Ethernet/Gigabit Ethernet Tester Analyzer Bercut-ET

Operations manual

Version 1.1.0, 2009

Metrotek

Contents

1. General description

Ethernet/Gigabit Ethernet tester-analyzer **Bercut-ET** (referred to as device, analyzer) is intended for performing analysis and diagnostic tests according to the RFC 2544 [5] methodology, checking the state of a cable, and checking link connectivity. In addition, the analyzer supports operations in the loopback mode, and statistics getting for received and transmitted traffic.

Bercut-ET analyzer provides the following options.

1. Traffic generating and analyzing at the data link (MAC) and network (IP) layers.
2. Getting and displaying statistics about traffic received and transmitted at the physical, data link, and network layer.
3. RFC-2544 measurements: Throughput, Latency, Frame Loss, Back-to-Back.
4. Copper cable faults diagnostics.
5. Ethernet loopback for physical, data link, network and transport layers of the OSI model.
6. Loopback control via OAM protocol.
7. Bit Error Rate Testing (BERT).
8. Packet jitter measurements.
9. IP testing (ping, traceroute, telnet/http requests).

2. Supply kit

Table 2.1. Supply kit

Item	**Quantity**
Ethernet/Gigabit Ethernet tester-analyzer **Bercut-ET** device	1
Ethernet/Gigabit Ethernet tester-analyzer **Bercut-ET**. Operational manual	1
Power supply unit (12 V, 1,5 A)	1
Cable (220 V, 3-polar)	1
USB cable	1
Ethernet cable	1

3. Setting-up procedures

1. Get the tester from the box and make the external inspection.
2. Keep the tester in normal environmental conditions for at least 2 hours (if the tester has been previously kept in conditions distinct from normal).
3. Plug-in the power supply unit to the electric network (if you use mains voltage 110–240 V with the 50–60 Hz frequency).
4. Switch on the tester.

4. Overview

4.1 Front panel

Front panel of **Bercut-ET** analyzer is shown on the figure 4.1.

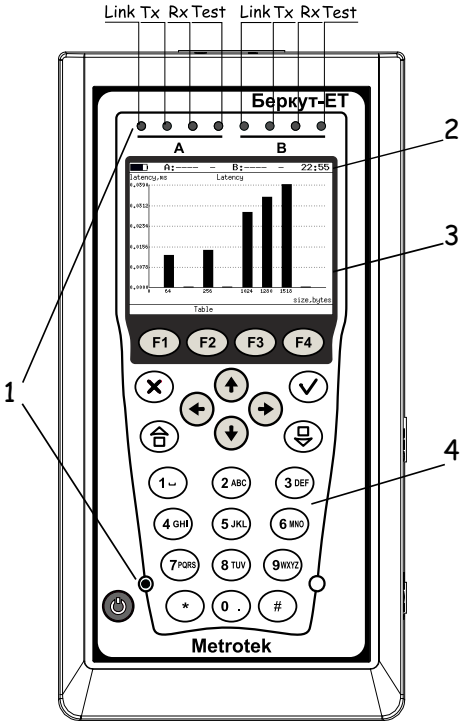


Figure 4.1. Front panel

1 – LEDs.

Three-color LEDs at the top of the front panel provide information about interface state.

LEDs description

LEDs which are marked as *Link* on the fig. 4.1 show the **connection state**:

- green — connection to DUT is successfully established;
- red — no connection.

LEDs which are marked as *Tx* on the fig. 4.1 show the **data transmission state**:

- green (blinking or constant light) — data is transmitted at the moment;
- off — no data transmission at the moment.

LEDs which are marked as *Rx* on the fig. 4.1 show the **data receiving state**:

- green (blinking or constant light) — data packets are received at the moment;
- off — no data is received at the moment.

LEDs which are marked as *Test* on the fig. 4.1 show the **test state**:

- green — test is running at the moment;
- green (blinking) — Loopback mode is on at the moment.

LEDs in the bottom part of the front panel light up when the power supply unit is plugged in:

- green — the battery is charged;
- green (blinking) — the battery is charging;
- green (twinkling) — updating analyzer software.

2 – Status bar.
See section 4.3 for details.
3 – Display.
Color graphic display.
4 – Keyboard.
Keys function:

- — **Switch device on/off**
  To switch device on/off press and hold the button for 1–2 seconds.
- — **Main menu**
  Press the button to return to the *Main menu*.
- — **Enter**

– in the menu mode, if the selected item is highlited, pressing the (✓) button will open the corresponding menu and display the corresponding screen;
– in the data entering mode, pressing the button will switch to edit mode or switch to the parameter selecting menu. If the (✓) button is used for the data input, then to return to the previous menu, press the (✗) button.

- (✗) — **Cancel/Escape**
  – in menu mode, press the button to return one level up (to the previous menu);
  – in data setup mode, press the button to cancel set values.
- (⏬) — **Infobar**
  When the (⏬) button is pressed, the LEDs captions are displayed (background color corresponds to the LED's color).
- F1, F2, F3, F4 — **Functional buttons**.
- (←), (→), (↑), (↓) — **Cursor moving buttons**.
- (1 ␣), (2 ABC), (3 DEF), (4 GHI), (5 JKL), (6 MNO), (7 PQRS), (8 TUV), (9 WXYZ), (0 .), (*), (#) — **Digits, letters, and symbols input buttons**.

Table 4.1. Digits, letters, and symbols

Button	Digits	Letters	Symbols
(1 ␣)	1	---	␣ @ / –
(2 ABC)	2	a b c	---
(3 DEF)	3	d e f	---
(4 GHI)	4	g h i	---
(5 JKL)	5	j k l	---
(6 MNO)	6	m n o	---
(7 PQRS)	7	p q r s	---
(8 TUV)	8	t u v	---
(9 WXYZ)	9	w x y z	---
(0 .)	0	---	. , : ;
(*)	---	---	*

4.2 External connectors

Location of external connectors on the top and side panels is shown on the figures 4.2 and 4.3.

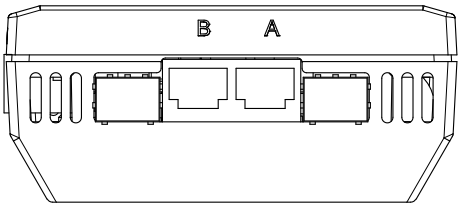


Figure 4.2. Top panel

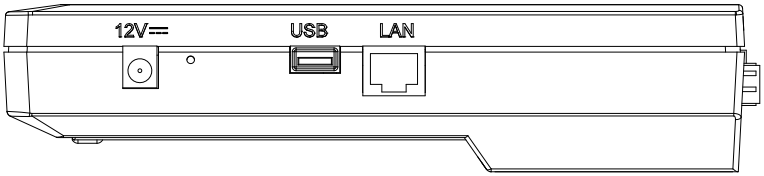


Figure 4.3. Side panel

Tester connectors and equipment to be connected are described in the table 4.2.

Table 4.2. Connectors description

Designation	Description	Connected equipment
A, B	RJ-45 connectors to connect to the tested network or equipment (supported rates 10/100/1000 Mbps)	Ethernet cable
	SFP-module connectors	SFP-module
LAN[1]	Remote control connector (supported rates 10/100 Mbps)	Ethernet cable
USB	Connect to PC via USB-interface	USB cable
12 V	External power unit connector	Power supply unit

[1]Connector availability depends on the tester version.

4.3 Status bar

Status bar shows information about the following parameters (left to right):

- battery charge state;
- transmission rate for the port A;
  Note: *if you connect SFP-module, white color of this inscription will be changed to yellow.*
- test that is running now via port A;
- transmission rate for the port B;
  Note: *if you connect SFP-module, white color of this inscription will be changed to yellow.*
- test that is running now via port B;
- current time.

Type of test running via port A(B) is marked in the status bar with the following abbreviations:

- **THR** — throughput analysis;
- **LAT** — latency analysis;
- **BTB** — back-to-back test;
- **FRL** — frameloss test;
- **LB1** — loopback at the Physical layer (layer 1);
- **LB2** — loopback at the Data Link layer (layer 2);
- **LB3** — loopback at the Network layer (layer 3);
- **LB4** — loopback at the Transport layer (layer 4)
- **BER** — bit error rate test;
- **PJ** — packet jitter analysis;
- **GEN** — test flow generation;
- **J+G** — packet jitter analisys and test flow generation on the same port;
- **PTH** — pass through mode.

5. Analysis. Typical tasks and solutions

5.1 Typical tasks

The main task for the Ethernet-network testing is the estimation of compliance of the tested services with the service level agreement (SLA) between operators and subscribers. In the first place, the task concerns the guaranteed Quality of Service (QoS) providing described by the following parameters: throughput, frame loss rate, latency, and back-to-back. These parameters are tested according to the RFC 2544 methodology. To test availability of specific address within or out of a network and to analyze routes of data transmission, Ping and Traceroute utilities are used. The Loopback mode allows redirecting traffic at the physical, data link, network and transport OSI layers.

5.2 RFC 2544 methodology

The RFC 2544 methodology defines a specific set of tests to measure and report the performance characteristics of network devices.

According to the RFC 2544, for Ethernet-network test the following frame sizes are recommended to be used: 64, 128, 256, 512, 1024, 1280, and 1518 bytes. Taking into consideration the tests defined by the methodology (throughput, latency, frame loss rate, and back-to-back), this methodology is the de-facto standard for analyzing the Ethernet-network performance.

Bercut-ET analyzer supports four standard tests defined by the RFC 2544 methodology.

1. *Throughput. This test allows to determine the maximum possible rate for the Ethernet-networks equipment.*
   Throughput — the fastest rate at which the number of test frames transmitted by the DUT is equal to the number of test frames sent to it by the test equipment.[1]
   When measuring the throughput, specific number of frames with min-

[1]The following terms are synonyms in the tests descriptions: frame, datagram, and packet.

imum interframe gap is sent to DUT[2] (fig. 5.1 [3]). Then, the analyzer counts the frames that are transmitted by the DUT. If the fewer frames are received than transmitted, the interframe gap is increased and the test reruns.

> ***Note:*** *relation between interframe gap and load is inverse, thus, the bigger gap value is, the lesser the load is.*

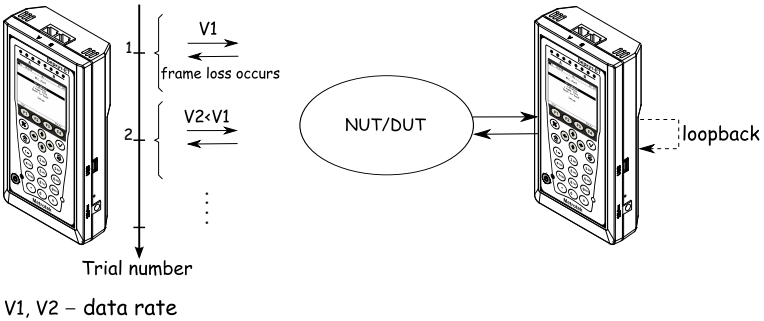


Figure 5.1. Throughput

2. *Latency. This test allows to analyze the time during which a frame will be transmitted from the source to destination and then back to source. The latency is one of the major parameters for the real-time services operation.*
   When analyzing the latency, the throughput for DUT at each of the listed frame sizes is determined first. Then, a stream of frames at a particular frame size is sent through the DUT at the determined throughput rate to a specific destination. The minimum duration of the stream transmission is set as 120 seconds (user can specify alternative value in the range of 1–2886 seconds). In a specific time, an identifying tag is included into one frame with the type of tag being implementation dependent. The time at which this frame is fully transmitted is recorded as a **Ta** time stamp value. The receiver port of the analyzer then recognizes the tag information in the frame stream and records the time at which the tagged frame was received (**Tb** value).
   The latency value is the difference between time stamp **Tb** and time stamp **Ta** values.

