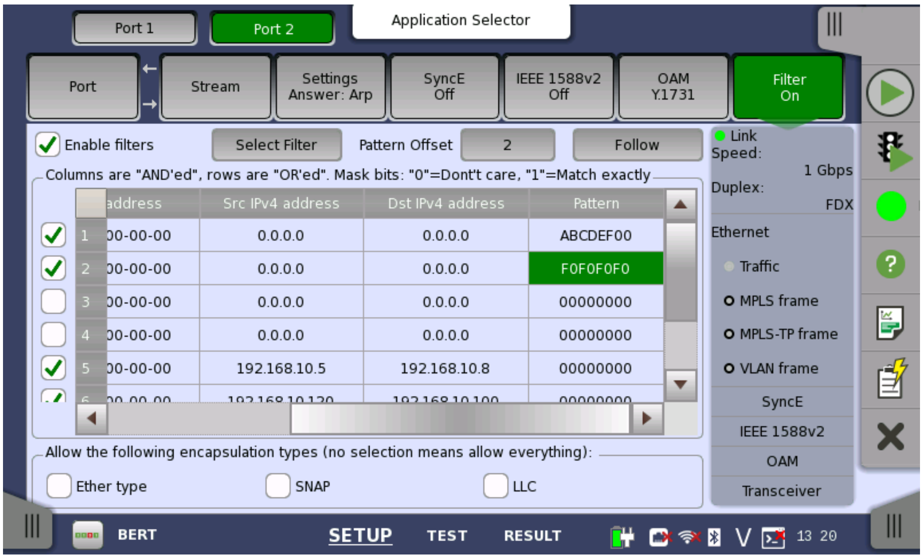
**Accept**
Touch the **Accept** button when you have entered the desired data in the dialog box. The identified unit is then added to the list displayed on the Discovery view screen. Note that the **Accept** button is enabled only when you have entered a value in the **MEP ID** field.

**Removing devices**

To remove a device from the list displayed on the Discovery view screen, select the device and then touch the **Remove** button on the left side of the screen.

### 6.1.2.7 Filter

Touching the **Filter** button in the navigation area will display the screen shown below.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen allows you to set up filters and masks for the reception of Ethernet frames. It can also be used to inspect the current status of the selected port.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Enable filters**

Select this checkbox to be able to set up new filters or make changes to the existing ones.

At the bottom of the screen it is possible to only allow certain encapsulation types. If none are selected, all encapsulation types will pass.

**NOTE**

*It is possible to let the currently selected port copy the setup from another port by selecting the 'Follows' checkbox and choosing the relevant port in the drop-down menu. Please note, however, that if the port is already itself being followed by another port, it cannot follow that port for the same parameters.*

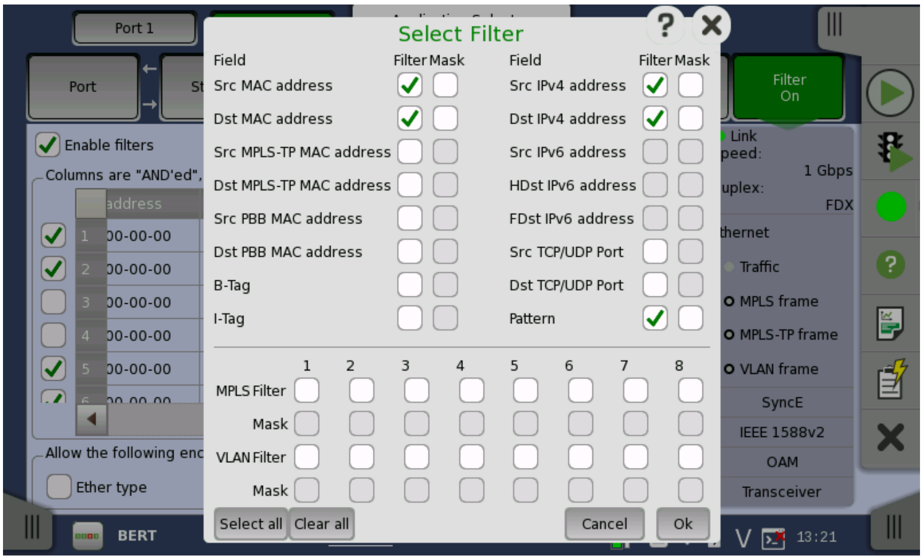
**Filter and mask setup**

The filter and mask table shows the currently existing filters. There are 8 rows, each representing a filter which (when enabled) is applied to each received frame. Each filter is composed as a set of values and/or masks (e.g. MAC destination address, IP addresses etc.). If all values in at least one enabled row/filter matches, the frame will pass.

If the mask for a specific value is enabled, only bits that are "1"/on are compared to the frame. For instance, if MAC Destination value is '00-12-34-56-78-9A' and the mask is set to '00-FF-00-FF-FF-FF', only frames with MAC addresses 'XX-12-XX-56-78-9A' will pass.

To specify the set of values and/or masks available for each filter (i.e. the columns of the table), touch the **Select Filter** button. This will launch the filter editor dialog box, which contains a number of checkboxes for enabling filters and masks on different addresses.

To set up / edit a filter, touch the relevant table cell. This will launch the filter/mask NumPad dialog box.




The filter editor dialog box contains a number of checkboxes for enabling filters and masks on different addresses. Selectable checkboxes depends on frame structure. The selected filters appear in row of the table.

### MPLS Filter, VLAN Filter setting

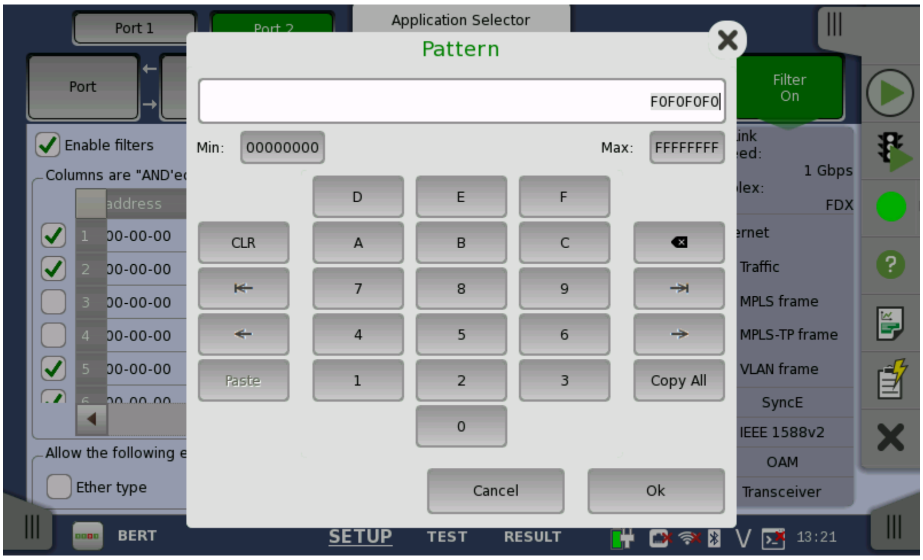
MPLS Filter and VLAN Filter can be selected upto eight levels because these layer may have up to eight level. The parameters in each filters can be set independently.

For setting parameters, refer to MPLS or VLAN in "Stream" subsection.

### Pattern filter setting

With the pattern value it is possible to match a user-defined 32 bit value to a specific offset defined by **Pattern Offset**. The pattern offset applies to all 8 filters but will only affect the enabled ones.

1. Select checkbox of **Pattern** on Select Filter dialog box.
2. Touch **Pattern Offset** button.
3. Specify the Pattern Offset. This is the number of bytes counted from top of destination MAC address byte. If you specified "7", the four bytes of source MAC address are set to the object of filtering.
4. Touch the cell of **Pattern** in the table on the setup area.
5. Specify the pattern of four bytes.
6. Select the checkbox at left-side of the table.




The filter Numpad dialog box allows you to edit a specific filter/mask pattern.

## 6.1.3 Status Information

This section describes the status information available in the status area of the Ethernet ports setup screen.

### 6.1.3.1 Status Summary

The status summary displayed for the Ethernet interface consists of the following information:

NOTE *The actual summary information displayed depends on the type of the Ethernet interface.*

**Physical Status** The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Interface Status** The middle part of the status area gives you access to alarm and error information for the selected interface. The status is indicated by the lamp color. You can choose whether to view only the current alarm and error status, or to view all alarms and errors in the alarm trap since it was last reset.

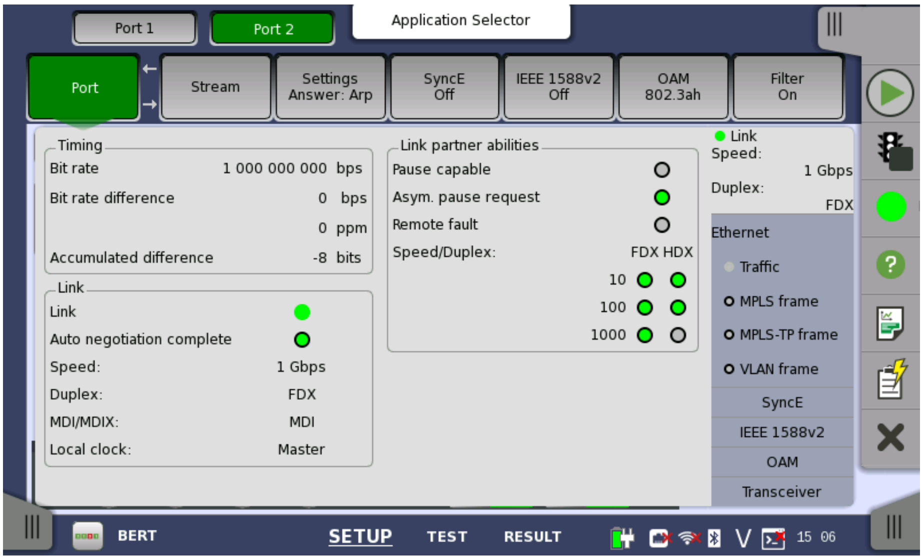
A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

**Monitor Buttons** At the bottom of the status area are below buttons that give you access to various monitor information. By touching a button, you can launch the corresponding information display.

- **SyncE**
- **IEEE 1588v2**
- **OAM**
- **Transceiver**

### 6.1.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the received signal at the Ethernet interface.

The physical status information consists of the following parameters:

- Bit rate, which shows the current bit rate.
- Bit rate difference, which shows the difference in bit rate between received signal and reference source signal.
- Accumulated difference, which shows the accumulated bit rate difference between the received signal and the reference source signal.
- Link, which shows the link status of Ethernet.
- Link partner abilities, which shows the abilities of the opposite interface port. (Only available for Electrical)

**Timing**

**Bit rate**
The currently received bit rate is shown in bits per second (bps).

**Bit rate difference**
The current difference between the received signal and the reference source signal is shown in both parts per million (ppm) and bits per second (bps).

**Accumulated difference**
The accumulated difference between the received signal and the reference source signal is shown. The information is presented as number of bits of difference detected over the accumulation period.

NOTE

*This is important information for identifying small frequency differences, which may not be visible by showing the current bit rate difference.*

The accumulated difference information is accumulated continuously. The accumulation is reset when measurement is started or restarted.

**Link**

When *Electrical* interface type is selected, the link status is shown.

**Link**
Ethernet link has established or not is shown.

**Auto negotiation complete**
Auto negotiation has completed or not is shown.

**Speed**
10 Mbps, 100 Mbps, 1 Gbps or 10 Gbps is shown.

**Duplex**
FDX: Full Duplex, HDX: Half Duplex.

**MDI/MDIX**
MDI: Medium Dependent Interface, MDIX: Medium Dependent Interface Crossover

**Local clock**
Master or Slave is shown.

**Link partner abilities**

When *Electrical* interface type is selected, the Link partner abilities is shown.

**Pause capable**
Indicates in green when the device is capable of flow control using Pause request.

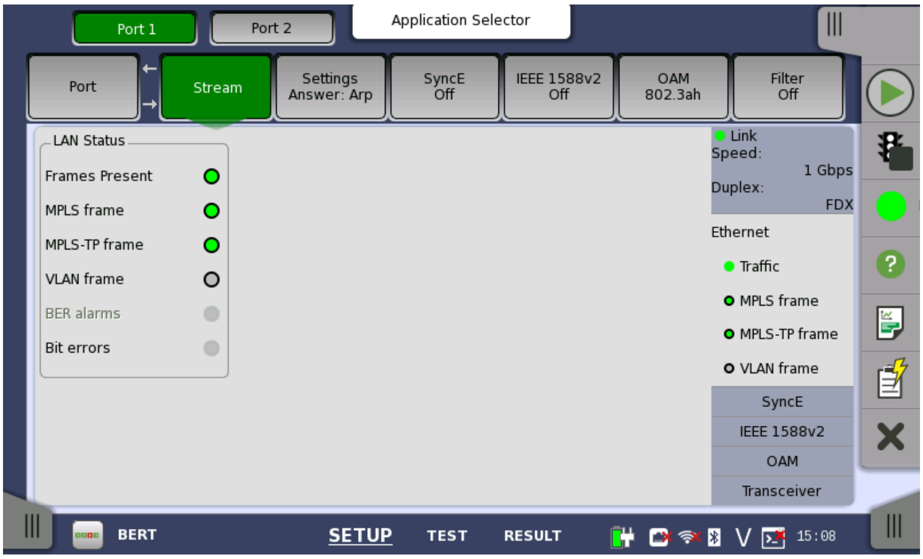
**Asym. pause request**
Indicates in green when the device is capable of asymmetric flow control using Pause request.

**Remote fault**
Indicates in green when the device is sending the remote fault signal.

**Speed/Duplex**
Available speed and duplex are indicated in green.

### 6.1.3.3 Interface

Touching the middle summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents key interface status indicators, with Lamp icons showing the current status. These indicators give a quick overview of the condition of the lines.

**LAN Status**

- **Frame Present**: Ethernet frames are detected.
- **MPLS frame**: Label of MPLS (Multi-Protocol Label Switching) is detected.
- **MPLS-TP frame**: Label of MPLS-TP (Multi-Protocol Label Switching Transport Profile) is detected.
- **VLAN frame**: Virtual LAN tag is detected.
- **Multi stream frame loss**: Multi stream frame loss is detected.
- **BER alarms**: BER Alarms are detected.
- **Bit errors**: Bit errors are detected.

**Multi stream frame loss** appears in case of Mon./Gen. application.

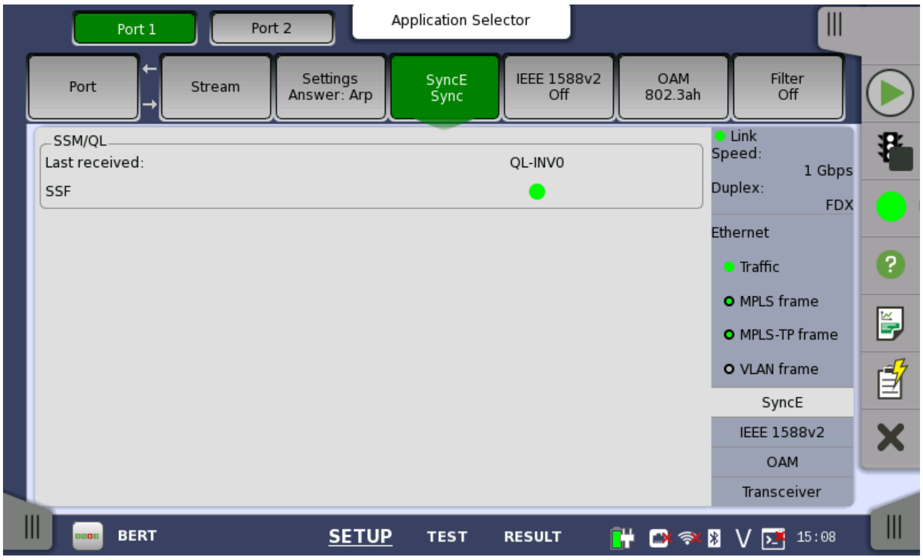
**PCS Alarms**

This status appears when the SFP+ is set to Interface Type.

- **Local fault**: Local fault is detected.
- **Remote fault**: Remote fault is detected.

### 6.1.3.4 SyncE

Touching the **SyncE** button in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents information related to the status of synchronous Ethernet.

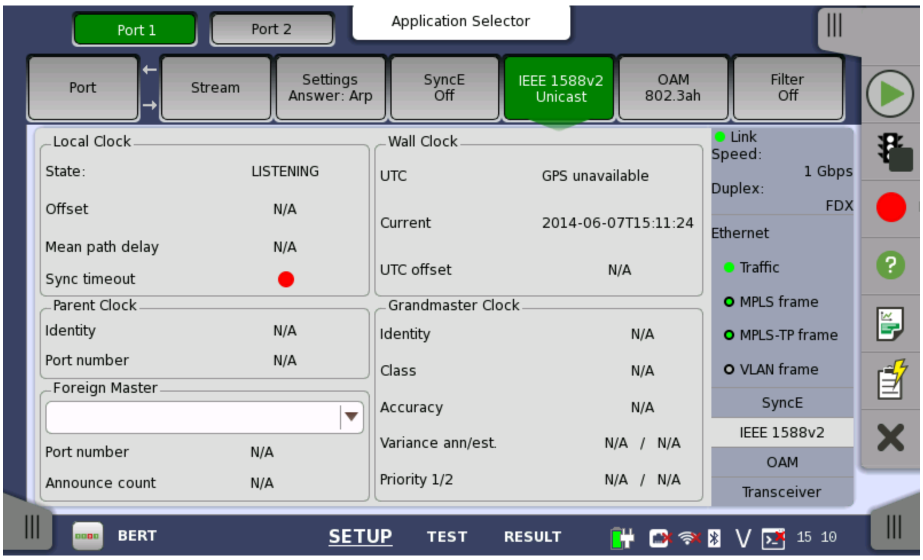
**SSM/QL** *Synchronization Status Message* and *Quality Level* status

**Last received**
Shows the latest QL value.

**SSF**
*Server signal fail*. The Lamp icon becomes red when no ESMC message has been received within the last five seconds.

### 6.1.3.5 IEEE 1588v2

Touching the **IEEE 1588v2** button in the status area of the **Ports Setup** screen displays the status shown below.



This screen presents information about the status of the IEEE 1588 clock.

**Local Clock**

**State**
Shows the current clock state of the ports (**MASTER**/**SLAVE**). A unicast slave may be stuck in INIT-state until the master clock grants access.

**Offset**
Shows the current offset from the master clock.

**Mean path delay**
Shows the mean path delay, which is the time from master to slave back to master again, divided by two.

**Sync timeout**
Shows the current status of Sync Message reception. The Lamp icon becomes red if no Sync Message has been received within five times the Sync interval.

**Wall Clock**

**UTC**
Shows the current UTC time. Requires an external GPS receiver.

**Current**
Shows the current wall clock time.

**UTC offset**
Shows the offset between the wall clock time and the UTC time.

**Parent Clock**

**Identity**
Shows the identity of a slave's parent clock.

**Port number**
Shows the port number of a slave's parent clock.

**Grandmaster Clock**

**Identity**
Shows the identity of the grandmaster.

**Class**
Shows the class of the grandmaster.

**Accuracy**
Shows the accuracy of the grandmaster.

**Variance ann/est.**
Shows the offset variance of the grandmaster. Both the announced value and a calculated estimate are shown (in $s^2$).

**Priority 1/2**
Shows priority 1 and 2 of the grandmaster.

**Foreign Masters**

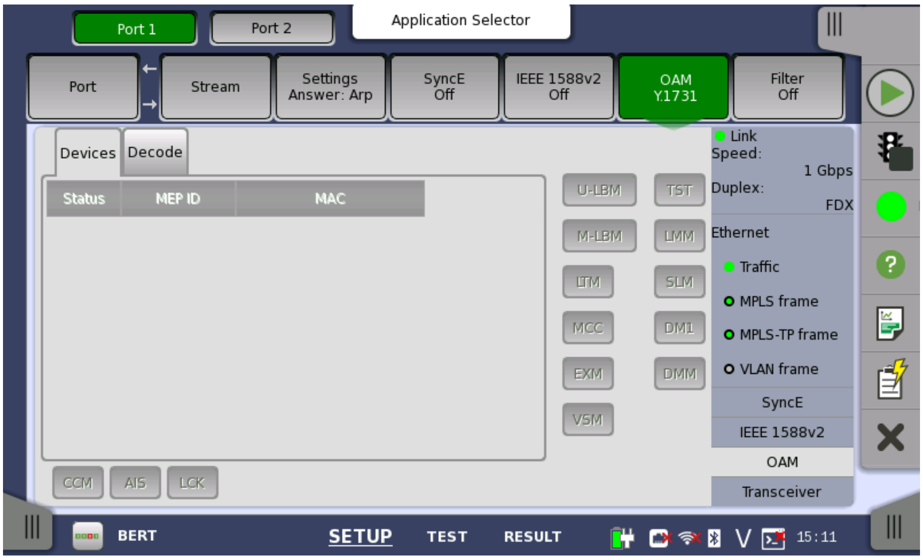
Provides a list of detected foreign masters. The identity of the current master is shown in the field, the other masters are listed in a drop-down menu.

**Port number**
Shows the port number of the currently selected foreign master.

**Announce count**
Shows the number of Announce Messages received from the currently selected foreign master.

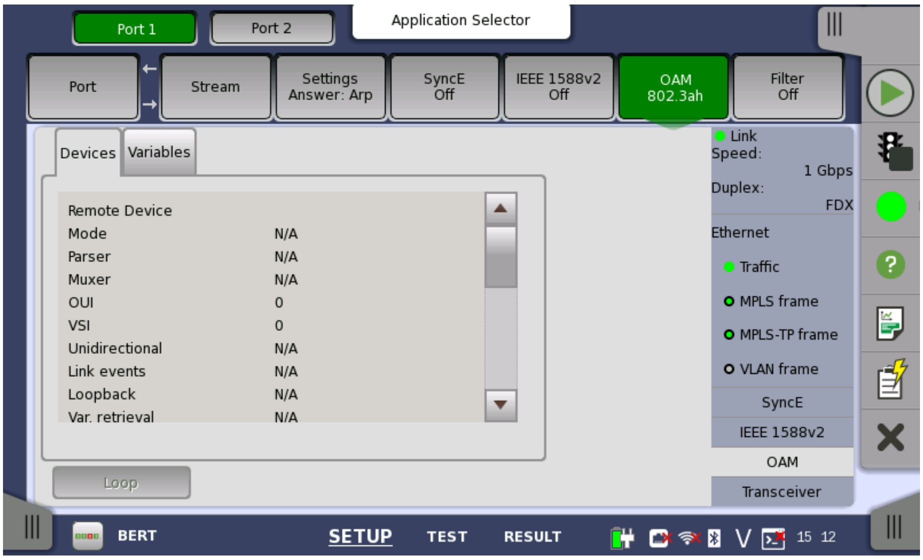
### 6.1.3.6 OAM

Touching the **OAM** button in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents information about the status of the OAM functions. The information is split up on a number of tab pages. Note that the layout of the dialog depends on the currently selected OAM protocol.

**802.3ah status information**




**Loop button**
Touch the **Loop** button to send the far-end device into loopback mode and reflect frames.

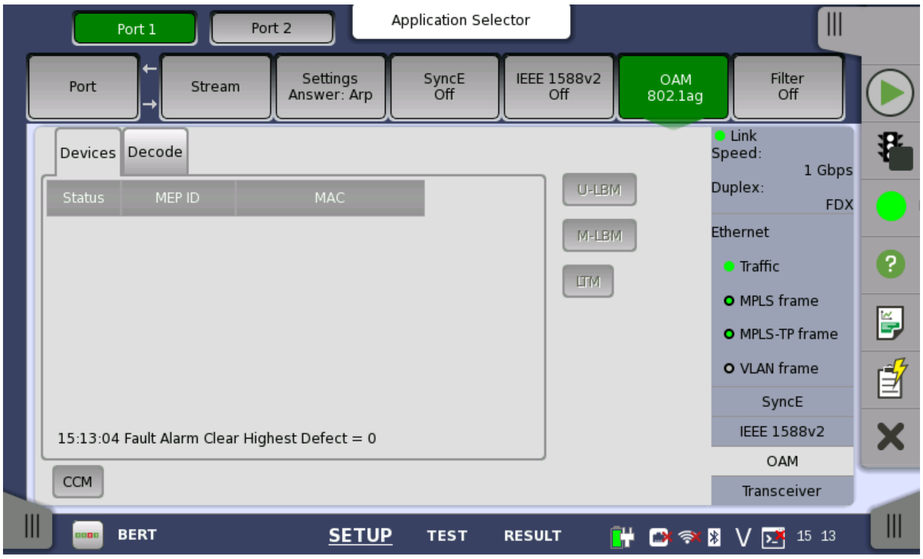
#### Devices tab page

Shows the status of the remote and local devices.

#### Variables tab page

On the **Variables** tab page you can request various variables. Select the relevant variable from the drop-down menu and then touch the **Request** button.

**802.1ag status information**




**Message buttons**
Allows you to send messages either to a remote MEP ID or to a unicast MAC Address.

- **U-LBM**: Data-path integrity to/from the far-end to/from one address (unicast).
- **M-LBM**: Data-path integrity to/from the far-end to/from multiple addresses (multicast).
- **LTM**: Enumerate and identify all hops between two end points.

**Fault button**
The fault messages are sent when the button is active.

- **CCM**:Continuity Check Messages.

## Devices tab page

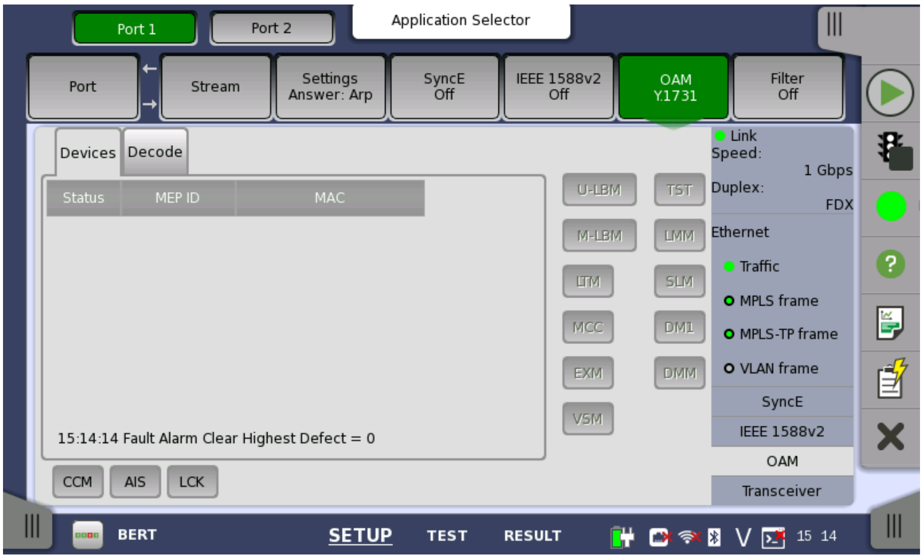
Shows the current status of the devices.

The outer circle of the colored Lamp in the Status column represents the CCM status (green means that CCMs are received from that RMP, red means no CCMs are received). The inner circle indicates whether the RDI bit in the CCM frame is set (red) or not set (green).

## Decode tab page

Shows extra information about LTM frames.

**Y.1731 status information**




**Message buttons**
Allows you to send messages either to a remote MEP ID or to a unicast MAC Address.

- **U-LBM**: Data-path integrity to/from the far-end to/from one address (unicast).
- **M-LBM**: Data-path integrity to/from the far-end to/from multiple addresses (multicast).
- **LTM**: Enumerate and identify all hops between two end points.
- **MCC**: Maintenance communication channel message.
- **EXM**: Experimental message and response.
- **VSM**: Vendor-specific message and response.
- **TST**: Test message used for Bit Error Rate measurement and /or throughput measurement.
- **LMM**: Determine packet loss.
- **SLM**: Determine frame loss.
- **DM1**: One-way delay measurements.
- **DMM**: Propagation delay between two end points.

**Fault buttons**
The fault messages are sent when the button is active.

- **CCM**:Continuity Check Messages.
- **AIS**: Alarm Indication Signal.
- **LCK**: Locked Signal Function.

## Devices tab page

Shows the current status of the devices.

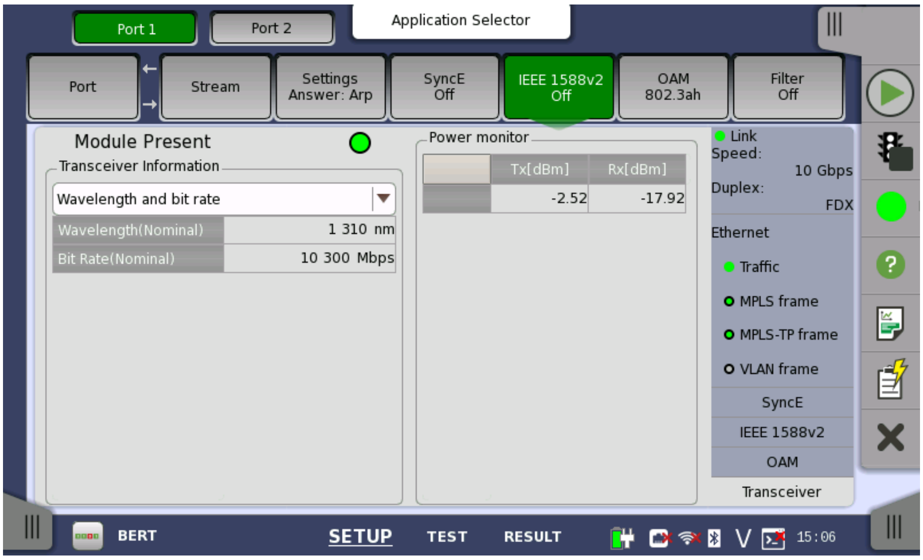
The outer circle of the colored Lamp in the Status column represents the CCM status (green means that CCMs are received from that RMP, red means no CCMs are received). The inner circle indicates whether the RDI bit in the CCM frame is set (red) or not set (green).

## Decode tab page

Shows extra information about the various frame types.

### 6.1.3.7 Transceiver

Touching the **Transceiver** button in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents status information about the optical transceiver.

**Module Present**

**Green** indicates that optical transceiver presents.

**Transceiver Information**

Select the information from pull down menu.

- **Wavelength and bit rate** shows the nominal wavelength and bit rate.
- **Compliance** shows the available standards.
- **Vendor information** shows the data stored in the optical transceiver.

**Power monitor**

The transmitting optical power is displayed in left column. Unit of the optical power is dBm.

The received optical power is displayed in right column. Unit of the optical power is dBm.

# 6.2 BERT

The Bit Error Rate Test (BERT) described in this section is applicable for Ethernet interfaces.

For BERT of OTN interface, refer to BERT in "OTN Application".

## 6.2.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

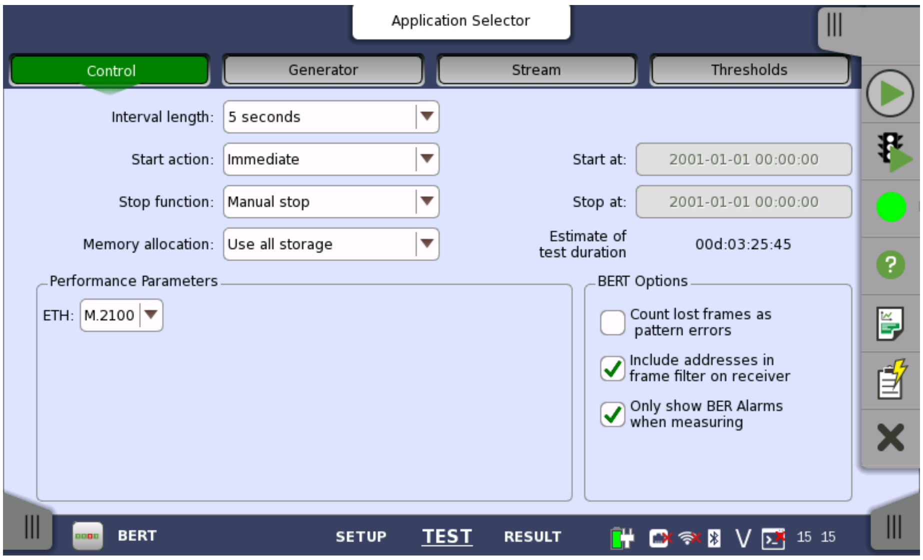
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.2.2 Test Setup

### 6.2.2.1 Control

When you go to the test setup of the Ethernet BERT application, the following screen is displayed.




This screen contains the parameters that are generally required in a test setup.

**Interval length**
Allows you to specify the duration of the BERT intervals. The drop-down menu contains the following values: **1**, **2**, **5**, **10**, **15**, **30 seconds**, **1**, **5**, **10**, **15**, **30 minutes**, **1**, **2**, **4**, **6**, **12 hours** or **No intervals**.

**Start action**
Allows you to specify when the measurement is started.

- If **Immediate** is selected, the measurement starts when you touch the

**Start** button.
- Selecting **Start at** will enable a delayed start. The start time for a delayed start can be specified in the adjacent **Start at** field.

**Stop function**
Allows you to specify when the measurement ends. Select the relevant option from the drop-down menu:

- If **Manual stop** is selected, the measurement will stop immediately when the **Stop** button is touched.
- Selecting **Stop at** will enable the adjacent field, in which you can specify the stop time.
- Selecting **Duration** will allow you to specify a duration time in the adjacent field.

**Memory allocation**
Allows you to specify how the measurement will be stored in the Network Master's memory. Select the relevant option from the drop-down menu:

- **Use all storage**: When Network Master's memory became full with measured data, the whole measurement is stopped.
- **Continuous**: When Network Master's memory became full with measured data, oldest records in that memory will be overwritten.

**Estimate of test duration**
Contains an estimation of the time (in days, hours, minutes and seconds) before the whole memory will be filled out by the test. The estimated value is dependent on the current interface and selections concerning this interface. During an ongoing measurement, the estimate will be recalculated periodically, meaning that the estimate will get better and better. The estimate can be seen on the status line during a measurement.

**Performance Parameters**

The titles of ITU-T Recommendation are below.

- **G.8201** Error performance parameters and objectives for multi-operator international paths within the Optical Transport Network (OTN)
- **M.2100** Performance limits for bringing-into-service and maintenance of international multi-operator PDH paths and connections
- **M.2401** Error performance limits and procedures for bringing-into-service and maintenance of multi-operator international paths and sections within an optical transport network
- **M.2110** Bringing into service international multi-operator paths, sections and transmission systems

### OTN-related

This item appears if 'BERT on OTN' is running.

**OTN**
G.8201, M.2401 (M.2110)

**Time period**
15 minutes, 1 hour, 2 hours, 24 hours, 7 days

**Allocation**
Touching the **Setup** button launches the dialog box. Refer to Performance Parameters in "OTN Application" .

### Ethernet-related

**ETH**
M.2100

#### BERT Options

*This option appears in the BERT application.*

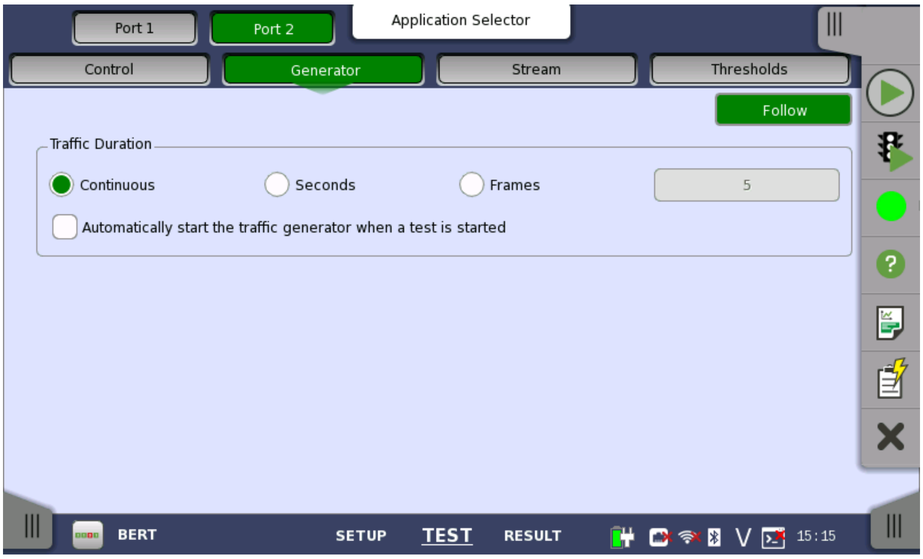
**Count lost frames as pattern errors**
Enabling this function means that if a frame is lost then all test pattern bits in the frame are considered errored and will be included in the pattern error counter.

**Include addresses in frame filter on receiver**
The receiver uses a filter to determine which frames should be counted in the results. When this function is enabled then, by default, the receiver will use the MAC and IP addresses of each incoming frame in addition to the 'filter key' used.

**Only show BER Alarms when measuring**
BER alarms in Interface status dialog box is enabled only when the measurement is running. This function allows to avoid the BER alarms occurrence when no data is input.

### 6.2.2.2 Generator

Touching the **Generator** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen contains the traffic-related parameters.

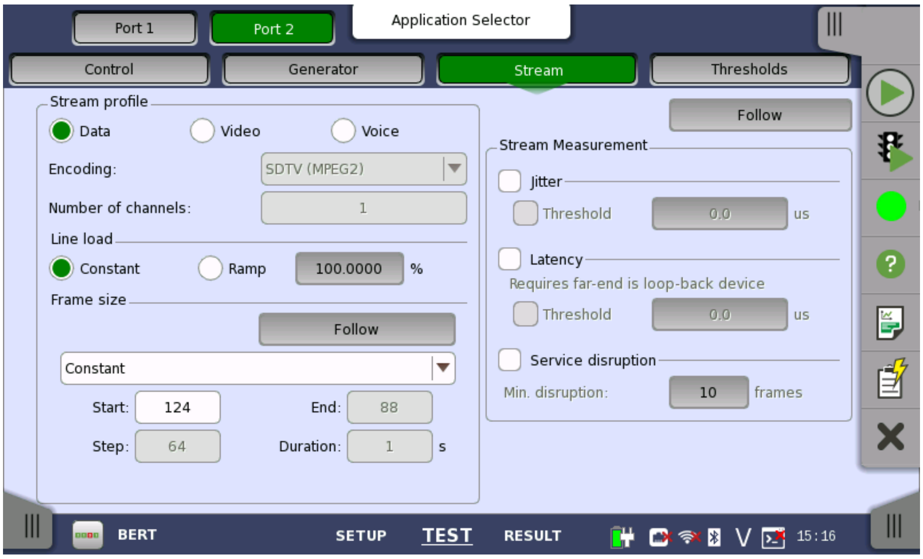
**Traffic Duration**

Allows you to set conditions concerning frames transmission. Choosing **Continuous** will make a continual test sequence. Alternatively, the duration can be set manually in either **Seconds** or **Frames**, coupled with a specification of the number of seconds/frames in the adjacent field.

**Automatically start the traffic generator when a test is started**
In case of **Continuous**, you can select this checkbox to make the traffic generator start synchronously with the test starting.

### 6.2.2.3 Stream

Touching the **Stream** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen contains the parameters for specifying a profile and pattern for each stream and for specifying which measurements are made.

**Stream profile**

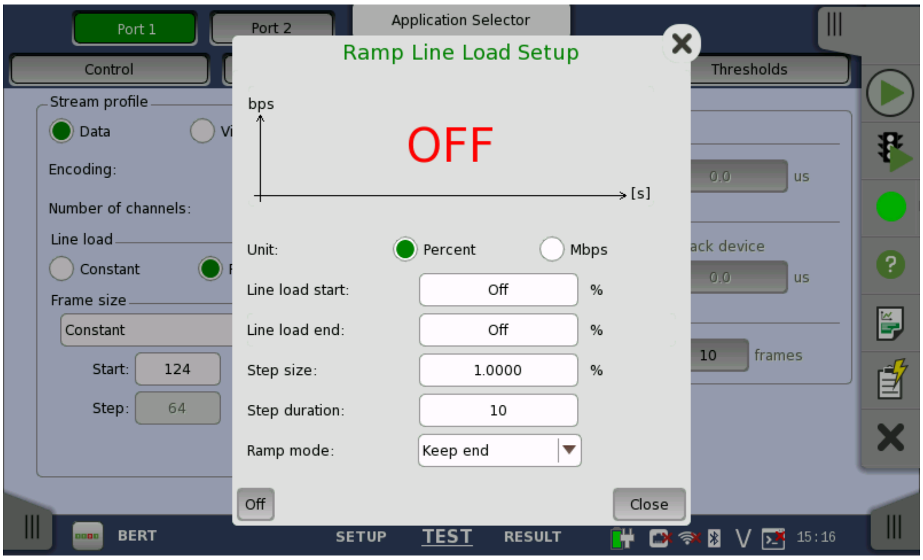
Allows you to specify and configure a profile type for the currently selected stream. Using the radio buttons, you can select the stream profile as either **Data**, **Video** or **Voice**.

**Encoding**
Open the drop-down menu to select the relevant encoding type. The available values depend on the selected profile type.

**Number of channels**
Specify the number of channels.

**Line load**

Using the radio buttons, you can select the line load profile as either **Constant** or **Ramp**. If you select **Ramp**, you can touch the adjacent button to display the **Ramp Line Load Setup** dialog box.




The dialog box contains the following settings:

**Line load start**
The line load at which the ramp will start.
**Line load end**
The line load at which the ramp will end. (This is the value shown on the line load button.)
**Step size**

The step size from start to end.

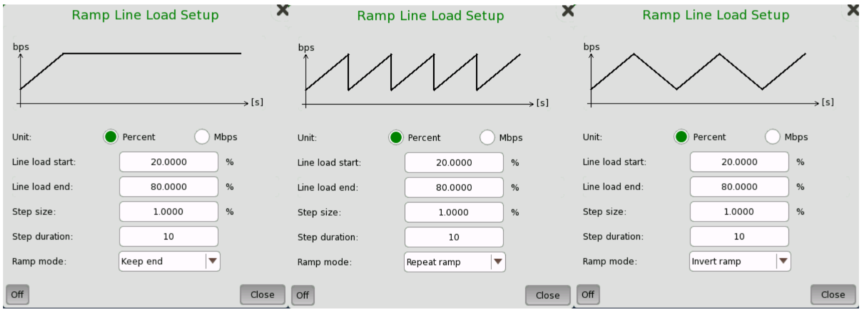
**Step duration**

The duration of each step.

**Ramp mode**

How the ramp should continue. 3 modes are available:

- **Keep end**: The specified end line load is maintained after the ramp is ended.
- **Repeat ramp**: The ramp is repeated.
- **Invert ramp**: The ramp is inverted.




**Frame size**

Three setups are available, using one or more of the available setting options:

**Constant**

Uses the fixed frame size specified by the **Start** value for the duration of the test.

**Stepped**

Steps the frame size from **Start** to **End** in increments of **Step**. Each frame size is transmitted for the period in seconds specified by **Duration**.
If the traffic duration is set to *Continuous* on the **Generator** screen, the step sequence will be repeated indefinitely. If traffic duration is set to *a number of seconds*, the step sequence will be terminated when the specified total period has elapsed. Similarly for traffic duration set to *a number of frames*, the step sequence will be terminated when the total number of transmitted frames reaches the specified count.

**Random**

Sends a continuous stream of frames of random sizes, evenly distributed between **Start** and **End**.

NOTE

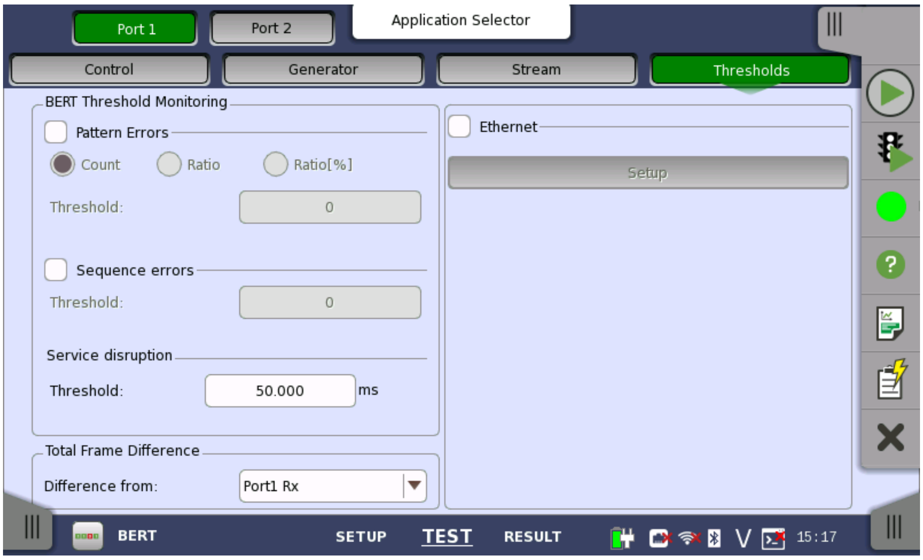
*Frame size is protocol headers and payload combined. Frame size does not include preamble and interframe gap.*

**Stream Measurement**

Select one or more of the measurements (**Jitter**, **Latency** and **Service disruption**) and then specify a threshold value for each.

### 6.2.2.4 Thresholds

Touching the **Thresholds** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen contains the parameters for setting up the various threshold values (i.e. limits) for errors and Pass/Fail status that are used during the monitoring.

**Pattern Errors**

Allows you to enable monitoring of pattern errors (i.e. bit errors) and to set up a threshold value for the bit error ratio.

Choose whether the threshold is specified as an absolute value or a percentage, using the **Count**, **Ratio** and **Ratio (%)** radio buttons, and then specify the value in the **Threshold** field.

**Sequence errors**

Allows you to enable monitoring of sequence errors and to set up the relevant threshold value.

**Service disruption**

If you specify a threshold value for the service disruptions (using the **Threshold** field), any disruption whose maximum duration time exceeds the threshold value will be marked in red on the Test Result screen.

**Total Frame Difference**

Allows you to select the reference port to measure the differential time, using **Difference from:** drop down menu.

**Transport**

This setting appears in case of BERT on OTN.

When you select the checkbox, you can enable alarm or error thresholds.