[2]For the current test and tests described further, all steps are performed automatically.
[3]At the figures, only one of connection type is shown. For other possible connection schemes please refer to the see section 5.3.

The test is repeated at least 20 times (user can specify alternative value from 1 to 30).

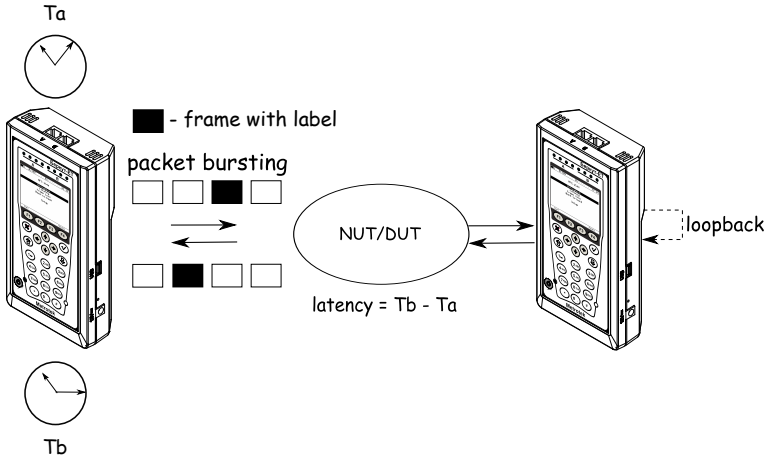


Figure 5.2. Latency

3. *Frame Loss Rate. This test allows to estimate network's ability to support real-time operating applications because the big loss percentage will result in service quality degrading.*
   Frame loss test allows to count the percentage of frames that have not been transmitted by DUT due to lack of hardware resources.
   To test the frame loss rate, a specific number of frames (input count) is sent at a specific rate through the DUT to be tested and then the analyzer counts the frames that are transmitted by the DUT (output count). The frame loss rate at each point is calculated using the following equation:

$$\frac{100 \times (input\,count - output\,count)}{(input\,count)}$$

   The first trial should be run for the frame rate that corresponds to 100% of the maximum rate for the frame size on the input media. Repeat the procedure for the rate that corresponds to 90 % of the maximum rate used and then for 80 % of this rate. The trials are continued with 10 % reducing intervals (a finer granularity is supported) until there are two successive trials in which no frames are lost.

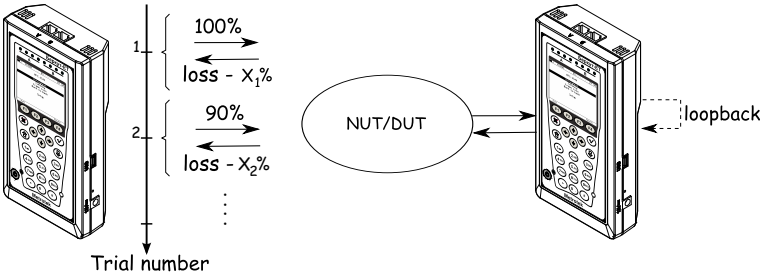


Figure 5.3. Frame Loss Rate

4. *Back-to-back. The test allows estimating the time during which the DUT is capable to manage the maximum load.*
   The analyzer sends a burst of frames with minimum interframe gap to the DUT and then counts the number of frames forwarded by the DUT. If the count of transmitted frames is equal to the number of frames forwarded, the time of transmission is being increased and the test is being rerun until there are two trials succeeded with no frame lost. If the number of forwarded frames is less than the number of transmitted ones, the time of transmission is being reduced and the test is being rerun.

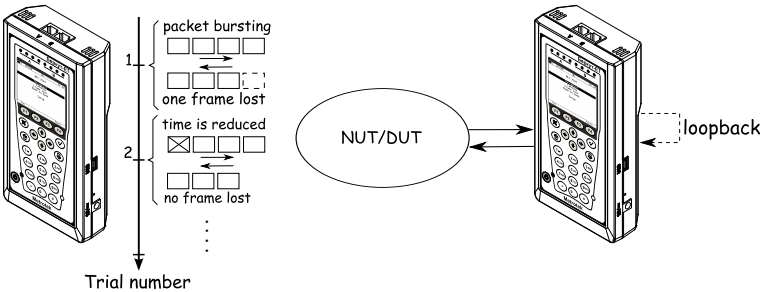


Figure 5.4. Back-to-Back

5.3 Connecting device and starting to operate

5.3.1 Device connection schemes

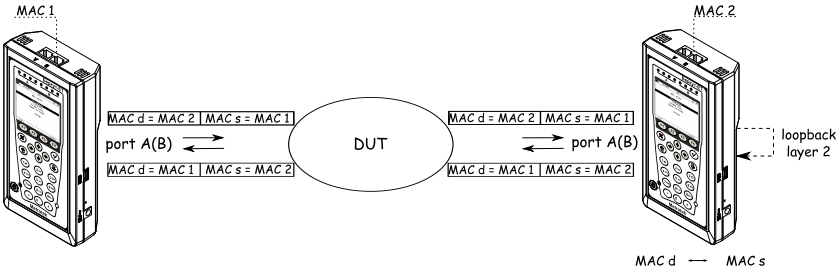


Figure 5.5. Connection scheme 1

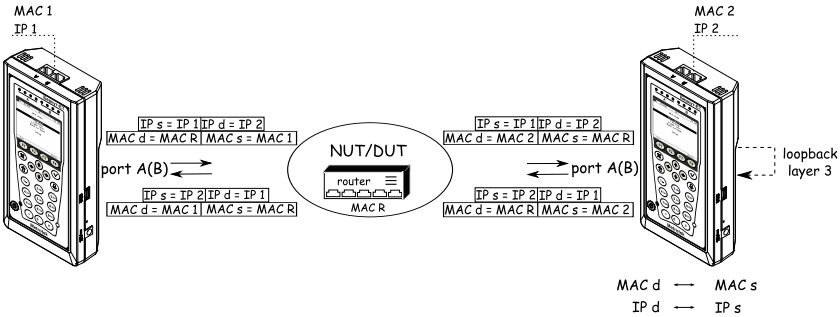


Figure 5.6. Connection scheme 2

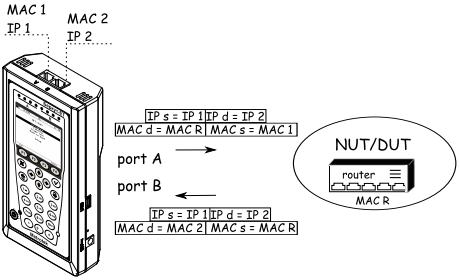


Figure 5.7. Connection scheme 3

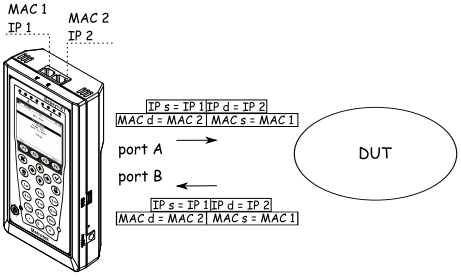


Figure 5.8. Connection scheme 4

The scheme 5.5 shows the connection of the analyzer (using one analyzer's port) to the network with equipment operating on the Data Link layer (for example, network switch). In this case, generated test traffic should be rerouted back to the analyzer via the loopback. At the DUT, source and destination MAC addresses are swapped in the incoming packets, and the test stream is retransmitted back to the source port on the analyzer.

All the connection schemes use the following notation:

- MAC s — source MAC address;
- MAC d — destination MAC address;
- MAC R — gateway MAC address;
- IP s — source IP address;
- IP d — destination IP address.

The figure 5.6 shows analyzer connection to a network with equipment operating on both the Data Link and Network layers (for example, switches and routers). Unlike the first case, with this connection scheme both source and destination MAC and IP addresses are swapped and the traffic is returned to the source port.

In the case of testing networks/equipment with capability of IP-traffic routing, two device ports are used (fig. 5.7). Packets are rerouted from one port to another via a router. In addition, **Bercut-ET** can be connected to a network switch as shown on fig. 5.8.

5.4 RFC 2544. General settings

5.4.1 Setting up header

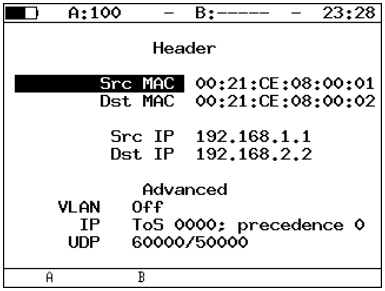


Figure 5.9. Header menu

- **Src MAC** — source MAC address. Use MAC address of a source interface.
- **Dst MAC** — destination MAC address.
  1. If a transmitter and receiver are connected directly, without using any router, use MAC address of the receiver interface.
  2. If there is at least one router between the sender and the receiver, use MAC address of the router nearest to the receiver.
- **Src IP** — source IP address.
- **Dst IP** — destination IP address.

Bercut-ET can set up MAC and IP addresses automatically.

- To substitute the current MAC address value with the A (B) port MAC address specified in the *Information* menu, press F1 (F2).
- To substitute the current IP address value with the A (B) port IP address specified in the *Network setup* menu, press F1 (F2).
- If you press F3 button (with *Dst MAC* selected), the ARP-request will be performed. As a result of the request, instead of destination IP address the IP address corresponding to the destination MAC address will be used.

Values specified in the *Header (adv)* menu are also displayed on the screen.

5.4.2 Setting up header (advanced)

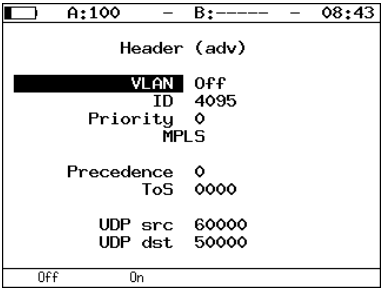


Figure 5.10. Header (adv) menu

- **ID** — 12-bit VLAN identifier is a number in the 0–4095 range that explicitly defines VLAN to which the packet belongs. Zero value of the VLAN ID means that current frame contains information about priority only, not about VLAN. If the ID is set to 1, then while transmitting through the router's port, the VLAN ID will be automatically set equal to the VLAN ID of this port.
- **Priority** — this field defines the traffic priority. Eight values of priority ([1]) are supported, correspondence between priority and traffic type is shown in the table 5.1.

Table 5.1. Priorities and types of traffic

Value	Description
1	Background
0 (Default)	Best Effort
2	Excellent Effort
3	Critical Applications
4	Video
5	Voice
6	Internetwork Control
7	Network Control

Network Control and Internetwork Control traffic types are intended for network management messages. 4 and 5 priority values can be used for latency sensitive traffic such as video or speech.
Priority values 3–1 are intended for use with different tasks from streaming applications to FTP traffic that can cope with possible data loss.

0 priority is reserved for the best transmission and is assigned if none other class has been specified.

- **MPLS** — switch to the *Label stack* menu.
- **Precedence** — frame priority field. In accordance with RFC 791 [2], eight priority values are available. Sender can specify any priority value from the table 5.2 below.

Table 5.2. Precedence value

Value	Description
0	Routine
1	Priority
2	Immediate
3	Flash
4	Flash Override
5	CRITIC/ECP
6	Internetwork Control
7	Network Control

- **ToS (Type of Service)** — the field determines type of service for datagram. The source can set any value from the table 5.3 in accordance with RFC 1349 [4] methodology.

Table 5.3. ToS field values

Value	Description	Notes
1000	Minimize delay	Use the value if a period of packet delivery from the source to destination (latency period) is the main priority and must be minimum.
0100	Maximize throughput	Use the value to specify that the packet must be routed through the link with the maximum throughput.
0010	Maximize reliability	Use the value to ensure the packet is delivered without retransmission.
0001	Minimize monetary cost	Use the value to minimize the monetary cost of the data delivery.