**Interface**
Fixed to OTN.

**Evaluation item**
Select the item to evaluate. If selecting other than **Any Alarm or Error**, another menu appears.

**Evaluation type**
Select the relevant type.

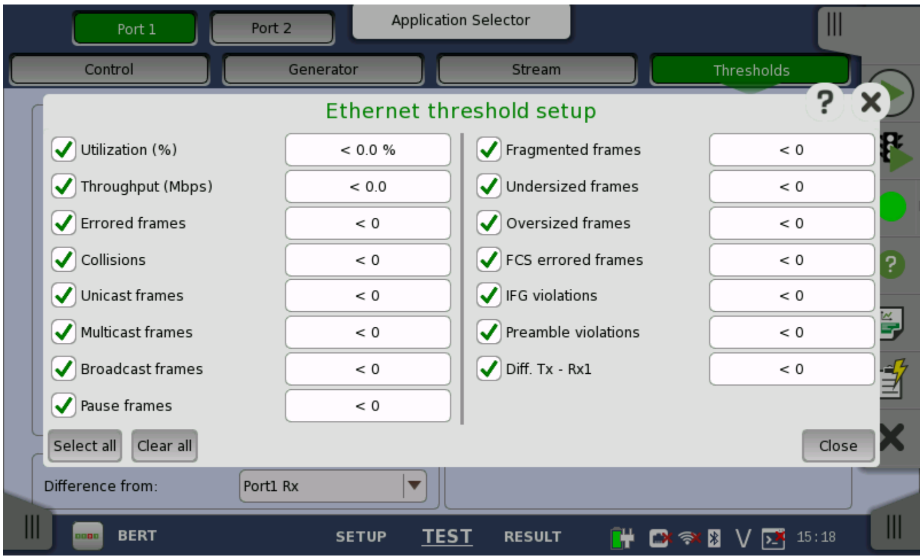
**Pass & fail threshold**
Touch the left-hand number to set the lower limit for "Warning". Touch the right-hand number to set the lower limit for "Fail". The lower limit of "Fail" must be equal to or greater than the lower limit of "Warning" (defining a "Within limits" range in between them).

NOTE

*Thresholds can only be set/modified while no measurement is running, as they are active during a measurement.*

**Ethernet**

When you select the checkbox, you can enable various thresholds. Touch the **Setup** button to display the **Ethernet threshold setup** dialog box.




In the dialog box, select the checkboxes for the relevant thresholds and then touch the **Close** button to list them on the **Thresholds** screen. You can select/deselect all checkboxes in the dialog box by using the **Select all** / **Clear all** buttons. Touch the individual value fields either in the dialog box or in the list on the screen to specify the threshold values.

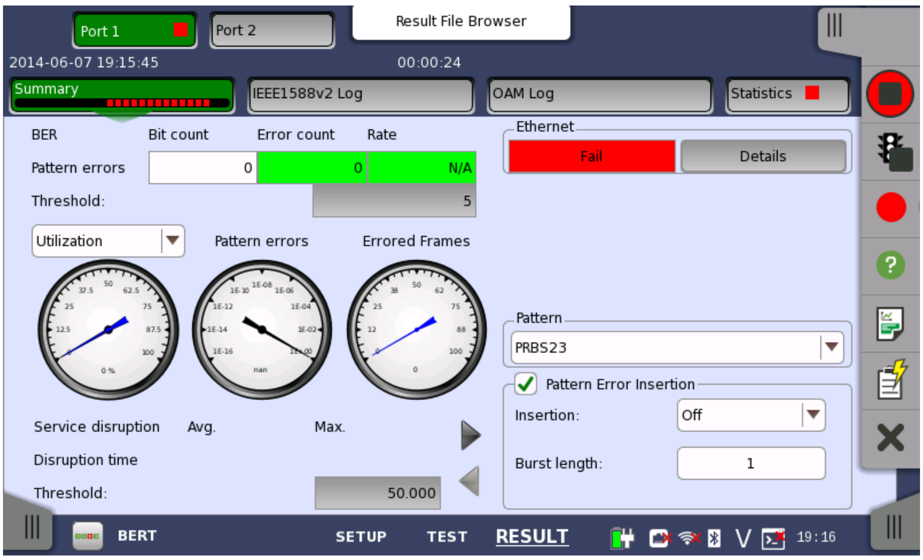
NOTE

*The Network Master transmits the 32-bit "jam sequence" eight times when the Ethernet frames collide at any point in the frame. This collision motion is different from the definition of the IEEE Standard.*
*In the "back off" process of the Network Master, the maximum wait time is expanded up to the 12 power of 2. Moreover, the Network Master does not discard the frame when the collision has occurred 16 times.*

## 6.2.3 Test Results

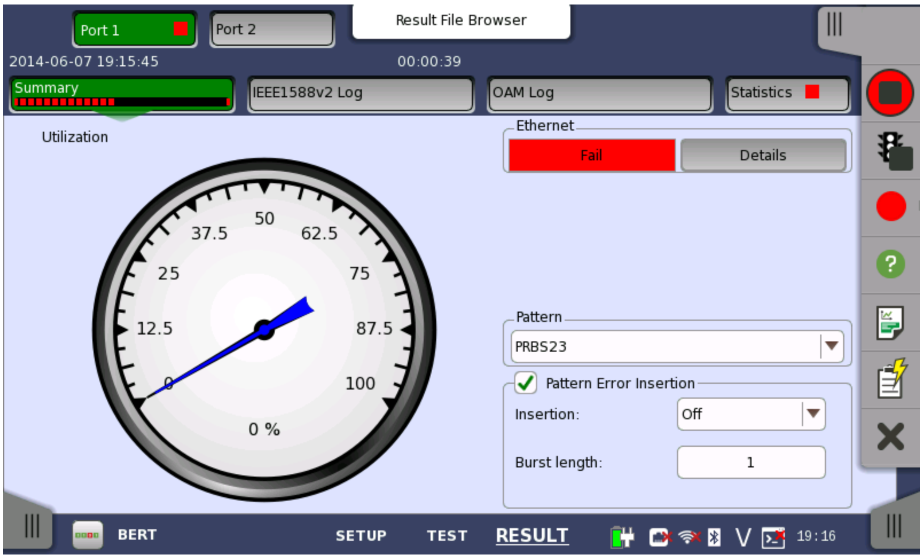
### 6.2.3.1 Summary

When you go to the test results of the Ethernet BERT application, the following screen is displayed.



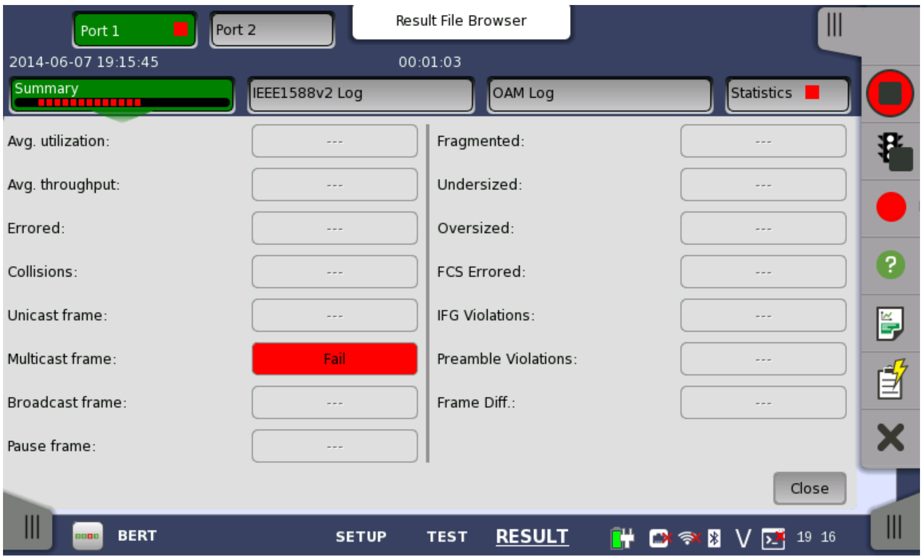

This screen contains a summary of the results of the Ethernet BERT test. The information includes such things as number of pattern errors, average and maximum disruption time, and number of exceeded thresholds.

The three dials showing utilization/throughput results, pattern errors and errored frames can be enlarged by clicking on them. The blue needle points the average value from starting the test. The black needle points the measured value in the latest period.




To view throughput information, select **Throughput** in the drop-down menu and then expand the dial. Use the drop-down menu above the expanded dial to select the relevant layer.

When **Ethernet** is selected on 'Threshold' of Test Setup screen, the **Ethernet** information appears in the upper right-hand corner, shows pass/fail status summary. Touching the **Details** button allows you to inspect the individual pass/fail status.




**Transport** Displays the results of Transport test. This result appears if 'Transport' checkbox is selected in Test Setup screen.

**Pattern** Select the pattern.

**Pattern Error insertion** This provides the Error insertion same as *Stimuli setup options* in Application Toolbar.

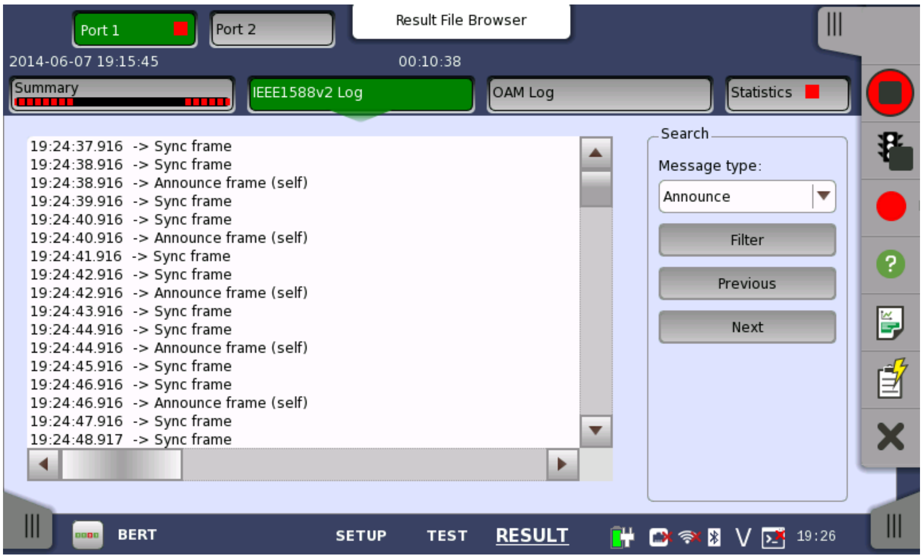
**Insertion**
If selecting **Manual**, error(s) are inserted when you touch the **Alarm/Error Insert** icon ( ) button.

Set **Off** to stop the error insertion.

**Burst length**
If 'Insertion' is set to **Manual**, touch the button and set the number of errors to insert.

### 6.2.3.2 IEEE1588v2 Log

Touching the **IEEE1588v2 Log** button in the navigation area will display the screen shown below.




This screen presents an IEEE1588v2 Log of the test results. You can search the messages by specifying the type.

**Search**

**Message type** Select the message type from below.

- **Announce**
- **DelayReq**
- **DelayResp**
- **FollowUp**
- **Management**
- **PDelayReq**
- **PDelayResp**
- **PDelayRespFollowUp**
- **Signaling**
- **Sync**

Select the search method.

- **Filter**
- **Previous**
- **Next**

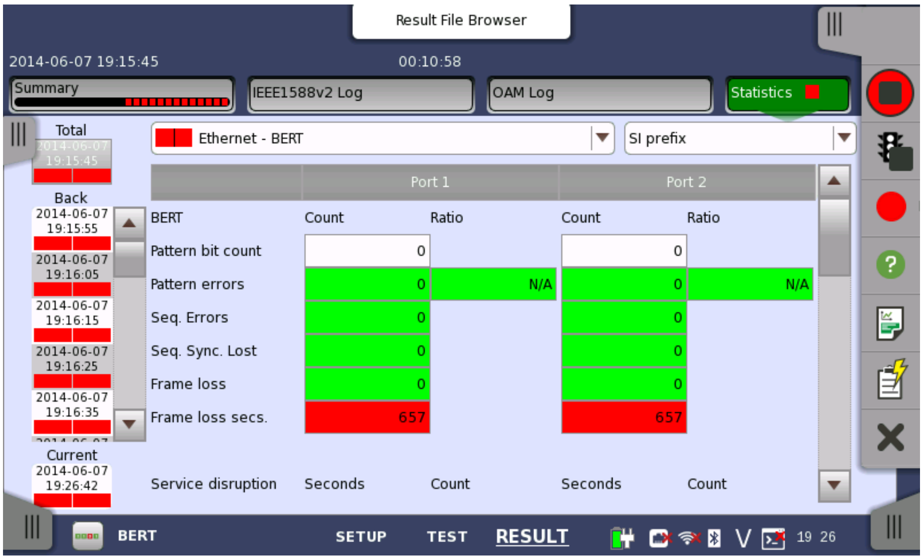
### 6.2.3.3 OAM Log

Touching the **OAM Log** button in the navigation area will display the screen shown below.


This screen presents an OAM Log of the test results. Note that the layout of the dialog box depends on the currently selected OAM protocol.

### 6.2.3.4 Statistics

Touching the **Statistics** button in the navigation area displays the screen shown below.




This screen presents a detailed analysis of the test results. You can choose to view either the total results from measurement start or the results of a specific interval during the test. You can also zoom in on a specific result item. The results can be displayed either in table (list) form or as a graph.

#### Selecting which results to view

**Selecting the interval time**

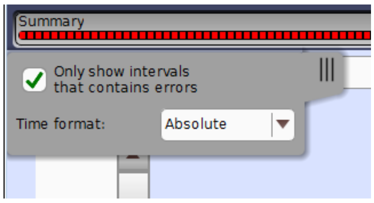
Touch the **Total** button to switch the total values measured in all interval times. The start time of measurement is displayed on the button.

Touching the button in left side **Back** field shows the measured values in the interval time. The end time of the interval is displayed on the button.

**Current** button is displayed at left bottom when the measurement is running. Touching the **Current** button shows the measured values in the current interval time. The start time of the current interval is displayed on the button.

The slide-out panel on the left-hand side of the screen contains the following functions:

- Only show intervals that contains errors
- Time format




NOTE

*If you have stopped measurement during the interval time, the measurement results of current interval are discarded. The log of current interval is not displayed in **Back** field.*
In this case, result data are re-calculated excluding the data of current interval when the measurement is stopped. This causes that "Count" and "Ratio" displayed after the measurement will be different from that of during measurement.
The sum of interval time (multiplied interval time by the number of back logs) may not match the differential time between displayed time at left top and right top after the measurement.

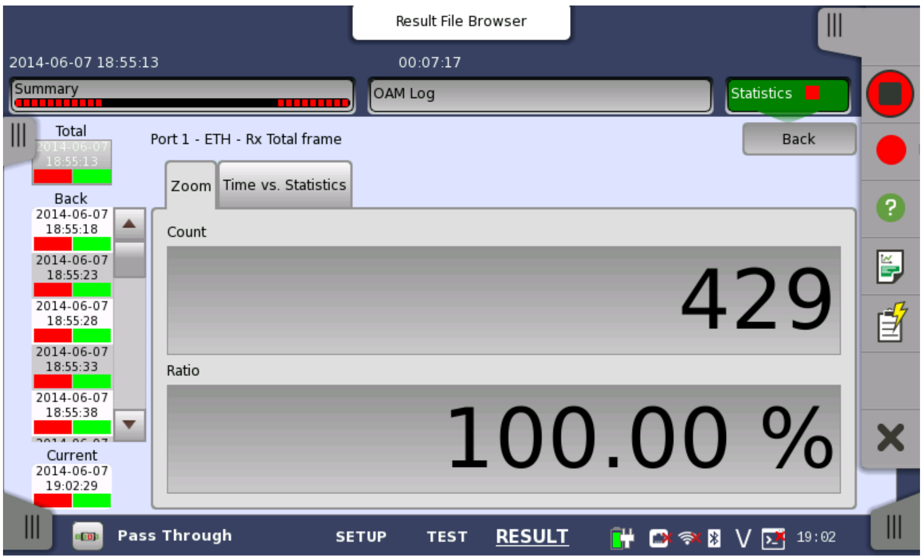
**Selecting type of results**

Open the middle drop-down menu in the top row of buttons to select which results you want displayed on the screen.

- **BERT**
- **Performance**
- **Frame**
- **Burst**
- **Size Distribution**
- **Transmit**
- **Latency**
- **Jitter**
- **SyncE**
- **IEEE 1588v2**
- **802.3ah**
- **802.1ag/Y.1731**

**Studying a specific result**

Touch a specific cell in a result table to zoom in on the corresponding result item. The **Count** and **Ratio** fields are displayed on a **Zoom** tab page. A **Time vs. Statistics** tab page is also available. Use the **Back** button or touch the zoom filed to return to the statistics screen.



## Selecting how results are displayed

**Selecting notation**

Select the required notation for the results from the notation drop-down menu.

- **Unformatted** - e.g. 71892
- **SI prefix** - e.g. 71.892 k (k means "kilo")
- **Engineering** - e.g. 71.892E3
- **Scientific** - e.g. 7.1892E4

## Results

Results are displayed according to your choice.

BERT Results
- **BERT**
- **Service disruption**
- **M.2100**
- **Throughput**
- **Latency**
- **Jitter**

Performance Results
- **Utilization**
- **Throughput**
- **Frame rate**

Frame Results
- **Alarms**
- **Good Frames**
- **Errored Frames**
- **Other Frames**
- **Last Received**

Burst Results
- **Frames**
- **Burst Size**

Size Distribution Results
- **Total Frames**
- **Size Dist.**
- **Frame Size**

Transmit Results
- **Traffic**
- **Frame Diff.**

Latency Results

Jitter Results

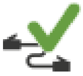
SyncE Results
- **SSM Statistics**
- **Alarms**
- **Rx SSM QL**

IEEE 1588v2 Results
- **Offset Stat**
- **Offset Variance**
- **Mean Path Delay**
- **PDV**
- **Message Stat**
- **Clock Status Stat.**

802.3ah Results

802.1ag/Y.1731 Results

# 6.3 Cable



The Ethernet Cable Test uses Time Domain Reflectometry (TDR) to validate and detect open and short circuited CAT5/CAT5E cables. This test is convenient for installation and troubleshooting of cables.

**Time Domain Reflectometry Principle**

The TDR method can be used for control of electrical cables. The TDR transmits a short pulse which will be fully absorbed if the cable is perfectly terminated. In case of open or short circuited cables, the pulse will be reflected.

- An open circuited cable will result in an *increase* of impedance.
- A short circuited cable will result in a *decrease* of impedance.

These conditions will give a pulse reflection in an either positive or negative mirrored pulse. If the time is measured and the speed of the signal in the cable is known, a distance to the problem can be estimated.

The magnitude of the reflection (called the *reflective coefficient P*) can be found from a formula involving the impedance to the load ($Z_t$) and the resistance in the media ($Z_0$):

P = ($Z_t$ - $Z_0$) over ($Z_t$ + $Z_0$).

P = **0** indicates no reflection. **+1** indicates an open circuit, and **-1** indicates a short circuit.

**Wiring of Ethernet Cables**

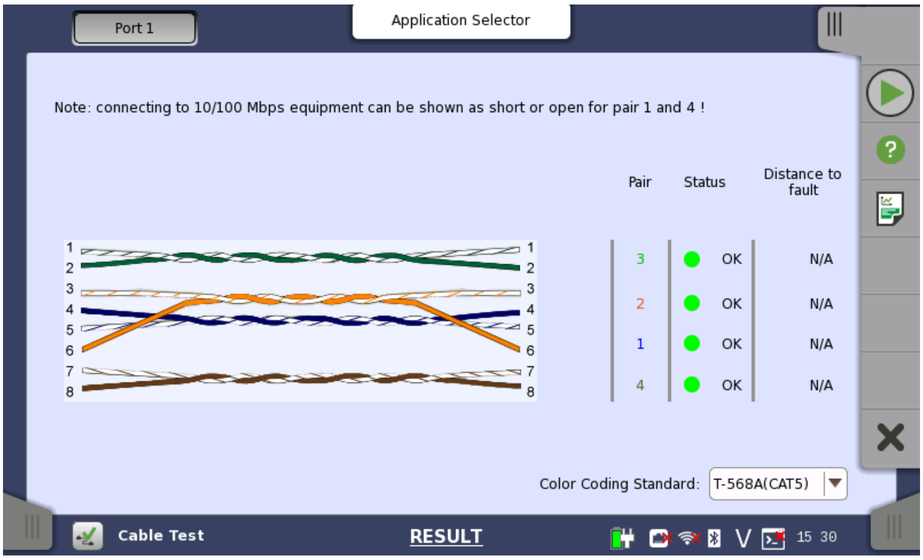
A CAT5/CAT5E cable consists of 4 twisted pairs which typically are terminated in a RJ45 connector.

**CAT5**
Defined in *ANSI/TIA/EIA-568-A*. The color code referring to this standard is called **T568A**.

**CAT5E**
Defined in *TIA/EIA-568-B*. The color code referring to this standard is called **T568B**.

## 6.3.1 Test Setup

When you go to the test setup of the Ethernet Cable Test, the following screen is displayed.




This screen allows you to control and monitor an Ethernet Cable Test.

**Test setup controls**

**Color Coding Standard**
Allows you to select the color coding used for the graphical representation of the cables. n the drop-down menu you can choose between **T-568A (CAT5)** and **T-568B (CAT5E)**.

**Test monitoring information**

**Pair**
Lists the individual cable pairs in relation to the pin number and color coding.

**Status**
Shows the status of the wires inside the cable. The Lamp indicator will be *green* if there is no problem and *red* if there is a problem.

- **OK** indicates a fully functional cable.
- **Short** indicates an short circuited cable.
- **Open** indicates an open circuited cable.

**Distance to fault**
In case of cable troubles (i.e. an open or a short circuit) the distance to the problem will be indicated approximately in this field.

# 6.4 Mon/Gen

*Ethernet Monitor/Generate* is typically used for out-of-service and performance testing. It is possible to perform a passive, non-intrusive monitoring or at the same time transmit test data, which can be reflected for further evaluation and testing of the network.

## 6.4.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.4.2 Test Setup

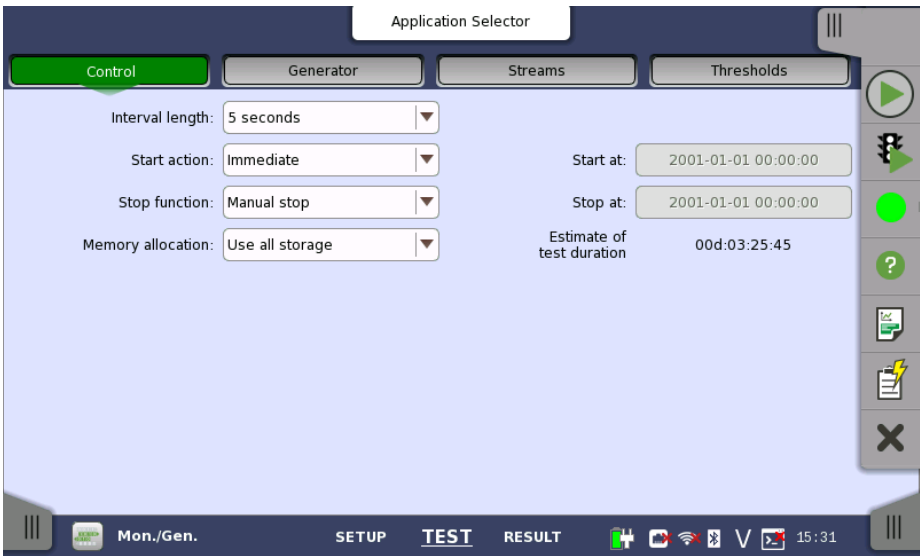
**Copy frame content to other stream(s)**

This feature allows you to copy the frame content of the stream that you are currently configuring to all streams in another port or to a single stream.


Touching the **Copy To** button opens a drop-down menu from which you can select the relevant port and **All** or a specific stream.

### 6.4.2.1 Control

When you go to the test setup of the Ethernet Monitor/Generate application, the following screen is displayed.




This screen contains the parameters that are generally required in a Monitor/Generate test setup.

**Interval length**
Allows you to specify the duration of the test intervals. The drop-down menu contains the following values: **1**, **2**, **5**, **10**, **15**, **30 seconds**, **1**, **5**, **10**, **15**, **30 minutes**, **1**, **2**, **4**, **6**, **12 hours** or **No intervals**.

**Start action**
Allows you to specify when the measurement is started.

- If **Immediate** is selected, the measurement starts when you touch the **Start** button.
- Selecting **Start at** will enable a delayed start. The start time for a delayed start can be specified in the adjacent **Start at** field.

**Stop function**
Allows you to specify when the measurement ends. Select the relevant option from the drop-down menu:

- If **Manual stop** is selected, the measurement will stop immediately when the **Stop** icon is touched.
- Selecting **Stop at** will enable the adjacent field, in which you can specify the stop time.
- Selecting **Duration** will allow you to specify a duration time in the adjacent field.

**Memory allocation**
Allows you to specify how the measurement will be stored in the Network Master's memory. Select the relevant option from the drop-down menu:

- **Use all storage**: When Network Master's memory became full with measured data, the whole measurement is stopped.
- **Continuous**: When Network Master's memory became full with measured data, oldest records in that memory will be overwritten.

**Estimate of test duration**
Contains an estimation of the time (in days, hours, minutes and seconds) before the whole memory will be filled out by the test. During an ongoing measurement, the estimate will be recalculated periodically.

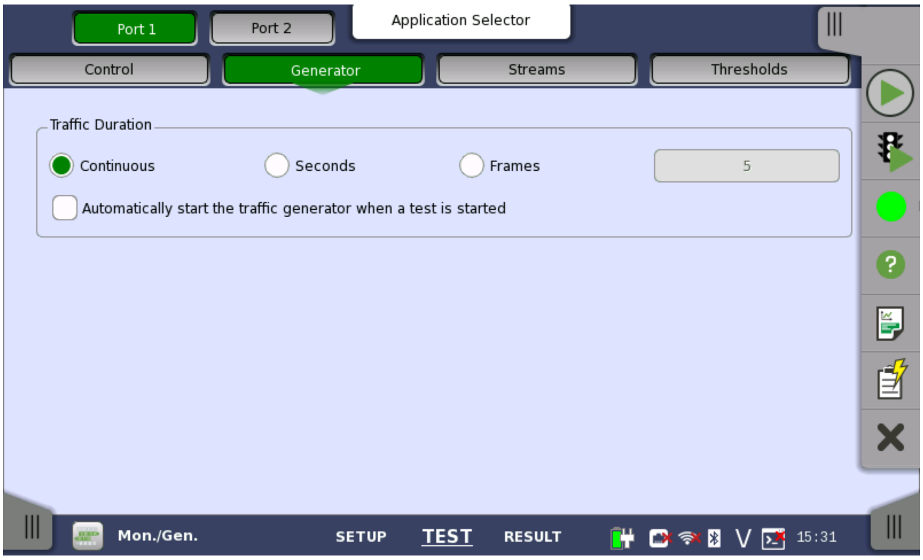
**Performance Parameters**

**OTN-related**

This item appears if 'Mon./Gen. on OTN' is running. Refer to "Performance Parameters" in BERT.

### 6.4.2.2 Generator

Selecting the **Generator** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen contains the traffic-related parameters.

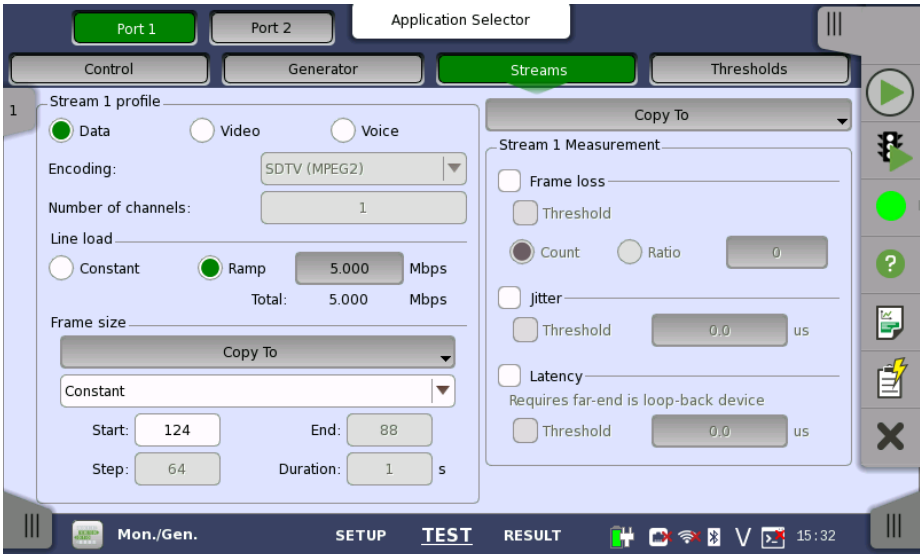
**Traffic Duration**

Allows you to set conditions concerning frames transmission. sequence. Selecting **Continuous** will make a continual test. Alternatively, the duration can be set manually in either **Seconds** or **Frames**, coupled with a specification of the number of seconds/frames in the adjacent field.

**Automatically start the traffic generator when a test is started**
In case of **Continuous**, you can select this checkbox to make the traffic generator start synchronously with the test starting.

### 6.4.2.3 Streams

Touching the **Streams** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen contains the parameters for specifying a profile and pattern for each stream and for specifying which measurements are made.

**Stream selection**

Use the slide-out panel on the left-hand side of the screen to select the relevant stream. Enable the stream by touching the button on the slide-out panel.

**Stream X profile**

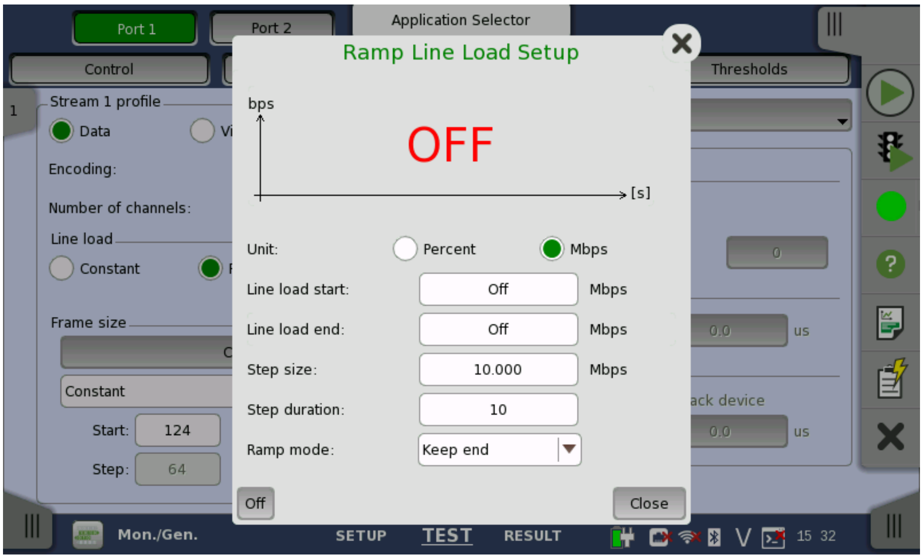
Using the radio buttons, you can select the stream profile as either **Data**, **Video** or **Voice**.

**Encoding**
Open the drop-down menu to select the relevant encoding type. The available values depend on the selected profile type.

**Number of channels**
Specify the number of channels.

**Line load**

Using the radio buttons, you can select the line load profile as either **Constant** or **Ramp**. If you select **Constant button**, touch the adjacent button to set the line load. If you select **Ramp**, you can touch the adjacent button to display the **Ramp Line Load Setup** dialog box. When 'Off' is displayed on the button, no streams are transmitted.




The dialog box contains the following settings:

**Line load start**
The line load at which the ramp will start.

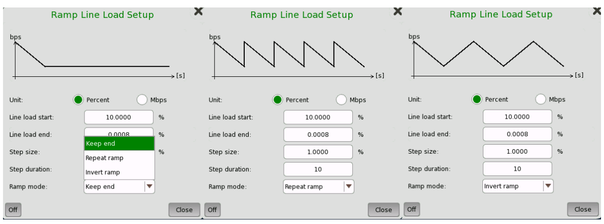
**Line load end**
The line load at which the ramp will end. (This is the value shown on the line load button.)

**Step size**
The step size from start to end.

**Step duration**
The duration of each step.

**Ramp mode**
How the ramp should continue. 3 modes are available:

- **Keep end**: The specified end line load is maintained after the ramp is ended.
- **Repeat ramp**: The ramp is repeated.
- **Invert ramp**: The ramp is inverted.




**Frame size**

Three setups are available, using one or more of the available setting options:

**Constant**
Uses the fixed frame size specified by the **Start** value for the duration of the test.

**Stepped**

Steps the frame size from **Start** to **End** in increments of **Step**. Each frame size is transmitted for the period in seconds specified by **Duration**.
If the traffic duration is set to *Continuous*, the step sequence will be repeated indefinitely. If it is set to *a number of seconds*, the step sequence will be terminated when the specified total period has elapsed. Similarly for *a number of frames*, the step sequence will be terminated when the total number of transmitted frames reaches the specified count.

**Random**

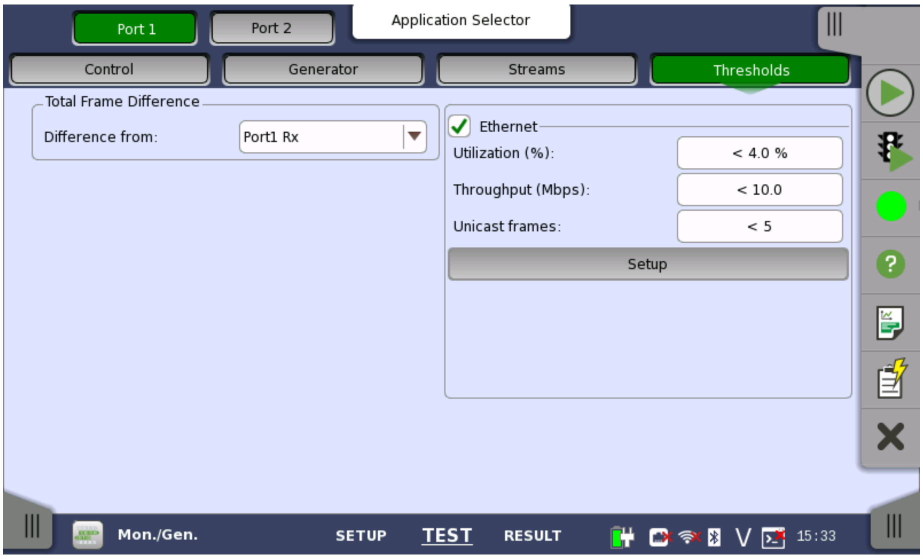
Sends a continuous stream of frames of random sizes, evenly distributed between **Start** and **End**.

NOTE *Frame size is protocol headers and payload combined. Frame size does not include preamble and interframe gap.*

**Stream X measurement** Select one or more of the measurements (**Frame loss**, **Jitter** and **Latency**) and then specify a threshold value for each.

#### 6.4.2.4 Thresholds

Touching the **Thresholds** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.



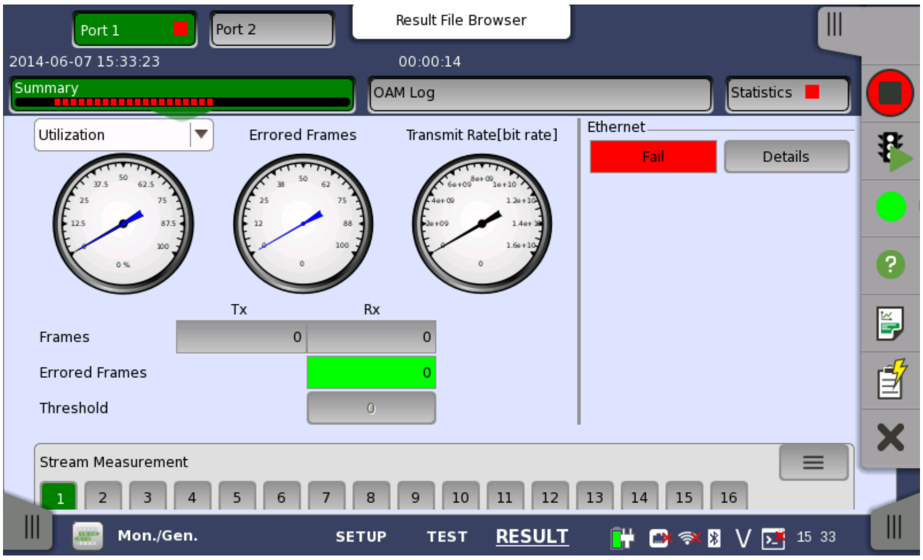

This screen allows you to set up a number of special monitoring items related to the various interface types. Refer to Thresholds in BERT section. When specified and enabled, these threshold values (i.e. limits) for errors and Pass/Fail status will be used during the monitoring. **Transport** appears in case of Mon./Gen. on OTN.

NOTE *Thresholds can only be set/modified while no measurement is running, as they are active during a measurement.*

### 6.4.3 Test Results

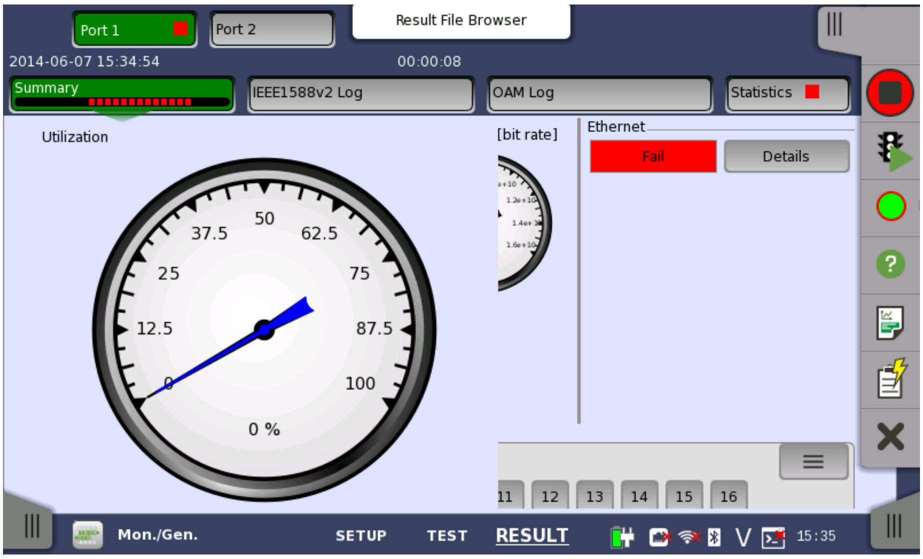
#### 6.4.3.1 Summary

When you go to the test results of the Ethernet Monitor/Generate application, the following screen is displayed.



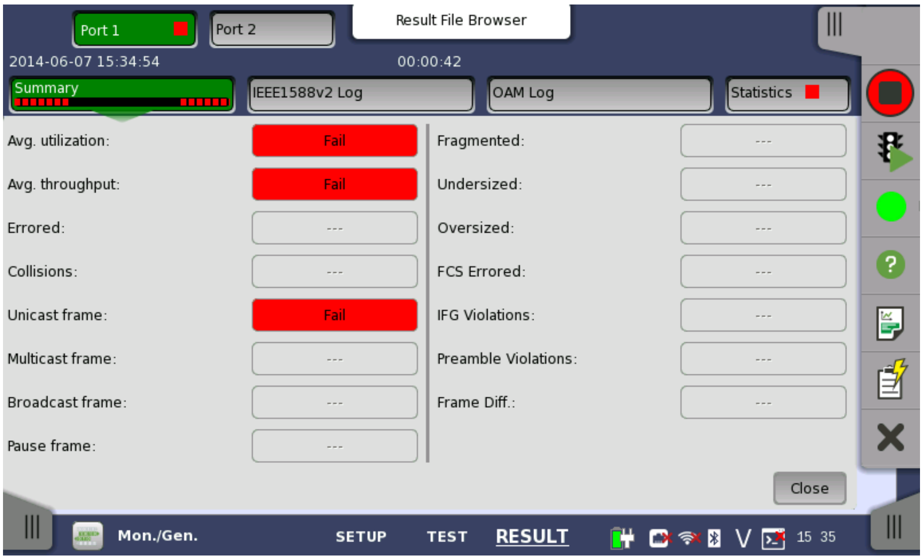

This screen contains a summary of the results of the Ethernet Monitor/Generate test. The information includes such things as number of errored frames and number of exceeded thresholds.

The three dials showing utilization/throughput results, pattern errors and errored frames can be enlarged by touching on them. The blue needle points the average value from starting the test. The black needle points the measured value in the latest period.



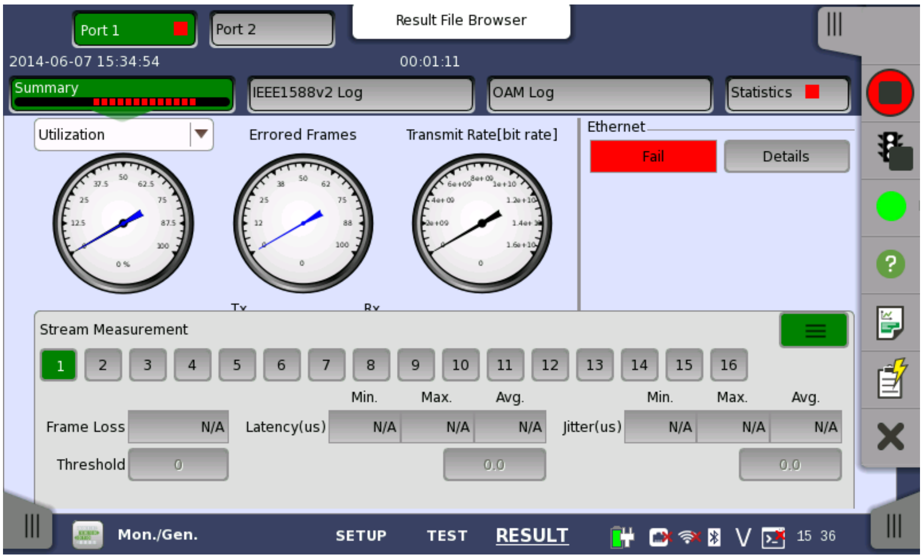

To view throughput information, select **Throughput** in the drop-down menu and then expand the dial. Use the drop-down menu above the expanded dial to select the relevant layer.

When **Ethernet** is selected on 'Threshold' of Test Setup screen, the **Ethernet** information appears in the upper right-hand corner, shows pass/fail status summary. Touching the **Details** button allows you to inspect the individual pass/fail status.




**Transport**
Displays the results of Transport test. This result appears if 'Transport' checkbox is selected in Test Setup screen.

The stream slide-up at the bottom of the screen allows you to configure and inspect the measurements of each individual stream. Display/Hide the slide-up by touching the handle icon. You can set up thresholds for frameloss, latency and jitter for each stream as well as inspect the measurement results.




### 6.4.3.2 IEEE1588v2 Log

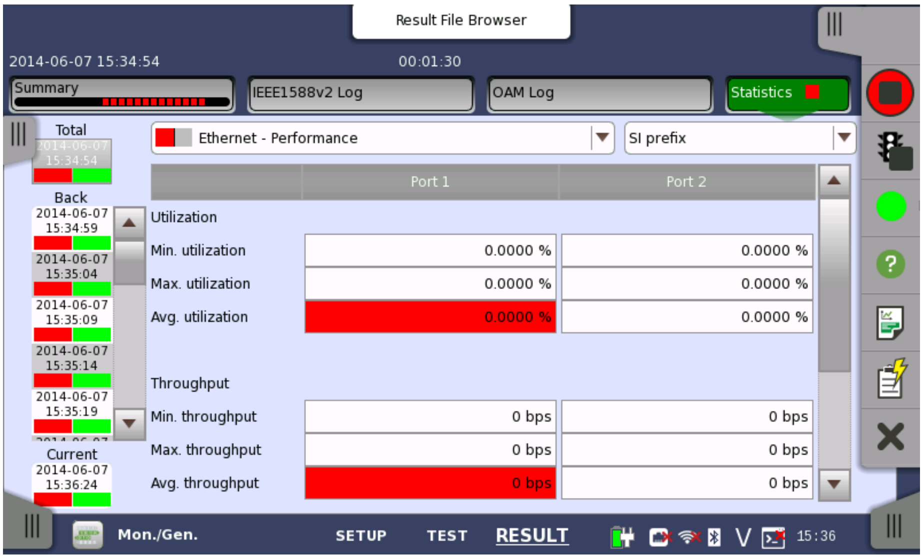
If **Ext. log** is selected in IEEE1588v2 screen of Ethernet Frame Setup, the **IEEE1588v2 Log** button appears in the navigation area. Refer to IEEE1588v2 Log in BERT for the operation.

### 6.4.3.3 OAM Log

The operation of **OAM Log** screen is the same as that of BERT application. Refer to OAM Log in BERT for the operation.

### 6.4.3.4 Statistics

Touching the **Statistics** button in the navigation area displays the screen shown below.




This screen presents a detailed analysis of the test results. You can choose to view either the total results from measurement start or the results of a specific interval during the test. You can also zoom in on a specific result item. The results can be displayed either in table (list) form or as a graph.

## Selecting which results to view

**Selecting the interval time**

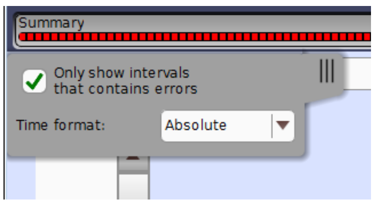
Touch the **Total** button to switch the total values measured in all interval times. The start time of measurement is displayed on the button.

Touching the button in left side **Back** field shows the measured values in the interval time. The end time of the interval is displayed on the button.

**Current** button is displayed at left bottom when the measurement is running. Touching the **Current** button shows the measured values in the current interval time. The start time of the current interval is displayed on the button.

The slide-out panel on the left-hand side of the screen contains the following functions:

- Only show intervals that contains errors
- Time format




NOTE

*If you have stopped measurement during the interval time, the measurement results of current interval are discarded. The log of current interval is not displayed in **Back** field.*

In this case, result data are re-calculated excluding the data of current interval when the measurement is stopped. This causes that "Count" and "Ratio" displayed after the measurement will be different from that of during measurement.

The sum of interval time (multiplied interval time by the number of back logs) may not match the differential time between displayed time at left top and right top after the measurement.

**Selecting type of results**

Open the middle drop-down menu in the top row of buttons to select which results you want displayed on the screen.

- **Performance**
- **Frame**
- **Burst**
- **Size Distribution**
- **Transmit**
- **Multi Stream Transmit**
- **Multi Stream Throughput**
- **Multi Stream Frame Loss**
- **Multi Stream Latency**
- **Multi Stream Jitter**
- **SyncE**
- **IEEE 1588v2**
- **802.3ah**
- **802.1ag/Y.1731**

**Studying a specific result**

Touch a specific cell in a result table to zoom in on the corresponding result item. The **Count** and **Ratio** fields are displayed on a **Zoom** tab page. A **Time vs. Statistics** tab page is also available. Use the **Back** button or touch the zoom filed to return to the statistics screen.

### Selecting how results are displayed

**Selecting notation**

Select the required notation for the results from the notation drop-down menu.

- **Unformatted** - e.g. 71892
- **SI prefix** - e.g. 71.892 k (k means "kilo")
- **Engineering** - e.g. 71.892E3
- **Scientific** - e.g. 7.1892E4

### Results

Results are displayed according to your choice.

Performance
- **Utilization**
- **Throughput**
- **Frame rate**

Frame
- **Alarms**
- **Good Frames**
- **Errored Frames**
- **Other Frames**
- **Last Received**

Bursts
- **Frames**
- **Burst Size**

Size Distribution
- **Total Frames**
- **Size Dist.**
- **Frame Size**

Transmit
- **Traffic**
- **Frame Diff.**

Multi Stream Transmit
- **Traffic**

Multi Stream Throughput
- **Throughput**

Multi Stream Frame Loss
- **Frame Loss**

Multi Stream Latency
- **Latency(us)**

Multi Stream Jitter

**Jitter(us)**

SyncE

**SSM Statistics**

**Alarms**

**Rx SSM QL**

IEEE 1588v2

**Offset Stat.**

**Offset Variance**

**Mean Path Delay**

**PDV**

**Message Stat**

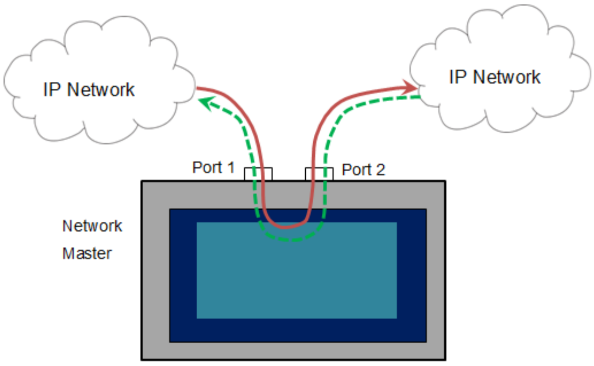
**Clock Status Stat.**

802.3ah

802.1ag/Y.1731

# 6.5 Pass Through

*Ethernet Pass Through* enables non-intrusive in-service monitoring for both fast troubleshooting and detailed analysis of the live traffic on a network. All traffic received on a port is forwarded on the other port and vice versa. Traffic between the two network DUT elements is monitored as illustrated below.




## 6.5.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

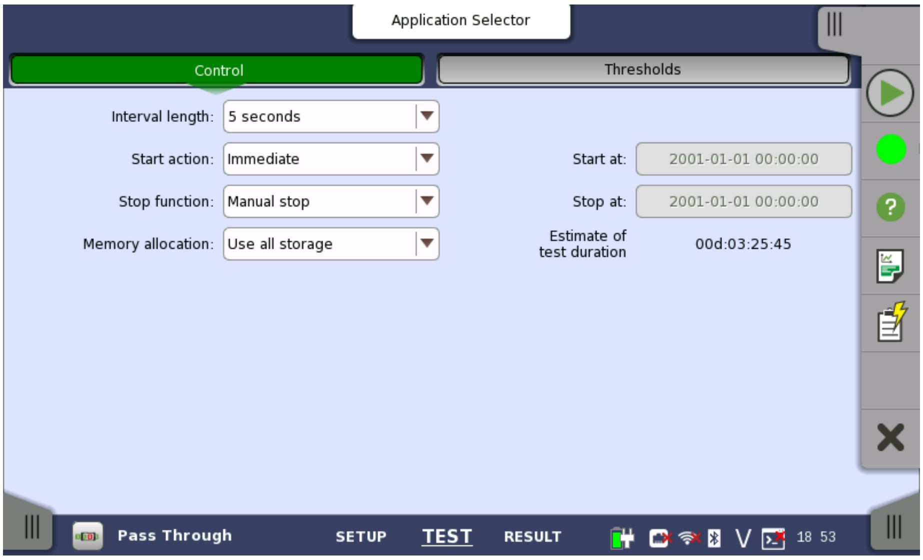
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.5.2 Test Setup

### 6.5.2.1 Control

When you go to the test setup of the Ethernet Pass Through application, the following screen is displayed.




This screen contains the parameters that are generally required in a *Pass Through* test setup.

**Interval length**
Allows you to specify the duration of the test intervals. The drop-down menu contains the following values: **1**, **2**, **5**, **10**, **15**, **30 seconds**, **1**, **5**, **10**, **15**, **30 minutes**, **1**, **2**, **4**, **6**, **12 hours** or **No intervals**.

**Start action**
Allows you to specify when the measurement is started.

- If **Immediate** is selected, the measurement starts when you touch the **Start** button.
- Selecting **Start at** will enable a delayed start. The start time for a delayed start can be specified in the adjacent **Start at** field.

**Stop function**
Allows you to specify when the measurement ends. Select the relevant option from the drop-down menu:

- If **Manual stop** is selected, the measurement will stop immediately when the **Stop** icon is touched.
- Selecting **Stop at** will enable the adjacent field, in which you can specify the stop time.
- Selecting **Duration** will allow you to specify a duration time in the adjacent field.

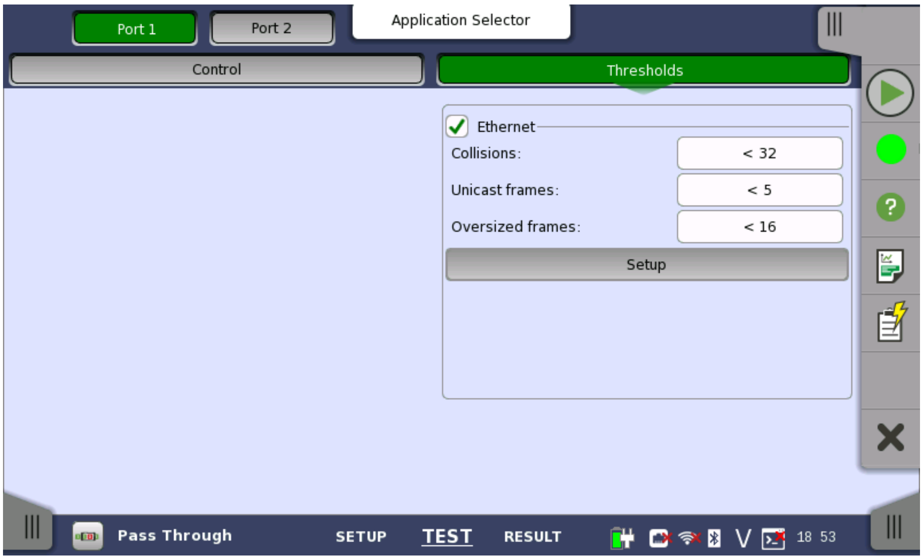
**Memory allocation**
Allows you to specify how the measurement will be stored in the Network Master's memory. Select the relevant option from the drop-down menu:

- **Use all storage**: When Network Master's memory became full with measured data, the whole measurement is stopped.
- **Continuous**: When Network Master's memory became full with measured data, oldest records in that memory will be overwritten.

**Estimate of test duration**
Contains an estimation of the time (in days, hours, minutes and seconds) before the whole memory will be filled out by the test. During an ongoing measurement, the estimate will be recalculated periodically.

### 6.5.2.2 Thresholds

Touching the **Thresholds** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.



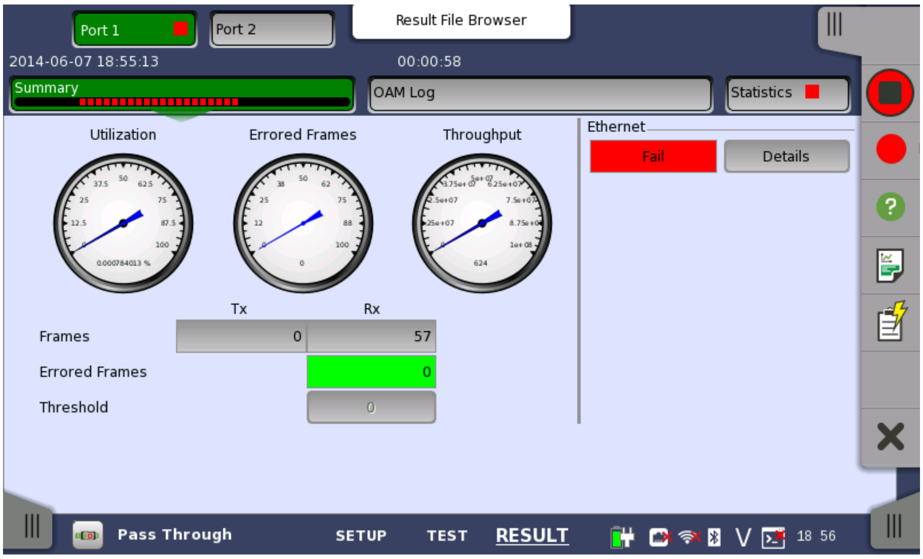

**Ethernet** When you select the checkbox, you can enable various thresholds. Touch the **Setup** button to display the **Ethernet threshold setup** dialog box.

NOTE *Thresholds can only be set/modified while no measurement is running, as they are active during a measurement.*

## 6.5.3 Test Results

### 6.5.3.1 Summary

When you go to the test results of the Ethernet Pass Through application, the following screen is displayed.




This screen contains a summary of the results of the Ethernet Pass Through test. The information includes such things as number of errored frames and number of exceeded thresholds.

The three dials showing utilization/throughput results, pattern errors and errored frames can be enlarged by touching on them. The blue needle points the average value from starting the test. The black needle points the measured value in the latest period.

When **Ethernet** is selected on 'Threshold' of Test Setup screen, the **Ethernet** information appears in the upper right-hand corner, shows pass/fail status summary. Touching the **Details** button allows you to inspect the individual pass/fail status. Refer to Summary in BERT section.

### 6.5.3.2 OAM Log

The operation of **OAM Log** screen is the same as that of BERT application. Refer to OAM Log in BERT for the operation.

### 6.5.3.3 Statistics

Touching the **Statistics** button in the navigation area displays the screen providing the statistics data. Refer to Statistics of BERT for the operation.

# 6.6 Ping

The Ethernet Ping test is a quick and easy way for testing, troubleshooting and verification of connectivity and latency. Packets are sent from the source address to the destination address and back again - allowing the user to determine whether traffic is possible.

## 6.6.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

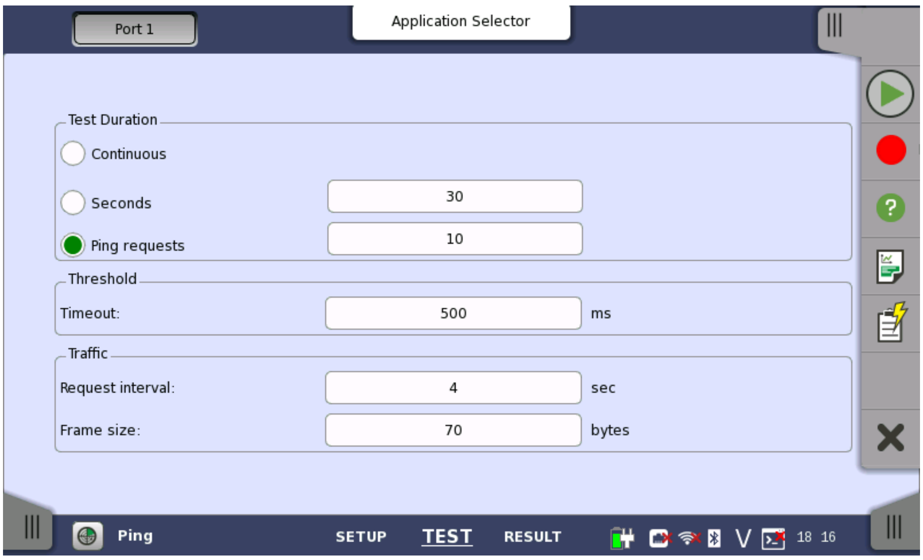
For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.6.2 Test Setup

When you go to the test setup of the Ethernet Ping application, the following screen is displayed.




This screen allows you to configure the Ping test conditions for the currently selected port.

**Test Duration**

Allows you to define the test duration in one of three ways:

- **Continuous** - Used when a *persistent Ping test* is needed.
- **Seconds** - Used to define the test duration in *seconds*.
- **Ping requests** - Used to define the test duration in *number of ping requests*.

**Threshold**

Allows you to specify the **Timeout** threshold value in milliseconds (ms).

**Traffic**

**Request interval**

Allows you to specify the interval between frames in seconds. When the value is set to zero (**0**), frames are transmitted back-to-back.

**Frame size**
Allows you to specify the frame size in bytes.

NOTE *Frame size is protocol header and payload combined. Frame size does not include preamble and interframe gap.*

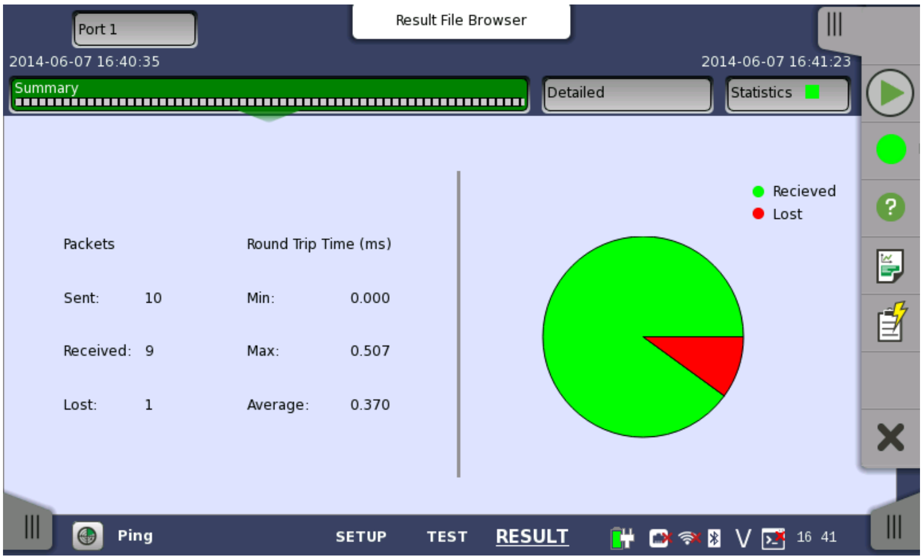
## 6.6.3 Test Results

The results of an Ethernet Ping test relate to a specific port and consist of the Round Trip Times of the ping requests. The data is shown in both list-form and in a graphical presentation.

**Graphical presentation** The graphical presentation consists of a bar diagram of the Round Trip Times and of a pie chart showing the percentage distribution of echo replies and timeouts.

### 6.6.3.1 Summary

When you go to the test results of the Ethernet Ping test, the following screen is displayed.




This screen presents a summary of the results of an Ethernet Ping test. The results relate to a specific port and consist of information about sent/received/lost packages and the minimum/maximum/average Round Trip Time.

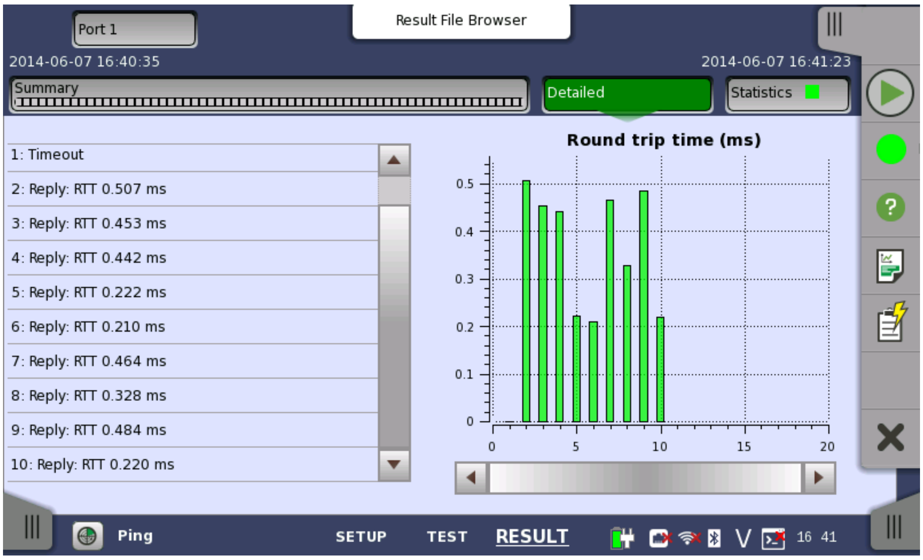
**Graphical presentation** The graphical presentation consists of a pie chart showing the percentage distribution of received/lost packages.

### 6.6.3.2 IEEE1588v2 Log

If **Ext. log** is selected in IEEE1588v2 screen of Ethernet Frame Setup, the **IEEE1588v2 Log** button appears in the navigation area. Refer to IEEE1588v2 Log in BERT for the operation.

### 6.6.3.3 Detailed

Touching the **Detailed** button in the navigation area will display the following screen.




This screen presents the detailed results of an Ethernet Ping test. The results relate to a specific port and consist of the Round Trip Times of the individual Ping requests. The data is shown in both list-form and in a graphical representation.

**Graphical presentation**

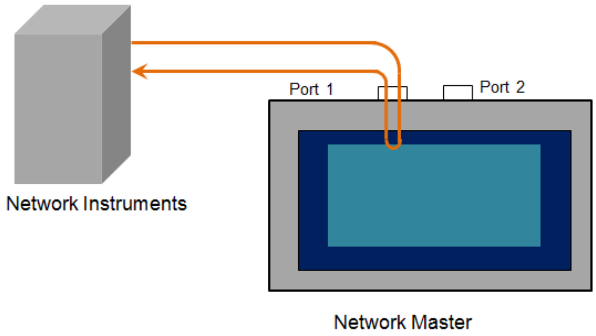
The graphical presentation consists of a bar diagram of the round trip times.

### 6.6.3.4 Statistics

Touching the **Statistics** button in the navigation area displays the screen providing the statistics data. Refer to Statistics of BERT for the operation.

# 6.7 Reflector

In *Ethernet Reflector* mode the Network Master loops incoming traffic on a port swapping MAC and/or IP addresses.




NOTE

*HDX (Half Duplex) is not possible in 'Reflector' mode.*

## 6.7.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

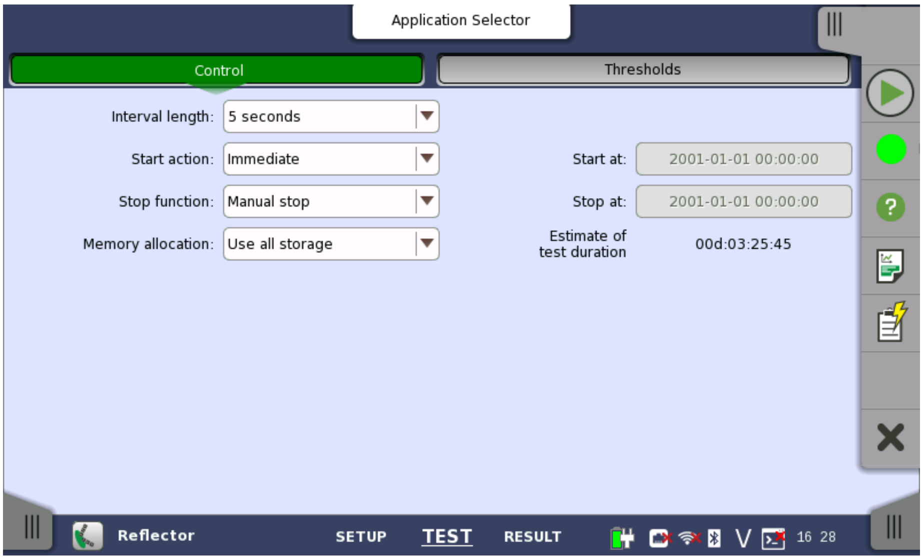
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.7.2 Test Setup

### 6.7.2.1 Control

When you go to the test setup of the Ethernet Reflector application, the following screen is displayed.




This screen contains the parameters that are generally required in a Reflector test setup.

**Interval length**
Allows you to specify the duration of the test intervals. The drop-down menu contains the following values: **1**, **2**, **5**, **10**, **15**, **30 seconds**, **1**, **5**, **10**, **15**, **30 minutes**, **1**, **2**, **4**, **6**, **12 hours** or **No intervals**.

**Start action**
Allows you to specify when the measurement is started.

- If **Immediate** is selected, the measurement starts when you touch the **Start** button.
- Selecting **Start at** will enable a delayed start. The start time for a delayed start can be specified in the adjacent **Start at** field.

**Stop function**
Allows you to specify when the measurement ends. Select the relevant option from the drop-down menu:

- If **Manual stop** is selected, the measurement will stop immediately when the **Stop** icon is touched.
- Selecting **Stop at** will enable the adjacent field, in which you can specify the stop time.
- Selecting **Duration** will allow you to specify a duration time in the adjacent field.

**Memory allocation**
Allows you to specify how the measurement will be stored in the Network Master's memory. Select the relevant option from the drop-down menu:

- **Use all storage**: When Network Master's memory became full with measured data, the whole measurement is stopped.
- **Continuous**: When Network Master's memory became full with measured data, oldest records in that memory will be overwritten.

**Estimate of test duration**
Contains an estimation of the time (in days, hours, minutes and seconds) before the whole memory will be filled out by the test. During an ongoing measurement, the estimate will be recalculated periodically.

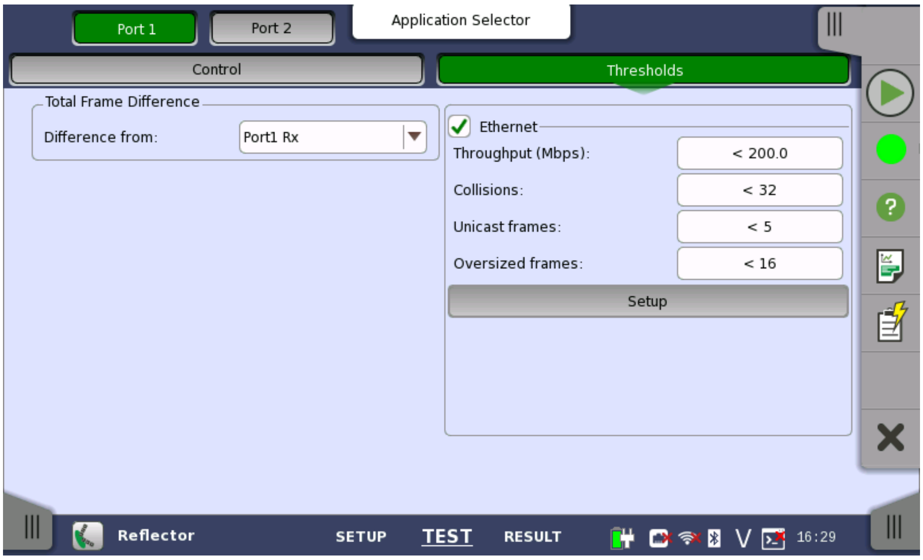
## Performance Parameters

### OTN-related

This item appears if 'Reflector on OTN' is running. Refer to "Performance Parameters" in BERT.

### 6.7.2.2 Thresholds

Touching the **Thresholds** button in the navigation area displays the following screen.
**Follow** button appears when the Port 1 settings can be copy to Port 2.




This screen allows you to set up a number of special monitoring items related to the various interface types. When specified and enabled, these threshold values (i.e. limits) for errors and Pass/Fail status will be used during the monitoring.

**Total Frame Difference**

Allows you to select the reference port to measure the differential time, using **Difference from:** drop down menu.

**Ethernet**

When you select the checkbox, you can enable various thresholds. Touch the **Setup** button to display the **Ethernet threshold setup** dialog box same as BERT.

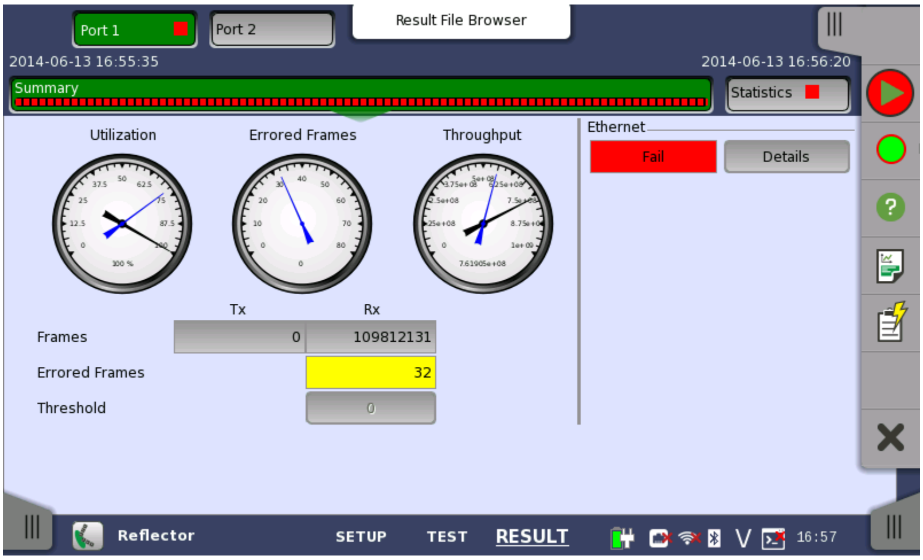
NOTE

*Thresholds can only be set/modified while no measurement is running, as they are active during a measurement.*

## 6.7.3 Test Results

### 6.7.3.1 Summary

When you go to the test results of the Ethernet Reflector application, the following screen is displayed.




This screen contains a summary of the results of the Ethernet Reflector test. The information includes such things as number of errored frames and number of exceeded thresholds.

The three dials showing utilization/throughput results, pattern errors and errored frames can be enlarged by touching on them. The blue needle points the average value from starting the test. The black needle points the measured value in the latest period.

When **Ethernet** is selected on 'Threshold' of Test Setup screen, the **Ethernet** information appears in the upper right-hand corner, shows pass/fail status summary. Touching the **Details** button allows you to inspect the individual pass/fail status. Refer to Summary in BERT section.

### 6.7.3.2 Statistics

Touching the **Statistics** button in the navigation area displays the screen providing the statistics data. Refer to Statistics of BERT for the operation.

# 6.8 RFC 2544

The RFC 2544 is a benchmarking methodology and defines a number of tests to be used for describing the performance characteristics of a network device (or a complete network). The Network Master includes several physical setups (test modes) and four different tests.

Throughput Test
: The throughput is the fastest rate at which a DUT (Device Under Test) can forward frames without frame loss for a specific frame size. That is, the fastest rate at which the count of test frames transmitted by the DUT is equal to the number of test frames sent to it by the test equipment.

Frame Loss Test
: Used to determine the frame loss rate of a DUT throughout the entire range of input data rates and frame sizes.

Latency Test
: Used to determine the duration from when the frame left the unit to when the frame returned to the unit. The test is done for different line loads for a specific frame size.

Burst Test
: This is also called burstability or back-to-back test. The burst value is the number of frames in the longest burst that the DUT will handle without the loss of any frames.

*If your test parameters are identical for the throughput and the frame loss test, use the combined test 'Throughput and Frame loss' to save time and enhance overview at the results pages.*

## 6.8.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

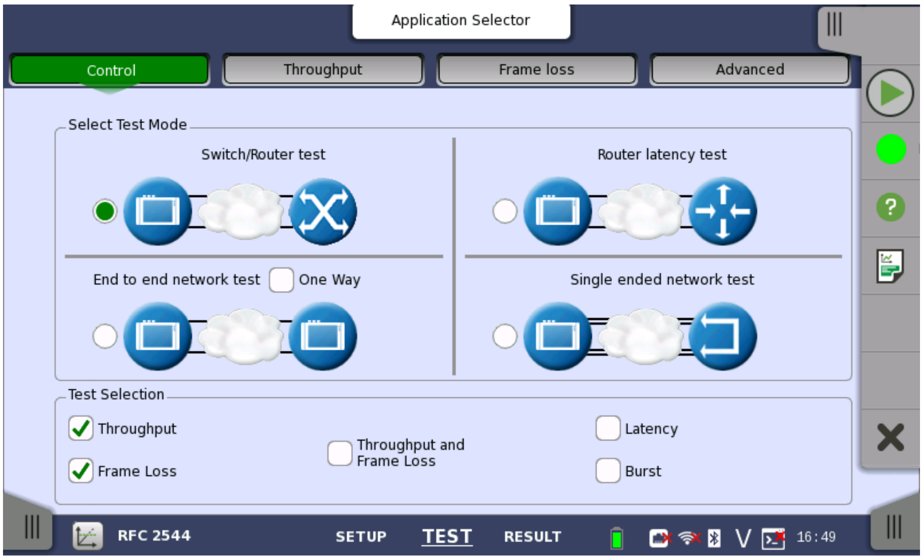
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.8.2 Test Setup

### 6.8.2.1 Control

When you go to the test setup of the RFC 2544 application, the following screen is displayed.




This screen allows you to specify your test mode and select which RFC 2544 tests to carry out.

**Select Test Mode**

4 different test modes are available:

- Switch/Router test
- Router latency test
- End to end network test
- Single ended network test

Select the test mode to define your test configuration. See the description of the test modes below.

**Test Selection**

Select one or more of the following RFC 2544 tests:

- **Throughput**
- **Frame Loss**
- **Throughput and Frame Loss**
- **Latency**
- **Burst**

NOTE

*For each test that you select, a separate test setup screen will become available, containing the relevant setup parameters for that test. Similarly, the test results will include only the tests that you have selected in 'Test Selection'.*

## Test Mode Descriptions

**Switch/Router test**

In this test mode one instrument is able to test, e.g. the data link layer of a switch or router. Both ports must be active and linked in this mode, with port 2 in follow port 1 mode. IP and MAC-addresses must be swapped, ensuring that the switch will forward frames from port 1 to port 2 and vice versa.

**Testing in this mode**

- Throughput test
- Frame Loss test
- Throughput and Frame Loss test
- Latency test
- Burst test

NOTE

*Both ports must be activated in order to perform the Switch/Router test.*
*You cannot select 'Throughput and Frame Loss' and 'Throughput' / 'Frame Loss' at the same time.*

**Router latency test**

In this test mode, the latency-test sends out ping frames, used for measuring the response time for router equipment. The maximum line load for the Router Latency Test is 1 Mbps.

The Network Master is capable of responding to incoming ping frames, and can thus be used to run the Router Latency Test port to port, if required.

NOTE *When the instrument is used to reply to incoming ping frames, the settings of the Encapsulation type and VLAN/no VLAN in port traffic setup will decide which ping requests to answer. So do VLAN ID and Address setups.*

The Router Latency Test works with both IPv4/ICMPv4 and IPv6/ICMPv6.

**Testing in this mode**

- Latency test

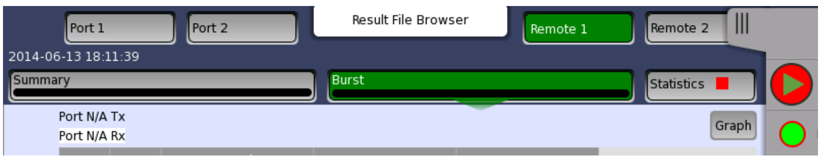
**End to end network test**

In this test mode, two Network Master units will work together performing an RFC 2544 test. The unit initiating the test is the *Local* unit and the other unit is the *Remote* unit. Control information is sent from the 'remote' unit on port 1 (alternative, port 2 will be used, if port 1 is turned off). When the test is started on the 'local' unit, the unit will try to contact the 'remote' unit on the control port using the Destination IP and MAC address (or use ARP if selected). If the 'remote' unit receives the communication on a port with a matching Source address, the test will begin. Apart from the Address setup, both the 'local' and the 'remote' unit should have the *Accept Network Master Configuration frames* option enabled.

The only needed setups on the 'remote' side are the source addresses and the enabling of Accept incoming configuration frames. The complete RFC 2544 setup is transferred from the 'local' unit when the test is started (except for the address setup which is optional).

NOTE *When the test is started on the 'local' unit, a popup will appear on the 'remote' unit, telling that the unit is being remotely controlled - providing a 'break connection' button. The popup will disappear when the test is completed or stopped on the 'local' unit.*

When the test is completed, the test results are transferred from the 'remote' unit to the 'local' unit. **Remote 1** and **Remote 2** buttons appear in Navigation area for displaying the 'remote' side test results.




NOTE *The local results and 'remote' results are related in the way that Tx statistics for the local ports match up with the Rx statistics for the remote ports and vice versa.*

The End to End Test can be run in several modes: By default, both ports are used for transmitting and receiving on both the 'local' unit and the 'remote' unit. Depending on the address setup the test will run either Local port 1 > Remote port 1, and Local port 2 > Remote port 2 or vice versa.

If **One Way** is selected, the test will transmit frames from either the 'remote' unit or the 'local' unit.

**Testing in this mode**

- Throughput test
- Frame Loss test
- Throughput and Frame Loss test
- Burst test

Note that you cannot select 'Throughput and Frame Loss' and 'Throughput' / 'Frame Loss' at the same time.

**Single ended network test**

This test is used when testing network by reflecting traffic back to the Network Master. This requires a device to reflect the traffic back e.g. a second Network Master.

HINT

*If both ports are active, the test will require both ports to be linked and do a dual 'Single ended network test'. Turn off one of the ports to only test on one of the ports.*

**Testing in this mode**

- Throughput test
- Frame Loss test
- Throughput and Frame Loss test
- Latency test
- Burst test

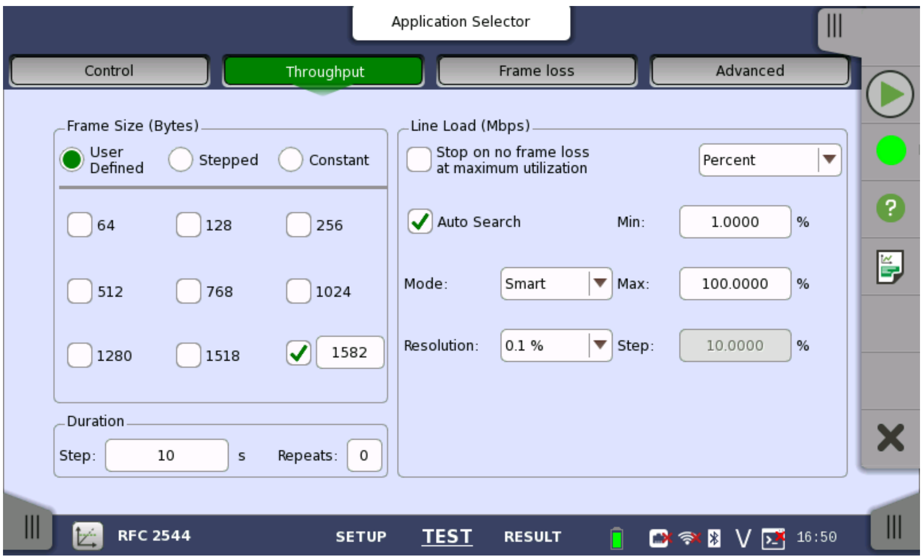
Note that you cannot select 'Throughput and Frame Loss' and 'Throughput' / 'Frame Loss' at the same time.

### 6.8.2.2 Throughput

NOTE

*Only available if you have specified a Throughput test on the 'Control' of Test Setup screen.*

Touching the **Throughput** button in the navigation area will display the screen shown below.



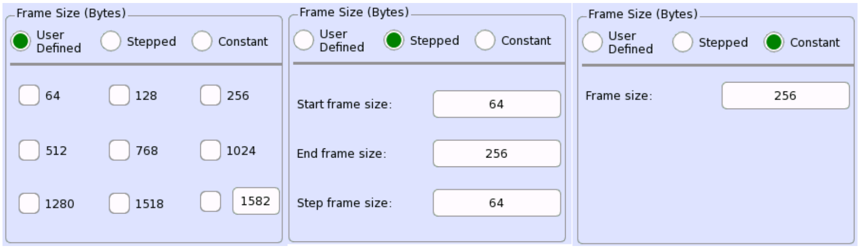

This screen allows you to configure the following parameters related to an RFC 2544 Throughput test:

NOTE

*The changes affect both Port 1 and Port 2 when the Switch/Router Test mode is selected.*

**Frame Size (Bytes)**

Frame size can be specified in 3 ways. Observe that the screen layout changes depending on the type of Frame Size selected.




User Defined

Checkboxes for the following predefined sizes are available: **64**, **128**, **256**, **512**, **768**, **1024**, **1280**, **1518** and **1519** to **16000**(Using the field at right bottom).

Stepped

Setup of **Start frame size**, **End frame size** and **Step frame size** is available. The frame size starts at *Start frame size* and increases/decreases in intervals of *Step frame size* until the frame size is above/below *End frame size* (the increase or decrease depending on the specified start and end values).

Constant

A **Frame size** field for specifying the constant size is available.

HINT

*The 'stepped' mode is convenient for testing different frame sizes consistently and equally distributed. As a consequence it produces more smooth and detailed graphs when the step frame size is arbitrarily low. The test extends in time for smaller step frame sizes.*

NOTE

*Frame size is protocol headers and payload combined. Frame size does not include preamble and interframe gap.*

**Line Load (Mbps)**

The different test line loads used in the test are specified as a Minimum (**Min**) and Maximum (**Max**) - varied in intervals of the value specified in the **Step** field. The test always starts at Maximum line load and decreases until the line load is less than Minimum. The results can be presented in either **Mbps** or as **Percent**.

Valid range of *Min*, *Max*, *Step* depends on the unit and Ethernet interface.

Percent

0.0008 to 100.0000 %.

Mbps

10M interface: 0.00008 to 10.000 Mbps *1

100M interface: 0.0008 to 100.00 Mbps *1

1G interface: 0.008 to 1000.00 Mbps *1

10G interface: 0.08 to 10000.00 Mbps *2

*1: Setting is only available with the Ethernet 10/100/1000 interface.

*2: Setting is only available when the Ethernet 10 Gig option is installed.

**Stop on no frame loss at maximum utilization**

The test will continue to test the next frame size if the current test step at a specific line load and frame size does not have any frames lost.

**Auto Search**

Allows you to let the test automatically find the maximum line load that gives zero frame loss, using a specified resolution. Auto Search can run in one of the two following modes:

- **Smart** that assumes that there is a higher probability of frame loss occurring closer to Max, and therefore makes a skewed binary search searching the higher line loads first.

- **Binary** that will perform a binary search of the specified line load interval from Max to Min.

The **Resolution** field lets you specify the precision of the auto search. A higher precision extends the duration of the test. Available resolutions are: **0.1**, **1.0** and **10.0** %.

NOTE *The check boxes are enabled except when selecting 'End to End network test' on Control screen.*

**Duration**

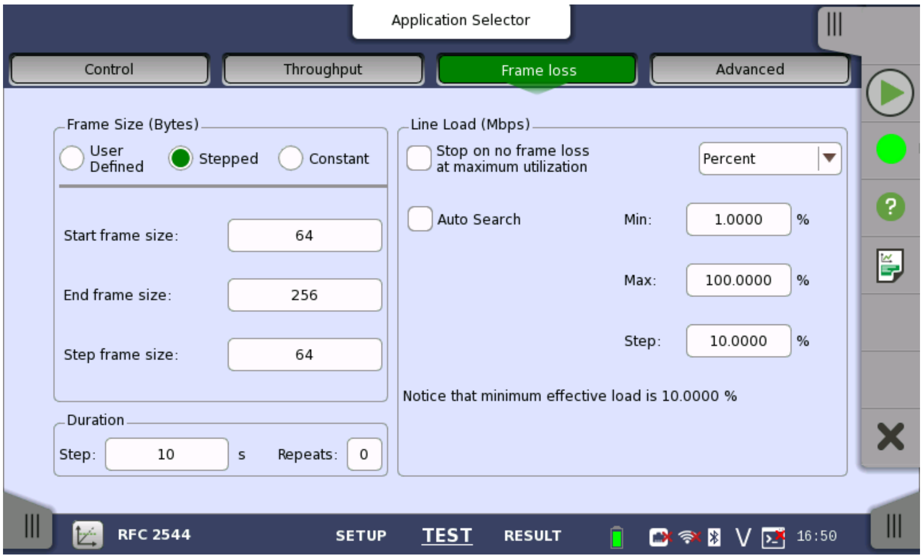
**Step**
Specify the approximate duration in time of each step of the test. It can be set to a number of seconds (minimum 3 seconds).

**Repeats**
Specify the number of times the complete test will repeat. Valid range: **0** to **1000**.

### 6.8.2.3 Frame Loss

NOTE *Only available if you have specified a Frame Loss test on the 'Control' of Test Setup screen.*

Touching the **Frame loss** button in the navigation area will display the screen shown below.




This screen allows you to configure the following parameters related to an RFC 2544 Frame Loss test:

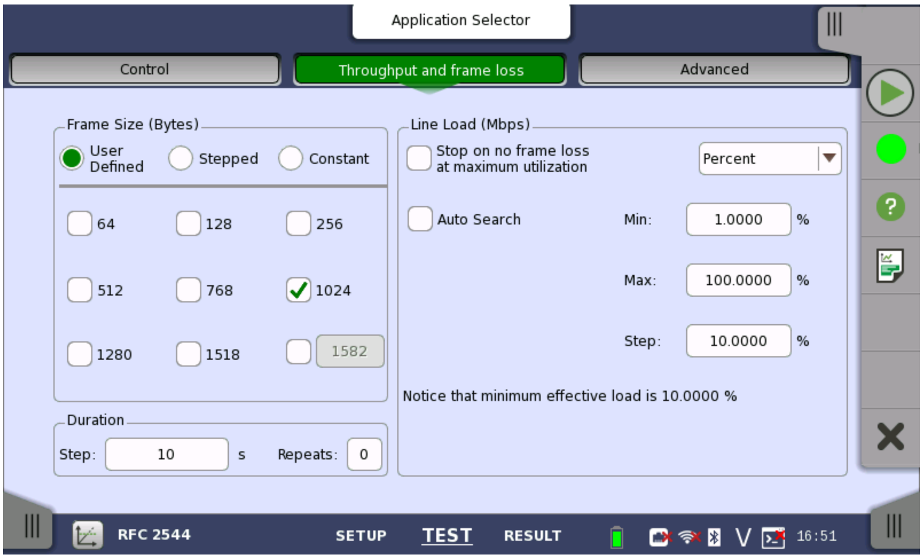
- Frame Size
- Line Load
- Duration

The parameters are identical to the ones described in the *Throughput* section above.

### 6.8.2.4 Throughput and Frame Loss

NOTE *Only available if you have specified a 'Throughput and Frame Loss' test on the 'Control' of Test Setup screen. Use this test if you want to perform both a Throughput test and a Frame Loss test while using the same test parameters for both.*

Touching the **Throughput and frame loss** button in the navigation area will launch the screen shown below.




This screen allows you to configure the following parameters related to an RFC 2544 Throughput and Frame Loss test:

- Frame Size
- Line Load
- Duration

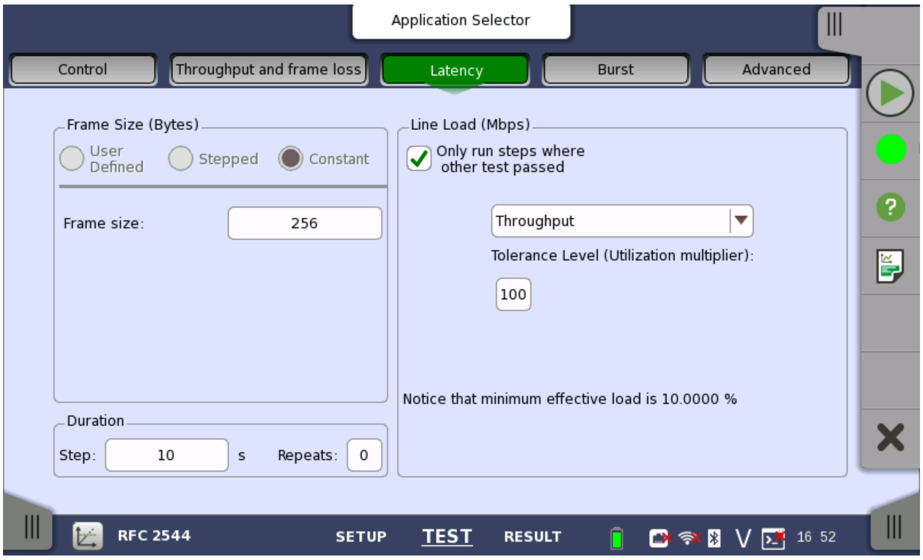
The settings for 'Throughput and Frame Loss' are identical to the ones described in the *Throughput* section above.

### 6.8.2.5 Latency

**NOTE**

*Only available if you have specified a Latency test on the 'Control' of Test Setup screen.*

Touching the **Latency** button in the navigation area will display the screen shown below.




This screen allows you to configure the parameters related to an RFC 2544 Latency test:

- Frame Size

- Line Load
- Duration

Most of the settings for Latency are identical to the ones described above in the *Throughput* section. Please see the detailed descriptions in that section in addition to the Latency-specific information provided here.

**Only run steps where other test passed**
Allows you to select the other test that must have passed. It is possible to choose between: **Throughput**, **Frame Loss**, and **Throughput and Frame Loss**.

In addition, you can specify a tolerance level (utilization multiplier).

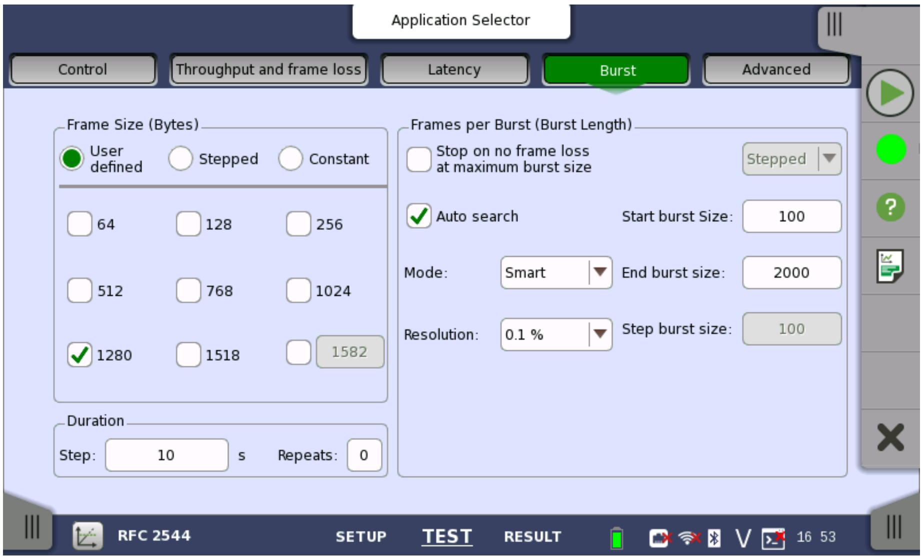
NOTE *When 'Only run steps where other test passed' is selected, all other settings are forced identical for the Frame Loss and Latency tests.*
*'Only run steps where other test passed' is enabled in case of 'Switch/Router test' or 'Single ended network test'.*

NOTE *If duration 'Repeats' is set to 0 (zero), the test will run a single time. If it is set to 1, the test will run two times (repeated once).*

### 6.8.2.6 Burst

NOTE *Only available if you have specified a Burst test on the 'Control' of Test Setup screen.*

Touching the **Burst** button in the navigation area will display the screen shown below.