Table 5.3. ToS field values *(continued)*

0000	All normal	In this case packet routing is left at the discretion of a provider.

- **UDP src** — specify number of source UDP port.
- **UDP dst** — specify number of destination UDP port.

5.4.3 RFC 2544. MPLS settings

Label stack for networks testing can be specified in the *Label stack* menu: *Tests* ⇒ *RFC-2544* ⇒ *Setup* ⇒ *Header* ⇒ *Advanced* ⇒ *MPLS*.

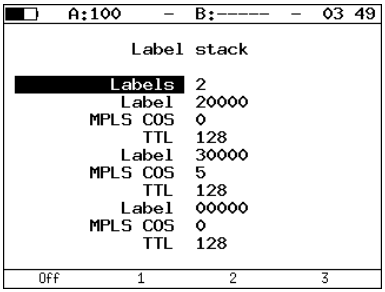


Figure 5.11. Label stack menu

- **Labels** — number of labels (1–3).
- **Label** — label value.
- **MPLS COS** — class of service for datagram.
- **TTL** — time to live for datagram.

5.4.4 Test topology

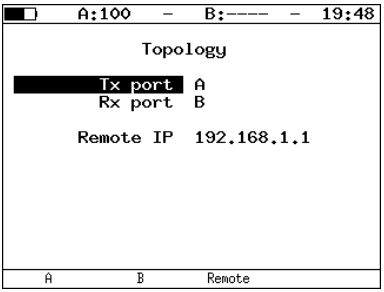


Figure 5.12. Topology menu

Use the *Topology* menu to specify receiving and transmitting ports. The same port can be used for both data transmission and receiving (for example, with the Loopback feature). If you use asymmetric test function you must select **Remote** as receiving/transmitting port (see section 5.7).

5.4.5 Selecting frame size

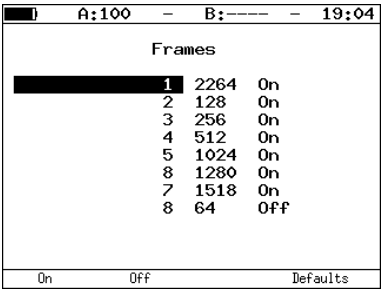


Figure 5.13. Frames menu

To perform tests, user can do either of the followings:

- select standard sizes of transmitted frames according to the RFC 2544 methodology by pressing F4 (*Defaults*): 64, 128, 256, 512, 1024, 1280, 1518 bytes;
- define any frame size within 64–9600 bytes range.

5.5 RFC 2544. Test parameters setup

5.5.1 Throughput test settings

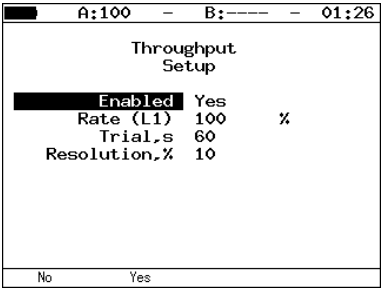


Figure 5.14. Configuring test settings

- **Enabled** — enable/disable throughput analysis.
- **Rate (L1)** — physical rate value in percent (F1), in kbps (F2) or in Mbps (F3).
- **Trial, s** — time of the trial performing for each of the specified frame sizes.
- **Resolution, %** — throughput analysis resolution value. Possible values: 10 (F1), 1 (F2), 0.1 (F3), 0.01 (F4). Lesser resolution value is, the bigger throughput analysis accuracy is.

5.5.2 Latency test settings

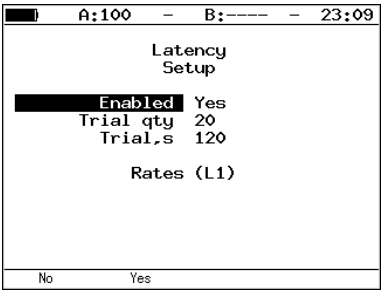


Figure 5.15. Configuring test settings

- **Enabled** — enable/disable latency analysis.

- **Trial qty** — number of trials that should be performed for each specified frame size.
- **Trial, s** — time of the trial performing (within 1–2886 s range) for each specified frame size.
- **Rates (L1)** — switched to *Rates (L1)* menu.

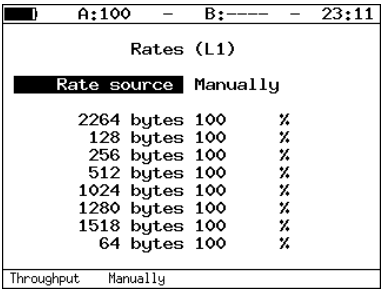


Figure 5.16. Rates menu

- **Rate source** — if you press F1 button (*Throughput*), Latency test will be performed with rates values that are a result of Throughput test. If you press F2 button (*Manually*), Latency test will be performed with physical (L1) rates value defined by user in percent (F1), in kbps (F2) or in Mbps (F3).

5.5.3 Frame loss test settings

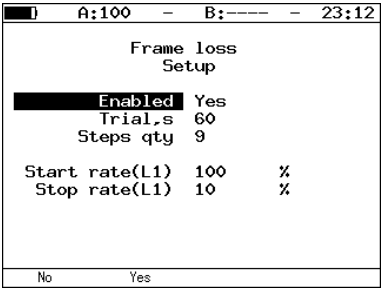


Figure 5.17. Configuring test settings

- **Enabled** — enable/disable frameloss analysis.

- **Trial, s** — time of the trial performing (within 1–2886 s range) for each of the specified frame sizes.
- **Steps qty, %** — number of rate changing steps within 1–10 % range.
- **Start rate (L1)** & **Stop rate (L1)** fields will determine range of physical (L1) rates value (specified in percent (F1), in kbps (F2) or in Mbps (F3)).

5.5.4 Back-to-back test settings

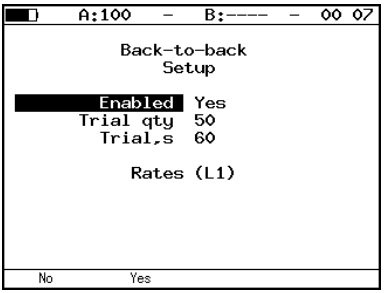


Figure 5.18. Configuring test settings

- **Enabled** — enable/disable back-to-back analysis.
- **Trial qty** — number of test trials performed for each specified frame size.
- **Trial, s** — time of the trial performing (within 2–2886 s range) for each of the specified frame sizes.
- **Rates (L1)** — switched to *Rates (L1)* menu (see fig. 5.16).

5.5.5 Advanced

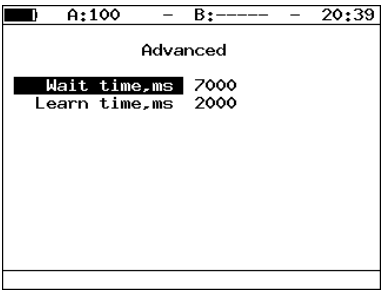


Figure 5.19. Advanced menu

- **Wait time, ms** — period between end of test traffic generation and end of trial.
- **Learn time, ms** — period between learning frame sending and trial start.

In accordance with RFC 2544 methodology the *wait time* is 7000 ms and *learn time* is 2000 ms.

User can specify arbitrary values of *wait time* within 100–7000 ms range. Learn time must be within 100–2000 ms range.

5.6 RFC 2544. Performing analysis

5.6.1 Throughput. Test results

- Table

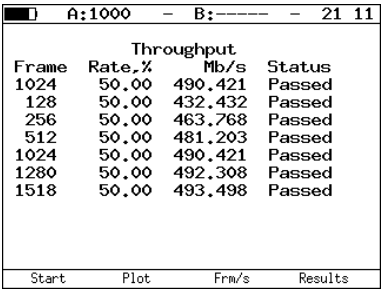


Figure 5.20. Test results

Test results are displayed as a table that contains the following values: frame size (bytes), throughput value (percents), measured value for the throughput (select unit measure by pressing F3: Mb/s or Frm/s).

- Graph

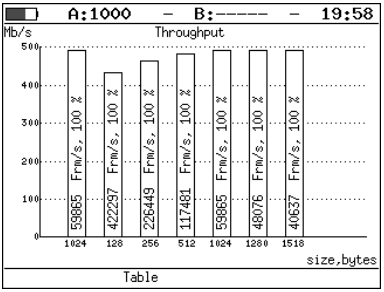


Figure 5.21. Test results

The diagram shows throughput values for each specified frame size.

The measured throughput value in Frm/s and in percentage (relatively to the specified rate) is displayed on the diagram vertical bars.

The results may be displayed in two ways (press F3 button):

1. The maximum value marked on the Y axis is the maximum transmission rate value. The X axis shows frame size value.
   Empty bars display maximum theoretical rate value. Completed bars display measured rate value.
2. The maximum value marked on the Y axis is the maximum measured rate value. The X axis shows frame size value.

5.6.2 Latency. Test results

- Table

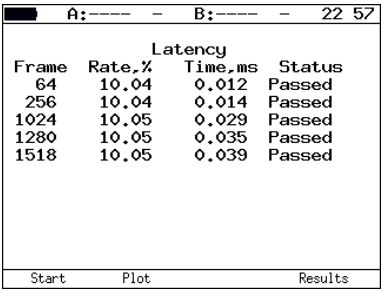


Figure 5.22. Test results

The table shows mean value for the latency (ms) for each of the specified frame sizes, and the corresponding value of the throughput (percent) measured as a result of the Throughput test.

- Graph

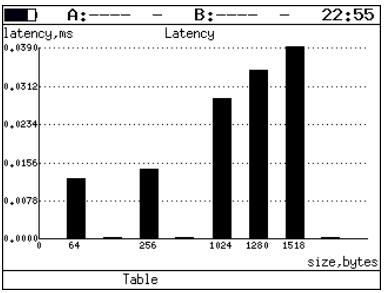


Figure 5.23. Test results

On the diagram, for each of the frame sizes a vertical bar shows the mean value of the latency (ms).

5.6.3 Frame loss. Test results

- Table

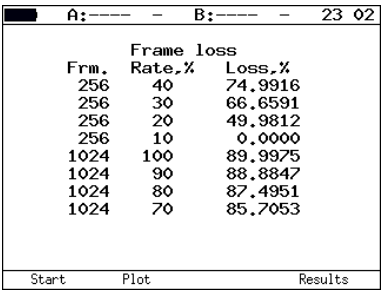


Figure 5.24. Test results

The table shows the frame loss value (percent) for each of the specified frame sizes (in bytes) and the rate value (percent).

- Graph

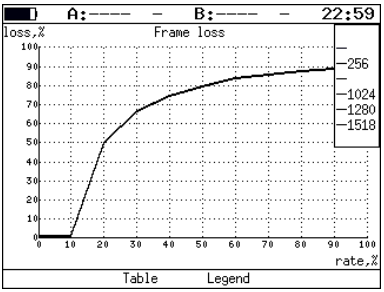


Figure 5.25. Test results

On the diagram, for each of the specified frame sizes the relation between frame loss (percent) and the rate (percent) is shown.

5.6.4 Back-to-back. Test results

- Table

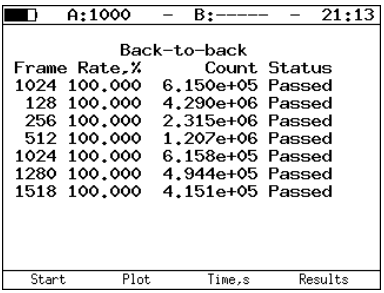


Figure 5.26. Test results

For each of the specified frame sizes, the table shows period of time during which the tested equipment is coping with peak load.

If this time is not detected, the *error messages* are shown in the test stage column and dashes appear in the *Time, s* column.

If you press F3 button (*Frames*), the *Count* column will be shown instead *Time, s* column.