This screen allows you to configure the following parameters related to an RFC 2544 Burst test:

- Frame Size
- Frames per burst (burst length)
- Duration

*Frame Size* and *Duration* are identical to the ones described above in the *Throughput* section. Please see the detailed descriptions in that section in addition to the Burst-specific information provided here.

**Frames per Burst (Burst Length)** The number of frames per burst can either be varied (selecting **Stepped** in the drop-down menu) or constant (selecting **Constant**).

**Stepped** works like *Stepped* for frame sizes, i.e. the test starts with **Start burst Size** and in intervals of **Step burst size** increases or decreases to **End burst size**.

**Constant** allows you to specify a *Start burst size*.

**Stop on no frame loss at maximum burst size**
If selected, the burst test stops on no frame loss at maximum burst size.

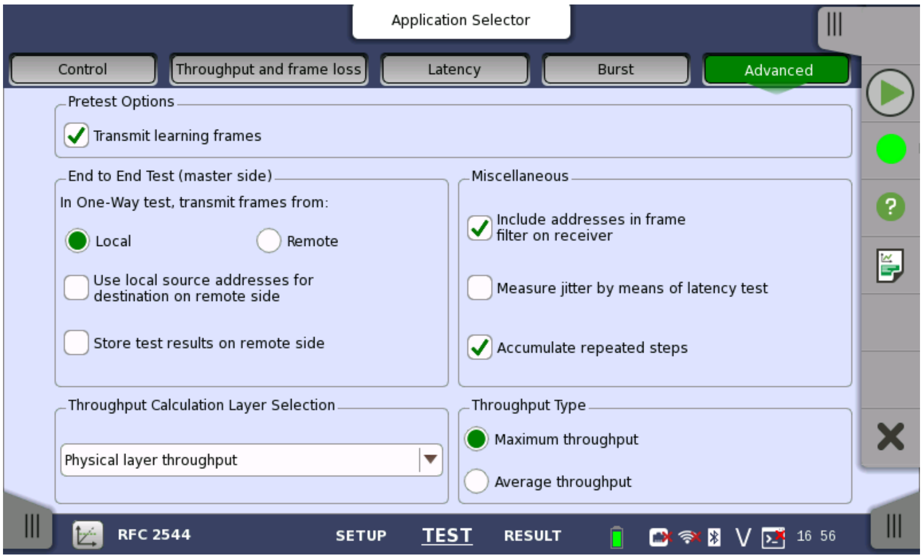
**Auto search**
If selected, the burst length is searched automatically. Select the search method from **Mode**. Select the search resolution from **0.1 %**, **1.0 %**, or **10.0 %**.

NOTE *The check boxes are enabled except when selecting 'End to End network test' on Control screen.*

NOTE *If duration 'Repeats' is set to 0 (zero), the test will run a single time. If it is set to 1, the test will run two times (repeated once).*

### 6.8.2.7 Advanced

Touching the **Advanced** button in the navigation area will display the screen shown below.




This screen allows you to specify various advanced settings for the RFC 2544 test(s).

- Pretest Options
- End to End Test (master side)
- Miscellaneous
- Throughput Calculation Layer Selection
- Throughput Type

**Pretest Options**

**Transmit learning frames**
When this option is enabled, the RFC 2544 test will send out a number of 'learning frames' before the first test-step starts on each port. This happens to train network equipment, so that initial latency results will not be invalid.

**End to End Test (master side)**

**In One-Way test, transmit frames from**
This parameter defines the direction of the frames when transmitted during an End to End test with the One-Way setting enabled. Available directions are: **Local** or **Remote**.

**Use local source addresses for destination on remote side**
When this function is enabled, the Network Master does not use the IP or MAC addresses for differentiating frames during the RFC 2544 test. An exception is End to End test control, but routing equipment in the network may need the addresses to be set up correctly. To limit the amount of needed setups on the Remote side, this setting can be enabled to transfer the source address setup from the Local using it as destination on the Remote. However, the source addresses must still be correctly setup on the remote in order to make the End to End test work.

**Store test results on remote side**
When this function is enabled, test results will be stored on the remote instrument.

**Miscellaneous**

**Include addresses in frame filter on receiver**
The receiver uses a filter to determine which frames should be counted in the results. When this function is enabled, the receiver will use the MAC addresses of each incoming frame in addition to the 'filter key' used by default.

**Measure jitter by means of latency test**
When selected the Latency Test will measure jitter instead of latency.

**Accumulate repeated steps**
When this function is enabled, repeated steps are accumulated into one result line.

**Throughput Calculation Layer Selection**

Select the layer on which the throughput calculation is done. As described in the *Throughput Calculation* section there are 6 different layers:

- **Utilization layer throughput**
- **Physical layer throughput (without preamble)**
- **Physical layer throughput**
- **Link layer throughput**
- **Network layer throughput**
- **Data layer throughput**

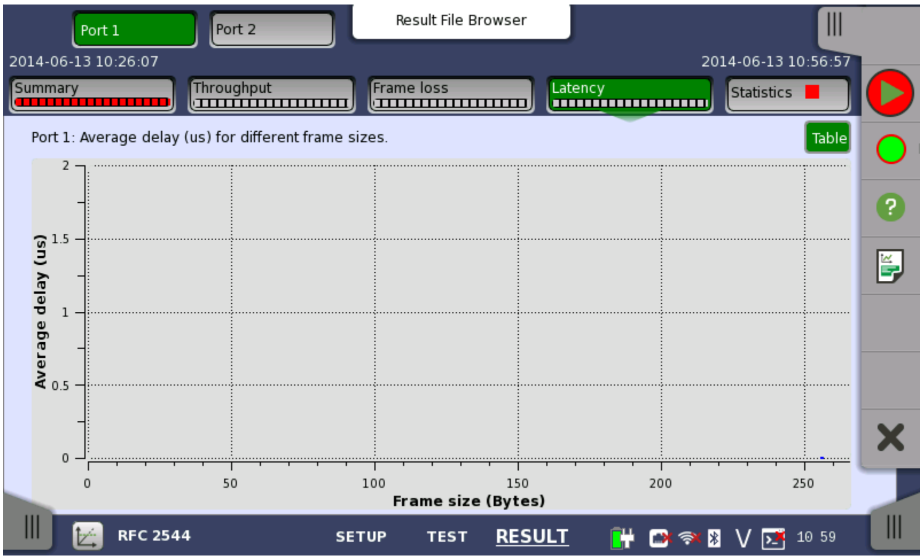
**Throughput Type**

Select whether to register **Average throughput** or **Maximum throughput**.

## 6.8.3 Test Results

**Graphical presentation**

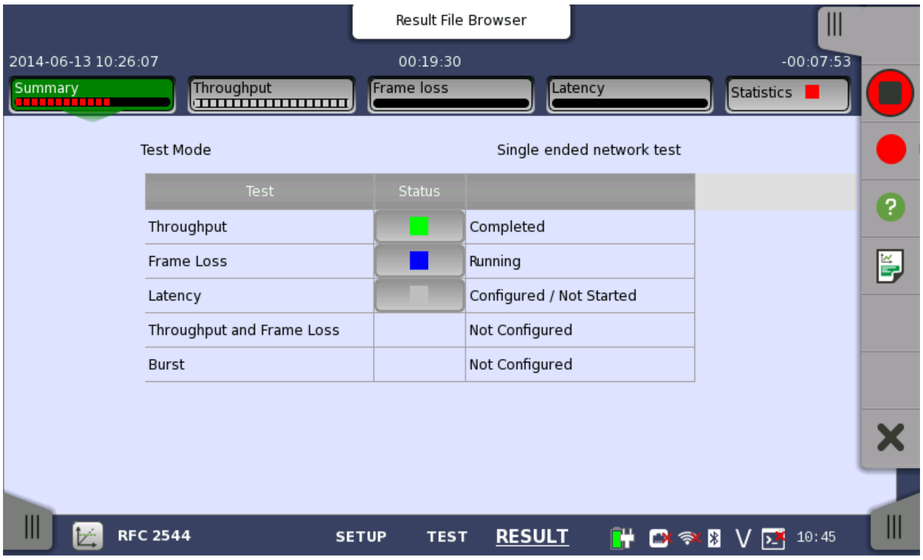
The results of the performed RFC 2544 tests can be presented in either tabular form or as graphical representations. The graphical presentation mode provides an overview of the results and the progress of the test.




On the test-specific result screen, you switch between the two modes by using the **Graph** and **Table** buttons.

### 6.8.3.1 Summary

When you go to the test results of the Ethernet RFC 2544 application, the following screen is displayed.




This screen presents the current status of the test(s) (**Configured / Not Started**, **Running**, **Completed** or **Not Configured**). Touching the status button for a specific test will display the relevant screen with detailed results information.

### 6.8.3.2 Throughput

Touching the **Throughput** button in the navigation area will display the screen shown below.


This screen presents the results from the Throughput test.

The most important columns of the tables are the varied main parameters *Frame size* and *Throughput* and the performance parameter *Frames lost*.

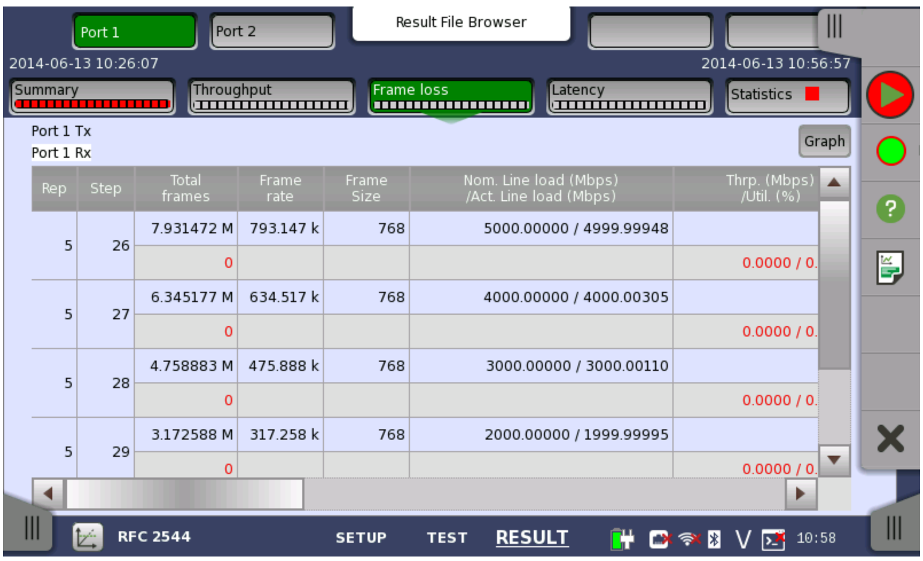
NOTE *The order of the tables will vary depending on the test mode and the relation of the ports.*

| **Test Mode** | **Port 1** | **Port 2** |
|---|---|---|
| Switch/Router test | Port 1 Tx<br>Port 2 Rx | Port 2 Tx<br>Port 1 Rx |
| End to End test<br>Router latency test<br>Single ended network test | Port 1 Tx<br>Port 1 Rx | Port 2 Tx<br>Port 2 Rx |

### 6.8.3.3 Frame Loss

NOTE *Only available if you have specified a Frame Loss test on the 'Control' of Test Setup screen.*

Touching the **Frame loss** button in the navigation area will display the screen shown below.



This screen presents the results from the Frame Loss test.

The most important columns of the tables are the varied main parameters *Frame size* and *Throughput* and the performance parameter *Loss rate*.

NOTE *The order of the tables will vary depending on the test mode and the relation of the ports. Refer to the table in "Throughput" subsection of "Test Results".*

### 6.8.3.4 Throughput and Frame Loss

Touching the **Throughput and frame loss** button in the navigation area will display the screen shown below.

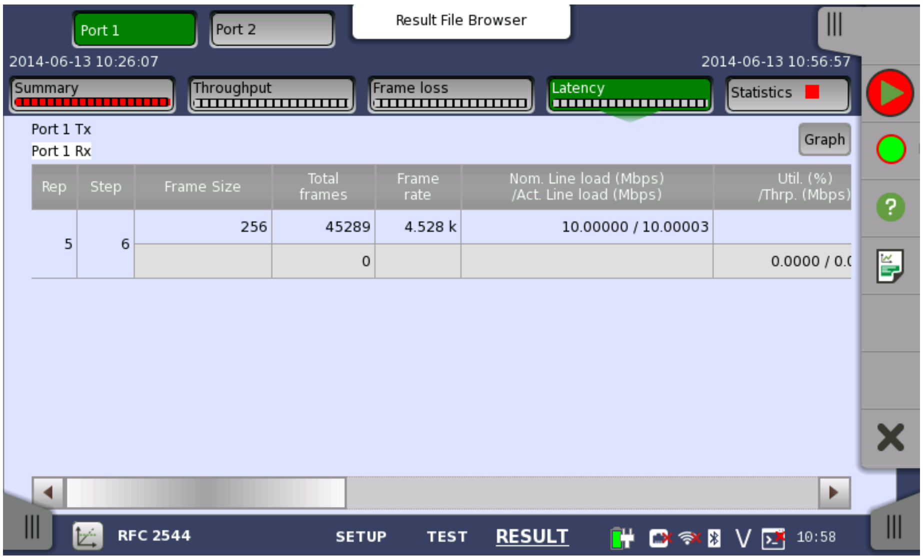

This screen presents the results from the Throughput and Frame Loss test.

The most important columns of the tables are the varied main parameters *Frame size* and *Throughput* and the performance parameters *Frames lost* and *Loss rate*.

NOTE *The order of the tables will vary depending on the test mode and the relation of the ports. Refer to the table in "Throughput" subsection of "Test Results".*

### 6.8.3.5 Latency

Touching the **Latency** button in the navigation area will display the screen shown below.



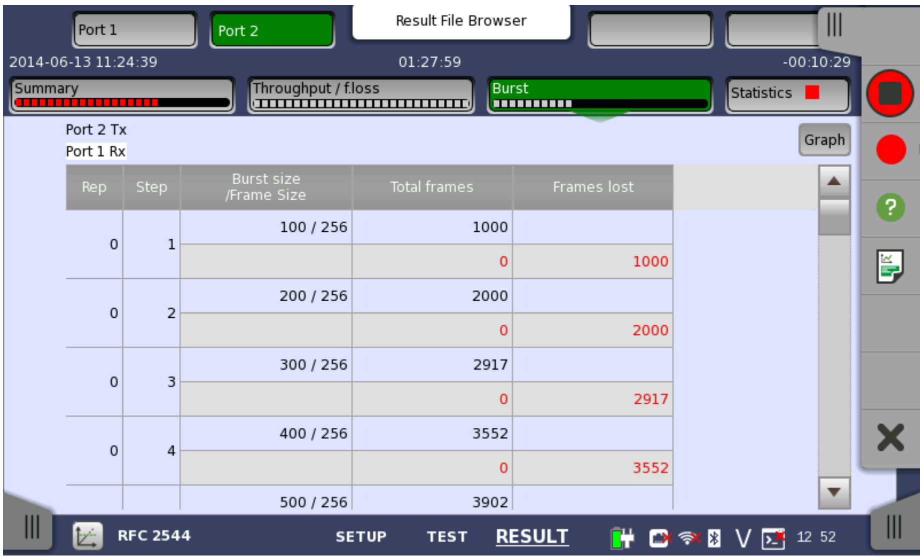
This screen presents the results from the Latency test.

The most important columns of the tables are the varied main parameters *Frame size* and *Throughput* and the performance parameters *Min*, *Avg* and *Max* latency stated in micro seconds.

NOTE *The order of the tables will vary depending on the test mode and the relation of the ports. Refer to the table in "Throughput" subsection of "Test Results".*

### 6.8.3.6 Burst

Touching the **Burst** button in the navigation area will display the screen shown below.



This screen presents the results from the Burst test.

The most important columns of the tables are the varied main parameters *Frame size* and *Burst size* (number of frames transmitted at 100% line load) and the performance parameter *Frames lost*.

NOTE *The order of the tables will vary depending on the test mode and the relation of the ports. Refer to the table in "Throughput" subsection of "Test Results".*

### 6.8.3.7 Statistics

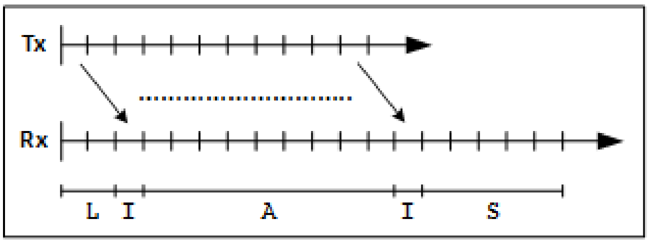
Touching the **Statistics** button in the navigation area displays the screen providing the statistics data. Refer to Statistics of BERT for the operation.

## 6.8.4 Throughput Calculation

Throughput may be calculated on 6 different layers. Each calculation is done on a one second base. It is possible either to register the maximum throughput (actually showing only the second with the highest throughput), or to register an *average throughput per second* taken over a selected part of the test period.

NOTE *The calculation depends on the setting of the transmitted frame contents. Even in cases where the transmitter is not used, the calculation will be based on this setting.*

The part of the test from which the average throughput is calculated, is selected in a way to avoid influence from latency and missing frames. The drawing below illustrates this.




The **Tx** graph shows the transmitted periods, and the **Rx** graph shows the received periods. Due to latency the receiver will first see the transmitted frames some time later than when transmitter actually sent the frames (the L-period). This is also why the receiver may have more periods than the transmitter, in order to await delayed frames. However the receiver will maximum wait for 10 extra periods (seconds) before it times out, as frames may actually physically be lost somewhere in the network.

The average calculation is triggered when the receiver actually sees the first frame. The frames in this first I-period are ignored. Then the average calculation is started and runs over the next duration-2 A-periods. Frames in the last I-period are also ignored. Frames in the remaining S-periods have no influence on the average calculation.

# 6.9 SAT 1564

Service Activation Test is an out-of-service test used to assess the proper configuration and performance of Ethernet services. The test methodology, which is described in the ITU-T recommendation Y.1564, applies to point-to-point and point-to-multipoint connectivity in the Ethernet layer and to the network portions that provide (or contribute to) the provisioning of such services.

The recommendation also defines the terms used in the Network Master screens related to Service Activation Test.

ITU-T Y.1564 is designed around three key objectives:

- To serve as a network *service level agreement* (SLA) validation tool, ensuring that a service meets its guaranteed performance settings in a controlled test time.
- To ensure that all services carried by the network meet their SLA objectives at their maximum committed rate, proving that under maximum load network devices and paths can support all the traffic as designed.
- To perform medium- and long-term service testing, confirming that network elements can properly carry all services while under stress during a soaking period.

## 6.9.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

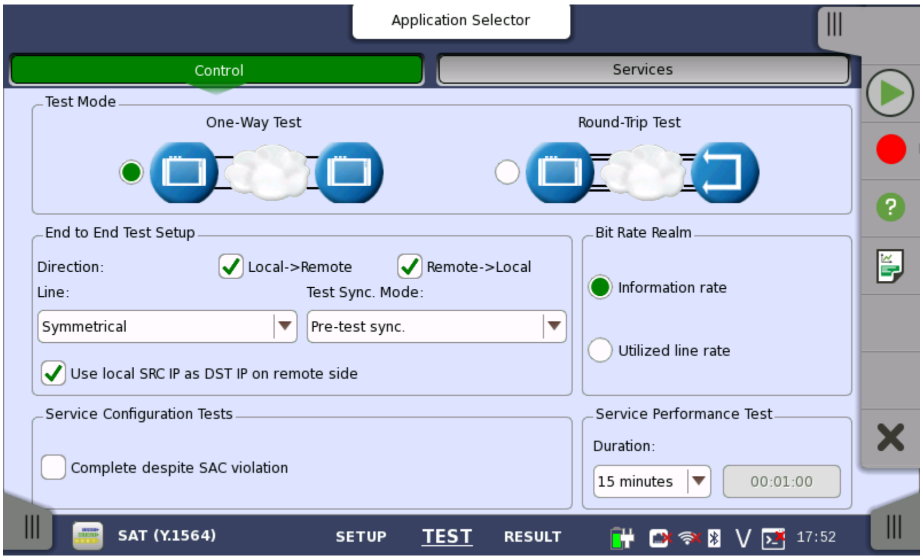
- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.9.2 Test Setup

### 6.9.2.1 Control

When you go to the test setup of the SAT 1564 application, the following screen is displayed.




This screen allows you to configure the test mode and other general parameters related to a Service Activation Test.

**Test Mode**

Use the radio buttons to select the relevant test mode.

**One-Way Test**
In this test mode, two Network Master units will work together performing the test. When the test is started on the local side, the unit will try to contact the remote side, using the Destination IP and MAC address (or use ARP if selected) for the first enabled service. If the remote side receives the communication on a port with a matching Source address, the test will begin.

**NOTE**

*The remote side Network Master must have "Accept Network Master Configuration frames" enabled, in order to detect the communication.*

**NOTE**

*Frames from Service 1 on the local side must reach Service 1 on the remote side and vice versa. This applies to all services.*

When the End to End test is started, a popup will appear on the remote side, telling that the unit is being remotely controlled and allowing the user to break the connection, if required. The popup will disappear when the test is completed or stopped on the local side.

When the End to End test is completed, the test results are transferred from the remote side to the local side.

**Round-Trip Test**
This test mode is used when testing network by reflecting traffic back to the instrument. This requires a device to reflect the traffic back, for instance a second Network Master.

**NOTE**

*A remote side Network Master in Reflector mode must have Swap IP address and Swap Ports on UDP and TCP frames enabled.*

**End to End Test Setup**

This setup is enabled when **One-Way Test** is selected.

**Direction**
Use the checkboxes to specify which directions to test. It can be either **Local->Remote** or **Remote->Local**, or both.

**Line**
Use the drop-down menu to select how the service attributes for the directions are set up.

- **Symmetrical**: The same service attributes are used for both directions.

- **Asymmetrical**: Service attributes are set up for each direction.

**Test Sync. Mode**
Use the drop-down menu to select the method for synchronization of the two instruments performing the test. Synchronization is required for correct measurement of FTD and FDV in End to End Test mode.

- Select **GPS** if external GPS receivers are available at both the local and the remote site. This gives the most accurate measurements.
- Select **Pre-test sync.** if GPS is not available for both instruments. In this mode, synchronization is obtained using proprietary protocol prior to the first step of the Service Configuration Test.

NOTE *External GPS sensor is available from Anritsu (part no. G0325A).*

**Use local SRC IP as DST IP on remote side**
Select this to transfer the local source IP address to the remote side, to be used as destination IP address. If ARP is enabled locally, it will also be enabled on the remote side.

**Bit Rate Realm**

Use the radio buttons to specify which bit realm to operate in.

**Information rate**
The bit rate of frames starting with the first MAC address bit and ending with the last FCS bit.

**Utilized line rate**
The bit rate of the Ethernet line, including the bits for:

- The minimum inter frame gap
- Preamble
- Start of frame delimiter
- Frame starting with the first MAC address bit and ending with the last FCS bit.

**Service Configuration Tests**

General setting for the configuration test.

**Complete despite SAC violation**
Select this checkbox to allow the configuration test to be completed despite any detected SAC violations. If not selected, the configuration test will stop when the first SAC violation is detected.

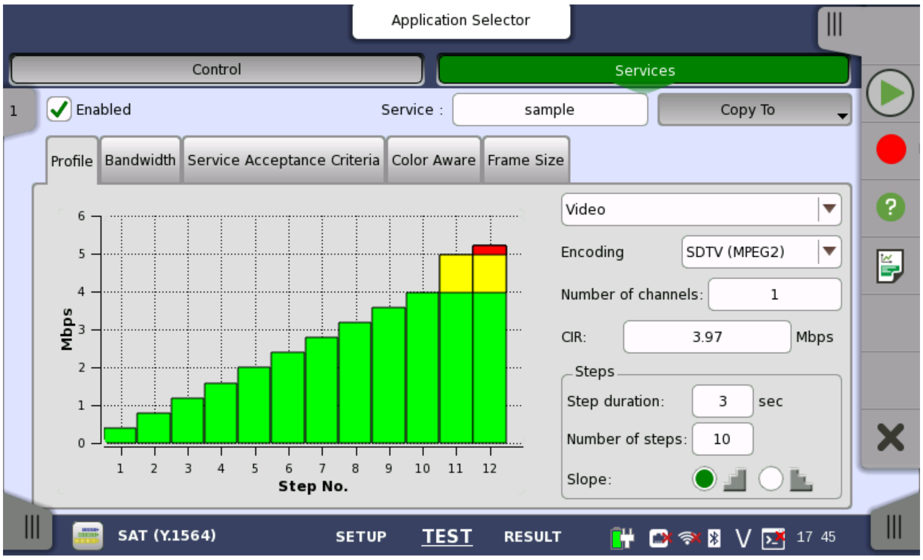
**Service Performance Test**

General setting for the performance test.

**Duration**
Allows you to set the duration period of the performance test. Either select one of the predefined values in the drop-down menu or use the field to specify a custom period.

### 6.9.2.2 Services

Touching the **Services** button in the navigation area will launch the screen shown below.




NOTE

*If the End to End test setup on the 'Control' screen has been set to asymmetrical service attributes setups, two Services buttons are displayed instead of one: Services L->R button and Services R->L button.*

This screen allows you to configure up to eight services being tested in the current Service Activation Test. For each service, you can:

- Enable/Disable the service
- Set up the profile
- Set up the bandwidth
- Set up the service acceptance criteria (thresholds)
- Set up the color aware
- Set up the frame size configuration

**Enable/Disable service**

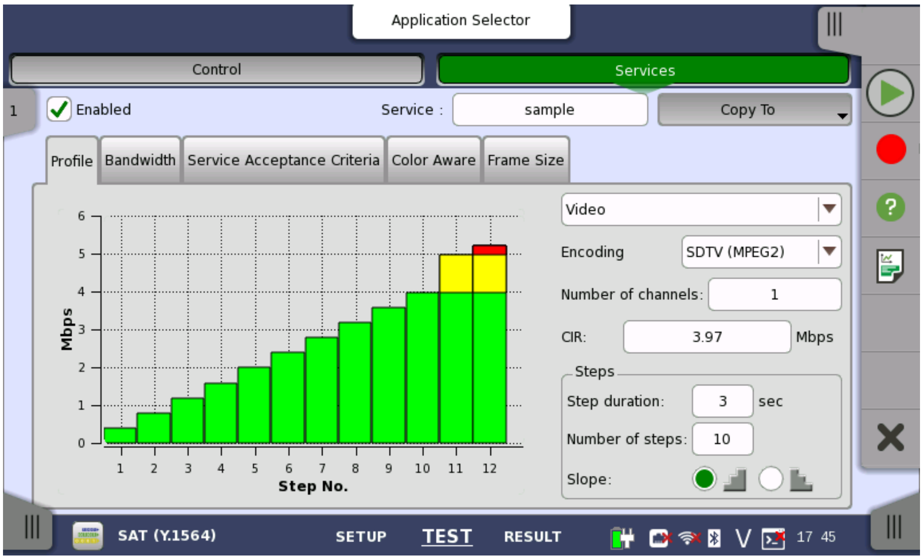
Select the services that are to be tested. Up to 8 services can be specified, either by enabling already defined services or by defining new ones. Use the stream slide-out to select the relevant services. The stream slide-out is displayed via the tab in the top left-hand corner of the setup area.

Use the **Enabled** checkbox to enable/disable the service specified in the **Service** field.

To define a new service, select the relevant stream, specify a name in the **Service** field and then configure the service using the tab pages.

## Profile tab

The **Profile** tab page contains the following parameters:




**Profile**

In case of Round-Trip Test mode, the drop-down menu at the top allows you to select the service profile as either **Data**, **Video** or **Voice**.

**Encoding**
Open the drop-down menu to select the relevant encoding type. The available values depend on the selected profile type.

**Number of channels**
Specify the number of channels.

**CIR**
Allows you to specify the Committed Information Rate (CIR). When set to zero, the CIR test is excluded. If color awareness is enabled (see below), this is the bit rate for green frames.

**Steps**

**Step duration**
Allows you to specify the test step duration. Valid setting is from 1 to 60 seconds.

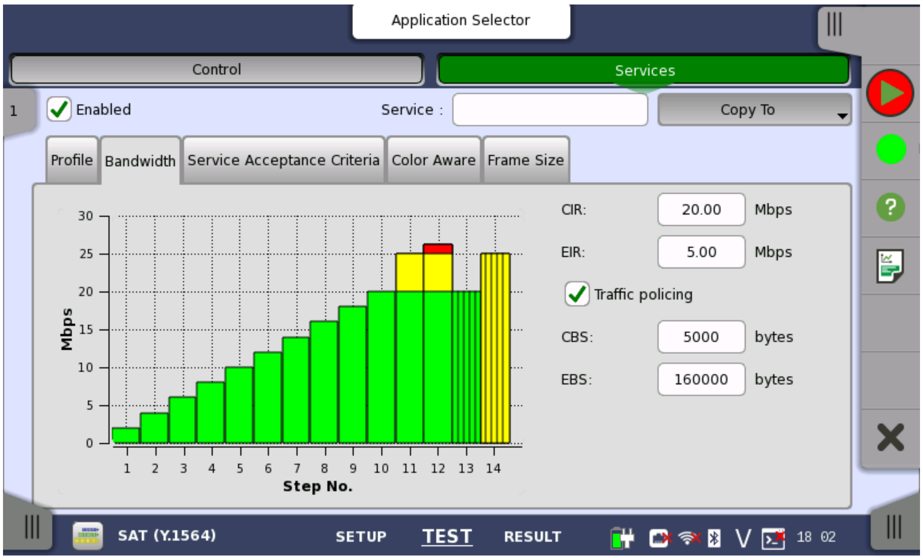
**Number of steps**
Allows you to specify the number of steps in the CIR test. Valid setting is from 1 to 10 steps.

**Slope**
Use the radio buttons to select an *ascending* or *descending* test slope for the CIR test.

- If the *descending* test slope is selected in *round-trip* test mode, all remaining CIR steps are skipped when a CIR step passes.
- In *one-way* test mode, all CIR steps are always performed.

## Bandwidth tab

The **Bandwidth** tab page contains the following parameters:




**CIR**
Allows you to specify the Committed Information Rate (CIR). When set to zero, the CIR test is excluded. If color awareness is enabled (see below), this is the bit rate for green frames.

**EIR**
Allows you to specify the Excess Information Rate (EIR). When set to zero, the EIR test is excluded. If color awareness is enabled (see below), this is the bit rate for yellow frames.

*CIR plus EIR for a service must be greater than zero.*

**Traffic policing**
Select this checkbox to enable the traffic policing test. When enabled, you can specify a margin on the **Service Acceptance Criteria** tab page and use that margin for pass/fail evaluation during the service configuration test. The test will fail if the throughput is greater than CIR + EIR + Margin.

**CBS**
Allows you to specify the Committed Burst Size (CBS) in bytes. When set to zero, the CBS test is excluded. If color awareness is enabled (see below), this is the burst size for green frames.

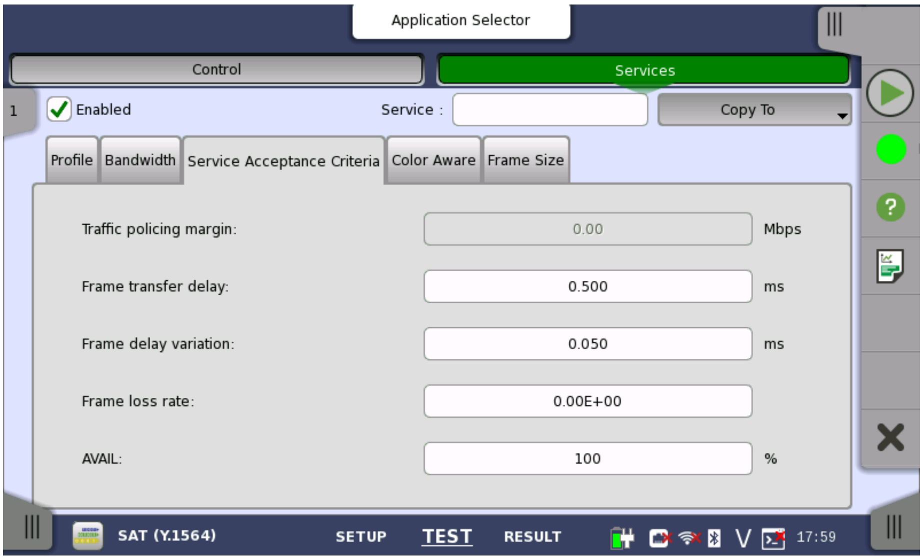
*The CBS test can only be executed if CIR is also greater than zero. Furthermore, it must be possible to send at least twice the number of CBS bytes with CIR rate within the step duration.*

**EBS**
Allows you to specify the Excess Burst Size (EBS) in bytes. When set to zero, the EBS test is excluded. If color awareness is enabled (see below), this is the burst size for yellow frames.

*The EBS test can only be executed if EIR is greater than zero. If CIR is greater than zero, the EBS test also requires that CBS is greater than zero. Furthermore, it must be possible to send at least twice the number of EBS bytes with EIR rate within the step duration.*

## Service Acceptance Criteria tab

The **Service Acceptance Criteria** tab page contains the following parameters:




**Traffic policing margin**
Only active when the traffic policing test is enabled. Allows you to specify a margin for the pass/fail evaluation during the service configuration test. The test will fail if the throughput is greater than CIR + EIR + Margin.

**Frame transfer delay / RT Frame transfer delay**
Allows you to specify the maximum acceptable transfer delay in ms (mean).

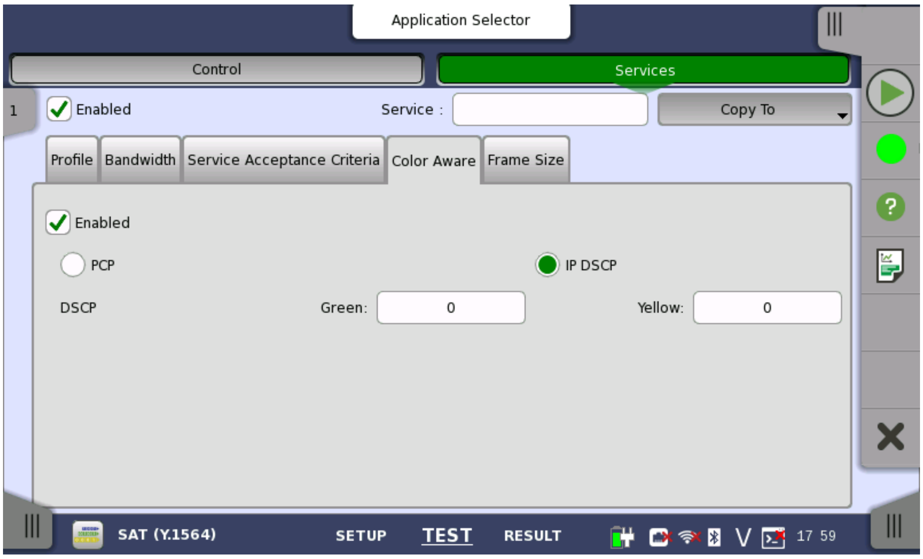
**Frame delay variation / RT Frame delay variatio**
Allows you to specify the maximum acceptable frame transfer deviation in ms (mean).

**Frame loss rate**
Allows you to specify the maximum acceptable frame loss rate.

**AVAIL**
Allows you to specify the minimum acceptable availability percentage.

## Color Aware tab

The **Color Aware** tab page contains the following parameters:



Select the **Enabled** checkbox to enable color awareness. You can then choose the color method (**IP DSCP** or **PCP**), as well as the priority values to mark the green and yellow frames with.

- Choose **IP DSCP** to use IP priority coloring.
- Choose **PCP** to use VLAN priority coloring. This requires that VLAN is enabled.

With color awareness enabled, the test will include results for green and yellow frames for the EIR, Traffic Policing and the EBS tests.

NOTE

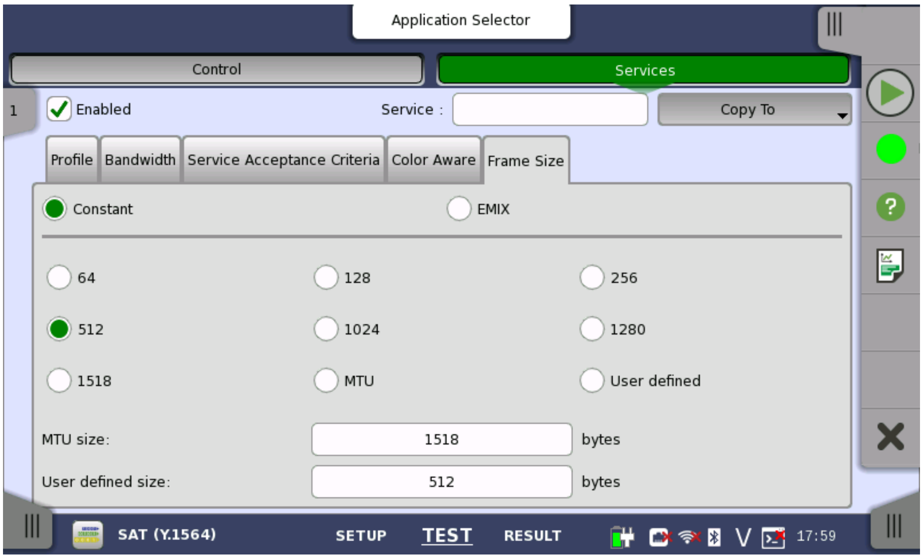
*With color awareness, the transmitted frame rate is 100% CIR green-marked frames plus 125% EIR yellow-marked frames. If EIR is less than 20% of CIR, the transmit rate is 100% CIR green-marked frames plus 25% CIR yellow-marked frames plus 100% EIR yellow-marked frames. Without color awareness, the transmit rate is 100% CIR + 125% EIR. If EIR is less than 20% of CIR, the transmit rate is 125% CIR + 100% EIR.*

## Frame Size tab

The contents of the **Frame Size** tab page depends on your choice of mode. Frame size has two modes: *Constant* and *EMIX*.

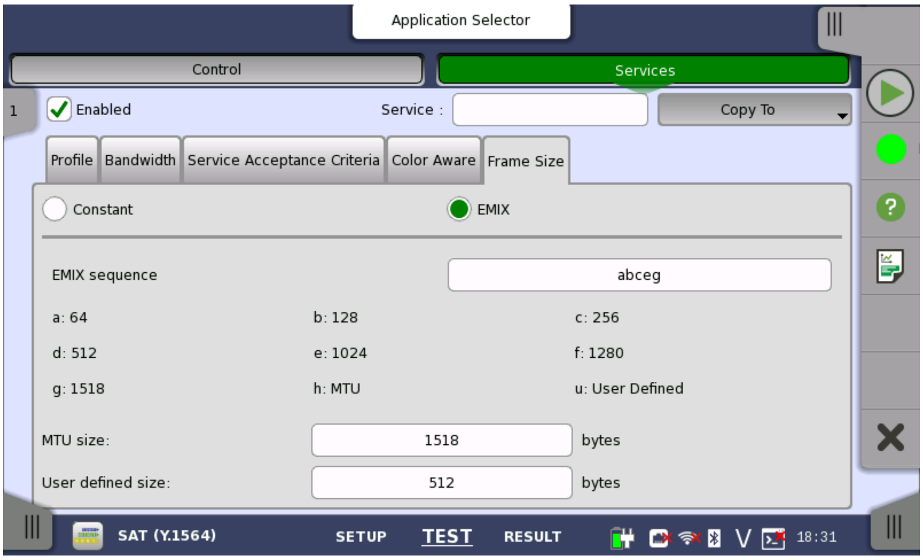
### Constant

Allows you to either select a constant frame size from one of several predefined sizes, or to define a custom frame size with MTU or User defined setting.

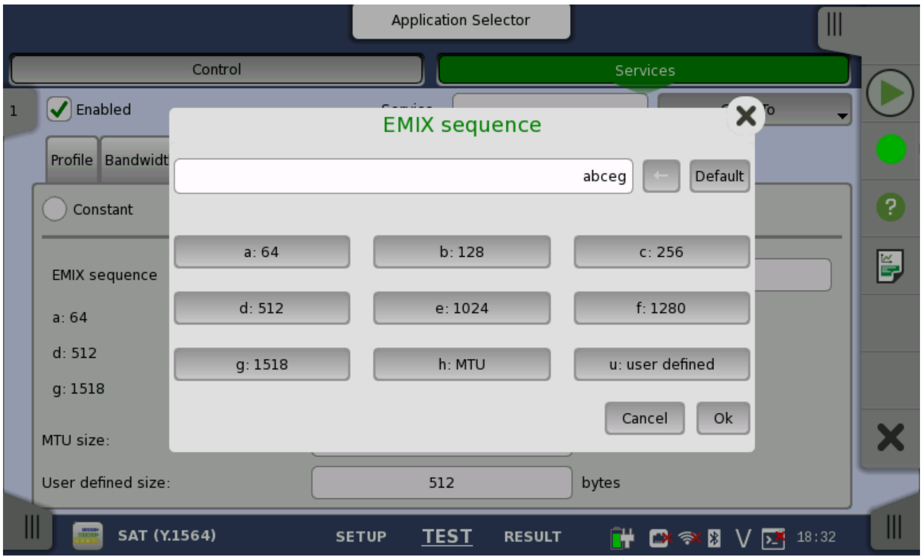



### EMIX

Allows you to set up a repeating frame size pattern. The pattern must consist of at least 1 frame size and at most 16.




*Frame size is protocol headers and payload combined. Frame size does not include preamble and interframe gap.*




## 6.9.3 Test Results

**Item status Lamp** Each result item has a colored Lamp indicating the status for this item and its sub items:

*Green*
The item and all its sub items are passing or have passed the Service Acceptance Criteria.

*Yellow*
The GPS synchronization has been lost for a longer period, typically one hour or more. The results are shown, but you should be aware of the possibly limited precision of the FTD results.

*Red*
The items and one or more of its sub items have failed the Service Acceptance Criteria.

*Gray*
Results for the item are pending.

**GPS status Lamp**

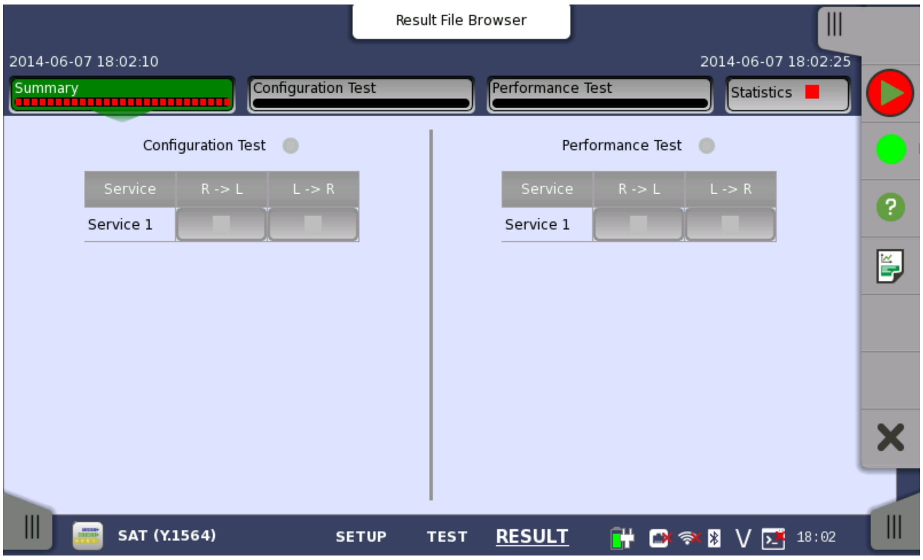
During a One-Way test, status for the GPS time synchronization is displayed at the top of the screen with colored Lamps - one Lamp for the local side and one for the remote side.

*Green*
: GPS synchronization is OK.

*Yellow*
: GPS synchronization has been lost for too long a time. FTD and FDV results could be compromised.

### 6.9.3.1 Summary

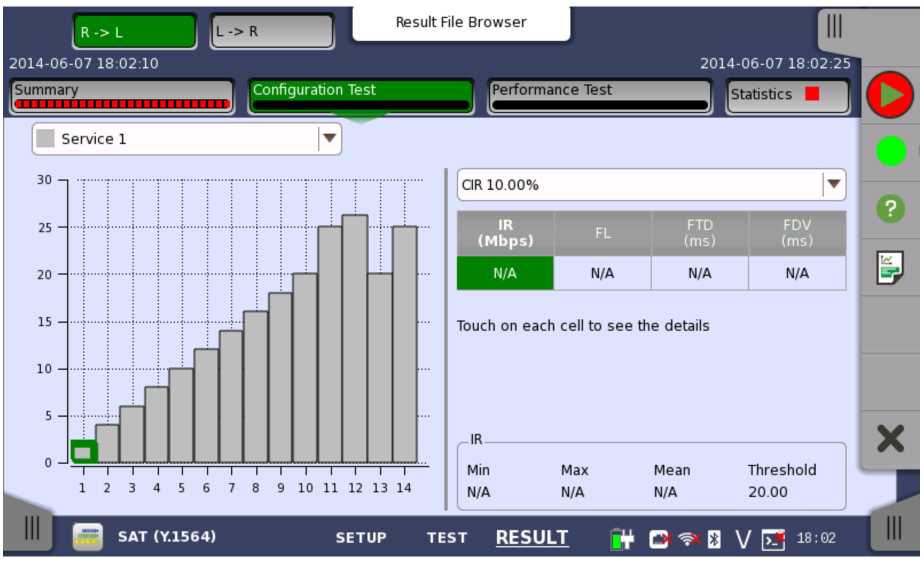
When you go to the test results of the Service Activation Test, the following screen is displayed.




This screen presents a summary of the results of the Service Activation Test. Selecting the result button for a specific service in either the **Configuration Test** or **Performance Test** result panel will display the relevant screen with detailed results information.

### 6.9.3.2 Configuration Test

Touching the **Configuration Test** button in the navigation area will display the screen shown below.



This screen presents the detailed Configuration Test results for a specific service. Use the drop-down menu at the top of the screen to select which service to view.

The results are presented in a table and are related to a specific CIR% (CIR 25.00%, CIR 50.00%, CIR 75.00%, and CIR 100%). Select the relevant CIR% either by selecting the corresponding bar in the bar graph or by using the CIR drop-down menu.

Touching a cell in table displays Minimum, Maximum, Mean value and the Threshold, at bottom of screen.