- Graph

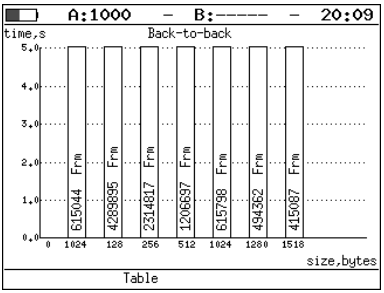


Figure 5.27. Test results: graph

On the diagram, for each of the specified frame sizes a vertical bar shows measured value of the time during which the tested equipment was coping with peak load.

The count of frames that are transmitted during the test is displayed on the diagram vertical bars.

5.7 Asymmetric test

Asymmetric test function [4] is used to check operability of communication link that has different transmitting and receiving rates.

By testing two **Bercut-ET** should be used: local and remote. On the local device the test parameters are set. The remote device is on the other end of asymmetric channel. Test traffic generation can be performed in two ways:

1. *From local device to remote.* In this case the port **A(B)** is set as a source port. Port **Remote** is selected as a destination one.
2. *From remote device to local.* In this case the port **Remote** is set as a source port. Port **A(B)** is selected as a destination one.

Connection scheme is shown on the fig. 5.28.

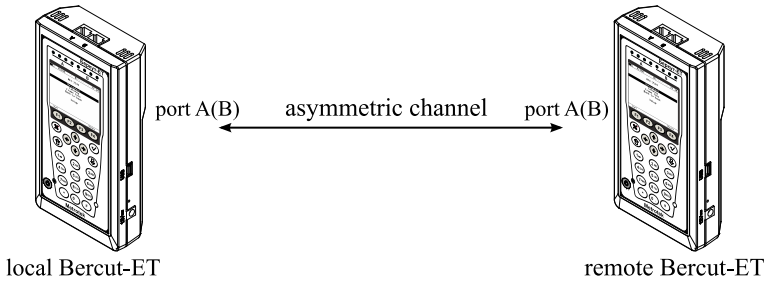


Figure 5.28. Connection scheme

Tests for which the function is available are listed below:

1. RFC 2544: throughput, frame loss, back-to-back.
2. BERT (L2, L3, L4).
3. Complex traffic.

Note: *To transmit data UDP protocol is used. Number of server UDP port is 0×9000.*

[4]The option is not included in the basic configuration; should be purchased additionally.

5.8 Complex traffic

Function of complex traffic generation[5] allows to generate up to 10 data streams with different settings. Using this function you can emulate various types of rates, check priority accuracy in the tested equipment.

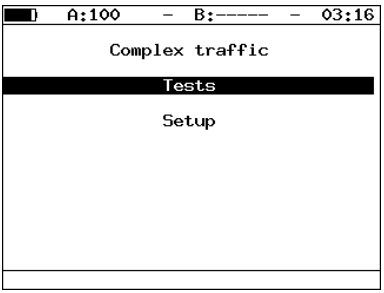


Figure 5.29. Complex traffic menu

- **Tests** — switch to the *Complex traffic: summary* menu (test starting, results displaying).

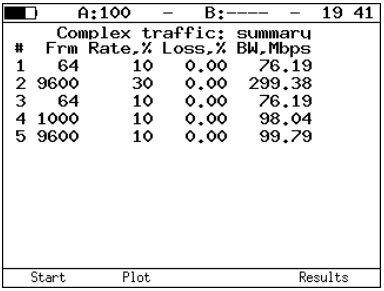


Figure 5.30. Complex traffic: summary menu

To start testing press F1 button (Start). Test settings should be set up preliminarily in *Setup* menu.
After the end of testing the following parameters will be displayed:

- specified frame size;
- specified rate;
- frame loss;
- bandwidth.

[5]The option is not included into the basic configuration; should be purchased additionally.

To switch to the screen that contains graphical representation of test results press F2 button (Plot).

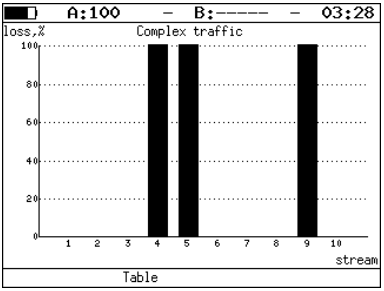


Figure 5.31. Complex traffic. Plot

On the diagram, for each stream a vertical bar shows measured loss value.
To switch to the *Results* menu press F4 button (Results) (see section 5.19).

To switch to the screen *Complex traffic: latency* press → button.

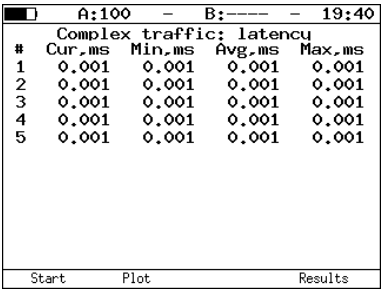


Figure 5.32. Complex traffic: latency screen

- **Cur** — current value of latency;
- **Min** — minimal value of latency;
- **Avg** — average value of latency;
- **Max** — maximal value of latency.

To switch to the screen that contains information about number of transmitted and received frames press → button.

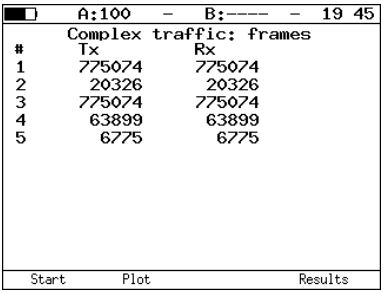


Figure 5.33. Complex traffic: frames screen

For each of the streams information about number of transmitted (Tx) and received (Rx) frames is displayed on the screen.

- **Setup** — switch to the *Setup* menu.

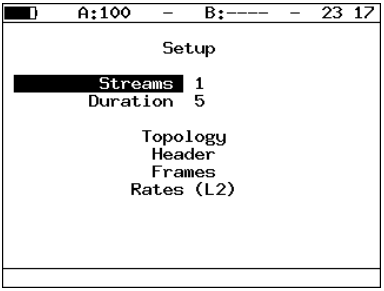


Figure 5.34. Setup menu

  - **Streams** — number of data streams (*1–10*).
  - **Duration** — time of data streams generation (*1–2886 s*).
  - **Topology** — switch to the *Topology* menu.

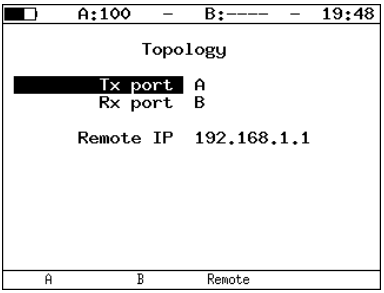


Figure 5.35. Topology menu

Use the *Topology* menu to specify receiving and transmitting ports. The same port can be used for both data transmission and receiving (for example, with the Loopback feature). If you use asymmetric test function you must select **Remote** as receiving/transmitting port (see section 5.7).

– **Header** — switch to the *Header* menu.

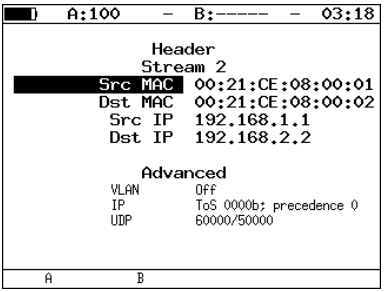


Figure 5.36. Header menu

To select stream number press ← or → buttons. Settings correspond to one described in the subsection 5.4.1 and 5.4.2.

– **Frames** — switch to the *Frames* menu.

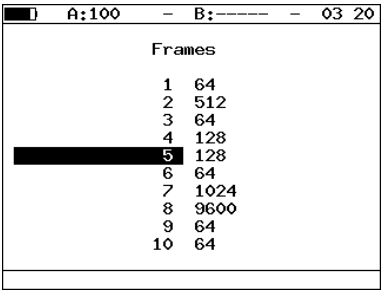


Figure 5.37. Frames menu

Frame size for every stream defines within 64–9600 bytes range.

– **Rates (L2)** — switch to the *Rates (L2)* menu.

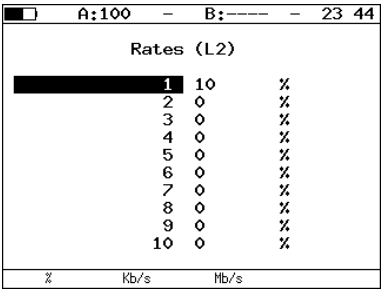


Figure 5.38. Rates (L2) menu

Framed rate value specified in percent (F1), in kbps (F2) or in Mbps (F3).

5.8.1 Complex traffic. MPLS settings

Label stack for networks testing can be specified in the *Label stack* menu: *Tests* ⇒ *Complex traffic* ⇒ *Setup* ⇒ *Header* ⇒ *Advanced* ⇒ *MPLS*.

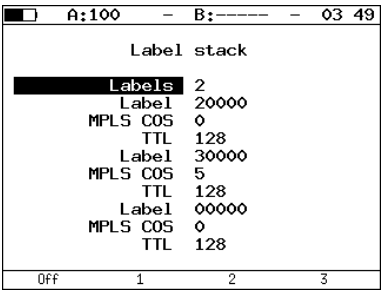


Figure 5.39. Label stack menu

- **Labels** — number of labels (1–3).
- **Label** — label value.
- **MPLS COS** — class of service for datagram.
- **TTL** — time to live for datagram.

5.9 Loopback

The Loopback function is necessary for networks testing in compliance with the RFC 2544, as well as for a number of other tasks. This function allows to test the network without changing it's settings. Network testing with the Loopback function can be performed at the following OSI layers:

- at the **Physical layer (L1)** all the incoming traffic is being retransmitted backward without changing; statistics is gathered for the incoming traffic;
- at the **Data link layer (L2)**, all the incoming frames are being retransmitted backward with swapping destination and source MAC addresses or without swapping MAC addresses. **Bercut-ET** supports substitution of destination and/or source MAC address with user-defined MAC address. Both incoming and outgoing traffic statistics are gathered.

Note: *for the loopback at the L2 or L3 layers, packets with identical destination and source MAC addresses as well as OAM protocol data units (OAMPDU) and ARP-requests, are not being retransmitted.*

- At the **Network layer (L3)** all incoming packets are being retransmitted backward with source and destination IP addresses swapping. **Bercut-ET** supports substitution of destination and/or source IP address with user-defined IP address. Both incoming and outgoing traffic statistics are being gathered.

Note: *if the incoming packet contains the label, it will be retransmitted without changing it's value.*

- At the **Transport layer (L4)** all incoming packets are being retransmitted backward (without error packets) with source and destination IP addresses and source and destination TCP/UDP port numbers swapping.

Note: *if the incoming packet contains the label, it will be retransmitted without changing it's value.*

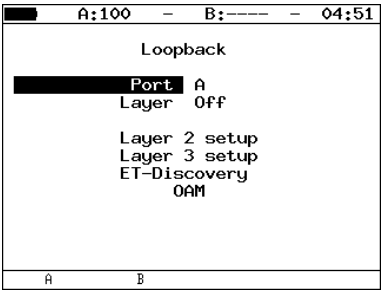


Figure 5.40. Loopback menu

- **Port** — select port (A or B) to enable the Loopback function.
- **Type** — select the layer at which the traffic will be retransmitted:
  - 1 — Physical Layer;
  - 2 — Data Link Layer (MAC);
  - 3 — Network Layer (IP);
  - 4 — Transport (TCP/UDP).
- **OAM** — switch to *OAM* menu.