**Test results**

Select a cell in the results table to see the details. The following information is presented:

**IR / ULR**
Shows the minimum, mean and maximum bit rate in Mbps. Depending on the test setup, the bit rate is either Information Rate (IR) or Utilized Line Rate (ULR).

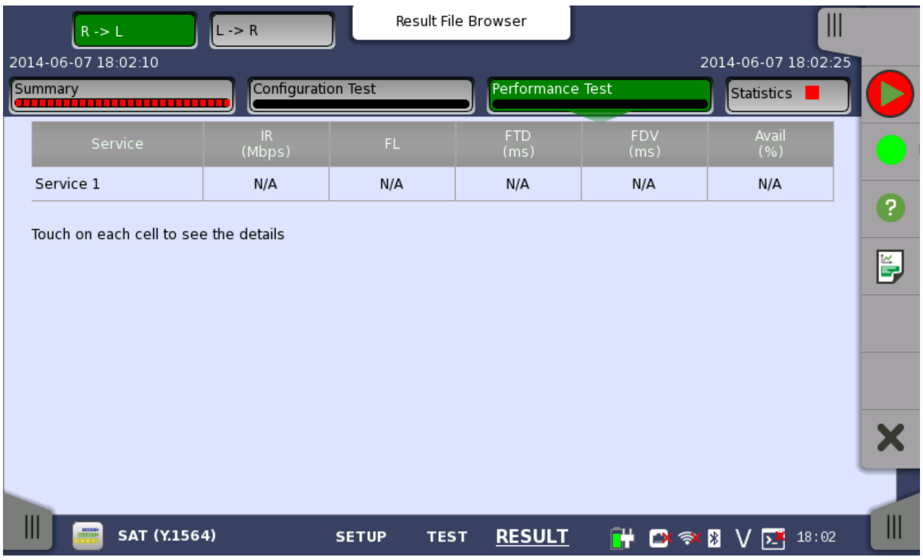
**FL**
Shows the number of lost frames and the frame loss ratio. The frame loss ratio is frames lost divided by frames transmitted.

**FTD / RT FTD**
Shows the minimum, mean, maximum and current Frame Transfer Delay in milliseconds. Depending on the test setup, the result is either one-way delay or round-trip delay.

**FDV / RT FDV**
Shows the minimum, mean, maximum and current Frame Delay Variation in milliseconds. Depending on the test setup, the result is either one-way or round-trip.

### 6.9.3.3 Performance Test

Selecting the **Performance Test** button in the navigation area will display the screen shown below.




This screen presents the detailed Performance Test results.

**Test results**

Select a cell in the results table to see the details. The following information is presented:

**IR**

Shows the minimum, mean and maximum bit rate in Mbps. Depending on the test setup, the bit rate is either Information Rate (IR).

**FL**
Shows the number of lost frames and the frame loss ratio. The frame loss ratio is frames lost divided by frames transmitted.

**FTD**
Shows the minimum, mean, maximum and current Frame Transfer Delay in milliseconds. Depending on the test setup, the result is either one-way delay or round-trip delay.

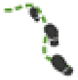
**FDV**
Shows the minimum, mean, maximum and current Frame Delay Variation in milliseconds. Depending on the test setup, the result is either one-way or round-trip.

**Avail**
Shows *Availability*, which is the percentage of one-second in intervals that are categorized as available. An available second occurs when the line is in the available state. The available state begins at the onset of 10 consecutive non-$SES_{eth}$ outcomes. A $SES_{eth}$ is defined as a second with a frame loss rate of 0.5 or more. See Y.1563 clause 9.

### 6.9.3.4 Statistics

Touching the **Statistics** button in the navigation area displays the screen providing the statistics data. Refer to Statistics of BERT for the operation.

# 6.10 Traceroute



The Traceroute test is used to determine the route taken by packets in an IP network. The intermediate routers traversed are identified by the sending of a sequence of ICMP Ping packets to the desired destination, each packet with a too low Time-to-Live (TTL) or *hop limit* so that it terminates in one of the routers and makes the router return an error message. Routers decrement the TTL and discard a package when the TTL value has reached zero.

Traceroute works by gradually increasing the TTL value for each packet, starting at "1". The first set of packets terminates at the first router, the second set at the second router, and so on until a ping reply is received from the destination. This is used to build a list of the hosts that the packets must pass through to reach the intended destination.

The test will send regular ICMP type 11 Ping packets to each host that is detected in this way, and display the resulting RTT (Round Trip Times).

## 6.10.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

The setup options and status information related to the Ethernet interface are described in a separate section:

- Ethernet Setup and Status

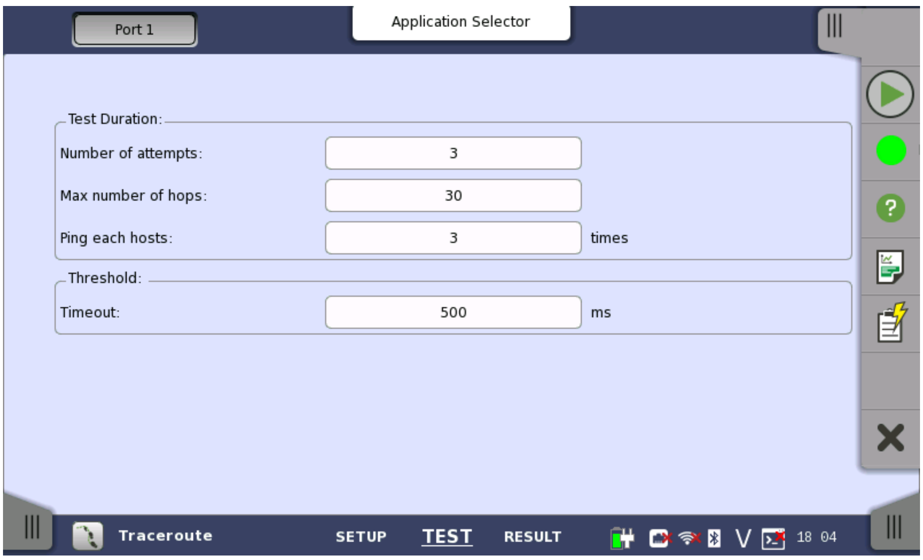
For applications also including an OTN interface, you can find a description of the setup options and status information for OTN in the following section:

- OTN Setup and Status

Please refer to the sections relevant for your current port setup requirements.

## 6.10.2 Test Setup

When you go to the test setup of the Ethernet Traceroute test, the following screen is displayed.




This screen allows you to configure the parameters related to a Traceroute test.

**Test Duration**

**Number of attempts**
Used to specify the maximum number of times that Ping packets with each TTL value are transmitted. If no ICMP type 11 or ping reply is received after this number of attempts, the test will move on to a higher TTL value.

**Max number of hops**
Used to specify the maximum number of hops performed in the test. The test will gradually increment the TTL value until a regular ping reply is received. If no ping reply is received before this number of hops, the test will stop.

**Ping each hosts**
Used to specify the number of times each host is pinged to determine the RTT. For each hop that responds with ICMP 11 type packets, and for the desired destination, this number of Ping packets is sent.

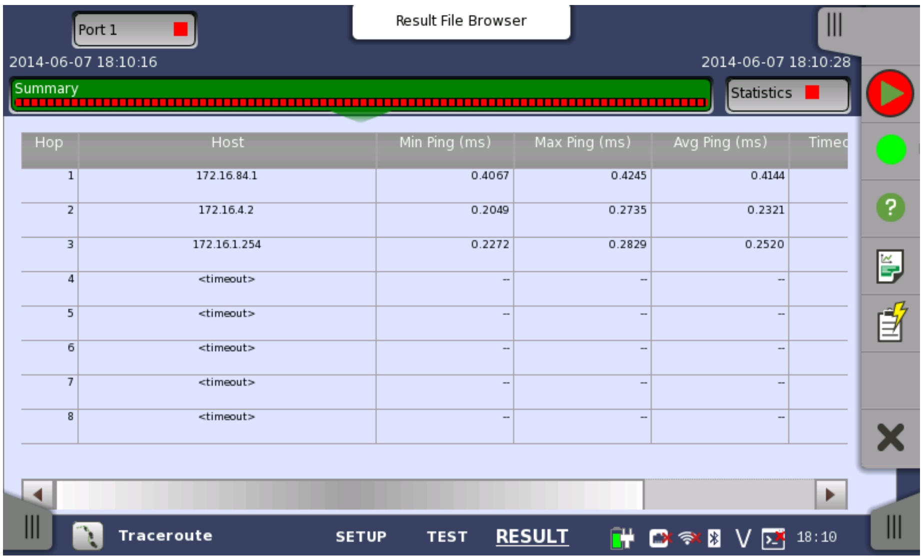
**Threshold**

**Timeout**
Used to specify the timeout limit for Ping packets sent by the test.

## 6.10.3 Test Results

### 6.10.3.1 Summary

When you go to the test results of the Ethernet Traceroute test, the following screen is displayed.




This screen shows the status/results of a running Traceroute test, or the results of the most recently completed test.

Each row in the table represents a hop in the chain of host servers of the traceroute. For each hop/host the following information is shown:

- The IP address of the host
- The Min., Max. and Average ping RTTs
- The number of ping timeouts during the determination of the RTT

NOTE

*In the results table for a successfully completed test, the last row will represent the destination of the traceroute.*

### 6.10.3.2 IEEE1588v2 Log

If **Ext. log** is selected in IEEE1588v2 screen of Ethernet Frame Setup, the **IEEE1588v2 Log** button appears in the navigation area. Refer to IEEE1588v2 Log in BERT for the operation.

#### 6.10.3.3 Statistics

Touching the **Statistics** button in the navigation area displays the screen providing the statistics data. Refer to Statistics of BERT for the operation.

# 7 OTN Applications

This chapter describes the graphical user interface (i.e. screens, sub-screens and major dialog boxes) related to OTN-only applications. Sub-screens and dialogs are described under the main screen from which they are activated/launched.

The following setting and applications are available:

- OTN Setup and Status
- APS
- BERT
- RTD

NOTE

*OTN Setup and Status may also be part of the various SDH/SONET/PDH/DSn and Ethernet tests.*

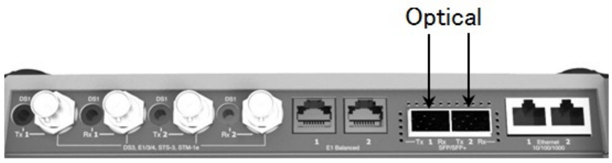
# 7.1 OTN Setup and Status

An **OTUk** button in the navigation area of the **Ports Setup** screen gives you access to the OTN setup for the transmitter and/or receiver of the currently selected port.

OTN (Optical Transport Networking) provides support for optical networking using wavelength-division multiplexing (WDM). OTN is defined in the ITU-T Recommendation G.709 as a set of Optical Network Elements (ONE) connected by optical fiber links, able to provide functionality of transport, multiplexing, switching, management, supervision and survivability of optical channels carrying client signals.

NOTE

*The OTUk interface uses the optical ports.*

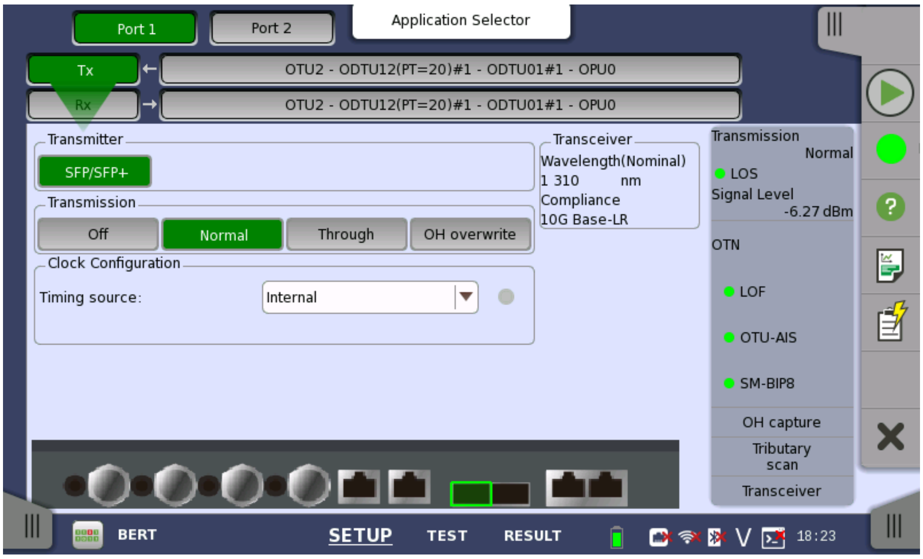



**MU100010A Connector Panel**

## 7.1.1 Transmitter Setup

### 7.1.1.1 Physical Setup

When the transmitter is set up with an OTUk interface, touching the **Tx** button in the navigation area will launch the following screen.




This screen allows you to enable the optical interface of the OTN transmitter. It can also be used to inspect the current status of the selected port in Port Mode lamps.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

**Transmitter**
**SFP/SFP+** is displayed for MU100010A.

**Transmission**
Select the transmission mode.

- **Off**: OTUk frame is not transmitted.

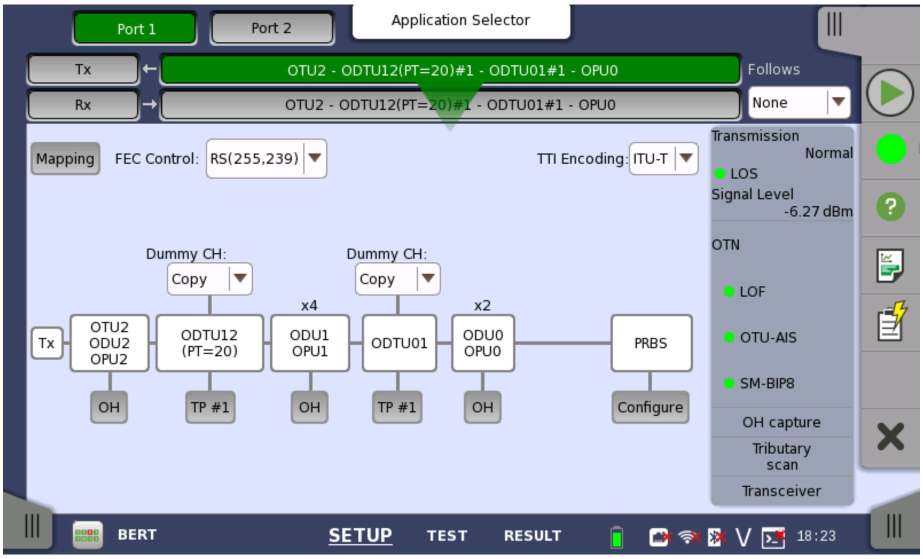
- **Normal**: Transmits OTUk frames generated in the Network Master.
- **Through** (pass through mode):Transmits the received data.
- **OH overwrite** (pass through mode with Overhead overwrite): Overwrite the overhead of the received data to OH data generated in Transmit side.

**Clock Configuration**
Use the drop-down menu to select the clock source. This is fixed to **Received** when **Transmission** is set to **Through** or **OH overwrite**.

Timing source
**Internal**: Internal clock of the module
**External**: The clock provided the connector
**GPS**: The clock provided from GPS (Global Positioning System)
**Received**: The clock generated from the received signal

### 7.1.1.2 OTUk Frame Setup

Touching the navigation area button which represents the transmitter's OTN layer will launch the screen shown below.




This screen allows you to configure OTUk frame of the currently selected transmitter. It can also be used to inspect the current status of the selected port in a separated screen.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

To setting up the OTU frame, touch **Mapping** button at first. Then select the relevant values for the various containers in the structure shown in the setup area, either by opening a drop-down menu or by touching a button to launch an editor dialog.

Note that the changes you make will be reflected in the text displayed in the OTUk button in the navigation area.

**Follows**

To make the Port 2 transmitter follow the Port 1 transmitter (i.e. copy its settings), touch the right-most button in the navigation area and select the **Tx1** in the drop-down menu. The default setting is **None**. Note that the Port 1 transmitter cannot follow the Port 2 transmitter.

**Mapping**
Touch the **Mapping** button and use the launched dialog box to define the OTUk frame mapping. The following settings are available:

- Output Signal

- Client Signal
- Multiplexing 1
- Multiplexing 2

See a description of the setting options in the *Mapping Dialog* section below.

**FEC Control**
Use the drop-down menu to select whether or not to transmit FEC (Forward Error Correction) data.

- **No FEC**: OTUk data is transmitted without FEC encoding.
- **RS(255,239)**: OTUk data is transmitted with FEC encoding. RS(255,239) code is defined in ITU-T Rec. G.709.

**TTI Encoding**
Use the drop-down menu to select TTI encoding method.

- **ITU-T**: Corresponding to ITU-T Rec. G.709.
- **ANSI**: All TTI 64 bytes can be edited as the operator specification.

**OH**
Touch an **OH** button to launch the corresponding **Overhead** dialog box. Depending on whether you have selected multiplexing or not in the frame mapping, there will be one or more overheads to configure.

The dialog box is described in detail in the *Overhead Dialog* section below.

**Dummy CH**
Only displayed when the frame mapping is set to multiplexing. Select the payload of the dummy channel from the drop-down menu.

- **Copy**: Transmit the copy of the main Tributary Port (TP) data to the dummy Tributary Port (TP).
- **Unused**: Dummy ODUj data which are generated separately from the Main ODUj data are embedded into the remained TPs.

**TP**
Only displayed when the frame mapping is set to multiplexing. Touch the **TP** button and use the launched dialog box to set the number of TP or TS. The selected TP number is showed on the button.

The dialog box is described in the *TP/TS Dialog* section.

**GFP-T**
Only displayed when the client signal is GbE. Touch the **GFP-T** button to launch a dialog box where you can to select CSF Replacement.

The dialog box is described in the *GFP-T Dialog* section.

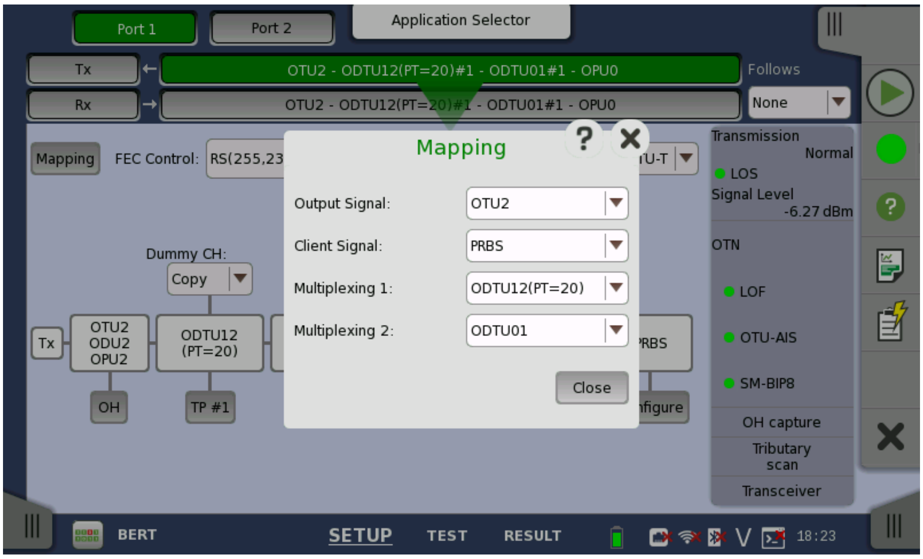
**Configure**
Only displayed when the client signal is PRBS. Touch the **Configure** button to launch a dialog box where you can select pattern type.

- **PRBS9** to **PRBS31**: Pseudo-random bit sequence. The number indicates the bit length of sequence.

  For example, bit length of PRBS9 is $2^9$-1=511.
  **PRBS Pattern Inversion** is enabled.
- **User [32] bit**, **User [2048] bit**: 32 bits or 2048 bits length pattern. The field which shows bit length is enabled. Touch the field to launch the dialog box to define the bit pattern. Refer to The User Pattern Editor.

### 7.1.1.3 Mapping

Touching the **Mapping** button in the upper left-hand corner of the **Ports Setup** screen launches the dialog box shown below.




This dialog box allows you to define OTUk frame mapping.

**Output Signal**

Defines the bit rate the output from the Tx port.

- **OTU1**: 2.666 Gbit/s
- **OTU1e**: 11.049 Gbit/s
- **OTU2**: 10.709 Gbit/s
- **OTU2e**: 11.096 Gbit/s
- **OTU1f**: 11.270 Gbit/s
- **OTU2f**: 11.318 Gbit/s

**Client Signal**

Defines the Client Signal. The available values change depending on the output signal type.

- **PRBS**: PRBS
- **GbE**: Giga bit Ethernet (1250 Mbit/s)
- **10GbE**: 10 Giga bit Ethernet (10312.5 Mbit/s)
- **STM64(Async)**: Synchronous Transport Module-64 (9953.28 Mbit/s)
- **STM16(Async)**: Synchronous Transport Module-16 (2488.32 Mbit/s)
- **STM4**: Synchronous Transport Module-4 (622.08 Mbit/s)
- **STM1**: Synchronous Transport Module-1 (155.52 Mbit/s)

**GbE** and **Ethernet** appear if the application is Ethernet on OTN.
**STM64(Async)** through **STM1** appear if the application is SDH/SONET on OTN.

**Multiplexing 1**

Applicable when there are two or more levels of multiplexing. Defines into which higher order the second level ODU is mapped.

- **None**
- **ODTU2.1** : One 1.25G Tributary Slot (TS) can be selected.
- **ODTU12 (PT=20)** : Supports 2.5G Tributary Slot (TS).
- **ODTU12 (PT=21)** : Supports 1.25G Tributary Slot (TS).
- **ODTU2.ts** : Supports ODUflex. One to eight TSs can be selected.

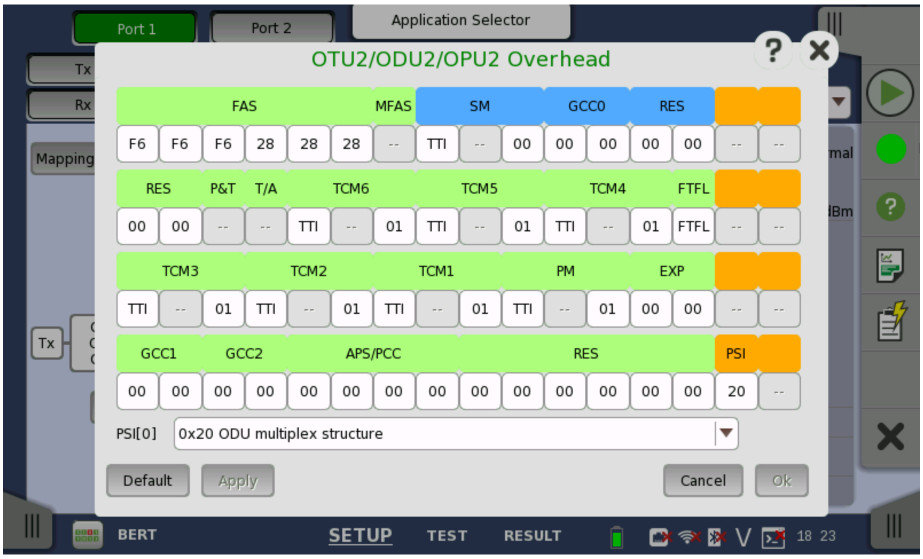
**Multiplexing 2**

Applicable when there are three levels of multiplexing. Defines into which higher order ODU is multiplexed.

- **None**
- **ODTU01**

### 7.1.1.4 Overhead

Touching an **OH** button in the setup area of the **Ports Setup** screen launches a dialog box similar to the one shown below.




This dialog box presents detailed information about the overhead and allows you to configure it. Blue fields are OTU overhead. Green fields except FAS and MFAS are ODU overhead. Orange fields are OPU overhead.

The actual layout of the dialog box depends on which overhead you are configuring. The description below provides a general description of the OTN overhead.

The overhead consists of the following parameters:

- FAS, which is the signal for the frame alignment.
- MFAS, which is the signal for the multiframe alignment.
- SM, which shows the Signal Monitoring.
- GCC0-GCC2, which shows the General Communication Channel.
- RES, which is the reserved for future international standardization.
- TCM1-TCM6, which shows the Tandem Connection Monitoring.
- FTFL, which shows the fault location channel and fault location reporting channel.
- PM, which shows the Path Monitoring.
- EXP, which shows the bytes for experimental use.
- APS/PCC, which shows the Automatic Protection Switching and Protection Communication Control channel.
- PSI, which shows the Payload Structure Identifier.

**FAS**

Default defined as: F6 F6 F6 28 28 28. To change a byte value, touch the relevant byte button to launch the editor dialog box.

**NOTE**

*If FAS(s) value is changed, a receiver which received the signal with changed FAS might be able not to detect the frame alignment.*

**MFAS**

This field counts the OTU frame number. The value changes from 0 through 255 cyclically.

**SM**

SM consists of the following parameters:

- TTI byte (Trail Trace Identifier)
- BIP-8 byte (Bit Interleaved Parity level 8 code)
- 3rd byte:
  - Bits 1-4: BIP violations (BEI/BIAE)
  - Bit 5: Signal fail status (BDI)
  - Bit 6: Frame alignment error (IAE)

- Bits 7-8: Reserved for future use

The TTI byte and 3rd byte can both be edited by launching the **OTUk SM-TTI** dialog box.


**TTI**
The TTI (Trail Trace Identifier) is a 64-Byte signal that occupies one byte of the frame and is aligned with the OTUk multiframe.

- SAPI (Source Access Point Identifier)
- DAPI (Destination Access Point Identifier)
- Operator (32-Byte Operator specific)

**3rd byte Bit 1-4: BEI/BIAE**
Bits 1-4 show BIP violations BEI/BIAE (Backward Error Indication / Backward Incoming Alignment Error). Only **1011** shows BIAE=true.

| Bits 1-4 | BIP violations |
|---|---|
| **0000** | 0 |
| **0001** | 1 |
| **0010** | 2 |
| **0011** | 3 |
| **0100** | 4 |
| **0101** | 5 |
| **0110** | 6 |
| **0111** | 7 |
| **1000** | 8 |
| **1001 to 1111** | 0 |

**3rd byte Bit 5: BDI**
BDI (Backward Defect Indication) is set to "1" to indicate a signal fail status, otherwise it is set to "0".

**3rd byte Bit 6: IAE**
IAE (Incoming Alignment Error) is set to "1" to indicate a frame alignment error, otherwise it is set to "0".

**3rd byte Bit 7,8: RES**
These bits are reserved.

**GCC0-GCC2** These fields are used to carry transmission management and signaling information. These bytes can be edited in hexadecimal value.

**TCM1-TCM6** TCM1-TCM6 consists of the following parameters:

- TTI byte (Trail Trace Identifier)
- BIP-8 byte (Bit Interleaved Parity level 8 code)
- 3rd byte:
  - Bits 1-4: BIP violations (BEI/BIAE)
  - Bit 5: Signal fail status (BDI)
  - Bits 6-8: Status (STAT)

The TTI byte and 3rd byte can both be edited by launching the **OTUk TCMn-TTI** dialog box, which is similar to the dialog box used to edit SM.


**TTI**
The TTI (Trail Trace Identifier) is a 64-Byte signal that occupies one byte of the frame and is aligned with the OTUk multiframe.

- SAPI (Source Access Point Identifier)
- DAPI (Destination Access Point Identifier)
- Operator (32-Byte Operator specific)

**3rd byte Bit 1-4: BEI/BIAE**
Bits 1-4 show BIP violations BEI/BIAE (Backward Error Indication / Backward Incoming Alignment Error). Only **1011** shows BIAE=true.

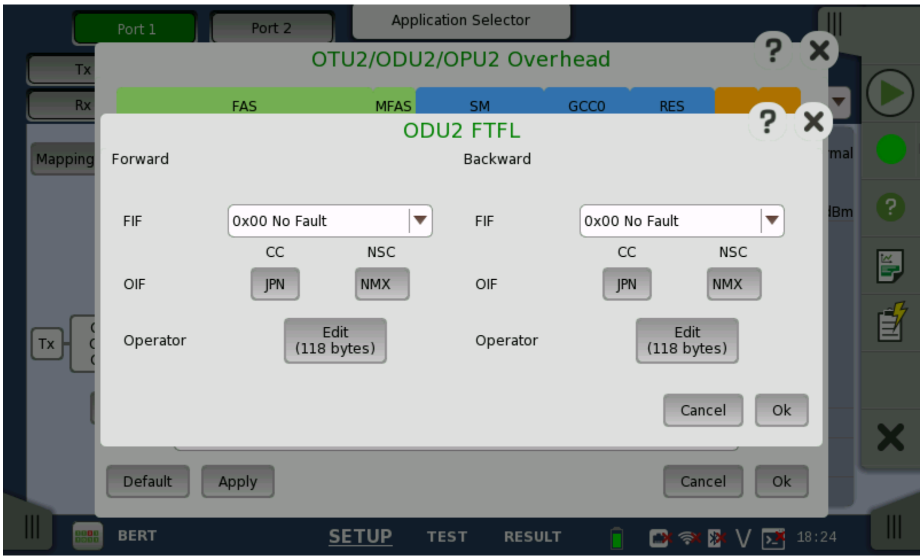
| Bits 1-4 | BIP violations |
|---|---|
| **0000** | 0 |
| **0001** | 1 |
| **0010** | 2 |
| **0011** | 3 |
| **0100** | 4 |
| **0101** | 5 |
| **0110** | 6 |
| **0111** | 7 |
| **1000** | 8 |
| **1001 to 1111** | 0 |

**3rd byte Bit 5: BDI**
BDI (Backward Defect Indication) is set to "1" to indicate a signal fail status, otherwise it is set to "0".

**3rd byte Bit 6-8: STAT**
Bits 6-8 show TCM status.

| Bits 6-8 | TCM status |
|---|---|
| **000** | no source TC |
| **001** | in use without IAE |
| **010** | in use with IAE |
| **011** | Reserved |
| **100** | Reserved |
| **101** | ODUk-LCK |
| **110** | ODUk-OCI |
| **111** | ODUk-AIS |

**FTFL** The FTFL message consists of two 128-byte fields. Launch the **ODUk FTFL** dialog box to edit the fields.




Both messages (Forward and Backward) consist of the following parameters:

**FIF (Fault indication field)**

| Byte | Fault indication |
|---|---|
| **0x00** | No Fault |
| **0x01** | Signal Fail |
| **0x02** | Signal Degrade |
| **0x03 to 0xFF** | Reserved |

**OIF (Operator identifier field)**

- **CC** Country code is a three-character ISO 3166 geographic/political countrycode (G/PCC).
- **NSC** National segment code is a 1-6 character ITU carrier code (ICC).

**Operator (Operator-specific field)**
This field is available for operator use. Touching the button launches the *Pattern Editor*.

**PM**

PM consists of the following parameters:

- TTI byte (Trail Trace Identifier)
- BIP-8 byte (Bit Interleaved Parity level 8 code)
- 3rd byte:
    - Bits 1-4: BIP violations (BEI)
    - Bit 5: Signal fail status (BDI)
    - Bits 6-8: Status (STAT)

The TTI byte and 3rd byte can both be edited by launching the **ODUk PM-TTI** dialog box, which is similar to the dialog box used to edit SM.

**TTI**
The TTI (Trail Trace Identifier) is a 64-Byte signal that occupies one byte of the frame and is aligned with the OTUk multiframe.

- SAPI (Source Access Point Identifier)
- DAPI (Destination Access Point Identifier)
- Operator (32-Byte Operator specific)

**3rd byte Bit 1-4: BEI**

BEI (Backward Error Indication) shows the count of interleaved-bit blocks that have been detected in error by the corresponding ODUk path monitoring sink using the BIP-8 code.

Bits 1-4 shows BIP violations.

| Bits 1-4 | BIP violations |
|---|---|
| **0000** | 0 |
| **0001** | 1 |
| **0010** | 2 |
| **0011** | 3 |
| **0100** | 4 |
| **0101** | 5 |
| **0110** | 6 |
| **0111** | 7 |
| **1000** | 8 |
| **1001 to 1111** | 0 |

**3rd byte Bit 5: BDI**
BDI (Backward Defect Indication) is set to "1" to indicate a signal fail status, otherwise it is set to "0".

**3rd byte Bit 6-8: STAT**
STAT (Path Monitoring Status) indicates the presence of a maintenance signal.

| STAT | Signal type |
|---|---|
| **000** | Reserved |
| **001** | Normal path signal |
| **010** | Reserved |
| **011** | Reserved |
| **100** | Reserved |
| **101** | ODUk-LCK |
| **110** | ODUk-OCI |
| **111** | ODUk-AIS |

**APS/PCC**

APS/PCC has four bytes. Requests/Status is defined for First byte. The request or status is shown in bits 1-4.
The protection type is shown in bit 5-8.


| Bits 1-4 | Meaning |
|---|---|
| **0000** | NR (No request) |
| **0001** | DNR (Do not revert) |
| **0010** | RR (Reverse request) |
| **0011** | Reserved |
| **0100** | EXER (Exercise) |
| **0101** | Reserved |
| **0110** | WT (Wait-to-restore) |
| **0111** | Reserved |
| **1000** | MS (Manual switch) |
| **1001** | Reserved |
| **1010** | SD (Signal degrade) |
| **1011** | Reserved |
| **1100** | SF (Signal fail) |
| **1101** | Reserved |
| **1110** | FS (Forced switch) |
| **1111** | Lockout |

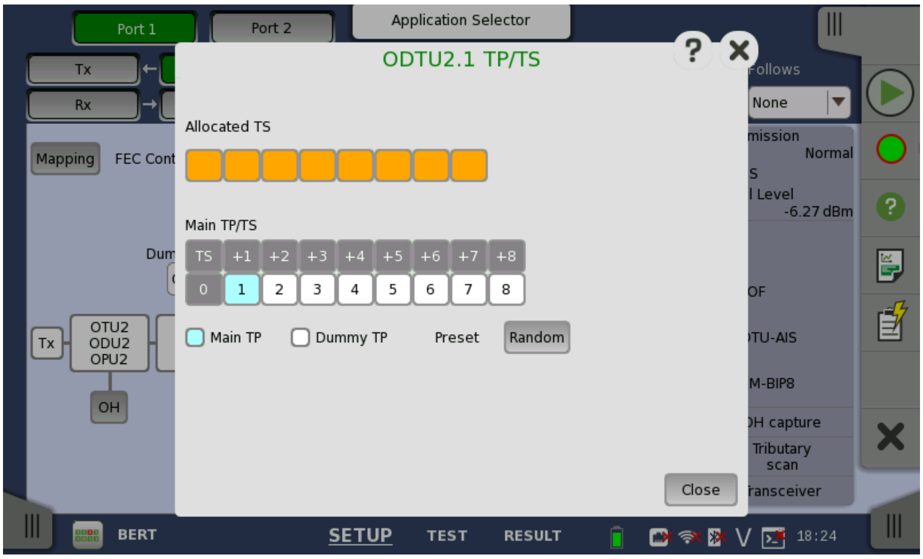
**PSI**

PSI means Protocol Structure Identifier. This field shows the payload type. You can either enter a new value directly in the field or select the relevant value from the **PSI[0]** drop-down menu.

| PSI value | Payload type |
|---|---|
| **0x01** | Experimental mapping |
| **0x02** | Asynchronous CBR mapping |
| **0x03** | Bit synchronous CBR mapping |
| **0x04** | ATM mapping |
| **0x05** | GFP mapping |
| **0x06** | Virtual Concatenated signal |
| **0x07** | PCS codeword transparent Ethernet mapping:<br>1000BASE-X into OPU0 |
| **0x08** | FC-1200 into OPU2e mapping |
| **0x09** | GFP mapping into Extended OPU2 |
| **0x0A** | STM-1 mapping into OPU0 |
| **0x0B** | STM-4 mapping into OPU0 |
| **0x0C** | FC-100 mapping into OPU0 |
| **0x0D** | FC-200 mapping into OPU1 |
| **0x0E** | FC-400 mapping into OPUflex |
| **0x0F** | FC-800 mapping into OPUflex |
| **0x10** | Bit stream with octet timing mapping |
| **0x11** | Bit stream without octet timing mapping |
| **0x12** | IB SDR mapping into OPUflex |
| **0x13** | IB DDR mapping into OPUflex |
| **0x14** | IB QDR mapping into OPUflex |
| **0x15** | SDI mapping into OPU0 |
| **0x16** | (1.485/1.001) Gbit/s SDImapping into OPU1 |
| **0x17** | 1.485 Gbit/s SDI mapping into OPU1 |
| **0x18** | (2.970/1.001) Gbit/s SDI mapping into OPUflex |
| **0x19** | 2.970 Gbit/s SDI mapping into OPUflex |
| **0x1A** | ESCON mapping into OPU0 |
| **0x1B** | DVB_ASI mapping into OPU0 |
| **0x1C** | FC-16000 mapping into OPUflex |
| **0x20** | ODU multiplex structure |
| **0x21** | OPU2,OPU3 1.25 Gbit/s tributary slot multiplex structure |
| **0x55** | Not available |
| **0x66** | Not available |
| **0x80** | Reserved code for proprietary use (non-standard payload mappings) |
| **0xFD** | NULL test signal mapping |
| **0xFE** | PRBS test signal mapping |
| **0xFF** | Not available |

### 7.1.1.5 TP/TS

Touching a **TP** button on the **Ports Setup** screen launches the **TP/TS** dialog box. Note that the contents and layout of the dialog box depends on which higher order type has been selected.

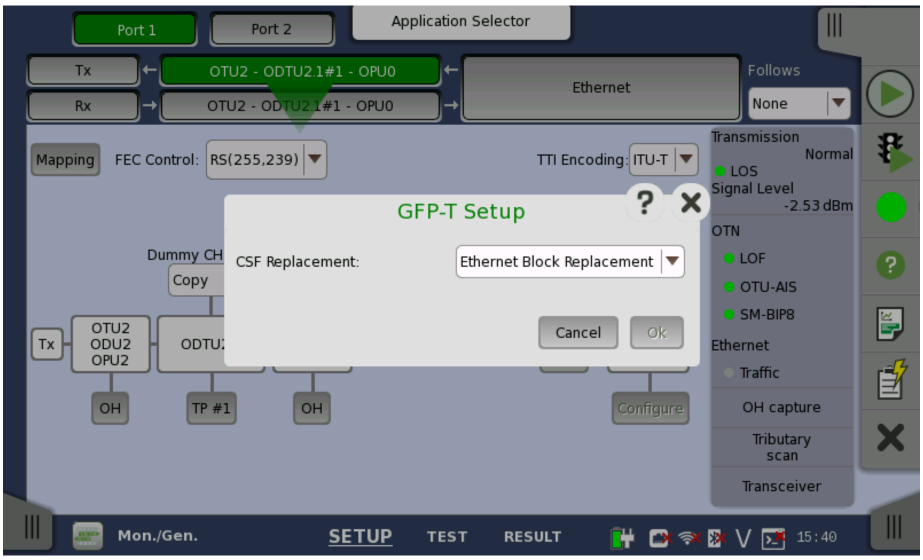



This dialog box allows you to define OTUk frame mapping.

- **Main TP/TS**: Tributary Port/Slot number of Measurement target for Lower order ODU frame.
- **Dummy TP**: Condition of TP/TS(s) other than Main TP/TS. Transmitted signal is selected by *Dummy CH*.
    - **Copy**: The signal same as Main TP/TS is transmitted.
    - **Unused**: Lower order ODU frame constructed of PRBS mapping is transmitted.

### 7.1.1.6 GFP-T

GFP-T means Transparent Generic Framing Procedure, defined by ITU-T G.7041/Y.1303. When OTN layer is added to Ethernet applications, **GFP-T** button appears in the setup area of the **Ports Setup** screen if Client Signal is selected to **GbE**. Touching an **GFP-T** button launches the below dialog box.



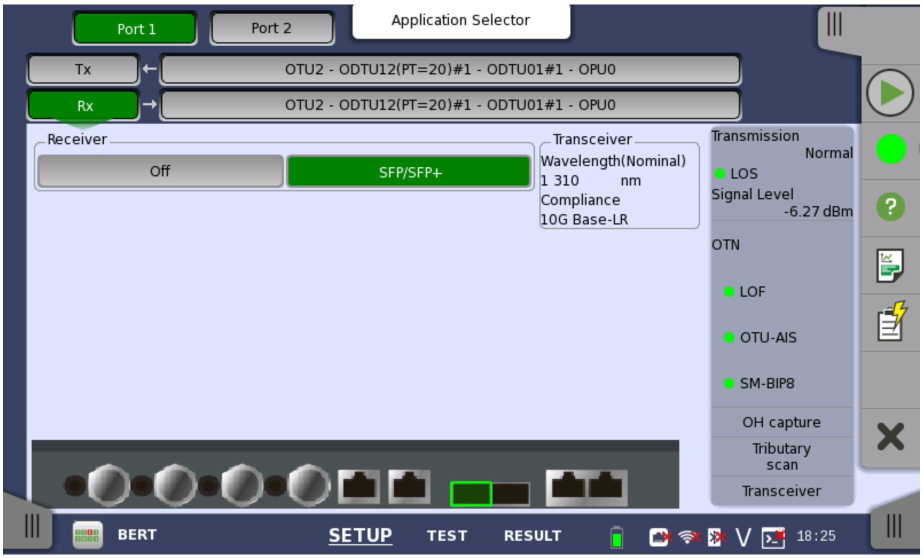
**CSF Replacement**
Setting behavior of GFP-T when CSF (Client Signal Fail) occurs.

- **Ethernet Block Replacement** :Transmits 10B data to indicate the link error.
- **GFP-T CSF Replacement** :Transmits CSF and IDLE frames CSF is transmitted with 500 ms interval.

## 7.1.2 Receiver Setup

### 7.1.2.1 Physical Setup

When the receiver is set up with an OTUk interface, touching the **Rx** button in the navigation area will launch the following screen.




This screen allows you to make the physical setup of the receiver in OTN mode. It can also be used to inspect the current status of the selected port in Port mode lamps.

The configuration options available in the setup area of the screen are described below. The status information is described in a separate section.

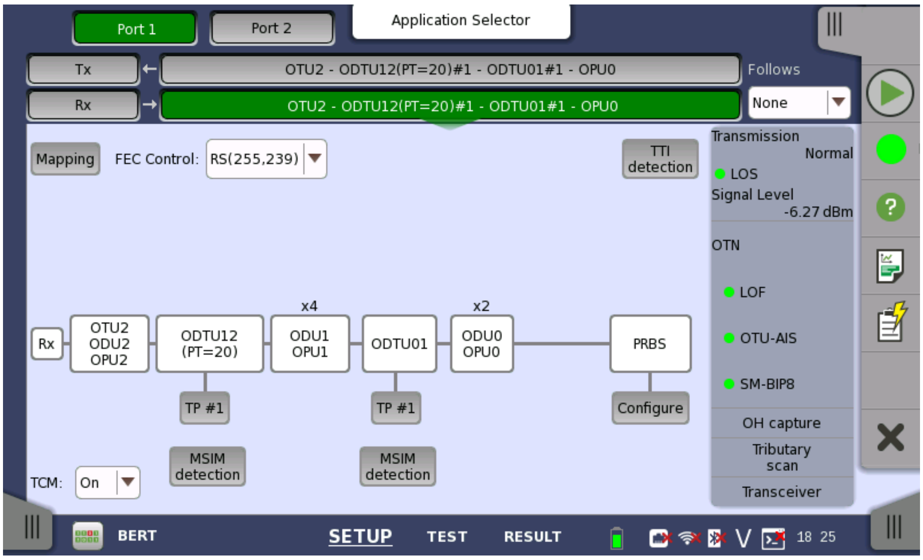
**Receiver** Touch the button to select the interface.

- **Off**: No signal input interface.
- **SFP/SFP+**: Available bit rate is up to 2.5 Gbit/s for SFP, up to 10 Gbit/s for SFP+.

**Transceiver** Displays the Transceiver information.

### 7.1.2.2 OTUk Frame Setup

Touching the navigation area button which represents the receiver's OTN layer will launch the screen shown below.




This screen allows you to configure OTUk frame of the currently selected receiver. It can also be used to inspect the current status of the selected port in a separate screen.

To setting up the OTU frame, touch **Mapping** button at first. Then select the relevant values for the various containers in the structure shown in the setup area, either by opening a drop-down menu or by touching a button to launch an editor dialog box.

Note that the changes you make will be reflected in the text displayed in the OTUk button in the navigation area.

**Follows**

To make the currently selected receiver follow either the transmitter or Port 1 receiver (i.e. copy its settings), touch the right-most button in the navigation area and select the relevant value in the drop-down menu. The default setting is **None**. Note that the Port 1 receiver cannot follow the Port 2 receiver.

**Mapping**

Touch the **Mapping** button and use the launched Dialog box to define the OTUk frame mapping. The following settings are available:

- Input Signal
- Client Signal
- Multiplexing 1
- Multiplexing 2

See a description of the setting options in the *Mapping* section under setup of transmitter.

**FEC Control**

Use the drop-down menu to select whether or not to transmit FEC (Forward Error Correction) data.

- **No FEC**: FEC Decoding (Error Correction) is set OFF.
- **RS(255,239)**: FEC Error Correction is active based on RS(255,239) code defined in ITU-T Rec. G.709.

**TTI detection**

Launches the **TTI detection** dialog box where you can select detection method for SM, PM, and TCM1-6.

The dialog box is shown and described in the *TTI detection* section.

**Auto, TP**

Only displayed when the frame mapping is set to multiplexing. Touch the **Auto** or **TP #** button and use the launched dialog box to set the number of TP or TS. When **Manual** or **Auto detect TS** are selected, TP number can be detect automatically, so "Auto" is shown on the button. **Auto detect TP** is selected, TP number can be set directly. So "TP #" is shown on the button.

The dialog box is described in the *TP/TS* section below.

**MSIM detection**
Only displayed when the frame mapping is set to multiplexing. Touch the **MSIM detection** button and use the launched dialog box to set the detection method of MSIM.

The dialog box is shown and described in the *MSIM Detection* section.

**Configure**
Only displayed when the client signal is PRBS. Touch the **Configure** button to launch a dialog box where you can select pattern type.