5.9.1 Configuring L2 Loopback

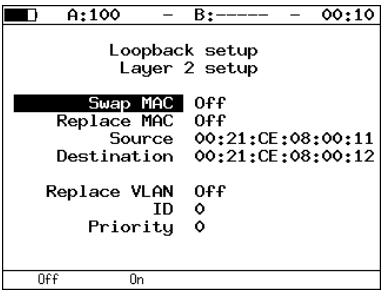


Figure 5.41. Layer 2 parameters

- **Swap MAC** — enable/disable swapping of destination and source MAC addresses in incoming packets.
- **Replace MAC** — select MAC address substitution mode:
  - **Off** — MAC address substitution is disabled;
  - **Source** — substitute *Source MAC Address* value, see fig. 5.43;

  - **Destination** — substitute *Destination MAC Address* value, see fig. 5.42;
  - **Src+Dst** — substitute both *Source MAC Address* and *Destination MAC Address* values, see fig. 5.44.

- **Source** — specify MAC address that will substitute *Source MAC Address* of an Ethernet frame.
- **Destination** — specify MAC address that will substitute *Destination MAC Address* of an Ethernet frame.

- **Replace VLAN** — select VLAN-tags swapping mode:

  - **Off** — VLAN-tags swapping is disabled;
  - **ID** — swap *VLAN ID* values;
  - **Priority** — swap *VLAN priority* values;
  - **ID+Pr** — swap both *VLAN ID* and *VLAN priority* values.

- **ID** — specify the value that will substitute *VLAN ID* of an Ethernet frame.
- **Priority** — specify the value that will substitute *VLAN priority* of an Ethernet frame.

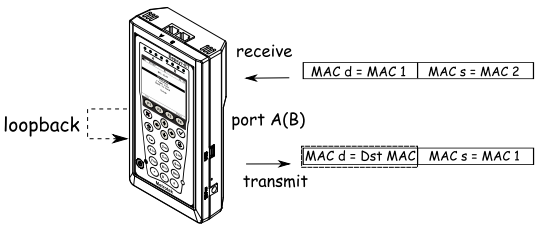


Figure 5.42. *Dst* swapping mode

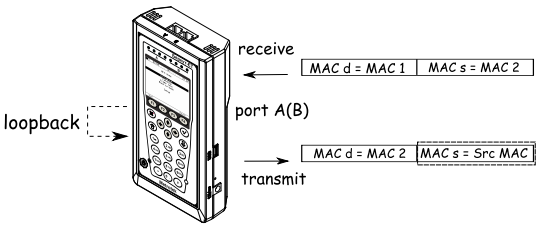


Figure 5.43. *Src* swapping mode

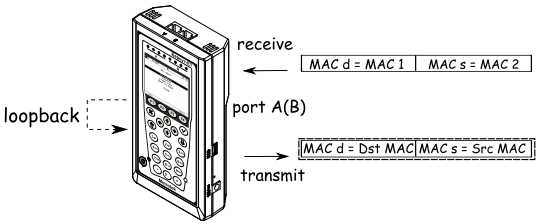


Figure 5.44. *Src+Dst* swapping mode

5.9.2 Configuring L3 Loopback

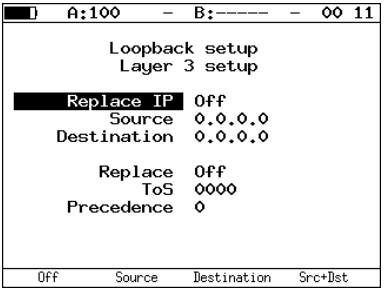


Figure 5.45. Layer 3 parameters

- **Replace IP** — select the mode of IP addresses swapping:
  - **Off** — IP address swapping is disabled;
  - **Source** — swap *Source IP address*, see fig. 5.46;
  - **Destination** — swap *Destination IP address*, see fig. 5.47;
  - **Src+Dst** — swap both *Source IP address* and *Destination IP address*, see fig. 5.48.
- **Source** — specify IP address that will substitute *Source IP Address* of an Ethernet frame.
- **Destination** — specify IP address that will substitute *Destination IP Address* of an Ethernet frame.
- **Replace** — select the mode of *ToS* swapping:
  - **Off** — swapping of *Type of Service* and *Precedence* values is disabled;
  - **ToS** — swap *Type of Service* values;
  - **Precedence** — swap *Precedence* values;

– **ToS+Prec** — swap both *Type of Service* and *Precedence* values.

- **ToS** — specify the value that will substitute *Type of Service* of an Ethernet frame.
- **Precedence** — specify the value that will substitute *Precedence* of an Ethernet frame.

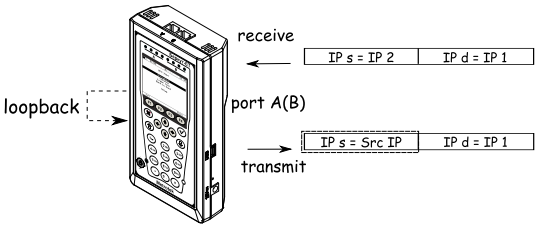


Figure 5.46. *Src* swapping mode

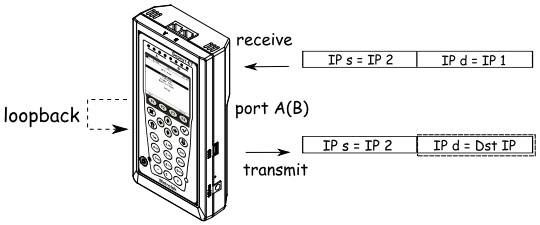


Figure 5.47. *Dst* swapping mode

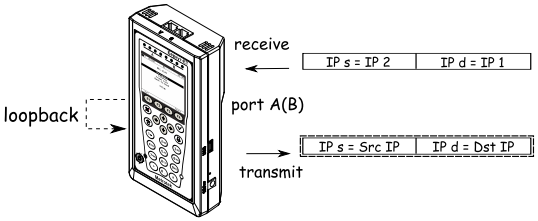


Figure 5.48. *Src+Dst* swapping mode

5.10 OAM

An important task is to provide high quality of administrating and maintenance for Ethernet-networks. To regulate these tasks the IEEE 802.3ah[8] standard (also known as *Ethernet in the First Mile (EFM) OAM*) has been worked out.

OAM (Operations, Administration, and Maintenance) is a protocol of monitoring the link state. The protocol operates at the Data Link Layer of OSI model. To transmit data between two Ethernet-devices, OAM protocol data units (OAMPDU) are used.

An important feature of the OAM protocol is providing the ability to use Loopback mode for the remote end. Both devices should support the IEEE 802.3ah standard.

To establish connection between **Bercut-ET** and remote device via OAM protocol and to switch on Loopback mode it is necessary to execute the following actions.

- Connect **Bercut-ET** and remote device directly in accordance with fig. 5.49 given below.

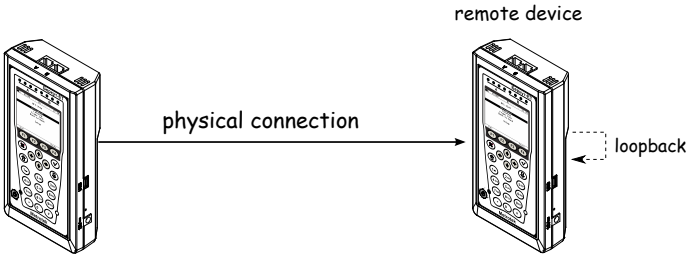


Figure 5.49. OAM testing scheme

On the remote device:

- Enable OAM protocol function in active or passive mode.

On the local device:

- Switch to the *OAM* menu (see fig. 5.50).
- In the menu item *Port* select port the remote device is connected to.
- In the menu item *Mode* select active operating mode of OAM protocol.
- The discovery state of the remote device must be *Send any*.
- Switch to the *Remote device* menu. Information about remote device will be displayed on the screen.

- Press F1 button (*LB up*). Loopback mode (**L2**) is switched on on the remote device (all the incoming traffic is being retransmitted backward without changing MAC-addresses).

Press F1 (*LB down*) button to switch Loopback mode off.

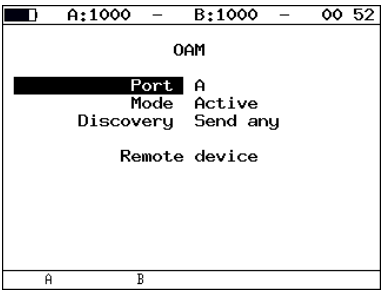


Figure 5.50. OAM menu

- **Port** — select a port for OAM configuring.
- **Mode** — available OAM states.
  - **Active** — active mode. In active mode, the selected port can send commands to locate remote device, to enable the Loopback mode on the remote device, and to response Ethernet OAM commands from the remote device.
  - **Passive** — passive mode. In passive mode, the port can only response to the Ethernet OAM commands from the remote device, but cannot initiate the Loopback mode.
  - **Off** — OAM disabled.
- **Discovery** — state of locating the remote device. Available states:
  - *Fault* — initial state, connection with remote device is not established;
  - *Send local* — transmission of OAMPDU with information about supported operating modes;
  - *Passive wait* — waiting for OAMPDU with information about supported operating modes from remote device that is configured in active mode;
  - *Send loc/rem* — transmission of OAMPDU with information about supported operating mode of local and remote devices (with label that means connection establishing possibility);
  - *Send loc/rem ok* — receiving OAMPDU with information that operating modes of local and remote devices are compatible;

– *Send any* — connection with remote device is established.

The connection can be established if the field *Discovery* state is *Send any*[6].

- **Remote device** — switch to the *Remote device* screen.

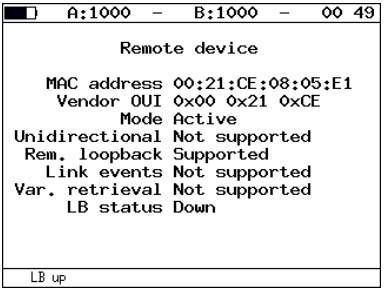


Figure 5.51. Remote device screen

- **MAC address** — MAC-address of a remote device.
- **Vendor OUI** — organization unique identifier, that is used to generate the MAC-address.
- **Mode** — OAM state of the remote device.
- **Unidirectional** — unidirectional connection support.
- **Rem. loopback** — support of the Loopback mode for the remote device.
- **Link events** — connection errors notification support.
- **Var. retrieval** — support of reading variables that are used for estimation of data link quality.
- **LB status** — Loopback mode state at the remote device.

[6]Successful connection will be established only if the remote device supports *Remote loopback* function.

5.11 ET discovery

ET discovery function allows to switch loopback mode on at the data link, network or transport layer on remote device **Bercut-ET** or **Bercut-ETL**.

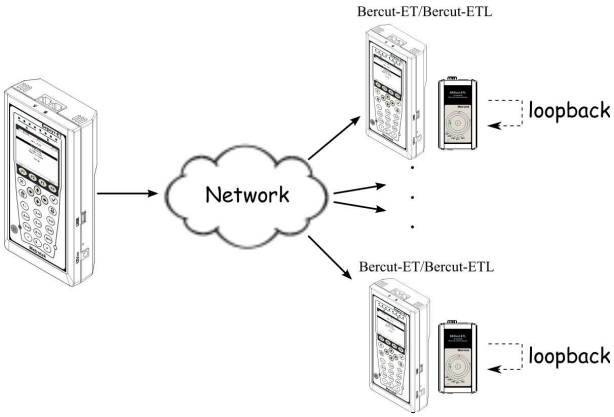


Figure 5.52. Connection diagram

In accordance with connection diagram it is possible to switch loopback mode on for several devices **Bercut-ET** and/or **Bercut-ETL** in series. The devices may be in the same or in the different subnets.

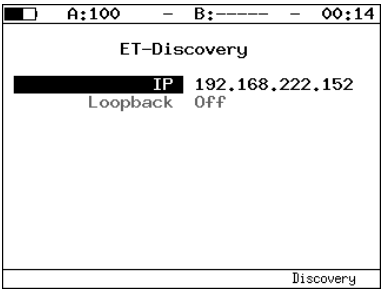


Figure 5.53. ET discovery menu

To receive data about remote device and to switch loopback on:

- connect the device to a network;
- in *IP* field enter IP address of remote device;
- press F4 (*Discovery*) button.