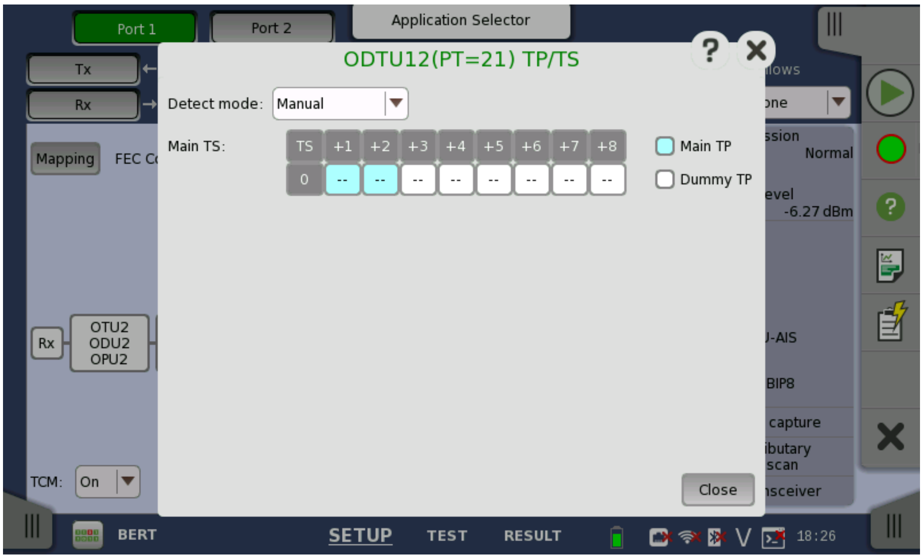
- **PRBS9** to **PRBS31**: Pseudo-random bit sequence. The number indicates the bit length of sequence.
  For example, bit length of PRBS9 is $2^9$-1=511.
- **User [32] bit**, **User [2048] bit**: 32 bits or 2048 bits length pattern.
  The field which shows bit length is enabled. Touch the field to launch the dialog box to define the bit pattern. Refer to The User Pattern Editor.

**TCM**
Use the drop-down menu to select whether or not to enable measuring TCM (Tandem Connection Monitoring) alarms and errors.

- **On**: Enables measuring TCM alarms and errors.
- **Off**: Disables measuring TCM alarms and errors.

### 7.1.2.3 TP/TS

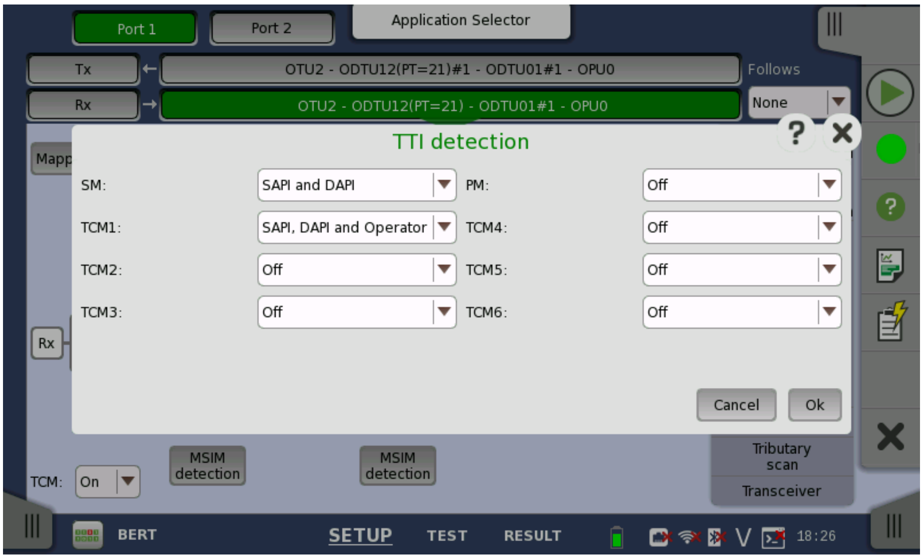
Touching a **TP** or **Auto** button on the **Ports Setup** screen launches the **TP/TS** dialog box. Note that the contents and layout of the dialog box depends on which higher order type has been selected.




TP/TS dialog box has three screen depending on the **Mode** setting.

### 7.1.2.4 TTI detection

Touching the **TTI detection** button in the upper right-hand corner of the **Ports Setup** screen launches the dialog box shown below.

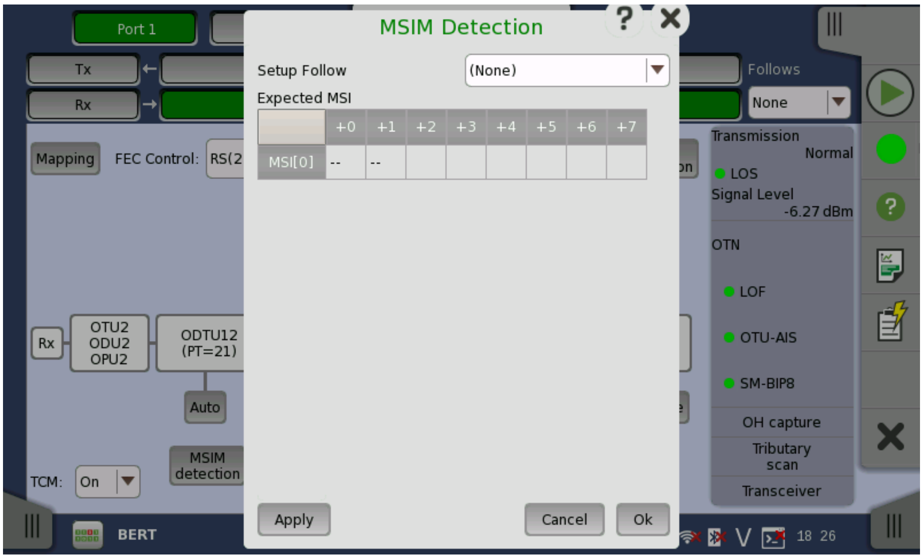



This dialog box allows you to select the detection method for SM, PM, and TCM1-6.

- **SAPI** (Source Access Point Identifier)
- **DAPI** (Destination Access Point Identifier)
- **SAPI and DAPI**
- **SAPI, DAPI and Operator** (32-Byte Operator specific)

### 7.1.2.5 MSIM detection

Touching an **MSIM detection** button on the **Ports Setup** screen launches the **MSIM Detection** dialog box.




The dialog box is used to set the detection method of MSIM (Multiplex Structure Identifier Mismatch).

**Setup Follow**
Select the source of the Expected MSI in the drop-down menu. The expected MSI is displayed in the dialog box.

- **(None)** : MSIM is not detected.
- **Tx Data** : Expected MSI are copied from OH Preset data.

- **Received Data**: Expected MSI are set from received MSI data.

## 7.1.3 Status Information

This section describes the status information available for the OTN layer in the status area of the **Ports Setup** screen.

### 7.1.3.1 Status Summary

The status summary displayed for the OTN layer consists of the following information:

**Physical Status**

The topmost part of the status area gives you access to information about the current physical status of the selected interface. A summary consisting of the most relevant status indicators is displayed constantly. By touching the summary, you can launch a display that contains the detailed status information.

**Alarm/Error Status**

The middle part of the status area gives you access to alarm and error information for the selected interface. The status is indicated by the lamp color. You can choose whether to view only the current alarm and error status, or to view all alarms and errors in the alarm trap since it was last reset.

A summary consisting of the most relevant alarm/error indications is displayed constantly. By touching the summary, you can launch a display that contains all alarms/errors.

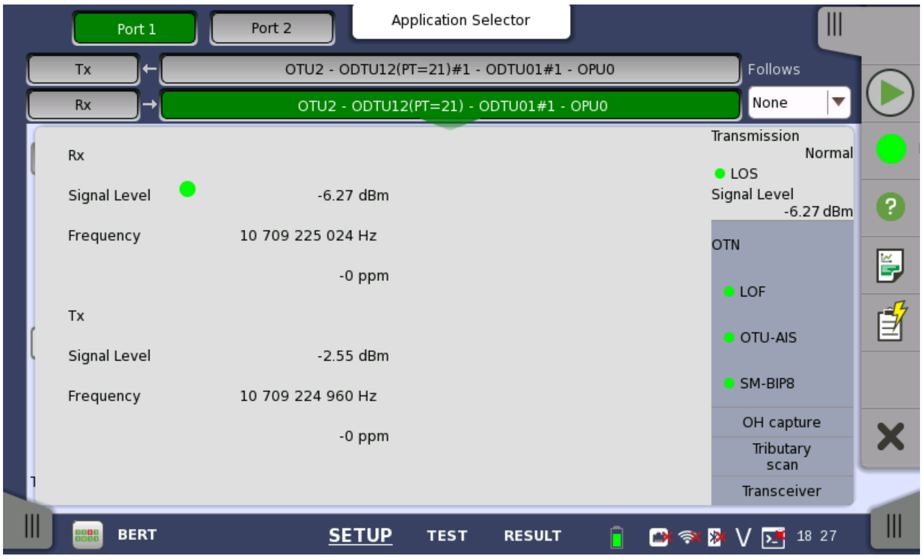
**Capture/Monitor Status**

At the bottom of the status area are below buttons that give you access to various capture/monitor information. By touching a button, you can launch the corresponding information display.

- **OH capture**
- **Tributary scan**
- **Transceiver**

### 7.1.3.2 Physical Details

Touching the topmost summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents detailed information about the current physical status of the optical signal.

**Rx**

**Signal Level**

Shows the input level of an optical signal. A lamp icon indicates the LOS state.

**Frequency**
Shows the input signal frequency and the deviation of the input signal from the nominal bit rate in ppm.

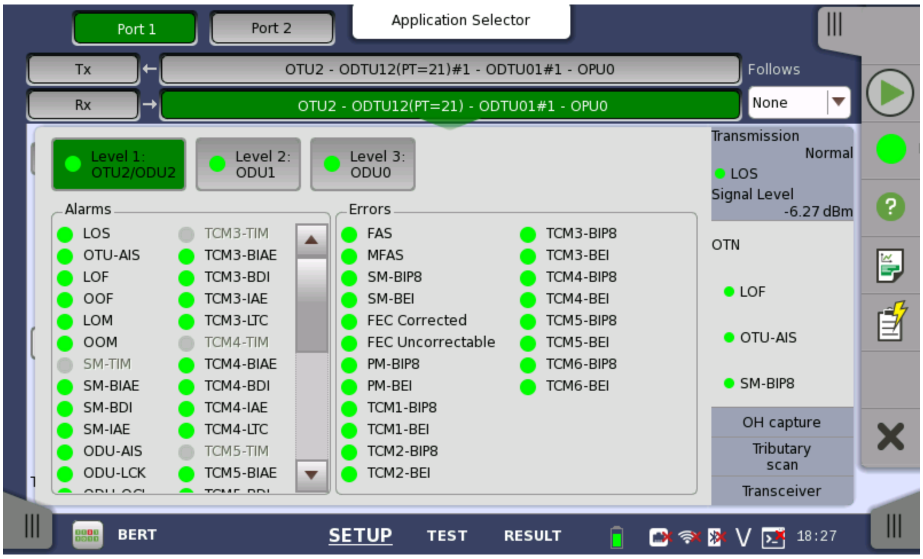
**Tx**

**Signal Level**
Shows the output level of an optical signal.

**Frequency**
Shows the output signal frequency and the deviation of the output signal from the nominal bit rate in ppm.

### 7.1.3.3 Alarms and Errors

Touching the middle summary box in the status area of the **Ports Setup** screen displays the status shown below.




This screen contains detailed alarm and error information related to the OTN layer. Status is indicated by the use of colored lamp icons.

**Level-specific alarms**

If the ODUk is multiplexed, touch the relevant OTU/ODUk level button.

Alarms

OTU Alarms
- **LOS**: Loss of Signal.
- **OTU-AIS**: Optical channel Transport Unit Alarm Indication Signal.
- **LOF**: Loss of Frame
- **LOFLOM**: Loss of Frame and Loss of Multiframe
- **OOF**: Out of Frame
- **LOM**: Loss of Multiframe
- **OOM**: Out of Multiframe
- **SM-TIM**: Section Monitoring Trail trace Indicator Mismatch
- **SM-BIAE**: Section Monitoring Backward Incoming Alignment Error
- **SM-BDI**: Section Monitoring Backward Defect Indicator
- **SM-IAE**: Section Monitoring Incoming Alignment Error

ODU Alarms
- **ODU-AIS**: Optical channel Data Unit Alarm Indication Signal
- **ODU-LCK**: Optical channel Data Unit Locked Signal
- **ODU-OCI**: Optical channel Data Unit Open Connection Indication
- **PM-TIM**: Path Monitoring Trail trace Indicator Mismatch
- **PM-BDI**: Path Monitoring Backward Defect Indicator
- **PLM**: Payload Mismatch
- **MSIM**: Multiple Structure Identifier Mismatch

**CI-AIS**: Characteristic Information Alarm Indication Signal
**CSF**: Client Signal Fail
**LSS**: Link Status Signal

TCM Alarms

**TIM**: Trace Indicator Mismatch
**BIAE**: Backward Incoming Alignment Error
**BDI**: Backward Defect Indicator
**IAE**: Incoming Alignment Error
**LTC**: Loss of Tandem Connection

Errors

OTU Errors

**FAS**: Frame Alignment Signal
**MFAS**: Multiframe Alignment Signal
**SM-BIP8**: Section Monitoring Bit Interleaved Parity 8
**SM-BEI**: Section Monitoring Backward Error Indication
**FEC corrected**: Forward Error Correction Corrected
**FEC uncorrected**: Forward Error Correction Uncorrected

ODU Errors

**PM-BIP8**: Path Monitoring Bit Interleaved Parity 8
**PM-BEI**: Path Monitoring Backward Error Indicator

OPU Errors

**Pattern error**: Bit error detected in the payload

TCM Errors

**TCMi-BIP8**: Bit Interleaved Parity 8
**TCMi-BEI**: Backward Error Indication
(i=1 to 6)

GMP Errors

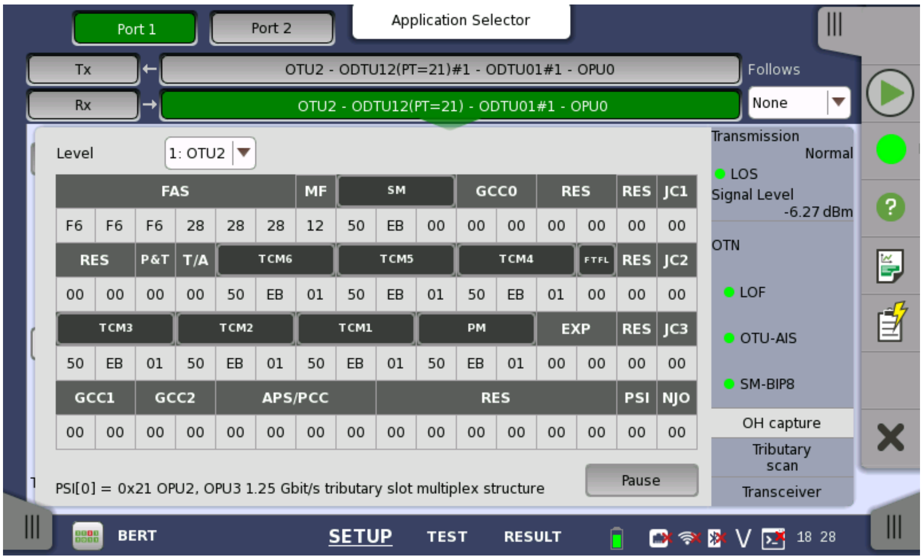
**CRC8 error**: CRC8 error occurred
**CRC5 error**: CRC5 error occurred
**FCS error**: Frame Check Sequence error detected

GFP Errors

**cHEC correctable**: core Header Error Check Correctable
**cHEC uncorrectable**: core Header Error Check Uncorrectable
**tHEC correctable**: type Header Error Check Correctable
**tHEC uncorrectable**: type Header Error Check Uncorrectable
**eHEC correctable**: extension Header Error Check Correctable
**eHEC uncorrectable**: extension Header Error Check Uncorrectable
**Invalid GFP frame**: Invalid Transport Generic Frame Procedure Frame
**Superblock CRC**: Superblock where CRC error occurred
**CSF signal**: Client Signal Fail
**CSF sync**: Client Signal Fail synchronization
**SSF**: Server Signal Failure

### 7.1.3.4 OH capture

Touching the **OH capture** button in the status area of the **Ports Setup** screen displays the status shown below.




This screen shows OTU/ODU/OPU OH capture data for one frame at time. Use the **Level** drop-down menu to select which multiplexing level to display. For a description of the frame structure, see the Overhead Dialog box section under the ports setup of OTN.

**Refreshing information**

Refresh once

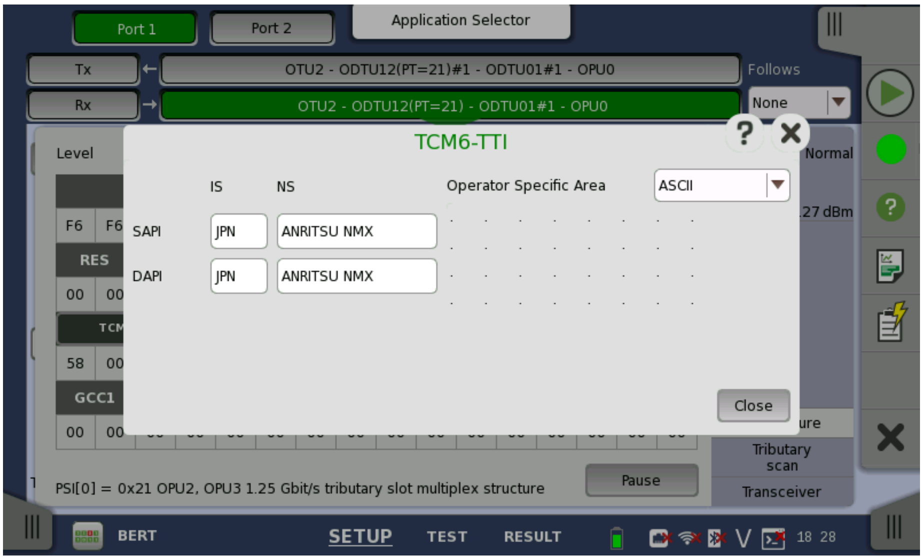
When touch the **Pause** button, the **Update** button appears at left side of the **Pause** one and information is not updated. Touching the **Update** button will refresh the dialog information once.

Refresh continuously

When the dialog is open and touch the **Pause** button at refresh once mode, information is updated continuously.

**Displaying detailed information**

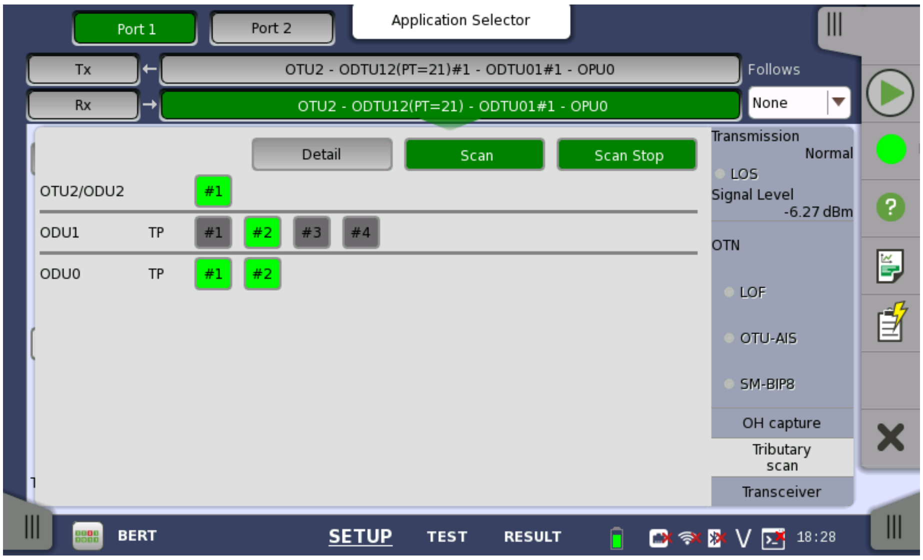
Detailed overhead byte information can be accessed by touching the name of a specific byte. This will launch a separate dialog box containing a description of and details about the selected byte.




In the byte-specific dialog box, select the display format (ASCII or Hex) using the **Operator Specific Area** drop-down menu.

### 7.1.3.5 Tributary scan

Touching the **Tributary scan** button in the status area of the **Ports Setup** screen displays the status shown below.

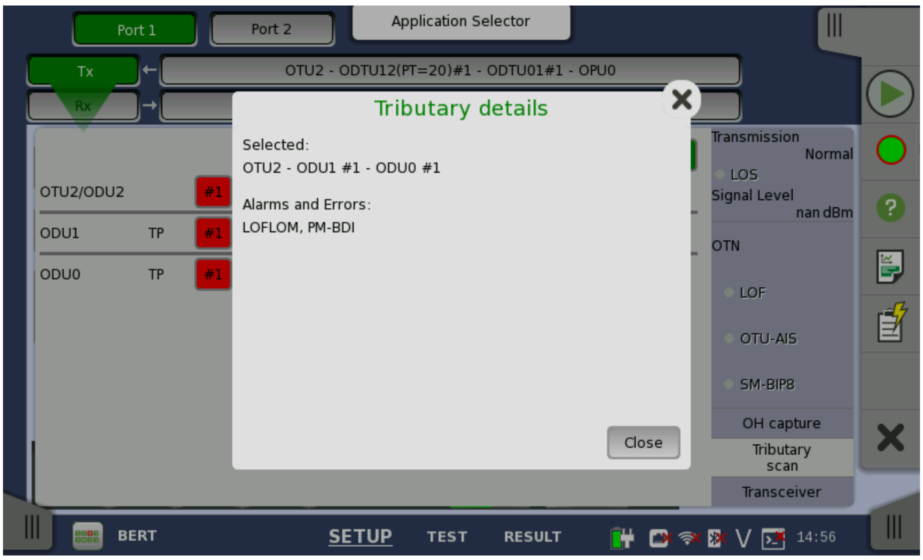



A *Tributary scan* detects errors and alarms over multiple Tributary Ports depending on the current mapping settings at the receiver port. The screen displayed by the **Tributary scan** button can be used to acquire the tributary status information.

The screen contains the following buttons: **Detail**, **Scan**, **Scan Start/Stop**. The **Scan** button is active when the screen is displayed.

**Start scanning**
Touching the **Scan Start** button scans one level at a time. With the **Scan** button active (displayed in green), you can select the Tributary Port to scan by touching the number button. The buttons are shown in green or red according to the scan result. Note that only one ODUk at the first level is displayed.

**Detail**
Touching the **Detail** button enables the showing of details for a specific ODUk. With the **Detail** button active, you can see the detail information by touching the button in red. **Tributary details** dialog box contains the following information:




- Path to the selected form (for example, "ODU2-ODTU12(PT=21)-ODU1 #2")
- Errors and alarms detected at the selected channel.

Touching the button in green does not launch the dialog box.

To change TP to scan, touch the **Scan** button.

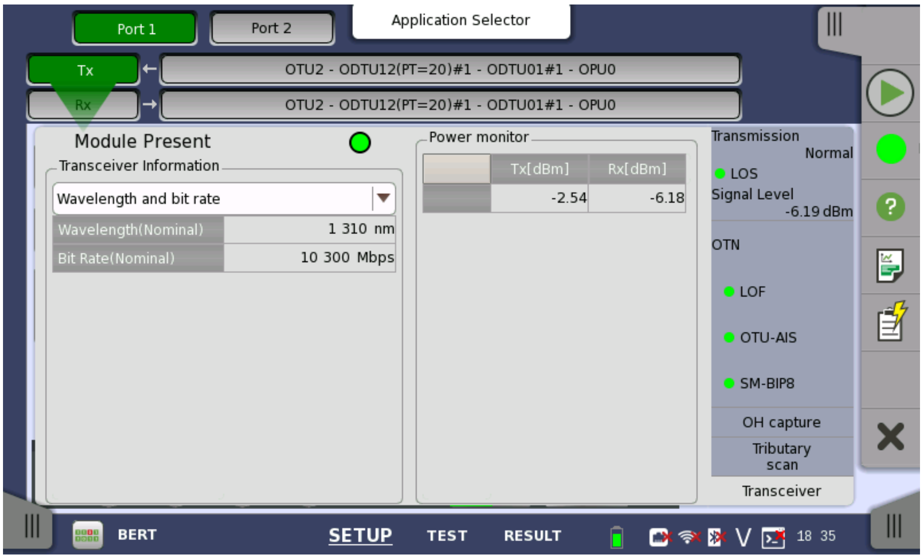
**NOTE**

*Tributary Scan Results are cleared, when close the dialog box, move other status area or move other screens.*

**Stop scanning**
Touching the **Scan Stop** button stops the scanning session.

### 7.1.3.6 Transceiver

Touching the **Transceiver** button in the status area of the **Ports Setup** screen displays the status shown below.




This screen presents status information about the optical transceiver.

**Module Present** Green indicates that optical transceiver presents.

**Transceiver Information** Select the information from pull down menu.

- **Wavelength and bit rate** shows the nominal wavelength and bit rate.
- **Compliance** shows the available standards.
- **Vendor information** shows the data stored in the optical transceiver.

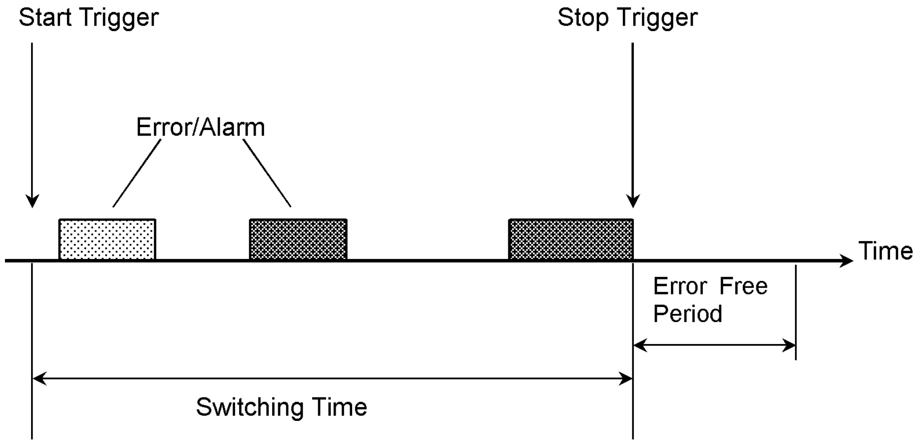
**Power monitor** The transmitting optical power is displayed in left column. Unit of the optical power is dBm.

The received optical power is displayed in right column. Unit of the optical power is dBm.

# 7.2 APS

The Automatic Protection Switching (APS) test measure the switching time protecting from the failure.

Switching time is defined as below.




- The start and stop trigger can be selected independently.
- Trigger event can be selected from the high order OTU and ODU.
- You can set the Pass/fail threshold for Switching Time.
- Test result include pass/fail, switching time (minimum, maximum and average) and the measurement count of switching.

## 7.2.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

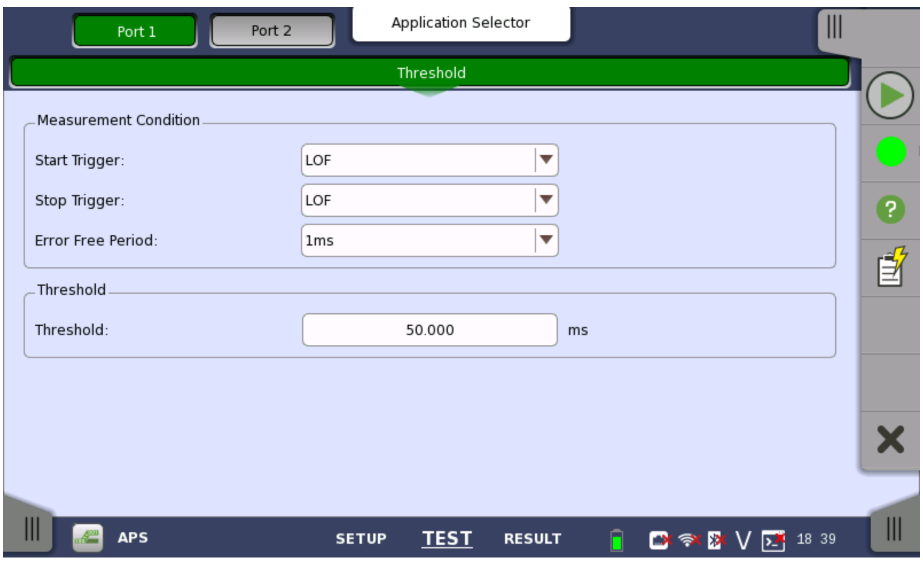
The setup options and status information related to the OTN interface are described in a separate section:

- OTN Setup and Status

## 7.2.2 Test Setup

### 7.2.2.1 Thresholds

Following screen is displayed for the **Test Setup**.



This screen contains the parameters for setting up the threshold values for errors and Pass/Fail status.

**Start Trigger, Stop Trigger**
Use the drop-down menu(s) to select the relevant item (**LOF**, **OOF**, **ODU-AIS** etc.).

**Error Free Period**
Alarms or Errors set up in stop trigger are not in a measured signal within the time of this cycle, end the switching time measurement.

**Threshold**
Allows you to specify the maximum duration of the selected reference event(s). Valid values are from **0.000 ms** to **10000.000 ms**.

## 7.2.3 Test Results

### 7.2.3.1 Summary

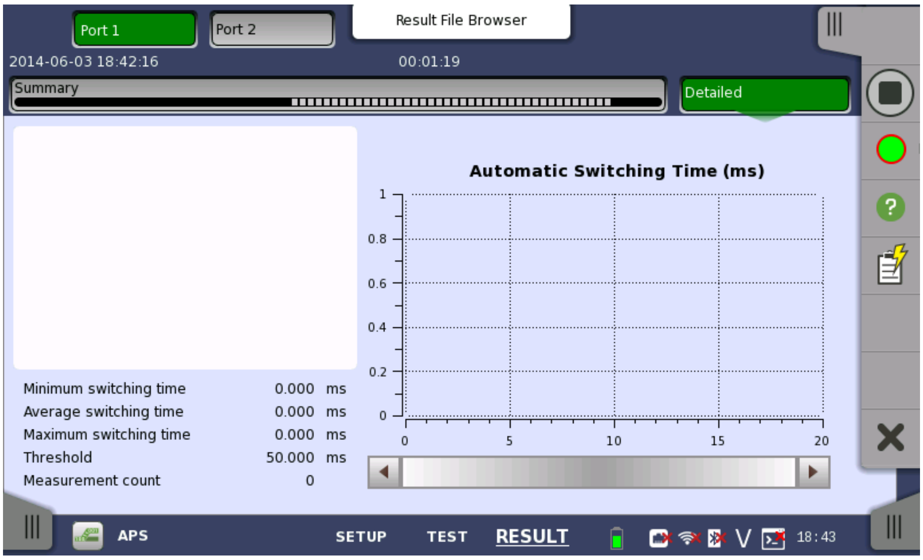
Touching the **Summary** button in the navigation area will display the screen shown below.


The following information is displayed:

- Start Trigger
- Stop Trigger
- Average switching time : Average time of switching
- Max. Time : Maximum time of switching
- Threshold : The threshold value used in the test

### 7.2.3.2 Detailed

Touching the **Detailed** button in the navigation area will display the screen shown below.




Buttons for selecting the relevant port are displayed at the top of the screen, with a color indication of the pass/fail status of the test.

This screen presents the detailed results of an OTN APS test. The results relate to a specific port and consist of the Automatic Switching times of the APS requests. The data is shown in both list-form and in a graphical presentation. This screen contains the summary field displayed below the list.

**Summary field** Consists of the minimum, maximum, and average automatic switching times in milliseconds, the specified threshold value, the number of measurements.

**List-form information** Presents the automatic switching times in list-form.

**Graphical presentation** The graphical presentation consists of a bar diagram of the automatic switching times. Results affected by unexpected alarms/errors are indicated.

# 7.3 BERT

The Bit Error Rate Test (BERT) described in this section is applicable for OTN interfaces.

## 7.3.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

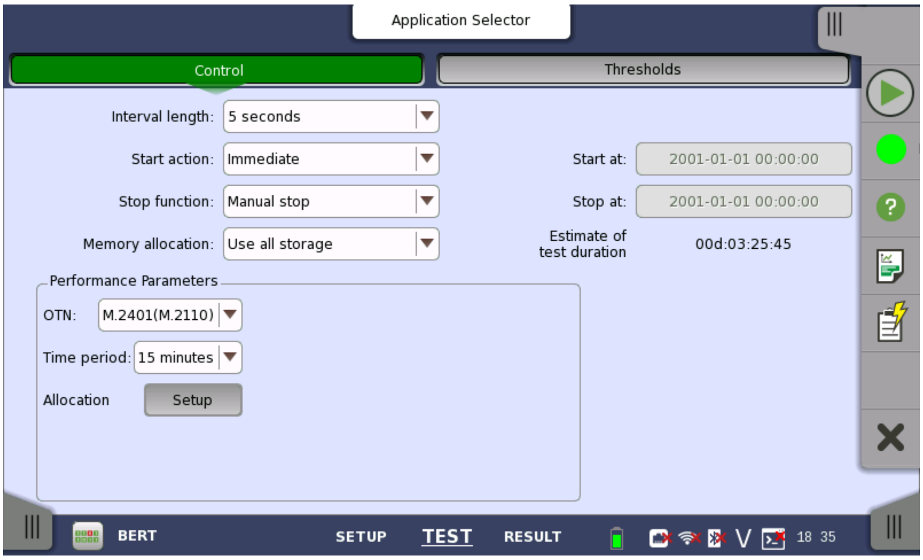
The setup options and status information related to the OTN interface are described in a separate section:

- OTN Setup and Status

## 7.3.2 Test Setup

### 7.3.2.1 Control

When you go to the test setup of the OTN BERT application, the following screen is displayed.




This screen allows you to configure the test mode and other general parameters related to the test.

**Interval length**
Allows you to specify the duration of the BERT intervals. The drop-down menu contains the following values: **1 second**, **2 seconds**, **5 seconds**, **10 seconds**, **15 seconds**, **30 seconds**, **1 minute**, **5 minutes**, **10 minutes**, **15 minutes**, **30 minutes**, **1 hour**, **2 hours**, **4 hours**, **6 hours**, **12 hours** or **No Intervals**.

**Start action**
Allows you to specify when the measurement is started.

- If **Immediate** is selected, the measurement starts when you touch the **Start** button.
- Selecting **Start at** will enable a delayed start. The start time for a delayed start can be specified in the adjacent **Start at** field.

**Stop function**

Allows you to specify when the measurement ends. Select the relevant option from the drop-down menu:

- If **Manual stop** is selected, the measurement will stop immediately when the **Stop** button is touched.
- Selecting **Stop at** will enable the adjacent field, in which you can specify the stop time.
- Selecting **Duration** will allow you to specify a duration time in the adjacent field.

**Memory allocation**
Allows you to specify how the measurement will be stored in the Network Master's memory. Select the relevant option from the drop-down menu:

- **Use all storage**: When Network Master's memory became full with measured data, the whole measurement is stopped.
- **Continuous**: When Network Master's memory became full with measured data, oldest records in that memory will be overwritten.

**Estimate of test duration**
Contains an estimation of the time (in days, hours, minutes and seconds) before the whole memory will be filled out by the test. The estimated value is dependent on the current interface and selections concerning this interface. During an ongoing measurement, the estimate will be recalculated periodically, that the estimate will get better and better.

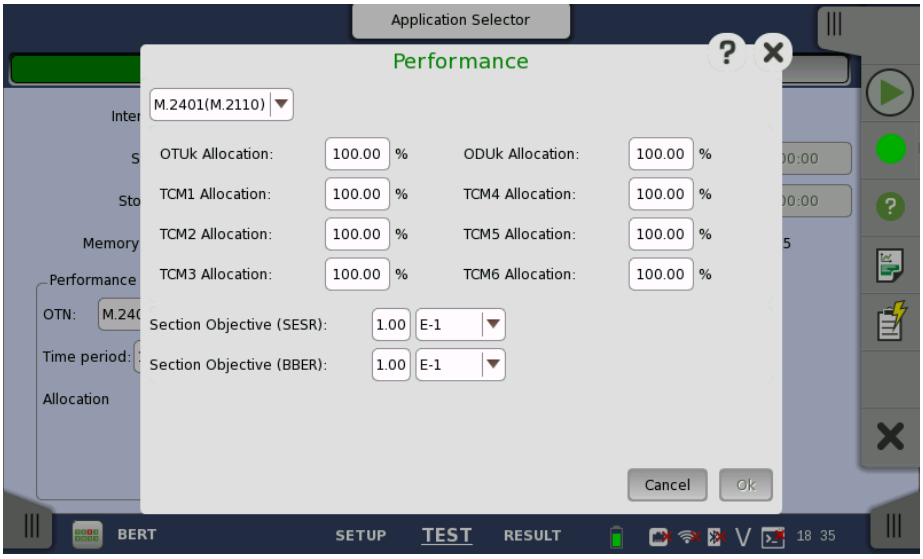
**Performance Parameters**

**OTN**
Select the ITU-T Recommendation applying to the test.

- **G.8201** Error performance parameters and objectives for multi-operator international paths within the Optical Transport Network (OTN)
- **M.2401 (M.2110)**
  **M.2401** Error performance limits and procedures for bringing-into-service and maintenance of multi-operator international paths and sections within an optical transport network
  **M.2110** Bringing into service international multi-operator paths, sections and transmission systems

**Time period**
This parameter is displayed if *OTN* is set to M.2401(M.2110).
**15 minutes**, **1 hour**, **2 hours**, **24 hours**, **7 days**

**Allocation**
Touching the **Setup** button launches the dialog box shown below.



The dialog box is used to set up various performance parameters.

**Type**
Select the performance type as either **G.8201** or **M.2401/M.2110**. The contents of the dialog box depends on the selected performance type.

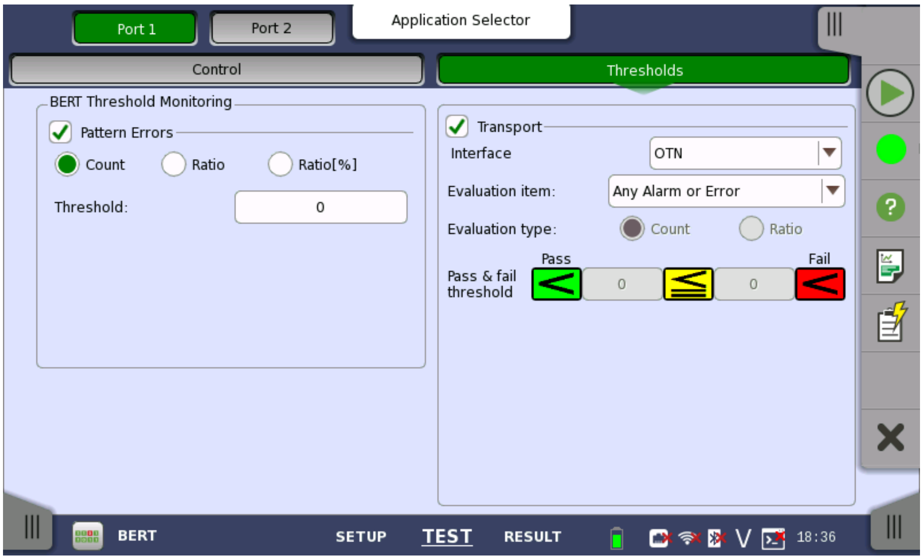
**Allocation**
This parameter is displayed if *OTN* is set to M.2401(M.2110).
Set the Allocation ratio of OTUk, ODUk or TCMi. These parameters are displayed if *Type* is M.2401/M.2110.

**Section Objective (SESR)**
Set the limit of SESR (Severely Errored Seconds Ratio). SES (Severely Errored Second) is a one-second period which contains 15% or more errored blocks or at least one defect.

**Section Objective (BBER)**
Set the limit of BBER (Background Block Errors Rate). BBE (Background Block Error) is an errored block not occurring as part of an SES.

### 7.3.2.2 Thresholds

Touching the **Thresholds** button in the navigation area displays the following screen.




This screen contains the parameters for setting up the various threshold values (i.e. limits) for errors and Pass/Fail status that are used during the monitoring.

**Pattern Errors**

Allows you to enable monitoring of pattern errors (i.e. bit errors) and to set up a threshold value for the bit error ratio. Select the checkbox to enable the parameters.

Choose whether the threshold is specified as an absolute value or a percentage, using the **Count**, **Ratio** and **Ratio [%]** radio buttons, and then specify the value in the **Threshold** field.

**Transport**

Select the checkbox to enable the transport-related parameters.

**Interface**
Fix to **OTN**.

**Evaluation item**
Use the drop-down menu to select the item to evaluate. If selecting other than **Any Alarm or Error**, another menu appears.

**Evaluation type**
Select the relevant type.

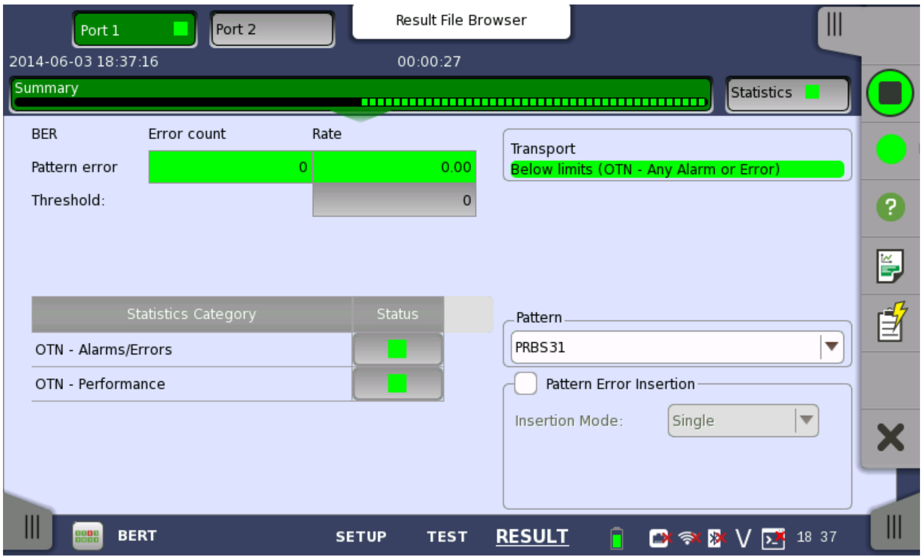
**Pass & fail threshold**
Touch the left-hand number to set the lower limit for "Warning". Touch the right-hand number to set the lower limit for "Fail". The lower limit of "Fail" must be equal to or greater than the lower limit of "Warning" (defining a "Within limits" range in between them).

*Thresholds can only be set/modified while no measurement is running, as they are active during a measurement.*

## 7.3.3 Test Results

### 7.3.3.1 Summary

Touching the **Summary** button in the navigation area will display the screen shown below.




This screen shows the summary of all error count and ratio. You can insert the pattern error in this screen.

**BER**
Displays the result of pattern errors and threshold.

**Statistics Category**
The lamp icon in Status column shows the Pass or Fail results. Touching the Status column displays the statistics results.

**Transport**
Displays the result of Pass & fail threshold if Transport is selecting in **Test Setup** screen.

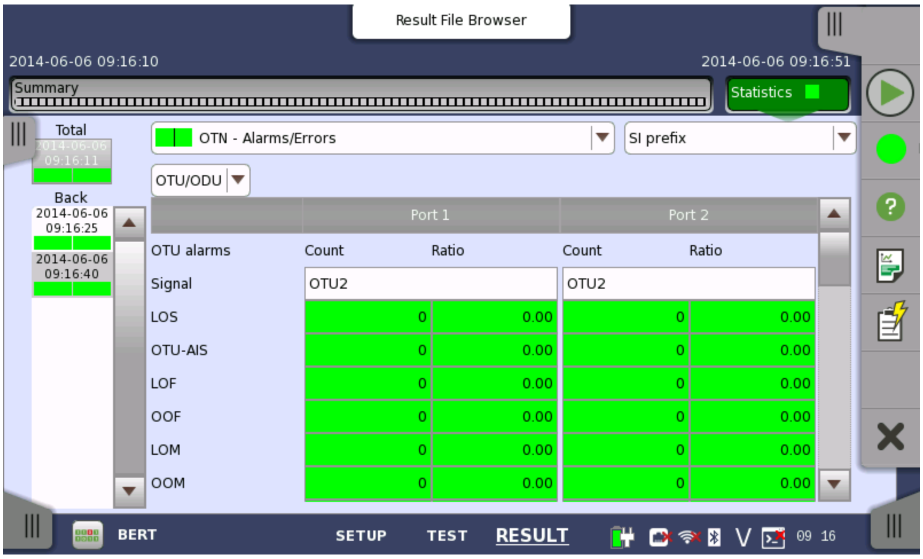
**Pattern**
Select the pattern. You can edit bit pattern when the pattern is User[32] bit or User[2048] bit.

**Pattern Error Insertion**
Select the checkbox to enable the pattern error insertion.

Select Insertion Mode to **Single** or **Rate**. When **Single** is selecting, touch Alarm/Error Insert icon in the Application Toolbar.

### 7.3.3.2 Statistics

Touching the **Statistics** button in the navigation area displays the screen shown below.




This screen presents a detailed analysis of the test results. You can choose to view either the current results (i.e. results measured during one second) or the total results from measurement start. You can also zoom in on a specific result item. The results can be displayed either in table (list) form or as a graph.

#### Selecting which results to view

**Selecting the interval time**

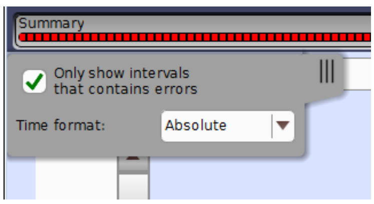
Touch the **Total** button to switch the total values measured in all interval times. The start time of measurement is displayed on the button.

Touching the button in left side **Back** field shows the measured values in the interval time. The end time of the interval is displayed on the button.

**Current** button is displayed at left bottom when the measurement is running. Touching the **Current** button shows the measured values in the current interval time. The start time of the current interval is displayed on the button.

The slide-out panel on the left-hand side of the screen contains the following functions:

- Only show intervals that contains errors
- Time format



*If you have stopped measurement during the interval time, the measurement results of current interval are discarded. The log of current interval is not displayed in **Back** field.*
In this case, result data are re-calculated excluding the data of current interval when the measurement is stopped. This causes that "Count" and "Ratio" displayed after the measurement will be different from that of during measurement.
The sum of interval time (multiplied interval time by the number of back logs) may not match the differential time between displayed time at left top and right top after the measurement.

**Selecting type of results**

Open the drop-down menu in the top row plus the drop-down menu below it to select which results you want displayed on the screen.

- **OTN - Alarms/Errors**
- **OTN - Performance**

## Selecting how results are displayed

**Selecting notation**

Select the required notation for the results from the notation drop-down menu.

- **Unformatted** e.g. 71892
- **SI prefix** e.g. 71.892 k (k means "kilo")
- **Engineering** e.g. 71.892E3
- **Scientific** e.g. 7.1892E4

## Results

- **OTN - Alarms/Errors**

  OTU/ODU
    - **OTU alarms**
    - **OTU errors**
    - **ODU alarms**
    - **ODU errors**

  Stage1 ODU
    - **ODU alarms**
    - **ODU errors**

  Stage2 ODU
    - **ODU alarms**
    - **ODU errors**

  Client
    - **Client alarms**
    - **Client errors**

  ODU TCM
    - **ODU TCMi alarms**
    - **ODU TCMi errors**

  Justification

- **OTN - Performance**

  OTU/ODU
    - **OTU**
    - **ODU**

  Stage1 ODU
    - **ODU**

  Stage2 ODU
    - **ODU**

  ODU TCM
    - **TCMi**

## 7.4 RTD

The Round-Trip Delay (RTD) time is the duration time of the network and the network equipments.

Network Master measures RTD using a trigger injected in ODU frame. At first, Network Master transmits the trigger signal. Network Master measures the RTD by receiving the trigger signal returned from the network to be measured or the network equipment.

### 7.4.1 Ports Setup and Status

The first step in running an application is to set up the port interfaces. This is done on the **Ports Setup** screen, which also provides port status information.

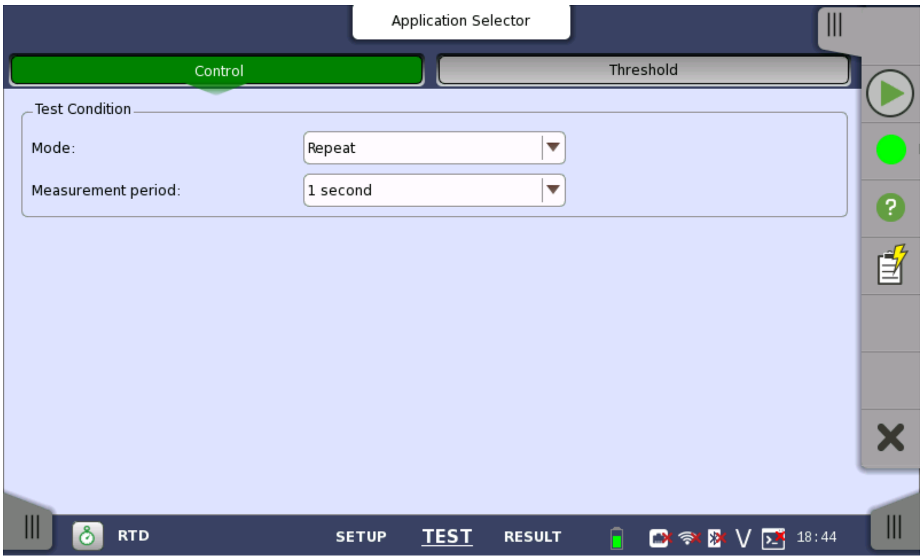
The setup options and status information related to the OTN interface are described in a separate section:

- OTN Setup and Status

### 7.4.2 Test Setup

#### 7.4.2.1 Control

When you go to the test setup of the RTD application, the following screen is displayed.




This screen allows you to configure the *RTD test* conditions for the currently selected port(s).

**Test Condition**

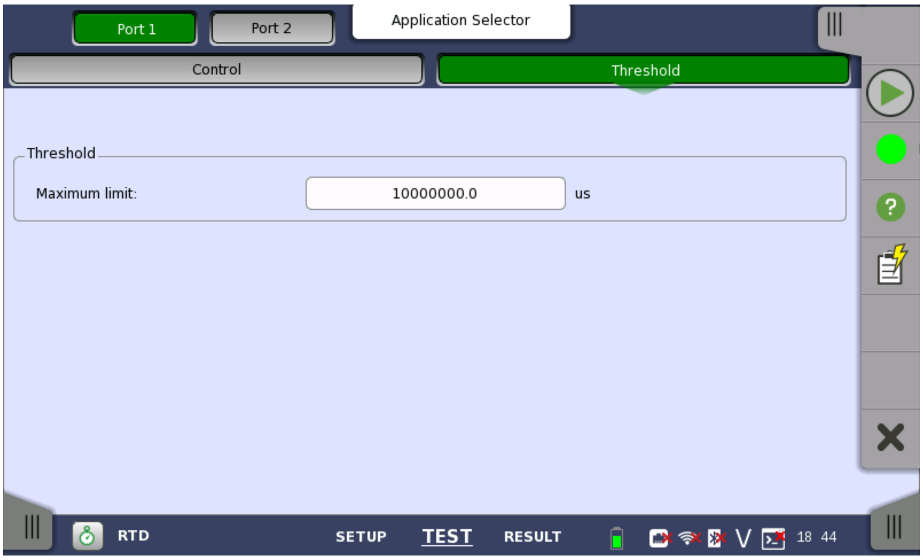
**Mode**
Allows you to define the test duration in one of two ways:

- **Single** - Used to perform RTD test once.
- **Repeat** - Used when a *persistent RTD test* is needed.

**Measurement period**
Measurement period can be set maximum RTD per one Test.

#### 7.4.2.2 Threshold

Touching the **Thresholds** button in the navigation area displays the following screen.




This screen allows you to configure the *RTD test* conditions for the currently selected port(s).

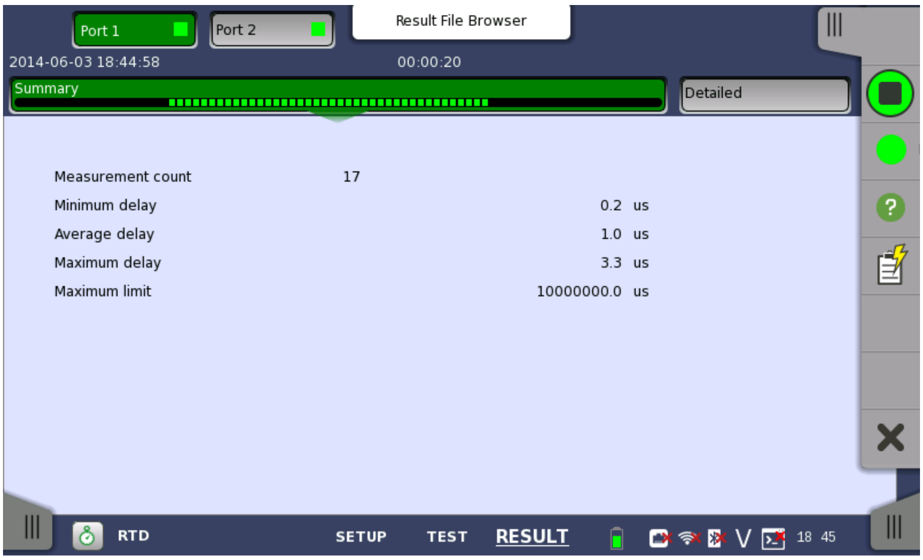
**Threshold**

**Maximum limit**
Allows you to specify a threshold value of RTD in micro seconds (µs).

### 7.4.3 Test Results

#### 7.4.3.1 Summary

Touching the **Summary** button in the navigation area will display the screen shown below.

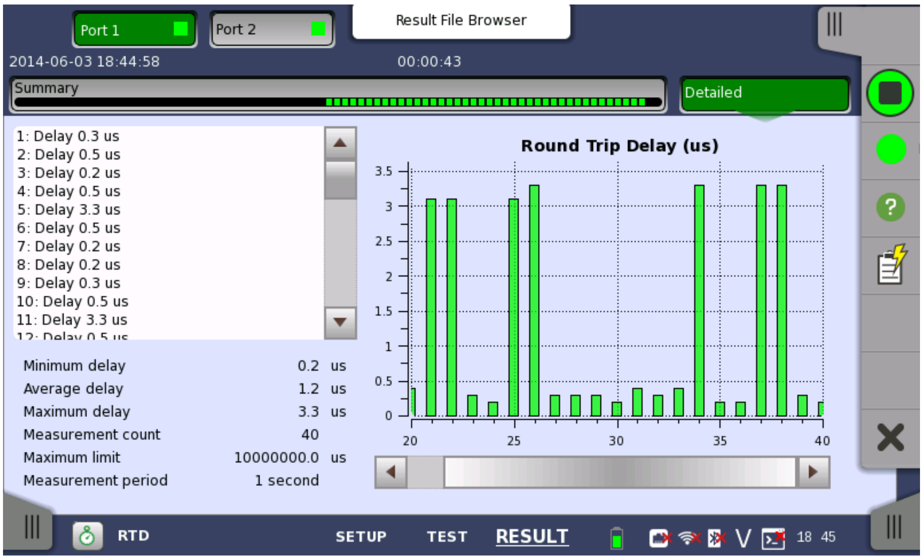



This screen presents a summary of the RTD test results, for all of the ports included in the test. For each port, the information consists of:

- The total number of measurements
- Minimum, Average and Maximum RTD in micro seconds
- Threshold value

### 7.4.3.2 Detailed

Touching the **Detailed** button in the navigation area will display the screen shown below.




Buttons for selecting the relevant port are displayed at the top of the screen, with a color indication of the pass/fail status of the test.

This screen presents the detailed results of an RTD test. The result is shown in both list-form and in a graphical presentation. This screen contains the summary field displayed below the list.

**Summary field**
Consists of the minimum, maximum, and average round-trip delay times in micro seconds, the number of measurements, the specified threshold value and measurement period.

**List-form information**
Presents the results of an RTD test in list-form.

**Graphical presentation**
The graphical presentation consists of a bar diagram of the round-trip delay times.

# 8 Specifications

# 8.1 MT1000A

This section contains specifications for the Network Master Pro, MT1000A (mainframe).

## 8.1.1 Configuration

| | |
|---|---|
| | **- Main Frame -** |
| MT1000A | Network Master Pro |
| | **- Standard Accessories -** |
| J1565A | Line Cord USA |
| J1566A | Line Cord Europe |
| J1567A | Line Cord UK |
| J1568A | Line Cord Australia |
| J1594A | Line Cord Japan |
| J1596A | Line Cord Korea |
| G0309A | AC Adapter |
| G0310A | LiION Battery |
| B0690A | Softbag |
| B0692A | ESD box |
| Z1746A | Stylus |
| Z1747A | Carrying Strap |
| Z1748A | Handle |
| Z1817A | Utilities ROM |
| W3681AE | Quick Reference Guide |
| | **- Options -** |
| MT1000A-003 | Connectivity for WLAN/Bluetooth |
| MT1000A-ES210 | 2 Years Extended Warranty Service |
| MT1000A-ES310 | 3 Years Extended Warranty Service |
| | **- Optional Accessories -** |
| B0691A | Hard case |
| G0324A | Battery Charger |
| G0325A | GPS receiver |
| J1570A | Head Set |
| W3682AE | Operation Manual |
| | **- Plug-in Unit -** |
| MU100010A | 10 G Multirate Module |

## 8.1.2 External Interfaces

**Internal Clock**

| | |
|---|---|
| Accuracy | ±4.6 ppm or less, STRATUM 3 compliant |

**Ref Clock Input**

BITS (DS1 1.544 Mbit/s), SETS (E1 2.048 Mbit/s), 2MHz Clock
ITU-T G.703 compliant

| | |
|---|---|
| Connector | BNC Jack |
| Range | ±100ppm |

**Service interface**

USB (A x 2,mini B x 1 Port, Revision 2.0)
RJ45 Ethernet (10/100/1000 BASE-T)
WLAN (2.4GHz IEEE802.11b/g/n)
Bluetooth (BT2.1+EDR)
3.5mm Audio Jack
AUX Connector (for connection of optional G0325A GPS receiver)

**Remote Control**

Ethernet

### 8.1.3 Other Interfaces

| | |
|---|---|
| **Input device** | Power switch, Touch panel |
| **LCD** | 9 inch display with WVGA resolution (800x480 pixels). |
| **LED** | On, Standby, Charge |
| **Speaker** | Built-in monaural speaker |
| **Storage Memory** | 1GB for User use |

### 8.1.4 Environment Performance

| | | |
|---|---|---|
| **Voltage** | DC | 18 V |
| | AC | 100 V to 240 V, 50/60 Hz (with dedicated AC adaptor) |
| | Battery | Dedicated 10.8 V Rechargeable smart Li-ion battery |
| **Power consumption** | 65 W max. | |
| **Temperature range** | Operating: | 0°C to +50°C, ≤85%RH (non-condensing) * |
| | Charging battery: | 0°C to +40°C, ≤85%RH (non-condensing) |
| | Storage: | -30°C to +60°C, ≤90%RH (Excluding battery and AC adapter)<br>-20°C to +50°C, ≤90%RH (Including battery and AC adapter)<br>(non-condensing) |
| | *: The maximum allowed charging temperature will be reduced if the instrument is switched on. | |
| **EMC** | EN61326-1 and EN61000-3-2. | |
| **LVD** | EN61010-1. | |

### 8.1.5 Mechanical Performance

| | |
|---|---|
| **Size** | 163(H) x 257.6 (W) x 43.5(D) (Excluding projections) |
| **Mass** | 1.6 kg max. |

## 8.2 MU100010A, 10 G Multirate Module

In the following you find specifications for the Network Master Pro MU100010A module. The MU100010A specification lists the functionality added to the basic Network Master Pro by installing the MU100010A option. Refer to the *Specifications, MT1000A* section for further information about the Network Master Pro's basic functionality.

### 8.2.1 Configuration

| | |
|---|---|
| | **- Module -** |
| MU100010A | 10G Multirate Module |
| | **- Options -** |
| MU100010A-ES210 | 2 Years Extended Warranty Service |
| MU100010A-ES310 | 3 Years Extended Warranty Service |
| | **- Basic Option (Software) -** |
| MU100010A-x01 | Up to 2.7G Dual Channel |
| | **- Protocol Option (Software) -** |
| Ethernet: | |
| MU100010A-x11 | Ethernet 10G Single Channel |
| MU100010A-x12 | Ethernet 10G Dual Channel |
| OTN: | |
| MU100010A-x51 | OTN 10G Single Channel |
| MU100010A-x52 | OTN 10G Dual Channel |
| MU100010A-x61 | ODU Multiplexing |
| MU100010A-x62 | ODU Flex |
| SDH/SONET: | |
| MU100010A-x81 | STM-64 OC-192 Single Channel |
| MU100010A-x82 | STM-64 OC-192 Dual Channel |

## 8.2.2 External Interfaces

**Test signal interface**

| | |
|---|---|
| SFP/SFP+: | 2 Slots |
| | SFF-8431, SFF-8472 compliant IEEE 802.3ae-2002, IEEE802.3-2008 compliant |
| RJ45: | 2 Sockets |
| | IEEE802.3-2008 10BASE-T, 100BASE-TX, 1000BASE-T compliant<br>Auto MDI-X<br>10/100 Mbps Full/Half Duplex, 1000 Mbps Full Duplex |
| RJ48: | 2 Sockets |
| | ITU-T G.703 compliant |
| RTT BANTAM: | 4 ports |
| | ANSI DS1.102 compliant |
| BNC: | 4 ports |
| | ITU-T G.703 compliant |

**Simultaneous Measurement Port**

2 ports

**Bit Rate**

| Standard | Bit Rate | Interfaces |
|---|---|---|
| 10BASE-T: | 12.5 Mbit/s | RJ-45 |
| 100BASE-TX: | 125 Mbit/s | RJ-45 |
| 1000BASE-T: | 1.25 Gbit/s | RJ-45 |
| 100BASE-XX: | 125 Mbit/s | SFP |
| 1000BASE-XX: | 1.25 Gbit/s | SFP |
| 10GBASE-XX: | 10.3125 Gbit/s | SFP+ |
| STM-1/OC-3: | 155.52 Mbit/s | SFP |
| STM-4/OC-12: | 622.082 Mbit/s | SFP |
| STM-16/OC-48: | 2488.32 Mbit/s | SFP |
| STM-64/OC-192: | 9953.28 Mbit/s | SFP+ |
| OTU1: | 2.666057143 Gbit/s | SFP |
| OTU2: | 10.70922532 Gbit/s | SFP+ |
| OTU1e: | 11.04910714 Gbit/s | SFP+ |
| OTU2e: | 11.09572785 Gbit/s | SFP+ |
| OTU1f: | 11.27008929 Gbit/s | SFP+ |
| OTU2f: | 11.31764241 Gbit/s | SFP+ |
| E1: | 2.048 Mbit/s | RJ-48/BNC |
| E3: | 34.368 Mbit/s | BNC |
| E4: | 139.264 Mbit/s | BNC |
| DS1: | 1.544 Mbit/s | RTT Bantam |
| DS3: | 44.736 Mbit/s | BNC |
| STM-1e/STS-3: | 155.52 Mbit/s | BNC |

**Bit rate offset range of transmitter**

Relative to Bit Rate:

| | |
|---|---|
| PDH/DSn: | -125 to +125 ppm |
| SDH/SONET: | -50 to +50 ppm |
| OTN | -50 to +50 ppm |
| Ethernet: | -100 to +100 ppm |

| | | | |
|---|---|---|---|
| **Bit rate tolerance of receiver** | Relative to Bit Rate: | | |
| | PDH/DSn: | -150 to +150 ppm, 1 ppm step | |
| | SDH/SONET: | -100 to +100 ppm, 1 ppm step | |
| | OTN | -100 to +100 ppm, 1 ppm step | |
| | Ethernet: | -100 to +100 ppm, 1 ppm step | |
| **Optical Output** | Bit Rate | Refer to Bit Rate. | |
| **Optical Input** | Bit Rate | Refer to Bit Rate. | |
| **Electrical Output** | 1.5M/2M Output | 1.5M/2M balanced output | |
| | Bit Rate | Refer to Bit Rate. | |
| | Pulse mask | ITU-T G.703 compliant | |
| | Code/Interface (Balance) | 1.544 Mbits/s | AMI/B8ZS Bantam 100Ω |
| | | 2.048 Mbits/s | HDB3 or AMI RJ-48 120Ω |
| | 2M to 139/45/156M Output | | |
| | Bit Rate | Refer to Bit Rate. | |
| | Pulse mask | ITU-T G.703 compliant | |
| | Code/Interface | 2.048 Mbits/s | HDB3, BNC 75 Ω |
| | (Unbalance ) | 34.368 Mbit/s | HDB3, BNC 75 Ω |
| | | 44.736 Mbit/s | B3ZS, BNC 75 Ω |
| | | 139.264 Mbit/s | CMI, BNC 75 Ω |
| | | 155.520 Mbit/s | CMI, BNC 75 Ω |
| | Return Loss (Unbalance) | ITU-T G.703 compliant | |
| | 10/100 /1000M Output | | |
| | Bit Rate | Refer to Bit Rate. | |
| | Code/Interface | RJ-45<br>IEEE802.3-2008 10BASE-T, 100BASE-TX, 1000BASE-T compliant | |
| **Electrical Input** | 1.5M/2M Input | | |
| | Code/Interface | 1.544 Mbits/s | AMI/B8ZS, Bantam 100 Ω |
| | (Balance) | 2.048 Mbits/s | HDB3, RJ-48 120 Ω |
| | Bit Rate | Refer to Bit Rate. | |
| | Sensitivity (1.5M) | DS1 Short Haul:<br>15 dB linear attenuation , 0 dB cable attenuation, nominal impedance<br>TERMINATE:<br>Up to 36 dB cable attenuation, nominal impedance<br>DSX MONITOR:<br>15 dB to 25 dB linear attenuation, nominal impedance<br>BRIDGED:<br>Up to 36 dB cable attenuation, high impedance | |
| | Sensitivity (2M) | TERMINATE:<br>Up to 40 dB cable attenuation, nominal impedance<br>MONITOR:<br>20 dB to 26 dB linear attenuation and up to 6 dB cable attenuation, nominal impedance<br>20 dB to 30 dB linear attenuation, 0 dB cable attenuation, nominal impedance<br>BRIDGED:<br>Up to 40 dB cable attenuation, high impedance | |

2M to 139/45/156M Input

| | | |
|---|---|---|
| Bit Rate | Refer to Bit Rate. | |
| Code/Interface (Balance) | 2.048,34.368 Mbit/s | HDB3, BNC 75 Ω |
| | 44.736 Mbits/s | B3ZS, BNC 75 Ω |
| | 139.264,155.52 Mbits/s | CMI, BNC 75 Ω |
| Sensitivity (2.048Mbit/s) | TERMINATE:<br>Up to 40 dB cable attenuation, nominal impedance<br>MONITOR:<br>20 dB to 26 dB linear attenuation and up to 6 dB cable attenuation, nominal impedance<br>20 dB to 30 dB linear attenuation, 0 dB cable attenuation, nominal impedance<br>BRIDGED:<br>Up to 40 dB cable attenuation, high impedance | |
| Sensitivity (34.368/44.736M) | TERMINATE:<br>Up to 12.0 dB cable attenuation, nominal impedance<br>MONITOR:<br>20 dB linear attenuation and up to 12 dB cable attenuation, nominal impedance<br>20 dB to 30 dB linear attenuation , 0 dB cable attenuation, nominal impedance | |
| Sensitivity (139.264/155.52M) | TERMINATE:<br>Up to 12.0 dB cable attenuation, nominal impedance<br>MONITOR:<br>20 dB linear attenuation and up to 12 dB cable attenuation, nominal impedance | |

10/100 /1000M Input

| | |
|---|---|
| Bit Rate | Refer to Bit Rate. |
| Code/Interface | RJ-45<br>IEEE802.3-2008 10BASE-T, 100BASE-TX, 1000BASE-T compliant |

**Return Loss** ITU-T G.703 compliant

**Jitter generation**

| | |
|---|---|
| Optical interface: | ITU-T G.783 compliant |
| Electrical interface: | ITU-T G.823, ANSI T1.403, ANSI T1.404 compliant |

**Jitter Tolerance**

| | |
|---|---|
| Optical interface: | ITU-T G.825, ITU-T G.8251 compliant |
| Electrical interface: | ITU-T G.823, ITU-T G.824 compliant |

**Rx Bit Rate counter**

| | |
|---|---|
| Bit Rate | Refer to Bit Rate. |
| Accuracy | According to the Internal Clock of MT1000A. |

### 8.2.3 Ethernet Measurements

**Cable test**

Identifies failures on electrical cables like short-circuits or breaks of a wire pair and indicates the distance from the instrument to the fault.

**Transmitter Clock**

Reference Clock

- Internal clock
- External clock
    - BITS
    - SETS
    - 2MHz
- GPS
- Received clock
- IEEE1588v2

**Frequency deviation measurement**

Refer to Bit Rate

**SyncE functionality**

Specify quality level (QL) of the transmitted Ethernet signal.

Analysis of QL indicated in received Ethernet signal. An alarm is raised on missing QL indications.

SyncE results

- SSM Rx count and rate
- SSM Tx count
- Indicated QL statistics
- SSF seconds

ESMC messages capture

- ESMC messages can be captured and exported in a Wireshark compatible format.

**IEEE 1588v2 functionality**

Timing master/slave

- Each port of the Ethernet interface can act as a timing master or a timing slave independently.

Supported modes: Multicast (native PTP) and Unicast (G.8265.1). When acting as master in Unicast (G.8265.1) mode, one slave is accepted at a time, other slaves are ignored. If the slave requires 32, 64 or 128 Sync messages per second, the IEEE 1588-2008 paragraph 7.7.2.1 concerning 90% confidence interval is not followed.

Configurable parameters (per port):

- Clock identity
- Port number
- Priority 1
- Priority 2
- Domain number
- Clock class
- Slave only mode
- Time source
- Encapsulation
- Announce receipt timeout
- Clock accuracy
- Clock step mode
- Announce interval
- Sync interval
- Minimum delay request interval

IEEE 1588 clock results:

- Clock state
- Announce count
- Sync count
- Follow-up count
- Delay request count
- Delay response count
- Delay follow-up count
- Peer delay request/response/response-follow-up counters
- Maximum/Minimum/Average offset
- Maximum/Minimum/Average offset deviation
- Maximum/Minimum/Average offset variance
- Maximum/Minimum/Average mean path delay
- Maximum/Minimum/Average peer mean path delay
- Maximum/Minimum/Average path delay variation

UTC time offset

- With a GPS signal present, the offset from UTC time is calculated.

Parent clock results:

- Identity and Port number.

Grand-master results:

- Identity
- Class
- Accuracy
- Priority 1
- Priority 2
- Announced- and observed offset variance.

Foreign master clock results (up to five clocks per port):

- Identity
- Port number and Announce count

The following IEEE 1588 events are counted and logged:

- Clock state transitions
  - State transition events
  - Faults and Changes in grand-master clock

IEEE 1588 messages can be captured and exported in a Wireshark compatible format.

**Transmitter, Receiver**

Supported encapsulations (frame formats)

- EtherType II (DIX v.2)
- IEEE 802.3 with 802.2 (LLC1)
- IEEE 802.3 with SNAP

Variable line rate traffic generation

- Up to full line rate

Transmitter Frame size

- From 44 bytes to 16,000 bytes

Receiver settings

- User-defined expected preamble length (3 to 15 bytes)
- User-defined IFG lower threshold * (8 to 15 bytes)
- User-defined Jumbo frame size upper limit (1519 to 16000 bytes)

*: Only for Ethernet 10/100/1000 Mbps (cannot use 10Gbps)

**Traffic generator**

Line load profile

- Constant: 0.0008% - 100%
- Ramp:
    - Line load: start, end, step (0.0001% resolution)
    - Duration: 3 to 3600 seconds
    - Ramp mode: Keep end line load, Repeat ramp, Invert ramp

Frame size profile

- Constant
- Stepped:
    - Frame size: start, end, step (to 16000 bytes)
    - Duration: 1 to 3600 seconds
- Random:
    - Frame size: start, end (to 16000 bytes),
      User-defined TCP/UDP frame size upper limit (2048 bytes)

Traffic duration

- Continuous
- Seconds: 1 to 2,000,000,000
- Frames: 1 to 2,000,000,000

Unicast/broadcast

- User-defined traffic mix of unicast and broadcast frames

VLAN

- User-defined VLAN ID and VLAN priority

Address

- Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing). Fixed, DHCP, DNS.

Flow control

- Generate pause frames
- Respond to pause frames

ARP

- Answer incoming ARP request On/Off

IP

- Fixed or incremented IP identifier
- User programmable DSCP/TOS byte

UDP/TCP

- User programmable UDP/TCP address
- UDP Checksum: automatic or fixed (null)
- TCP checksum: automatic

**Status, Results**

Status

- Link status, RF, Signal present, Jabber detected, Frames present, Speed, Full or half duplex, Interface type, Local clock (Ethernet 1000), Pause capable and Asymmetric pause request (excluding 10Gbps), Link partner capabilities (excluding 10Gbps)

Resolution

- User-defined resolution for statistical measurements:
  1, 2, 5, 10, 15, 30s, 1, 5, 15, 30 minutes, 1, 2, 4, 6, 12 hours.

Performance statistics

- Maximum/Minimum/Average utilization
- Maximum/Minimum/Average user and total throughput
- Maximum/Minimum/Average frame rate
- Maximum/Minimum/Average frame latency
- Maximum/Minimum/Average packet jitter

Frame statistics

- Total frames
- Total valid frames
- Unicast/multicast/broadcast frames
- Pause frame
- VLAN frame
- MPLS frames
- MPLS-TP frame
- PBB frame
- VLAN Max/Min level
- MPLS Max/Min level
- Fragmented frames
- Oversized and Undersized frames
- FCS errored frames
- Error symboled frames (Excluding 10Gbps)
- Code violation frames (For 10Gbps)
- Collisions (10/100 Mbps half duplex)
- Preamble Violations
- IFG violations
- Local Fault (For 10Gbps)
- Remote Fault (For 10Gbps)
- Last Received VLAN 1-8 (ID/Priority)
- Last Received MPLS 1-8 (Label/Priority/TTL)
- B-Tag, I-tag (ID/Priority)

Burst statistics

Disabled in case of the OTN client.

- Total frames in burst
- Good/Bursted frames
- Number of Bursts
- Maximum/Minimum/Average burst size

Frame distribution statistics

- Total valid/good frames
- 64 - 127 byte frames
- 128 - 255 byte frames
- 256 - 511 byte frames
- 512 - 1023 byte frames
- 1024 - 1518 byte frames
- Total number of jumbo frames
- Maximum/Minimum/Average frame size

Filters

Up to 8 filter conditions can be defined. Each condition can filter on:

- IP or MAC source address
- IP or MAC destination address
- Broadcast address
- IEEE OUI value
- Encapsulation type
- VLAN ID
- VLAN tag priority
- MPLS
- MPLS-TP source/destination MAC
- PBB source/destination MAC
- PBB I-tag/B-tag

- TCP/UDP source and destination port
- User-defined pattern at a defined offset

Adjustable thresholds

- Utilization
- Throughput
- Errored frames
- Collision rate
- Unicast frames
- Multicast frames
- Broadcast frames
- Pause frames
- Fragmented frames
- Undersized frames
- Oversized frames
- FCS errored frames
- IFG violations (Ethernet 10/100/1000 Mbps)
- Preamble violations
- Difference between Tx and Rx

DHCP

- Show source IP address assigned by DHCP.
- Show current lease expire time.
- Show IP addresses of primary and secondary DNS server when obtained by DHCP.

**Error generation**

- IFG (For 10/100/1000 Mbps), FCS, Preamble, Error symbol
- Alignment (For 10/100 Mbps)
- Wrong IP checksum, fragmented IP, UDP with zero checksum
- PRBS bit error, BERT sequence error

**Alarm generation**

- No link
- Local fault (For 10Gbps)
- Remote fault

**BER test**

Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation:

- Unframed (layer 1)
- Framed with Ethernet (MAC) header (layer 2)
- Framed with Ethernet (MAC) header and IP header (layer 3)
- Framed with Ethernet (MAC) header, IP header and UDP/TCP header (layer 4)

Test patterns:

- PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT
- User-defined up to 16 bits. Length in step of 1 bit.

Detection of sequence errors and loss of sequence synchronization.

Frame loss count and frame loss seconds.

Throughput measurement: Maximum/Minimum/Average values are presented.

Test resolution

- User-defined up to resolution:
  1, 2, 5, 10, 15, 30 sec, 1, 5, 10, 15, 30 minutes, 1, 2, 4, 6, 12 hours

**Throughput measurement**

Throughput may be calculated on 6 different layers:

- Utilization layer
- Physical layer

- Physical layer excl. preamble
- Link layer
- Network layer
- Data layer

**Service disruption measurement**

Can be activated as part of the BER test:

- Maximum/Average service disruption time, resolution 0.1 µsec
- Number of service disruptions

**Ping test**

For connectivity and configuration check.

- Round Trip Time (RTT)
- Supports IPv4 addressing
- Answer incoming Ping requests (On/Off)

**Traceroute**

Trace the IP route over the IP network.

- User-defined max no. of hops (1 to 255)
- Information per hop: Maximum/Minimum/Average ping time and number of ping timeouts

**Ethernet OAM option**

- Y.1731 (Service Layer OAM)
- IEEE 802.1ag (Connectivity layer OAM) and IEEE 802.3ah (Access Link OAM)

**VLAN**

Number of VLAN tag

- Up to 8 layers of VLAN can be inserted into the Ethernet frame.
  Only 1 level of VLAN is supported in ping, Traceroute and RFC2544 router latency tests.

Parameters per VLAN tag

- EtherType 0x8100 (802.1Q), 0x88a8 (802.1ad), 0x9100 or 0x9200
- User-defined VLAN ID, CFI and VLAN priority

Status

- Indicator for detection of VLAN tagged frames

Statistics

- Number of VLAN tagged frames
- Maximum number of VLAN layers detected

**Ethernet MPLS**

MPLS supported

- MPLS unicast is supported (EtherType 0x8847).
- Support for MPLS in BERT, RFC 2544 (excluding router latency) tests and general statistics

Number of MPLS headers

- Up to 8 MPLS headers can be set by the user.

Parameters per MPLS header

- User-defined label, Exp and TTL fields in each MPLS header

MPLS-TP support

- PWE (Pseudo Wire Emulation Edge-to-Edge) label (the RFC4448 control word) can be added.

Status

- Indicator for detection of MPLS frames and MPLS-TP

Statistics

- Number of MPLS frames and MPLS-TP frames
- Maximum number of MPLS layers detected

**Ethernet Multistream**

Number of streams

Up to 16 streams can be activated on the Ethernet line.

Parameters per stream

- Encapsulation (frame format)
- Line rate traffic load, up to full line rate
- Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing)
- User-defined traffic mix of unicast and broadcast frames
- Adjustable frame size from 44 bytes to 16000 bytes
- Frame sizes may be set to constant, stepped or random length.
- User programmable VLAN ID and VLAN priority
- User programmable DSCP/TOS byte
- User programmable UDP/TCP address

In stream 1 a BER test can be made.

Statistics

Available information per stream:

- Frame loss count/rate
- Frames and bytes received
- Frames and bytes transmitted
- Throughput
- Latency/Jitter

**RFC2544 installation and commissioning**

Switch/router test and Single ended network test modes:

- Throughput
- Frame loss
- Latency or packet jitter
- Back-to-back frames (burstability)

End-to-end network test mode (two Network Master Pros in a master-slave setup)

- Throughput
- Frame loss
- Back-to-back frames (burstability)

Router latency test mode: IP ping based latency test or packet jitter.

For RFC2544 throughput measurement the user can choose to make the measurement for:

- Physical layer
- Physical layer excl. preamble
- Link layer
- Network layer
- Data layer
- Average or maximum values

**Service Activation Test (Y.1564)**

Service Activation Test is an out-of-service test to assess the proper configuration and performance of Ethernet services.

- Test up to 8 services
- Color-Aware and Non-Color-Aware in combinations (IP DSCP or VLAN PCP)

- GPS timing synchronization

Two test modes:

- One-way (uni- or bi-directional, symmetrical or asymmetrical)
- Round-trip

Service Configuration Test:

- With subtests for:
    - Committed Information Rate
    - Excess Information Rate
    - Traffic Policing
    - Committed Burst Size
    - Excess Burst Size
- Step duration: 1 sec to 60 sec (user programmable)
- Number of steps: 1 to 10 (user programmable)
- Slope: rising or falling
- Results:
    - Pass/Fail indication
    - IR (Maximum/Minimum/Average)
    - FL (Count/FLR)
    - FTD and FDV (Maximum/Minimum/Average/Current (during measurement))

Service Performance Test:

- All services tested simultaneously at CIR
- Duration: 15 minutes, 2 hours, 24 hours or customer programmable
- Results:
    - Pass/Fail indication
    - IR (Maximum/Minimum/Average)
    - FL (Count/FLR)
    - FTD and FDV (Maximum/Minimum/Average/Current (during measurement))
    - AVAIL (%)
    - Unavail (sec)

Verification against Service Acceptance Criteria:

- Information Rate
- Frame Transfer Delay
- Frame Delay Variation
- Frame Loss Rate
- Availability

**Reflector mode** The following parameters are user-selectable:

- Swap all MAC addresses or one specific MAC address
- Swap IP addresses
- Swap port numbers on UDP/TCP frames
- Force ACK on TCP frames

## 8.2.4 SDH/SONET/PDH

SONET/SDH switchable.

**Number of ports** Max. 2

**Transmitter Clock** Reference Clock

- Internal clock
- External clock
    - BITS
    - SETS
    - 2MHz
- Received clock

**Frame format**

- STM-1/STM-1e/OC-3/STS-3
- STM-4/OC-12
- STM-16/OC-48
- STM-64/OC-192

For bit rate, refer to Bit Rate.

**Measurement Parameter**

Interval
1s, 2s, 5s, 10s, 15s, 30s,
1minute, 5minutes, 10minutes, 15minutes, 30minutes,
1hour, 2hours, 4hours, 6hours, 12hours,
No intervals
Start Key Action
Immediate
Start at(year-month-day, hour-minute-second)
Stop Function
Manual Stop
Stop at (year-month-day, hour-minute-second)
Duration (1second to 99days 23hour-59minute-59second )

### 8.2.4.1 SDH

**SDH Mappings**

STM-64 - AU4-64c - VC4-64c - Bulk
STM-64/STM-16 - AU4-16c - VC4-16c - Bulk
STM-64/STM-16/STM-4 - AU4-4c - VC4-4c - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - E4
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-3 - VC-3 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-3 - VC-3 - DS3
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-3 - VC-3 - E3
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-12 - VC-12 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-12 - VC-12 - E1 (Async/Sync)
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-11 - VC-11 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-4 - VC-4 - TU-11 - VC-11 - DS1 (Async/Sync)
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - DS3
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - E3
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - TU-12 - VC-12 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - TU-12 - VC-12 - E1 (Async/Sync)
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - TU-11 - VC-11 - Bulk
STM-64/STM-16/STM-4/STM-1/STM-1e - AU-3 - VC-3 - TU-11 - VC-11 - DS1 (Async/Sync)

**Dummy channel handling**

Copy, Unequipped (For AU only)

**Test patterns**

- PRBS: $2^{9}$-1, $2^{11}$-1, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, $2^{29}$-1,$2^{31}$-1 (Normal/Inverse)
- Fixed :User Pattern, All0, All1, Alternating 1:1, Alternating 1:3, Alternating 1:7, 2 in 8
- User Pattern : 32 bit, 2048 bit

**Preset data**

OH Preset data

- SOH : All bytes except B1, B2, H1, H2 and H3 byte
- VC-4/VC-3 POH : All bytes except B3
- VC-12/VC-11 POH : All bytes except BIP-2

Path trace Setting: J0, J1, J2 (Ascii data, 16 bytes/64 bytes)

**Tandem connection**

Off, N1(VC-4), N1(VC-3), N2(VC-12), N2(VC-11)

**Frequency Offset**

±50 ppm 1 ppm step

**Alarm Insertion**

Item

- LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-TIM, HP-PLM, HP-UNEQ, HP-RDI, TU-AIS, TU-LOP, TU-LOM, LP-TIM, LP-UNEQ, LP-RDI, LP-PLM, LSS, TC-UNEQ, TC-LTC, TC-TIM, TC-AIS, TC-RDI, TC-ODI

Insertion :

- Permanent, Alternate (Excluding LOS, OOF and LSS)
- Permanent (For LOS, OOF and LSS)

Alternate :

- Alarm length : 1 to 8000 (Frame)
- Normal length : 1 to 8000 (Frame)

**Error Insertion**

Item

- A1A2, B1, B2, MS-REI, B3, HP-REI, V5/B3, LP-REI, TC-IEC, TC-REI, TC-OEI, TC-BIP-2, ERR-TRANS, Pattern error

Insertion :

- Manual, Rate, Alternate (Excluding ERR-TRANS)
- Manual, Rate (For ERR-TRANS)

Manual :

- Burst length : 1 to 8000 (bit) (Excluding Pattern error)
- Burst length : 1 to 4000 (bit) (For Pattern error)

Rate:

- $1*10^{-3}$, $1*10^{-4}$, $1*10^{-5}$, $1*10^{-6}$, $1*10^{-7}$, $1*10^{-8}$, $1*10^{-9}$, $1*10^{-10}$
  The available highest rate varies depending on the error item.

Alternate :

- (Excluding Pattern error)
  - Error : 1 to 8000 (Frame)
  - Normal : 1 to 8000 (Frame)
- (For Pattern error)
  - Error : 1 to 4000 (bit)
  - Normal : 100 to 4000 (bit)

**Pointer**

AU-4, AU-3, TU-3, TU-12, TU-11

Test Sequence :

- No Test Sequence
- Single Alternating
- Regular + Double
- Regular + Missing
- Double Alternating

Movement :

- Positive
- Negative
- Burst: 1 to 100

Jump :

- NDF: Including NDF or Excluding NDF
- Pointer Value: 0 to 782(AU-4/AU-3) or 764(TU-3) or 139(TU-12) or 103(TU-11)

| | |
|---|---|
| **Error/Alarm detection** | Alarm detection<br>• LOS, LOF, OOF, MS-AIS, MS-RDI,AU-AIS, AU-LOP, HP-PLM, HP-TIM, HP-RDI, HP-UNEQ, TU-AIS, TU-LOP, TU-LOM, LP-PLM, LP-TIM, LP-RDI, LP-UNEQ, TC-AIS, HP-TC-RDI, HP-TC-ODI, HP-TC-UNEQ, TC-TIM, TC-LTC, TC-AIS, TC-RDI, TC-ODI, TC-UNEQ, LSS<br>Display : Seconds (Resolution : 1 second)<br>Error Detection<br>• A1A2, B1, B2, MS-REI, B3, HP-REI, V5/B3, LP-REI, TC-IEC, TC-BIP-2, TC-REI, TC-OEI, Pattern error, Pattern block error for G.826<br>Display : Count, Ratio |
| **Monitor** | Signal level:<br>• dBm (Excluding STM-1e)<br>• dB (For STM-1e)<br>Deviation: ppm (Resolution: 1 ppm)<br>Bit rate: bit/s |
| **Pointer analyze** | Pointer value: AU-PTR, TU-PTR<br>Element : Negative, Positive<br>Graph : Pointer movement |
| **OH Capture** | Item<br>• SOH: 64 Frames<br>• POH: 64 Frames<br>• Pathtrace: J0/J1/J2 (Displays in ascii characters)<br>Timing<br>• Single<br>• Repeat : Update period 1s |
| **Through Mode** | Mode :<br>• Through Rx<br>• OH Overwrite<br>    ◦ SOH, A1/A2, K1/K2, S1, DCC1-3, DCC4-12, J0, SOH 1byte<br>Stimuli<br>• Alarm : LOS, LOF, OOF, MS-RDI<br>Available alarms depend on Through mode setting.<br>• Error : A1A2, B1, B2, MS-REI, ERR-TRANS<br>Available errors depend on Through mode setting.<br>• Insertion: refer to Alarm Insertion and Error Insertion |
| **APS** | APS (Automatic Protection Switching) Measurement<br>• Trigger: LOS, LOF, OOF, MS-AIS, MS-RDI, APS Switchover, AU-AIS, AU-LOP, HP-TIM, HP-PLM, HP-UNEQ, TU-LOM, TU-AIS, TU-LOP, LP-TIM, LP-PLM, LP-UNEQ, A1A2, B1, B2, MS-REI, B3, V5/B3<br>• Max reference duration: 0.000 to 10000.000 ms<br>• Result: Average time, Maximum time, Minimum time<br>APS Protocol analyze<br>• APS configuration :Ring or Linear<br>    ◦ Ring : Short Path, Long Path<br>    ◦ Linear : 1+1 architecture, 1:n architecture |

- APS Protocol Request : The value of K1, K2 byte is sent depending on selected type.
- APS Interpretation : Number, Elapsed Time

**Delay measurement**

Measurement Mode : Single, Repeat

Measurement Period : 0.5, 1, 2, 5,10 s

Measurement Range : Up to 10 000 000.000 µs / resolution 0.1 µs, >Timeout

**SDH Performance Measurement**

- Setup : G826, G.828+G.829, M.2101.1(M2100)
- Allocation
  - Mux Allocation 0 to 100%
  - VC-4 Allocation 0 to 100%
  - VC-3 Allocation 0 to 100%
  - VC-11/VC-12 Allocation 0 to 100%
- Time period : 15minutes, 1hour, 2hour, 24hour, 7days (only M.21001)
- Result : ES, SES, BBE, UNAV
- Display : Count, Ratio

**Tributary Scan**

Displays the alarm status of all channels in a specified layer.

Green (No alarm), Red (Alarm occurring), Gray (Not applied)

### 8.2.4.2 SONET

**SONET Mappings**

OC-192 - STS-192c - STS-192c SPE - Bulk
OC-192/OC-48 - STS-48c - STS-48c SPE - Bulk
OC-192/OC-48/OC-12 - STS-12c - STS-12c SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - E4
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - TU-3 - VC-3 - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - TU-3 - VC-3 - DS3
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - TU-3 - VC-3 - E3
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - VT-12 - VT-12 SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - VT-12 - VT-12 SPE - E1 (Async/Sync)
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - VT-11 - VT-11 SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-3c - STS-3c SPE - VT-11 - VT-11 SPE - DS1 (Async/Sync)
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - DS3
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - E3
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - VT-12 - VT-12 SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - VT-12 - VT-12 SPE - E1 (Async/Sync)
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - VT-11 - VT-11 SPE - Bulk
OC-192/OC-48/OC-12/OC-3/STS-3 - STS-1 - STS-1 SPE - VT-11 - VT-11 SPE - DS1/J1 (Async/Sync)

**Dummy channel handling**

Copy, Unequipped (For STS only)

**Test patterns**

- PRBS: $2^{9}$-1, $2^{11}$-1, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, $2^{29}$-1,$2^{31}$-1 (Normal/Inverse)
- Fixed :User Pattern, All0, All1, Alternating 1:1, Alternating 1:3, Alternating 1:7, 2 in 8
- User Pattern : 32 bit, 2048 bit

**Preset data**

OH Preset data

- TOH : All bytes except B1, B2, H1, H2 and H3 byte
- STS-3c/STS-1 POH : All bytes except B3
- VT-2/VT-1.5 POH : All bytes except BIP-2

Path trace Setting: J0, J1, J2 (Ascii data, 16 bytes/64 bytes)

**Tandem connection** Off, Z5(STS-3c), Z5(STS-1), Z6(VT-2), Z6(VT-1.5)

**Frequency Offset** ±50 ppm 1 ppm step

**Alarm Insertion** Item

- LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, AIS-V, LOP-V, LOM-V, TIM-V, UNEQ-V, RDI-V, PLM-V, LSS, TC-UNEQ, TC-LTC, TC-TIM, TC-AIS, TC-RDI, TC-ODI

Insertion :

- Permanent, Alternate (Excluding LOS, OOF and LSS)
- Permanent (For LOS, OOF and LSS)

Alternate :

- Alarm length : 1 to 8000 (Frame)
- Normal length : 1 to 8000 (Frame)

**Error Insertion** Item

- A1A2, B1, B2, REI-L, B3, REI-P, V5/B3, REI-V, TC-IEC, TC-REI, TC-OEI, TC-BIP-2, ERR-TRANS, Pattern error

Insertion :

- Manual, Rate, Alternate (Excluding ERR-TRANS)
- Manual, Rate (For ERR-TRANS)

Manual :

- Burst length : 1 to 8000 (bit) (Excluding Pattern error)
- Burst length : 1 to 4000 (bit) (For Pattern error)

Rate:

- $1*10^{-3}$, $1*10^{-4}$, $1*10^{-5}$, $1*10^{-6}$, $1*10^{-7}$, $1*10^{-8}$, $1*10^{-9}$, $1*10^{-10}$
  The available highest rate varies depending on the error item.