If discovery is successfully completed, IP address, host name and MAC address will be represented on the screen. *Loopback* menu item will become accessible for editing.

Buttons for loopback level selection are described below:

- F1 — switch off loopback mode;
- F2 — switch on loopback at the data link layer;
- F3 — switch on loopback at the network layer;
- F4 — switch on loopback at the transport layer.

Note: *To transmit data UDP protocol is used. Number of server UDP port is 0×8018. Number of client UDP port is 0×8019.*

5.12 Testing TCP/IP

All the tests described in the current section are required for testing through routable networks. Using these tests, you can detect network configuration problems, check server availability, check operability and estimate load of data link.

5.12.1 Ping

Ping test[7] allows to check availability of specified address inside or outside of a subnet. Ping utility sends requests to the specified network host and registers incoming responses. This procedure is based on the IP and ICMP protocols of datagram transmission, and allows to check operability and measure load level of data links and intermediate devices.

To perform the test it is necessary to execute the following actions:

1. Connect **Bercut-ET** to network using one port in accordance with connection diagram given below.

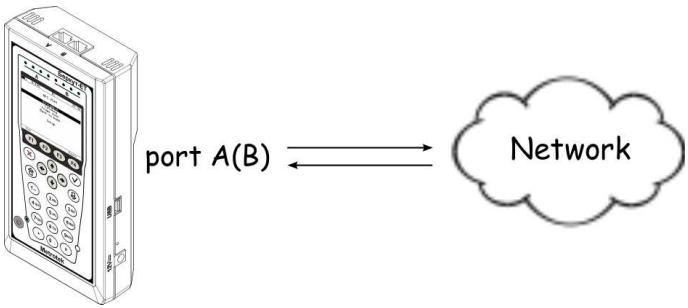


Figure 5.54. Connection diagram 1

Note: *you can connect* ***Bercut-ET*** *to network using two ports (see fig. 5.55). In this case settings are the same as for the one port connection.*

[7]The option is not included in the basic configuration; should be purchased additionally.

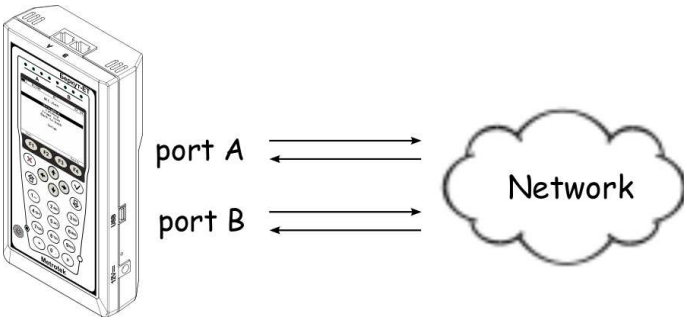


Figure 5.55. Connection diagram 2

2. Switch to the *Ping* menu (see fig. 5.56). Press F4 button (*Setup*).

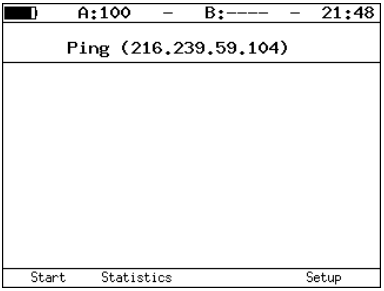


Figure 5.56. Ping menu

Functional buttons:

- F1 (*Start*) — test start;
- F2 (*Statistics*) — switch to the *Ping statistic* screen;
- F4 (*Setup*) — switch to the *Ping settings* menu.

3. Set test parameters in the *Ping settings* menu.

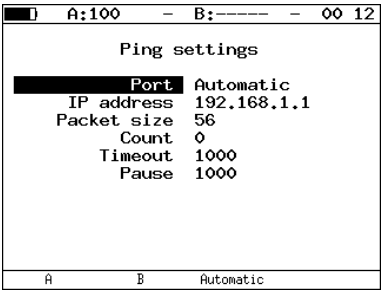


Figure 5.57. Ping settings

- **Port** — allows to select a port to send requests from (A/B/Automatic). If the device is connected to the network and *Automatic* is set, the port for data transmission will be selected automatically.
  - if port A and port B are in the same network (network parts of IP addresses are equal) ping will be sent from port A.
  - if port A and port B are in the different networks ping will be sent from the port that is located in the same network as DUT.
  - if port A, port B and DUT are in the different networks ping will be sent from port that is located in the same network as gateway [8].
- **IP address** — IP address of a network host to be tested for availability.
- **Packet size** — size of payload in transmitted frame, in bytes.
- **Count** — number of packets to be send (0–9999). If the null value is selected, the ping test will be performed until F1 button (*Stop*) is pressed.
- **Timeout** — period of time to wait for response to a ping request (ms).
- **Pause** — pause between two successive requests (ms).

4. Press F1 button (*Start*) to start the test. The following information will be displayed on the screen:
   - size of ICMP packet;
   - IP address of a network host that has responded to the request;
   - packet number;
   - time between request sending and response receiving.

[8] Gateway IP address is set in the *Network setup* menu

Test result example is shown on the fig. 5.58.

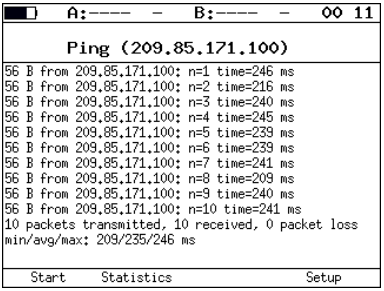


Figure 5.58. Ping results

Ping statistics (see fig. 5.59) show information about the following parameters:

- minimum, maximum, and average time between request sending and response receiving;
- number of packets sent, received, lost, and repeated (with the same sequential number);
- number of packets a waiting time for which has been exceeded (*timeout*).

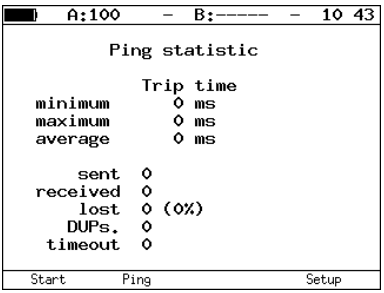


Figure 5.59. Ping test statistics

5.12.2 Traceroute

Traceroute utility[9] is used to determine data transmission routes in TCP/IP networks. The utility sends sequence of datagrams to a specified

[9]The option is not included in the basic configuration; should be purchased additionally.

network host, and registers data about all intermediate routers that sent datagrams passed through during transmission. Thus, Traceroute utility allows the diagnostics of all intermediate network equipment on a data transmission path.

To perform the test it is necessary to execute the following actions:

1. Connect **Bercut-ET** to network using one port in accordance with connection diagram (see fig. 5.54).
2. Switch to the *Traceroute* menu (see fig. 5.60). Press F4 button (*Setup*).

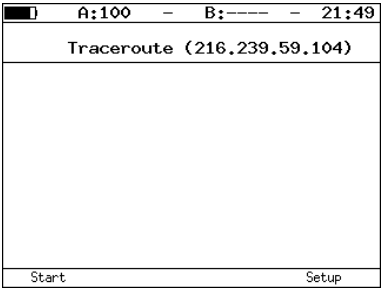


Figure 5.60. Traceroute menu

Functional buttons:

- F1 (*Start*) — test start;
- F4 (*Setup*) — switch to the *Ping settings* menu.

3. Set test parameters in the *Traceroute settings* menu.

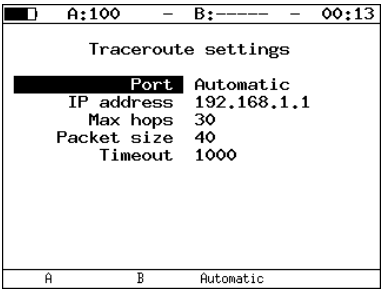


Figure 5.61. Traceroute settings

- **Port** — allows to select a port to send requests from (A/B/Automatic). If the device is connected to the network and *Automatic* is set, the port for data transmission will be selected automatically.

  - if port A and port B are in the same network (network parts of IP address are equal) ping will be sent from port A.
  - if port A and port B are in the different networks ping will be sent from the port that is located in the same network as DUT.
  - if port A, port B and DUT are in the different networks ping will be sent from port that is located in the same network as gateway [10].
- **IP address** — IP address of the host.
- **Max hops** — maximum number of routers that packets can be transmitted through.
- **Packet size** — size of payload in transmitted frame, in bytes.
- **Timeout** — period of time between two successive requests (if there was no response for the first request).

4. Press F1 button (*Start*) to start the test. The following information will be displayed on the screen:

   - hop number;
   - IP address of the transitional host;
   - response waiting time.

   If response waiting time is more than timeout "∗" will be displayed in the test results row.
   Test result example is shown on the fig. 5.62.

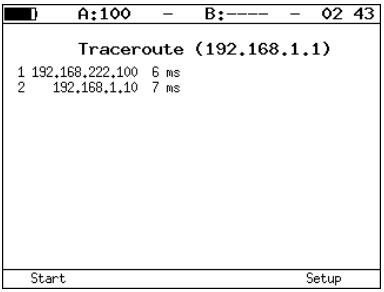


Figure 5.62. Traceroute test results

5.12.3 DNS (DNS lookup)

DNS (Domain Name System) — distributed database that is able to determine an IP address of a network host upon a request with the host domain

[10] Gateway IP address is set in the *Network setup* menu

name. DNS lookup feature[11] allows to detect errors in NS-servers operation.

To perform the test it is necessary to execute the following actions:

1. Connect **Bercut-ET** to network using one port in accordance with connection diagram (see fig. 5.54).
2. Switch to the *DNS lookup* menu (see fig. 5.63).
3. Enter domain name in the menu item *Host*.
4. Press F1 button (*Start*). In the menu item *IP* IP address of the host will be displayed.
   If requested IP address cannot be retrieved, all bits in IP address will be set to null.
   Test result example is shown on the fig. 5.63.

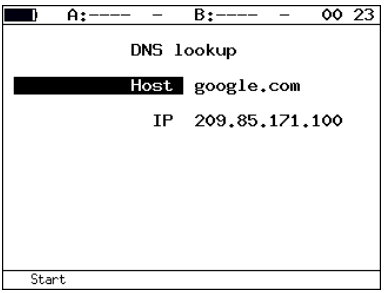


Figure 5.63. DNS menu

- **Host** — name of host, IP address of which should be determined.
- **IP** — IP address of the host, named above, determined during the test.

5.12.4 ARP monitor

ARP monitor utility allows to observe ARP replies that are transmitted in the network and to get the IP and MAC addresses they contain. This data form the table (see fig. 5.65).

To perform the test it is necessary to execute the following actions:

1. Connect **Bercut-ET** to network in accordance with connection diagram (see fig. 5.54 and 5.55).
2. Switch to the *ARP monitor* menu (see fig. 5.64).

[11] The option is not included in the basic configuration; should be purchased additionally.

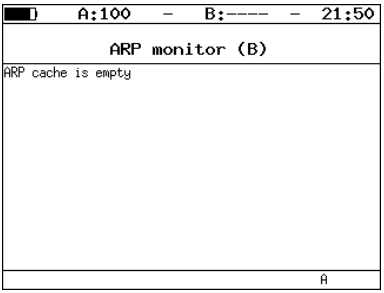


Figure 5.64. ARP monitor menu

Functional buttons:

- F1 (*Stop*) — test stop;
- F4 (*A/B*) — switch to the ARP table for the port B(A).

3. Press F4 button to select port.
4. After a short while inscription "ARP cache is empty" will be disappear from the screen. IP and MAC addresses of network hosts will be displayed on the screen (see fig. 5.65).

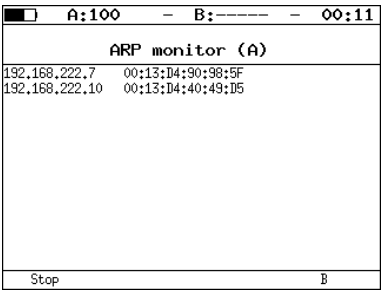


Figure 5.65. ARP monitor screen

If any of entries presented in the table is not updated within one minute, it will be deleted from the table.

5. Press F1 (Stop) button to stop the test.

5.12.5 TCP-client

TCP-client is a utility to establish connection with remote network node, to receive data from it and to transmit data to it. TCP-client option[12] allows

[12]The option is not included in the basic configuration; should be purchased additionally.

to manage the remote node via TELNET protocol.

To perform the test it is necessary to execute the following actions:

1. Connect **Bercut-ET** to network in accordance with connection diagram (see fig. 5.54).
2. Set connection parameters (*TCP-client* ⇒ *Setup* (F4)):
   - enter domain name or IP address of a node;
   - enter port number (see Table 5.4).

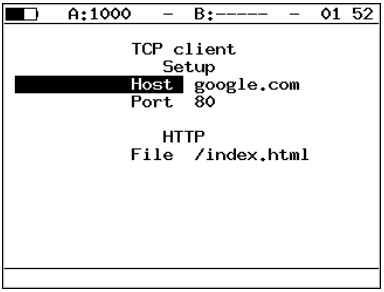


Figure 5.66. TCP-client setup

   - **Host** — domain name or IP address of a host.
   - **Port** — receiver's port number.
   - **File** — name of a file with content that will be displayed in the results window if the request is successful.
3. Open TCP connection (press F1 (*Open*)).

If TCP connection is successfully established, you can enter remote control commands and request web pages from server.

If there are problems with TCP connection establishing, the error message will be displayed. Some possible messages:

- protocol not supported;
- can't assign requested address;
- network is down;
- network is unreachable;
- network dropped connection on reset;
- software caused connection abort;
- connection reset by peer;
- connection timed out;
- connection refused;
- host is down;

- no route to host.

Port numbers of TCP/IP protocol are displayed in Table 5.4.

Table 5.4. Port numbers of TCP/IP protocol

Port number	**Protocol**
21	FTP
22	SSH
23	TELNET
25	SMTP
80	HTTP (WWW)
161	SNMP

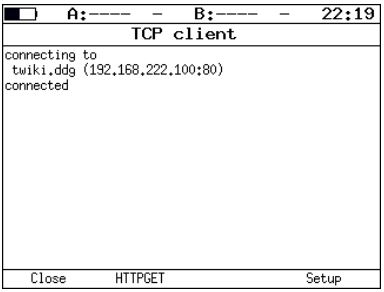


Figure 5.67. Example of successful connection

TCP-client option also allows to check whether tested server responds to HTTP-requests [13]. Content of the specified resource can be retrieved using HTTPGET method.

To retrieve this information you need:

1. Enter the file name in *File* field (see fig. 5.66).
2. Establish connection between **Bercut-ET** and host.
3. Press F2 button (*HTTPGET*). Test result example is shown on the fig. 5.68.

[13]The option is not included in the basic configuration; should be purchased additionally.

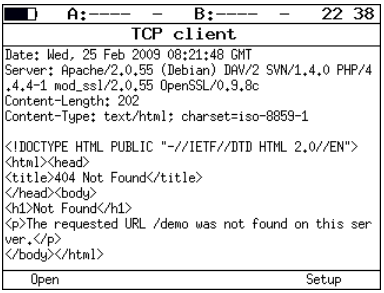


Figure 5.68. Response example

5.13 Pass through

In the Pass through mode, the tester joins between two tested devices. All the traffic incoming to port A(B) is retransmitted to the port B(A). See the connection example at the figure fig. 5.69.

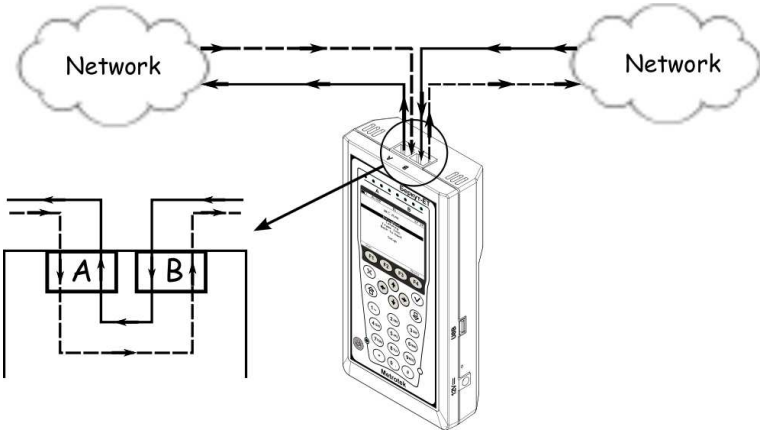


Figure 5.69. Example of Transit mode connection

During traffic retransmission from one port to another, the tester gathers statistics on transmitted traffic. Statistics results are shown in the *Statistics* menu.

When counting statistics data, error packets are not taken into consideration.

If transmission rates for port A and port B are different, data loss is possible. Data loss occurs if transmission is carried out from port with greater rate to the one with lesser one.

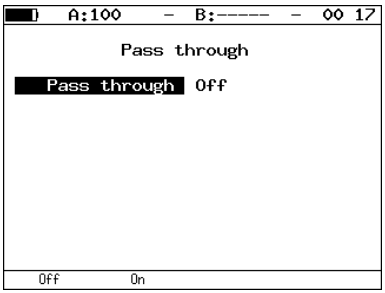


Figure 5.70. Transit menu

5.14 Cable diagnostics

Bercut-ET allows to perform diagnostics of twisted-pair cable by basic operating characteristic measuring and by analyzing its state and type.

To perform the test it is necessary to execute the following actions.

1. Switch to the *Cable test* screen (see fig. 5.71)
2. Connect cable to **Bercut-ET** using RJ-45 connector [14].
3. By pressing F2 (A) and F3 (B) buttons select port the cable is connected to.
4. Press F1 (Start) button.

To determine cable type it is necessary to execute the following actions.

1. Switch to the *Cable test* screen.
2. One end of the cable connect to the port A(B) of **Bercut-ET**, another one — to the port B(A).
3. By pressing F2 (A) and F3 (B) buttons select port one end of the cable is connected to.
4. Compare testing results displayed in the menu item *Crossover* for port A and port B with values that presented in the table 5.5.

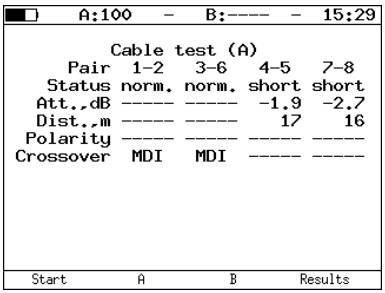


Figure 5.71. Cable test screen

- **Status** — current state of the cable.
  Possible states:
  - test — test is running;
  - norm. — normal state;
  - open — lack of continuity between the pins at each end of the twisted-pair cable;

[14] The measurements are only possible with connection to tested cable via RJ-45 connector. SFP-modules cannot be used for these tests.

  - short — two or more conductors are short-circuited together;
  - fail — test failed.

- **Att., dB** — signal attenuation value.
- **Dist., m** — distance to the defect.
- **Polarity** — polarity of twisted pairs.
  Possible states:

  - <+> — positive polarity (normal state);
  - <—> — negative polarity (two conductors in a twisted-pair are connected with reverse polarity).

- **Crossover** — cross-connection of twisted-pairs (MDI/MDI-X); these values allow to define the cable type.

In the table 5.5 speed (Mbit/s) for the port A and port B can be specified in the *Interface setup* menu.

Table 5.5. Cable type analyzing

Speed, Mbit/s	**Pair**	**Value in menu item *Crossover* for the port A**	**Value in menu item *Crossover* for the port B**	**Cable type**
10/100	1-2 3-6 4-5 7-8	MDI MDI — —	MDI MDI — —	crossover
	1-2 3-6 4-5 7-8	MDI-X MDI-X — —	MDI-X MDI-X — —	crossover
	1-2 3-6 4-5 7-8	MDI-X MDI-X — —	MDI MDI — —	straight-through
	1-2 3-6 4-5 7-8	MDI MDI — —	MDI-X MDI-X — —	straight-through

Table 5.5. Cable type analyzing *(*continued)

1000	1-2 3-6 4-5 7-8	MDI MDI MDI MDI	MDI MDI MDI MDI	crossover
	1-2 3-6 4-5 7-8	MDI-X MDI-X MDI-X MDI-X	MDI-X MDI-X MDI-X MDI-X	crossover
	1-2 3-6 4-5 7-8	MDI-X MDI-X MDI-X MDI-X	MDI MDI MDI MDI	straight- through
	1-2 3-6 4-5 7-8	MDI MDI MDI MDI	MDI-X MDI-X MDI-X MDI-X	straight- through

5.15 BERT

BERT (Bit Error Rate Test) — this test allows to measure *bit error rate*, the ratio of error bits to the total number of bits transmitted. To perform the test, a specific binary pattern (known both to the source and destination) is encapsulated into an Ethernet frame which is to be transmitted.

At the destination, the sent pattern is compared to the source one and then the bit error rate is counted. To connect to the TDM-network, the interface converter is used to convert packet network (Ethernet) traffic into the TDM-traffic format.

Testing can be performed at four layers of the OSI model.

- At the **Physical layer** test data is send piecemeal with specified inter-frame gap (IFG). In this case the test is performed from the port A(B) to the port B(A) (see fig. 5.83) or using the Loopback function (see fig. 5.84).

Figure 5.72. Physical layer frame

- At the **Data Link layer**, all data is encapsulated into an Ethernet frame thus allowing to transmit test packets through a network with the OSI's second-layer equipment (for example, network switch). Possible connection schemes are shown on fig. 5.85, 5.86, and 5.87.

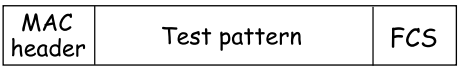


Figure 5.73. Data link layer frame

- At the **Network layer**, all data is encapsulated into IP packet, and then — into Ethernet-frame thus allowing to transmit test packets through a network with both OSI's second- and third-layer equipment (for example, network switch, network router). Possible connection schemes are shown on fig. 5.85, 5.86, and 5.87.

Figure 5.74. Network layer frame

- At the **Transport layer**, test data is encapsulated into an UDP header, then — into IP header and an Ethernet frame thus allowing to transmit test pattern using transport protocols. Possible connection schemes are shown on fig. 5.85, 5.86, and 5.87.

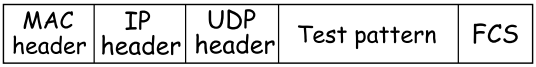


Figure 5.75. Transport layer frame

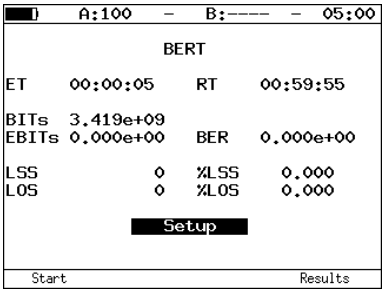


Figure 5.76. BERT screen

- **ET** — time elapsed since the test started.
- **RT** — time remained till test finish.
- **BITs** — number of received bits.
- **EBITs** — number of bits with errors.
- **BER** — ratio of the EBITs value to the BITs value.
- **LSS** — duration of the synchronization loss.
- **%LSS** — ratio of LSS duration to the elapsed time (ET), percentage.
- **LOS** — duration of signal loss.
- **%LOS** — ratio of LOS duration to the elapsed time (ET), percentage.
- **Setup** — switch to the *BERT Setup* menu.