Alternate :

- (Excluding Pattern error)
  - Error : 1 to 8000 (Frame)
  - Normal : 1 to 8000 (Frame)
- (For Pattern error)
  - Error : 1 to 4000 (bit)
  - Normal : 100 to 4000 (bit)

**Pointer** STS-3c, STS-1, TU-3, VT-2, VT-1.5

Test Sequence :

- No Test Sequence
- Single Alternating
- Regular + Double
- Regular + Missing
- Double Alternating

Movement :

- Positive
- Negative
- Burst: 1 to 100

Jump :

- NDF: Including NDF or Excluding NDF
- Pointer Value: 0 to 782(STS-3c/STS-1) or 764(TU-3) or 139(VT-2) or 103(VT-1.5)

**Error/Alarm detection**

Alarm detection

- LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, AIS-V, LOP-V, LOM-V, TIM-V, UNEQ-V, RDI-V, PLM-V, TC-UNEQ, TC-LTC, TC-TIM, TC-AIS, TC-RDI, TC-ODI, LSS

Display : Seconds (Resolution : 1 second)

Error Detection

- A1A2, B1, B2, REI-L, B3, REI-P, V5/B3, REI-V, TC-IEC, TC-BIP-2, TC-REI, TC-OEI, Pattern error, Pattern block error for G.826

Display : Count, Ratio

**Monitor**

Signal level:

- dBm (Excluding STS-3)
- dB (For STS-3)

Deviation: ppm (Resolution: 1ppm)

Bit rate: bit/s

**Pointer analyze**

Pointer value: STS-PTR, VT-PTR

Element : Negative, Positive

Graph : Pointer movement

**OH Capture**

Item

- TOH: 64 Frames
- POH: 64 Frames
- Pathtrace:J0/J1/J2 (Displays in ascii characters)

Timing

- Single
- Repeat : Update period 1s

**Through Mode**

Mode :

- Through Rx
- OH Overwrite
  - TOH, A1/A2, K1/K2, S1, DCC1-3, DCC4-12, J0, TOH 1byte

Stimuli

- Alarm : LOS, LOF, OOF, RDI-L
  Available alarms depend on Through mode setting.
- Error : A1A2, B1, B2, REI-L, ERR-TRANS
  Available errors depend on Through mode setting.
- Insertion: refer to Alarm Insertion and Error Insertion.

**APS**

APS (Automatic Protection Switching) Measurement

- Trigger : LOS, LOF, OOF, AIS-L, RDI-L, APS Switchover, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, LOM-V, AIS-V, LOP-V, TIM-V, PLM-V, UNEQ-V, A1A2, B1, B2, REI-L, B3, V5/B3
- Max reference duration: 0.000 to 10000.000 ms
- Result : Average time, Maximum time, Minimum time

APS Protocol analyze

- APS configuration :Ring or Linear

- Ring : Short Path, Long Path
- Linear : 1+1 architecture, 1:n architecture

- APS Protocol Request : The value of K1, K2 byte is sent depending on selected type.
- APS Interpretation : Number, Elapsed Time

**Delay measurement**

Measurement Mode : Single, Repeat

Measurement Period : 0.5, 1, 2, 5,10 s

Measurement Range : Up to 10 000 000.000 µs / resolution 0.1 µs, >Timeout

**SONET Performance Measurement**

- Setup : G826, G.828+G.829, M.2101.1(M2100)
- Allocation
  - Mux Allocation 0 to 100%
  - STS-3c Allocation 0 to 100%
  - STS-1 Allocation 0 to 100%
  - VT-2/VT-1.5/VC-12 Allocation 0 to 100%
- Time period : 15minutes, 1hour, 2hour, 24hour, 7days (only M.2101.1)
- Result : ES, SES, BBE, UNAV
- Display : Count, Ratio

**Tributary Scan**

Displays the alarm status of all channels in a specified layer.

Green (No alarm), Red (Alarm occurring), Gray (Not applied)

### 8.2.4.3 PDH

**Number of ports** Max. 2

**Frame format**

Non PCM frame

Bit rate : Refer to Bit Rate.

Framed

Bit rate (Format)

- E1 2.048Mbit/s (30,31ch with or without CRC4, Sa-bit, CAS)
- E3 34.368Mbit/s (G.751)
- E4 139.264Mbit/s (G.751)
- DS1 1.544Mbit/s (T1.107, SF/ESF/Japan ESF, CAS)
- DS3 44.736Mbit/s (T1.107, M13/C-bit)

Mux/DeMux

- E1 n*64kbit/s
- DS1 n*64kbit/s or n*56kbit/s

**BER Test patterns** PRBS:

E1

$2^6$-1, $2^7$-1, $2^9$-1, $2^{11}$-1, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, QRSS 11, QRSS 20

E3/E4

$2^9$-1, $2^{11}$-1, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, $2^{29}$-1, $2^{31}$-1, QRSS 20

($2^{29}$-1 and $2^{31}$-1 are only available for E4.)

DS1/DS3

$2^9$-1, $2^{11}$-1, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, $2^{29}$-1, $2^{31}$-1, QRSS 20

Fixed : User Pattern (32bis, 2048bits), All0, All1, 1 in 1, 1 in 3, 1 in 7, 3 in 24, Fox Pattern

(Fox Pattern is not available for E4.)

Logic : Normal, Inverse

**Line build out**

DS1

0 dB, -7.5 dB, -15 dB, -22.5dB, 1-133 ft, 133-266 ft, 266-399 ft, 399-533 ft, 533-655 ft

DS3
High-0 ft, DSX-450 ft

**Alarm Insertion**

Item

E1
No Signal, AIS, No Frame, Distant(RDI) Alarm, Pattern sync loss, No CAS MFAS, Distant(RDI) MF Alarm
E3/4
No Signal, AIS, No Frame, Distant(RDI), Pattern sync loss
DS1
LOS, AIS (Blue), RAI, OOF, LLS
DS3
LOS, AIS (Blue), RAI, LOF, Idle, LSS

**Error Insertion**

Item

E1
FAS, FAS and NFAS, FAS word, CRC4, CRC4 MFAS, Code, Pattern error, CAS MFAS, E-Bit, Pattern slip, Frame slip, Transparent
E3/E4
Frame, Code, Pattern error, Pattern slip (Code is only available for E3.)
DS1
Pattern error, Pattern slip, CRC-6, F-Bit, S-Bit, BPV, EXZ
DS3
Pattern error, Pattern slip, FEBE, C-Bit, F-Bit, P-Bit, BPV

Timing : Manual, Burst

**Error/Alarm detection**

Alarm detection

E1
LOS, AIS, No Frame, No CRC4 MF, Distant, No sync, No CAS MF, Distant MF
E3/E4
LOS, AIS, No Frame, Distant, No Sync
DS1
LOS, AIS, OOF, RAI, LLS
DS3
LOS, AIS, LOF, RAI, IDLE, LSS

Display : Second

Error Detection

E1
FAS, Pattern error, CRC4, CRC4 MFAS, E-bit, Code, Pattern slip, Frame slip, Pattern block error for G.826
E3/E4
FAS, Code, Pattern error, Pattern slip, Pattern block error for G.826 (Code is only available for E3.)
DS1
F-Bit, Pattern, CRC-6, S-Bit, BPV, Pattern slip, EXZ, Pattern block error for G.826
DS3
BPV, Pattern error, Pattern slips, Parity, C-bit, F-bit, FEBE, Pattern block error for G.826

Display : Count, Ration

**Error Performance**

G.821/G.826/M.2100 analysis of the received signal

**Result**

Status

Current information on:

- Alarms and errors

- Input level indication
- Actual bit rate
- Frequency deviation
- E1: CAS bits, FAS/non FAS bits
- DS1: CAS bits, F-Bit, S-Bit
- DS3: F-bits
- Round trip delay
- APS switching time (Only available in case of E1 or DS1.)

## 8.2.5 OTN

### 8.2.5.1 OTN Setup

**Frame Format** OTU2, OTU1e, OTU2e, OTU1f, OTU2f (opt-x51 or opt-x52)

OTU1 (opt-x01)

**Transmitter Clock** Internal, External (BITS, SETS, 2MHz), Received

**Through mode** Transparent, OH Overwrite Thr. (ALL OTU/ODU/OPU OH)

**Mapping** OTU2 (Client PRBS)

OTU2-ODU2/OPU2-PRBS
OTU2-ODTU2.1-ODU0/OPU0-PRBS
OTU2-ODTU12(PT20,21)-ODU1/OPU1-PRBS
OTU2-ODTU12(PT20,21)-ODU1/OPU1-ODTU01-ODU0/OPU0-PRBS
OTU2-ODTU2.ts-ODUflex-PRBS

OTU2 (Client Ethernet)

OTU2-ODTU2.1-ODU0/OPU0-GbE
OTU2-ODTU12(PT20,21)-ODU1/OPU1-ODTU01-ODU0/OPU0-GbE

OTU2 (Client SDH/SONET)

OTU2-ODU2/OPU2-STM64/STS192
OTU2-ODTU2.1-ODU0/OPU0-STM4/STS12
OTU2-ODTU2.1-ODU0/OPU0-STM1/STS3
OTU2-ODTU12(PT20,21)-ODU1/OPU1-STM16/STS48
OTU2-ODTU12(PT20,21)-ODU1/OPU1-ODTU01-ODU0/OPU0-STM4/STS12
OTU2-ODTU12(PT20,21)-ODU1/OPU1-ODTU01-ODU0/OPU0- STM1/STS3

OTU1 (Client PRBS)

OTU1-ODU1/OPU1-PRBS
OTU1-ODTU01-ODU0/OPU0-PRBS

OTU1 (Client Ethernet)

OTU1-ODTU01-ODU0/OPU0-GbE

OTU1 (Client SDH)

OTU1-ODU1/OPU1-STM16/STS48
OTU1-ODTU01-ODU0/OPU0-STM4/STS12
OTU1-ODTU01-ODU0/OPU0-STM1/STS3

OTU1e/2e (Client PRBS)

OTU1e-ODU1e/OPU1e-PRBS
OTU2e-ODU2e/OPU2e-PRBS

OTU1e/2e (Client Ethernet)

OTU1e-ODU1e/OPU1e-10GbE
OTU2e-ODU2e/OPU2e-10GbE

OTU1f/2f (Client PRBS)

OTU1f-ODU1f/OPU1f-PRBS
OTU2f-ODU2f/OPU2f-PRBS

**Client Signals**
Client Signals
Refer to Section Ethernet and SDH/SONET.

**Test Pattern**
PRBS : $2^9$-1, $2^{11}$-1, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, $2^{29}$-1, $2^{31}$-1 with polarization Normal / Inverted
User Pattern : 32bits, 2048bits

**Measurement channel**
Dummy (Unused), Copy
Tributary Port and Slot can be configured in ODTU mapping.

**FEC Encode/Decode**
RS(255,239) described in ITU-T Rec. G709, No FEC

**OH Edit**
All OTU, ODU bytes except MFAS and BIP8
TTI, FTFL bytes with multi-frame manner

**TTI measurement**
Condition for detecting TIM can be selected.
TCM measurement On/Off

**MSIM Detection**
Expected MSI bytes are set from Tx Data or Received Data.

### 8.2.5.2 OTN Stimuli

**Alarm Insertion**
OTU, ODU
OTU-AIS, OOF/LOF, OOM/LOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE, ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, TCMi-TIM, TCMi-BIAE, TCMi-BDI, TCMi-IAE, TCMi-LTC (i=1-6)
Multiplexed ODU
OOF/LOF, OOM/LOM, ODU-AIS, ODU-OCI, ODU-LCK, PM-TIM, PM-BDI
Client
Client-AIS, CSF
Insertion timing
Single, Burst, Alternate, All

**Error Insertion**
OTU, ODU
Bitall, FAS, MFAS, SM-BIP8, SM-BEI, PM-BIP8, PM-BEI, TCMi-BIP8, TCMi-BEI (i=1-6), Uncorrectable Error, Correctable Error
Multiplexed ODU
FAS, PM-BIP8, PM-BEI
GFP
cHEC, tHEC, Superblock CRC
Inserted Error bits are editable.
Client
Bit Error
Insertion timing
Single, Burst, Alternate, Rate, Rate (Random for Bitall), All

**Frequency Offset**
-50 ppm to +50 ppm 1 ppm step

**Payload Offset**
Movement type
AMP
Burst Insertion (Positive(+1), Positive(+2), Negative (-1)), Offset (ppm)
GMP
Offset (ppm)
Offset
AMP
-131 ppm to +83 ppm (Depending on mapping configuration)
0.1 ppm step
GMP
-150 ppm to +150 ppm 0.1 ppm step
Error insertion for GMP
CRC8, CRC5, Invalid JC1, Invalid JC2, Invalid JC1 & JC2

Error Insertion Timing
    Single

### 8.2.5.3 OTN Measurement

**Alarm Detection**

OTU, ODU
    LOS, OTU-AIS, LOF, OOF, LOM, OOM, SM-TIM, SM-BIAE, SM-BDI, SM-IAE, ODU-AIS,ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, MSIM, TCMi-TIM, TCMi-BIAE, TCMi-BDI, TCMi-IAE, TCMi-LTC (i=1-6)
Multiplexed ODU
    LOFLOM, OOF, OOM, ODU-AIS,ODU-OCI, ODU-LCK, PM-TIM, PM-BDI, MSIM
Client
    Client-AIS, PLM, CSF, LSS

**Error Detection**

OTU, ODU
    FAS, MFAS, SM-BIP8, SM-BEI, FEC Corrected, FEC Uncorrectable, PM-BIP8, PM-BEI, TCMi-BIP8, TCMi-BEI (i=1-6)
Multiplexed ODU
    FAS, MFAS, PM-BIP8, PM-BEI
GFP
    cHEC corrected, cHEC uncorrectable, tHEC corrected, tHEC uncorrectable, CSF Signal, CSF Sync., Invalid GFP Frame, Superblock CRC
Client
    Bit Error

**Justification analysis**

Count

AMP
    Positive(+1), Positive(+2), Negative (-1), offset(ppm)
GMP
    CRC8 Error, CRC5 Error, Inc, Inc>1, Inc>2, Inc Over, Dec, Dec>1, Dec>2, Dec Over, offset(ppm), Cm(t) Max, Cm(t) Min

**OH Capture**

OTU/ODU/OPU OH, Multiplexed ODU/OPU OH
TTI bytes, FTFL bytes with Multi-frame Manner

Update timing
    Repeat 1sec, Single

**APS Measurement**

Result : Switching Time

Trigger
    Start Trigger, Stop Trigger
Measurement Range
    0.001 to 10,000 ms
Error Free Period
    1,10,100,200,300,400,500,600,700,800,900 and 1000ms

**OTN Performance Measurement**

Standard
    ITU-T Rec. G.8201, M.2401(M.2110)

**Tributary Scan**

Detected Alarms
    OTU-AIS, LOF, OOF, LOM, OOM, SM-BIAE, SM-BDI, SM-IAE, ODU-AIS, ODU-OCI, ODU-LCK, PM-BDI, LOFLOM

**Round Trip Delay**

Result : RTD Time

Measurement Range
    0.5sec, 1sec, 2sec, 5sec, 10sec
Measurement Timing
    Single, Repeat

### 8.2.6 Environment Performance

| | |
|---|---|
| **Battery operating time** | Operating time: 4 hours (Typ.)<br>25°C, Depending on operating condition |
| **Temperature and Humidity range** | Operating: 0°C to +50°C, ≤85%RH (non-condensing)<br>Storage: -30°C to +60°C, ≤90%RH (Excluding battery and AC adapter)<br>-20°C to +50°C, ≤90%RH (Including battery and AC adapter)<br>(non-condensing) |
| **Laser Safety** | IEC 60825-1:2007 Class 1<br>FDA 21CFR1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated 2007-June-24. |
| **EMC** | EN61326-1 and EN61000-3-2. |
| **LVD** | EN61010-1. |

### 8.2.7 Mechanical Performance

| | |
|---|---|
| **Size** | MU100010A only: 163(H) x 257.6 (W) x 38.5(D) (Excluding projections)<br>When combined to MT1000A: 163(H) x 257.6 (W) x 77(D) (Excluding projections) |
| **Mass** | MU100010A only: 1.1 kg max.<br>When combined to MT1000A: 2.7 kg max. (Including battery (G0301A)) |

# 8.3 Optical Modules

Up to 2 optical modules can be installed.

NOTE

*Correct functionality can only be guaranteed with optical modules purchased from Anritsu for the MU100010A.*

**Safety measures for laser products**
Optical modules for the MU100010A comply with optical safety standards in IEC 60825-1.

**Specifications**

Specification of optical modules purchased from Anritsu for the MU100010A (each with 1 transmitter and 1 receiver) with LC connectors (subject to change without further notice):

| Model/ Order No. | Description (Approx. Distance) | Min. Input Sensitivity | Input Wavelength | Output Power | Output Wavelength |
|---|---|---|---|---|---|
| G0311A 1G 850 nm SX SFP | 1000BASE - SX 850 nm Multi mode (0.5 km) | -17 dBm | 770 to 860 nm | -9.5 to -3 dBm | 830 to 860 nm |
| G0312A 1G 1310 nm LX SFP | 1000BASE - LX 1310 nm Single mode (10 km) | -18 dBm | 1260 to 1580 nm | -10 to -3 dBm | 1260 to 1360 nm |
| G0313A 1G 1550 nm ZX SFP | 1000BASE - ZX 1550 nm Single mode (80 km) | -23 dBm | 1260 to 1580 nm | -2 to 5 dBm | 1480 to 1580 nm |
| G0314A 100 M LX 1310 nm SM SFP | 100BASE - LX 1310 nm Single mode (15 km) | -28 dBm | 1270 to 1600 nm | -15 to -8 dBm | 1261 to 1360 nm |
| G0315A 10G LR/LW 1310 nm SFP+ | 10GBASE - LR 1310 nm Single mode (10 km) | -14.4 dBm | 1260 to 1565 nm | -6 to -1 dBm | 1290 to 1330 nm |
| G0316A 10G ER/EW 1550 nm 40 km SFP+ | 10GBASE - ER 1550 nm Single mode (40 km) | -15.8 dBm | 1260 to 1565 nm | -3 to 3 dBm | 1530 to 1560 nm |
| G0318A 10G ZR/ZW 1550 nm 80 km SFP+ | 10GBASE - ER 1550 nm Single mode (80 km) | -22 dBm | 1260 to 1565 nm | 0 to 5 dBm | 1525 to 1565 nm |
| G0319A Up to 2.7G 1310 nm 15 km SFP | STM-1/-4/-16 short haul, 1310 nm (15 km) | -18 dBm | 1270 to 1580 nm | -5 to 0 dBm | 1260 to 1360 nm |
| G0320A Up to 2.7G 1310 nm 40 km SFP | STM-1/-4/-16 long haul, 1310 nm (40 km) | -27 dBm | 1270 to 1580 nm | -2 to 3 dBm | 1280 to 1335 nm |
| G0321A Up to 2.7G 1550 nm 80 km SFP | STM-1/-4/-16 long haul, 1550 nm (80 km) | -28 dBm | 1270 to 1580 nm | -2 to 3 dBm | 1500 to 1580 nm |
| G0322A 1G/2G/4G FC 1310 nm SFP | 1GFC, 2GFC, 4GFC 1310 nm (10 km) | -18 dBm | 1260 to 1360 nm | -8 to 0 dBm | 1260 to 1360 nm |
| G0323A 1G/2G/4G FC 1550 nm SFP | 1GFC, 2GFC, 4GFC 1550 nm (40 km) | -18 dBm | 1470 to 1600 nm | 0 to 5 dBm | 1510 to 1590 nm |
| G0328A 1G/2G/4G FC 850 nm SFP | 1GFC, 2GFC, 4GFC 850 nm (0.5 km) | -15 dBm | 830 to 860 nm | -9 to 0 dBm | 830 to 860 nm |
| G0329A 10G LR 1310 nm SFP+ | 10GBASE - LR 1310 nm Single mode (10 km) | -14 dBm | 1260 to 1355 nm | -8.2 to 0.5 dBm | 1260 to 1355 nm |
| G0332A 100 M FX 1310 nm MM SFP | 100BASE-FX 1310 nm Multi mode (2 km) | -31 dBm | 1270 to 1600 nm | -20 to -15 dBm | 1280 to 1380 nm |
| G0333A 10G SR/SW 850 nm SFP+ | 10GBASE - SR 850 nm Multi mode (0.3 km) | -11.1 dBm | 840 to 860 nm | -7.3 to -1 dBm | 840 to 860 nm |

# 9 Support

This chapter contains information about general maintenance of the Network Master. It also contains information about how to obtain support or service assistance.

# 9.1 Maintenance and Cleaning

This section contains information about general maintenance and cleaning of the Network Master.

## 9.1.1 Maintenance

The Network Master does not require any regular adjustments.

Using the Network Master in a normal environment and under normal conditions will not call for general maintenance.

⚠ **WARNING**

**There are no user-serviceable parts in the Network Master. Possible service or repair should be performed by Anritsu authorized personnel only.**

## 9.1.2 Cleaning

From time to time the Network Master needs to be cleaned. The surfaces of the Network Master can be cleaned with any mild detergent that does not contain solvents.

Before any cleaning, please take notice of the warnings below:

⚠ **WARNING**

**Disconnect the Network Master from the mains power connection before any cleaning involving fluid.**

- Only use a soft cloth moisturized with a mild detergent to clean the surface of the touch screen.
- Clean the main power adapter regularly. If dust accumulates around the power pins, there is a risk of fire.
- Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

# 9.2 Support and Service Assistance

In case your Network Master needs support or service, follow the instructions given in the sub-sections below.

## 9.2.1 Before you obtain assistance

To ensure fast help the Anritsu representative or the Anritsu Customer Services need detailed information about the Network Master and the problems concerning the Network Master. The minimum information required is listed below:

- A file containing the system information. The file can be generated using the icon in the *instrument toolbar*.
- Possible error code displayed on the touch screen, or any other error indications
- A detailed description of the problem and how it occurred. Please make the description as detailed as possible, e.g. by drawing an illustration and/or saving relevant screen captures.

## 9.2.2 Obtaining Support or Service Assistance

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information is available in a separate file on the DVD version.

# 9.3 Transporting and Disposal

This section describes the precautions to observe when transporting and disposing of the main frame at the end of its useful life.

## 9.3.1 Repackaging

Use the original shipping materials, or an approved optional transit case, when repacking the unit for transport. Repack according to the following procedure when the original shipping materials (or a transit case) are not available.

1. Procure a corrugated cardboard, wooden, or aluminum box large enough to pack in cushioning material around the unit.
2. Wrap the main frame in some material such as plastic sheeting that will prevent entry of dust and water.
3. Place the unit into the box.
4. Pack soft materials around the main frame so that it cannot slide around inside the packing box.
5. Secure the outside of the box with packaging cord, adhesive tape, bands, or other such implements.

## 9.3.2 Transporting

In addition to preventing vibration as much as possible, transport under conditions meeting the storage conditions outlined above.

## 9.3.3 Disposal

When the Network Master has reached the end of its useful life, dispose of it in accordance with local environmental regulations. Before disposal, dismantle or physically destroy any non-volatile memory media in the Network Master to ensure that data in memory cannot be recovered by third parties.

# 9.4 Special Information

## 9.4.1 Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations, and was found to meet the published specifications.

## 9.4.2 Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within one year after shipment due to a manufacturing fault. However, software fixes will be made in accordance with the separate Software End-User License Agreement. Moreover, Anritsu Corporation will deem this warranty void when:

- The fault is outside the scope of the warranty conditions separately described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster, including fire, wind, flooding, earthquake, lightning strike, or volcanic ash, etc.
- The fault is due to damage caused by acts of destruction, including civil disturbance, riot, or war, etc.
- The fault is due to explosion, accident, or breakdown of any other machinery, facility, or plant, etc.
- The fault is due to use of non-specified peripheral or applied equipment or parts, or consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.
- The fault is due to use in unusual environments(Note).
- The fault is due to activities or ingress of living organisms, such as insects, spiders, fungus, pollen, or seeds.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Note:
For the purpose of this Warranty, "unusual environments" means use:

- In places of direct sunlight
- In dusty places
- In liquids, such as water, oil, or organic solvents, and medical fluids, or places where these liquids may adhere
- In salty air or in places where chemically active gases (sulfur dioxide, hydrogen sulfide, chlorine, ammonia, nitrogen dioxide, or hydrogen chloride etc.) are present
- In places where high-intensity static electric charges or electromagnetic fields are present
- In places where abnormal power voltages (high or low) or instantaneous power failures occur
- In places where condensation occurs
- In the presence of lubricating oil mists
- In places at an altitude of more than 2,000 m
- In the presence of frequent vibration or mechanical shock, such as in cars, ships, or airplanes

## 9.4.3 Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the DVD version.

### 9.4.4 Licensing Information

This product includes copyrighted third-party software licensed under the terms of the GNU General Public License.

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Especially the following parts of this product are subject to GNU GPL:

- The Linux operating system kernel
- The busybox swiss army knife of embedded linux
- e2fsprogs - filesystem utilities for use with the ext2 filesystem

All listed software packages are copyrighted by their respective authors. Please see the source code for detailed information.

### 9.4.5 Availability of Source Code

Anritsu Corporation has the full source code of the GPL licensed software, including any scripts to control compilation of the object code.

# 9.5 GNU License Document

**GNU LESSER GENERAL PUBLIC LICENSE**
**Version 2.1, February 1999**



[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

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END OF TERMS AND CONDITIONS

# 9.6 EULA License Document

**Software End-User License Agreement (EULA)**

Please read this Software End-User License Agreement (hereafter this EULA) carefully before using (includes executing, copying, registering, etc.) this software (includes programs, databases, scenarios, etc., used to operate, set, etc., Anritsu electronic equipment). By reading this EULA and using this software, you are agreeing to be bound by the terms of its contents and Anritsu Corporation (hereafter Anritsu) hereby grants you the right to use this Software with the Anritsu-specified equipment (hereafter Equipment) for the purposes set out in this EULA.

**1. Grant of License and Limitations**

1. Regardless of whether this Software was purchased from or provided free-of-charge by Anritsu, you agree not to rent, lease, lend, or otherwise distribute this Software to third parties and further agree not to disassemble, recompile, reverse engineer, modify, or create derivative works of this Software.
2. You may make one copy of this Software for backup purposes only.
3. You are not permitted to reverse engineer this software.
4. This EULA allows you to install one copy of this Software on one piece of Equipment.

**2. Disclaimers**

To the extent not prohibited by law, in no event shall Anritsu be liable for personal injury, or any incidental, special, indirect or consequential damages whatsoever, including, without limitation, damages for loss of profits, loss of data, business interruption or any other commercial damages or losses, arising out of or related to your use or inability to use this Software.

**3. Limitation of Liability**

a. If a fault (bug) is discovered in this Software, preventing operation as described in the operation manual or specifications whether or not the customer uses this software as described in the manual, Anritsu shall at its own discretion, fix the bug, or exchange the software, or suggest a workaround, free-of-charge. However, notwithstanding the above, the following items shall be excluded from repair and warranty.
   i. If this Software is deemed to be used for purposes not described in the operation manual or specifications.
   ii. If this Software is used in conjunction with other non-Anritsu-approved software.
   iii. Recovery of lost or damaged data.
   iv. If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.
   v. For any other reasons out of Anritsu's direct control and responsibility, such as but not limited to, natural disasters, software virus infections, etc.
b. Expenses incurred for transport, hotel, daily allowance, etc., for on-site repairs by Anritsu engineers necessitated by the above faults shall be borne by you.
c. The warranty period for faults listed in article 3a above covered by this EULA shall be either 6 months from the date of purchase of this Software or 30 days after the date of repair, whichever is longer.

**4. Export Restrictions**

You may not use or otherwise export or re-export directly or indirectly this Software except as authorized by Japanese and United States law. In particular, this software may not be exported or re-exported (a) into any Japanese or US embargoed countries or (b) to anyone on the Japanese or US Treasury Department's list of Specially Designated Nationals or the US Department of Commerce Denied Persons List or Entity List. By using this Software, you warrant that you are not located in any such country or on any such list. You also agree that you will not use this Software for any purposes prohibited by Japanese and US law, including, without limitation, the development, design and manufacture or production of missiles or nuclear, chemical or biological weapons of mass destruction.

**5. Termination**

Anritsu shall deem this EULA terminated if you violate any conditions described herein. This EULA shall also be terminated if the conditions herein cannot be continued for any good reason, such as violation of copyrights, patents, or other laws and ordinances.

**6. Reparations**

If Anritsu suffers any loss, financial or otherwise, due to your violation of the terms of this EULA, Anritsu shall have the right to seek proportional damages from you.

**7. Responsibility after Termination**

Upon termination of this EULA in accordance with item 5, you shall cease all use of this Software immediately and shall as directed by Anritsu either destroy or return this Software and any backup copies, full or partial, to Anritsu.

**8. Dispute Resolution**

If matters of dispute or items not covered by this EULA arise, they shall be resolved by negotiations in good faith between you and Anritsu.

**9. Court of Jurisdiction**

This EULA shall be interpreted in accordance with Japanese law and any disputes that cannot be resolved by negotiation described in Article 8 shall be settled by the Japanese courts.

# 9.7 CE Conformity Marking

Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

## 9.7.1 Product Model

Model:
MT1000A Network Master Pro

## 9.7.2 Applied Directive

EMC:
Directive 2004
LVD:
Directive 2006/95/EC

## 9.7.3 Applied Standards

EMC:
Emission: EN 61326-1: 2013 (Class A)
Immunity: EN 61326-1: 2013 (Table 2)

| Standard | Performance Criteria* |
|---|---|
| IEC 61000-4-2 (ESD) | B |
| IEC 61000-4-3 (EMF) | A |
| IEC 61000-4-4 (Burst) | B |
| IEC 61000-4-5 (Surge) | B |
| IEC 61000-4-6 (CRF) | A |
| IEC 61000-4-8 (RPFMF) | A |
| IEC 61000-4-11 (V dip/short) | B, C |

*: Performance Criteria

- **A:** During testing, normal performance within the specification limits.
- **B:** During testing, temporary degradation, or loss of function or performance which is self-recovering.
- **C:** During testing, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.

Harmonic current emissions:

EN 61000-3-2:2006 + A1:2009 A2:2009 (Class A equipment)

LVD:
EN 61010-1:2010 (Pollution Degree 2)

## 9.7.4 Authorized Representative

| | |
|---|---|
| Name: | Murray Coleman<br>Head of Customer Service EMEA<br>ANRITSU EMEA Ltd |
| Address, City: | 200 Capability Green, Luton<br>Bedfordshire, LU1 3LU |
| Country: | United Kingdom |

### 9.7.5 CE Declaration

**Anritsu**

Anritsu Corporation.
5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan. Tel +81 46 223 1111

## DECLARATION of CONFORMITY
## For

Product: Anritsu Corporation
Model: MT1000A

**Supplied by**
Anritsu Corporation
5-1-1 Onna Atsugi-shi Kanagawa,
243-8555 Japan

**Technical Construction File held by**
Anritsu Corporation
5-1-1 Onna Atsugi-shi Kanagawa,
243-8555 Japan

**Notified Body**
N/A N/A

| | **Standard used for comply** |
|---|---|
| **R&TTE Directive (Article 3.1(a) Safety)** | EN 60950-1: 2006 + Amd.11: 2009 + Amd.1: 2010 + Amd.12: 2011<br>EN 62311: 2008 |
| **R&TTE Directive (Article 3.1(b) EMC)** | EN 301 489-1 V1.9.2: 2011<br>EN 301 489-17 V2.2.1: 2012<br>EN 61326-1: 2013<br>EN 61000-3-2: 2006 + Amd1: 2009 + Amd2: 2009<br>EN 61000-3-3: 2008 |
| **R&TTE Directive (Article 3.2 Spectrum)** | EN 300 328 V1.7.1: 2006 |

**Means of Conformity**

We declare under our sole responsibility that the Product (s) is conformity with the essential requirements and other relevant requirements of the Radio and Telecommunication Terminal Equipment (R&TTE) Directive (1999/5/EC).

**Date of issue:** May 28, 2014

**Signature of Responsible Person:**

H. Yanagawa

Hirokazu Yanagawa
Anritsu Corporation

No.: TAA-1CENMX0001

# 9.8 C-Tick Conformity Marking

Anritsu affixes the C-Tick mark on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

N274

## 9.8.1 Product Model

Model:

MT1000A Network Master PRO

## 9.8.2 Applied Standards

EMC:

Emission: EN 61326-1:2006 (Class A equipment)

# 9.9 Laser Safety

## 9.9.1 Laser Safety Classifications

Class 1 indicate the danger degree of the laser radiation specified below according to IEC 60825-1:2007.

Class 1:

Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

**⚠ WARNING**

The laser in the plug-in unit provided for this equipment is classified as Class 1 according to the IEC 60825-1:2007 standard, and is safe under reasonably foreseeable operating conditions.

**⚠ CAUTION**

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Table 1 Laser Safety Classifications Based on IEC 60825-1:2007

| Model Name | Class | Max. Optical Output Power (mW)* | Pulse Width (s)/ Repetition Rate | Emitted Wavelength (nm) | Beam Divergence (deg) | Laser Aperture | Built-in Laser |
|---|---|---|---|---|---|---|---|
| MU100010A | 1 | 0.5 | CW | 850 | 31.9 | Figure 1,[1],[2] | Table 2 (a) |
| | 1 | 0.5 | CW | 1310 | 11.5 | Figure 1,[1],[2] | Table 2 (b) |
| | 1 | 3.2 | CW | 1550 | 11.5 | Figure 1,[1],[2] | Table 2 (c) |
| | 1 | 0.8 | CW | 1310 | 11.5 | Figure 1,[1],[2] | Table 2 (d) |
| | 1 | 2.0 | CW | 1550 | 11.5 | Figure 1,[1],[2] | Table 2 (e) |
| | 1 | 3.2 | CW | 1550 | 11.5 | Figure 1,[1],[2] | Table 2 (f) |
| | 1 | 1.0 | CW | 1310 | 11.5 | Figure 1,[1],[2] | Table 2 (g) |
| | 1 | 2.0 | CW | 1310 | 11.5 | Figure 1,[1],[2] | Table 2 (h) |
| | 1 | 2.0 | CW | 1550 | 11.5 | Figure 1,[1],[2] | Table 2 (i) |
| | 1 | 1.0 | CW | 1310 | 11.5 | Figure 1,[1],[2] | Table 2 (j) |
| | 1 | 3.2 | CW | 1550 | 11.5 | Figure 1,[1],[2] | Table 2 (k) |
| | 1 | 1.0 | CW | 850 | 31.9 | Figure 1,[1],[2] | Table 2 (l) |
| | 1 | 1.2 | CW | 1310 | 11.5 | Figure 1,[1],[2] | Table 2 (m) |
| | 1 | 0.04 | CW | 1310 | 31.9 | Figure 1,[1],[2] | Table 2 (n) |
| | 1 | 0.8 | CW | 850 | 31.9 | Figure 1,[1],[2] | Table 2 (o) |

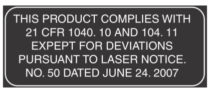
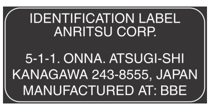
* Indicates the possible optical output power when each and every reasonably foreseeable single-fault condition is included.

Table 2 Specifications of Laser Built into MU100010A

| | Model | Max. Optical Output Power (mW)* | Pulse Width (s)/ Repetition Rate | Emitted Wavelength (nm) | Beam Divergence (deg) |
|---|---|---|---|---|---|
| (a) | G0311A | 0.5 | CW | 850 | 31.9 |
| (b) | G0312A | 0.5 | CW | 1310 | 11.5 |
| (c) | G0313A | 3.2 | CW | 1550 | 11.5 |
| (d) | G0315A | 0.8 | CW | 1310 | 11.5 |
| (e) | G0316A | 2.0 | CW | 1550 | 11.5 |
| (f) | G0318A | 3.2 | CW | 1550 | 11.5 |
| (g) | G0319A | 1.0 | CW | 1310 | 11.5 |
| (h) | G0320A | 2.0 | CW | 1310 | 11.5 |
| (i) | G0321A | 2.0 | CW | 1550 | 11.5 |
| (j) | G0322A | 1.0 | CW | 1310 | 11.5 |
| (k) | G0323A | 3.2 | CW | 1550 | 11.5 |
| (l) | G0328A | 1.0 | CW | 850 | 31.9 |
| (m) | G0329A | 1.2 | CW | 1310 | 11.5 |
| (n) | G0332A | 0.04 | CW | 1310 | 31.9 |
| (o) | G0333A | 0.8 | CW | 850 | 31.9 |
| * Indicates the possible optical output power when each and every reasonably foreseeable single-fault condition is included. | | | | | |

## 9.9.2 Indication Labels on Product

Table 3 Labels on Product

| | Type | Label | Affix to | Model Name |
|---|---|---|---|---|
| 1 | Explanation |  | Figure 2,A | MU100010A |
| 2 | Certification |  | Figure 2,B | MU100010A |
| 3 | Identification |  | Figure 2,C | MU100010A |
| 4 | Warning |  | Figure 2,D | MU100010A |

### 9.9.3 Laser Radiation Markings

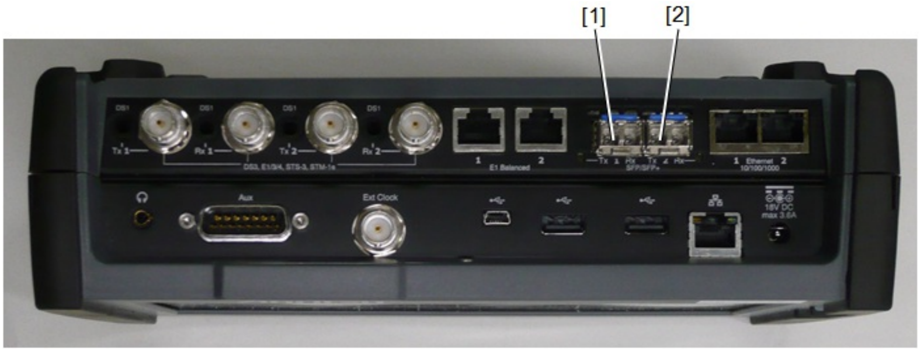



Figure 1: Locations of laser beam aperture

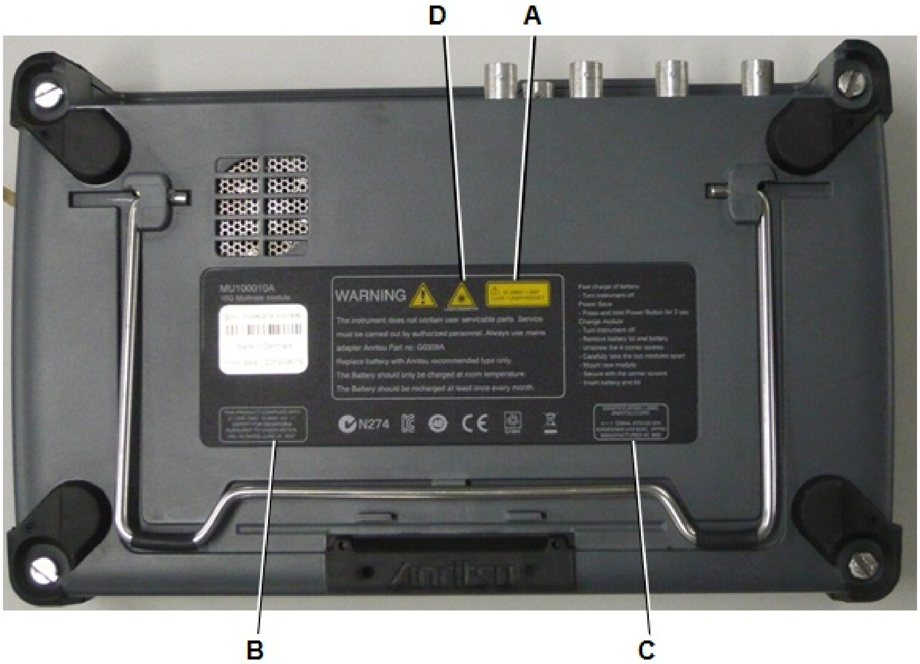



Figure 2: Locations of affixed labels

# 9.10 Wireless Certification

## 9.10.1 Japan MIC

MT1000A is certified the certification of construction type of specified radio equipment.

## 9.10.2 North America (USA FCC and Canada IC)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of this device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage.
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

**FCC CAUTION**

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

The available scientific evidence does not show that any health problems are associated with using low power wireless devices. There is no proof, however, that these low power wireless devices are absolutely safe. Low power Wireless devices emit low levels of radio frequency energy (RF) in the microwave range while being used. Whereas high levels of RF can produce health effects (by heating tissue), exposure of low-level RF that does not produce heating effects causes no known adverse health effects. Many studies of low-level RF exposures have not found any biological effects. Some studies have suggested that some biological effects might occur, but such findings have not been confirmed by additional research. MT1000A has been tested and found to comply with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the IC radio frequency (RF) Exposure rules.

Les connaissances scientifiques dont nous disposons n'ont mis en évidence aucun probème de santé associé à l'usage des appareils sans fil à faible puissance. Nous ne sommes cependant pas en mesure de prouver que ces appareils sans fil à faible puissance sont entièrement sans danger. Les appareils sans fil à faible puissance émettent une énergie radioélectrique (RF) très faible dans le spectre des micro-ondes lorsqu'ils sont utilisés. Alors qu'une dose élevée de RF peut avoir des effets sur la santé (en chauffant les tissus), l'exposition à de faibles RF qui ne produisent pas de chaleur n'a pas de mauvais effets connus sur la santé. De nombreuses études ont été menées sur les expositions aux RF faibles et n'ont découvert aucun effet biologique. Certaines études ont suggéré qu'il pouvait y avoir certains effets biologiques, mais ces résultats n'ont pas été confirmés par des recherches supplémentaires. MT1000A a été testé et jugé conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les régles les radioélectriques (RF) de la FCC lignes directrices d'exposition et d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC.

### 9.10.3 Europe CE

Hereby, Anritsu Corporation, declares that this instrument is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

### 9.10.4 China SRRC

- 使用频率：2.4 – 2.4835 GHz
- 等效全向辐射功率(EIRP)：

  天线增益 ＜ 10 dBi 时：≤ 100 mW 或 ≤ 20 dBm
- 最大功率谱密度：

  WLAN: 天线增益 ＜ 10 dBi 时：≤ 10 dBm / MHz (EIRP)

  Bluetooth: 天线增益 ＜ 10 dBi 时：≤ 20 dBm / MHz (EIRP)
- 载频容限：20 ppm
- 带外发射功率(在 2.4 – 2.4835 GHz 频段以外)

  ≤ – 80 dBm / Hz (EIRP)
- 杂散发射(辐射)功率(对应载波±2.5 倍信道带宽以外)：

  ≤ – 36 dBm / 100 kHz (30 – 1000 MHz)

  ≤ – 33 dBm / 100 kHz (2.4 – 2.4835 GHz)

  ≤ – 40 dBm / 1 MHz (3.4 – 3.53 GHz)

  ≤ – 40 dBm / 1 MHz (5.725 – 5.85 GHz)

  ≤ – 30 dBm / 1 MHz (其它 1 – 12.75 GHz)

不得擅自更改发射频率、加大发射功率(包括额外加装射频功率放大器)，不得擅自外接天线或改用其它发射天线；

使用时不得对各种合法的无线电通信业务产生有害干扰；一旦发现有干扰现象时，应立即停止使用，并采取措施消除干扰后方可继续使用；

使用微功率无线电设备，必须忍受各种无线电业务的干扰或工业、科学及医疗应用设备的辐射干扰；

不得在飞机和机场附近使用。

### 9.10.5 Indonesia SDPPI

34837/SDPPI/2014
4679

MT1000A is certified SDPPI wireless certification.

### 9.10.6 Mexico IFETEL

The operation of this equipment is subject to the following two conditions:

1. It is possible that this equipment or device may not cause harmful interference.
2. This equipment or device must accept any interference, including interference that may cause undesired operation.

La operación de este equipo está sujeta a las siguientes dos condiciones: :

1. es posible que este equipo o dispositivo no cause interferencia prejudicial.
2. este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

### 9.10.7 Singapore iDA

iDA

MT1000A is certified IDA wireless certification.

### 9.10.8 Thailand NTC

This telecommunication equipment is in compliance with NTC requirements.

# 9.11 Declarations

## 9.11.1 Notes on Export Management

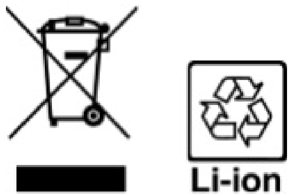
This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.

**Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.**

When you dispose of export-controlled items, the products/manuals need to be broken/shredded so as to be unlawfully used for military purposes.

## 9.11.2 Information for EU and EFTA Customers Only

**Please recycle the battery**




The product that you have purchased contains a rechargeable battery. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste. Check with your local solid-waste disposal officials for details of recycling options or proper disposal in your area.

Before disposing of this product, discharge the battery and mail it to your Anritsu Service or Sales office.

1. Disconnect the AC adapter, if used.
2. Turn the power switch to on.
3. Leave the product on until the power indicator goes off; the battery is now discharged.
4. Remove the battery.
5. Insulate the battery terminals with adhesive tape.
6. Please recycle in accordance with your national or regional legislation.

NOTE

*Equipment marked with the Crossed-out Wheeled Bin Symbol complies with council directive 2002/96/EC (the "WEEE directive") in European Union.*
*For products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.*

## 9.11.3 Information for U.S. Customers Only

**Please recycle the battery**


The product that you have purchased contains a rechargeable battery. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local solid waste officials for details in your area for recycling options or proper disposal.

Before disposing of this product, discharge the battery and mail it to your Anritsu Service or Sales office.

1. Attach the battery pack to the product.
2. Disconnect the AC adapter, if used.
3. Turn the power switch to ON.
4. Leave the product on until the power indicator goes off; the battery is now discharged.
5. Remove the battery.
6. Insulate the battery terminals with adhesive tape.
7. Mail it to your Anritsu Service or Sales office, or to the address shown below.

ANRITSU COMPANY
490 Jarvis Drive, Morgan Hill, CA 95037-2809, USA

### 9.11.4 Information for the Chinese Market Only

Concerning declaration of China RoHS, please see the note below.

NOTE

*China RoHS is not 100% identical to the European (EU) RoHS. EU RoHS has exemptions for Pb and Hg in various alloys, soldering, displays and other products. The China RoHS declaration in the next table does **NOT** comply with EU RoHS.*

产品中有毒有害物质或元素的名称及含量

| 部件名称 | 有毒有害物质或元素 | | | | | |
|---|---|---|---|---|---|---|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 [Cr(VI)] | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 印刷线路板 (PCA) | × | ○ | × | × | ○ | ○ |
| 机壳、支架 (Chassis) | × | ○ | × | × | ○ | ○ |
| LCD | × | × | × | × | ○ | ○ |
| 其他（电缆、风扇、连接器等）(Appended goods) | × | ○ | × | × | ○ | ○ |
| ○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。<br>×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。 | | | | | | |

环保使用期限

这个标记是根据 2006/2/28 公布的「电子信息产品污染控制管理办法」以及 SJ/T 11364-2006「电子信息产品污染控制标识要求」的规定，适用于在中国销售的电子信息产品的环保使用期限。仅限于在遵守该产品的安全规范及使用注意事项的基础上，从生产日起算的该年限内，不会因产品所含有害物质的泄漏或突发性变异，而对环境污染，人身及财产产生深刻地影响。

注）电池的环保使用期限是 5 年。