To switch to the *Results* menu press F4 button (*Results*). For more details see section 5.19.

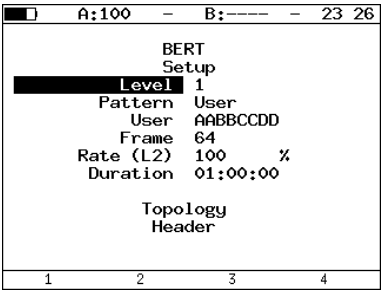


Figure 5.77. BERT setup menu

- **Level** — select OSI model layer to perform test at:
  - **1** — Physical layer;
  - **2** — Data Link layer;
  - **3** — Network layer;
  - **4** — Transport layer.
- **Pattern** — select standard or user-defined test pattern.
- **User** — specify user-defined pattern.
- **Frame** — specify frame size.
- **Rate (L2)** — framed rate value specified in percent (F1), in kbps (F2) or in Mbps (F3).
- **Test duration** — specify test duration.
- **Tests topology** — switch to *Topology* menu.

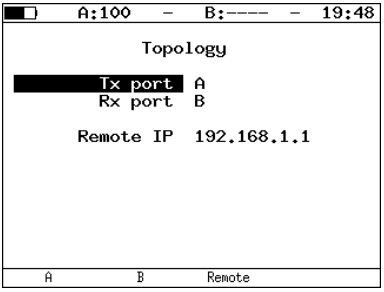


Figure 5.78. Topology menu

Use the *Topology* menu to specify receiving and transmitting ports. The same port can be used for both data transmission and receiving (for example, with the Loopback feature). If you use asymmetric test function you must select **Remote** as receiving/transmitting port (see

section 5.7).

- **Header** — switch to *Header* menu.

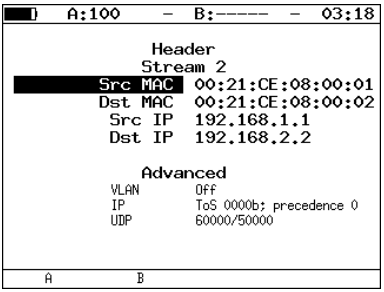


Figure 5.79. Header menu

Settings correspond to one described in the subsection 5.4.1 and 5.4.2.

All test patterns used for measurements are in compliance with ITU-T O.150 [7] standard.

Table 5.6. Test patterns

Pattern type	**Usage (recommended)**
2e9-1	Error measurements on data circuits at bit rates up to 14 400 bit/s.
2e11-1	Error and jitter measurements at bit rates of 64 kbit/s and 64×N kbit/s, where N is an integer number.
2e15-1	Error and jitter measurements at bit rates of 1544, 2048, 6312, 8448, 32 064 and 44 736 kbit/s).
2e20-1	Error measurements on data circuits at bit rates up to 72 kbit/s.
2e23-1	Error and jitter measurements at bit rates of 34 368 and 139 264 kbit/s.
2e29-1	Errors detection (for higher-speed data links (transmission rate is over 139 264 kbit/s)).
2e31-1	

5.15.1 BERT. MPLS settings

Label stack for networks testing and reception rules can be specified in the *MPLS* menu: *Tests* ⇒ *BERT* ⇒ *Setup* ⇒ *Header* ⇒ *Advanced* ⇒ *MPLS*.

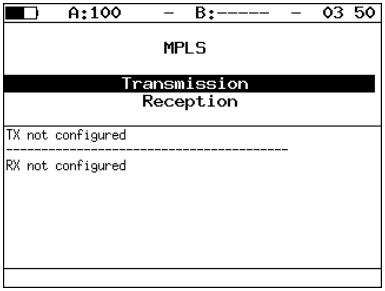


Figure 5.80. MPLS menu

- **Transmission** — switch to the *Label stack* menu.
- **Reception** — switch to the *Reception rules* menu.

Values specified in the *Label stack* and *Reception rules* menu are also displayed on the screen.

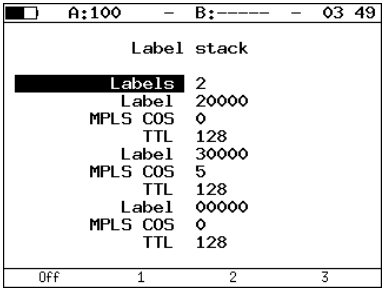


Figure 5.81. Label stack menu

- **Labels** — number of labels (1–3).
- **Label** — label value.
- **MPLS COS** — class of service for datagram.
- **TTL** — time to live for datagram.

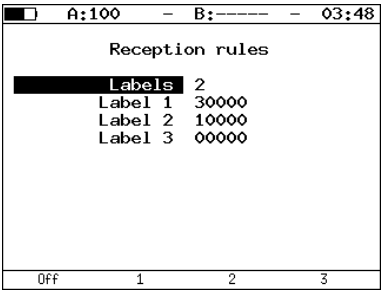


Figure 5.82. Reception rules menu

- **Labels** — number of labels (1–3).
- **Label 1, Label 2, Label 3** — label value.

5.15.2 Connection schemes

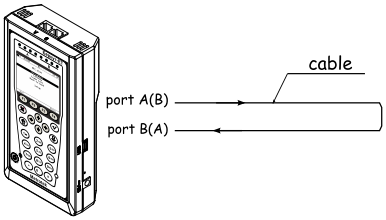


Figure 5.83. Physical layer testing (scheme 1)

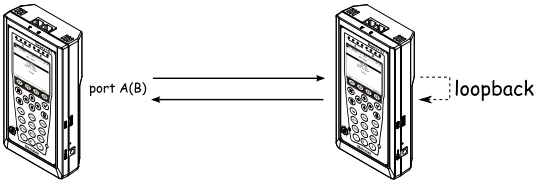


Figure 5.84. Physical layer testing (scheme 2)

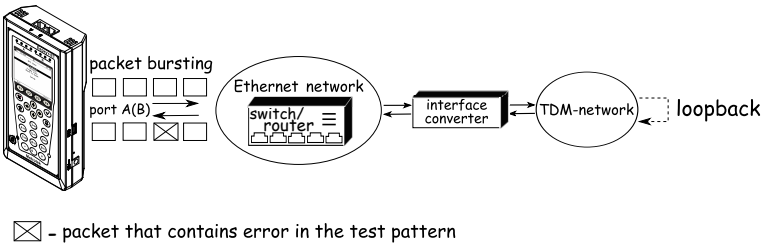


Figure 5.85. Data link/Network layer testing (scheme 1)

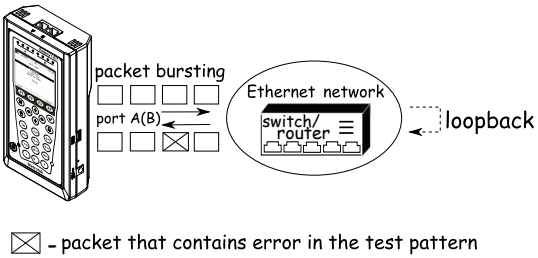


Figure 5.86. Data link/Network layer testing (scheme 2)

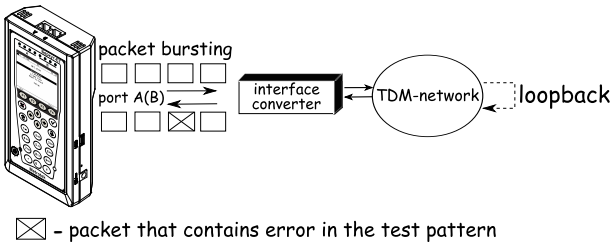


Figure 5.87. Data link/Network layer testing (scheme 3)

5.16 Packet jitter

Another important task for Ethernet-network testing is the packet jitter measurements. According to the RFC 4689 methodology [6], the packet jitter is the absolute value of the difference between the forwarding delay of two consecutive received packets belonging to the same stream. This parameter is used to estimate transmission capability of latency-sensitive traffic such as video and speech data.

Packet jitter measurement is an optional[15] feature.

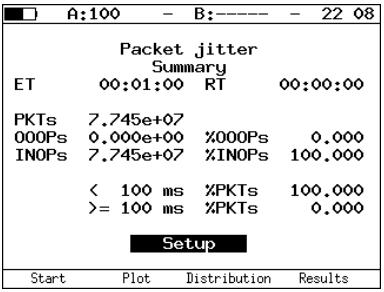


Figure 5.88. Packet jitter. Summary

- **ET** — time elapsed since the test started.
- **RT** — time remained to the test finish.
- **PKTs** — summary number of received packets.
- **OOOPs** — number of received out-of-order packets.
- **%OOOPs** — quantity of received out-of-order packets (percentage of PKTs).
- **INOPs** — number of packets received in the same order they were transmitted.
- **%INOPs** — quantity of packets received in the same order they were transmitted (percentage of PKTs).
- $< ms\%PKTs$ — number of packets (percentage of PKTs) with jitter value which is less then specified threshold.
- $>= ms\%PKTs$ — number of packets (percentage of PKTs) with jitter value exceeding or equal to the specified threshold.
- **Setup** — switch to the *Packet jitter. Setup menu.*

By pressing the F1 button (*Start*), the measurement of packet jitter for the port which has been specified in the *Packet jitter. Setup* menu, is started.

[15]The feature is not included into basic configuration and should be purchased additionally.

When the measurement starts, all settings of the menu become unavailable for editing.

To switch to the *Packet jitter Plot* screen, press the F2 button (*Plot*).

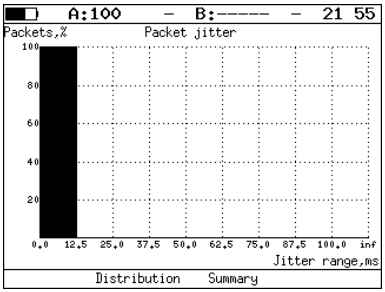


Figure 5.89. Packet jitter. Plot

To switch to the *Packet jitter Distribution* screen, press the F2 button (*Distribution*).

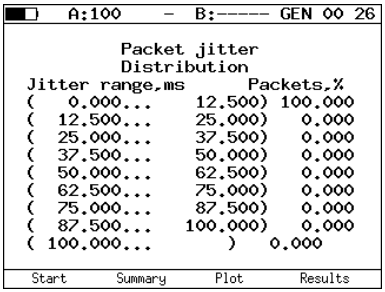


Figure 5.90. Packet jitter. Distribution

At the screen two columns are shown. In the first one, intervals are displayed, the second one shows the quantity of packets (percentage) jitter value of which lies within corresponding interval.

Upper limit of an interval can be specified in the *Packet jitter. Setup* menu (see *Threshold, ms* parameter). Interval between null and the threshold value is divided into defined number of sub-intervals. As a result of the test, in the right column the percentage of packets with jitter within corresponding sub-interval limits is displayed.

To switch to the *Results* menu press F4 button (*Results*). For more details see section 5.19.

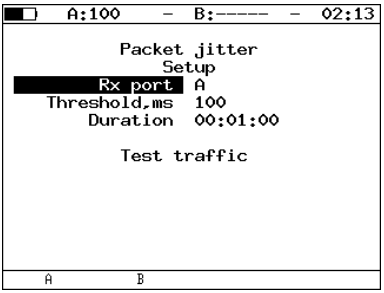


Figure 5.91. Packet jitter. Setup

- **Rx port** — select a port to measure jitter at.
- **Threshold, ms** — jitter threshold value.
- **Duration** — jitter measurements duration.
- **Test traffic** — switch to the *Test traffic* menu.

5.17 Test traffic

Test data generating feature is to be used for the packet jitter measurements. The analyzer supports generating the test data flow in two following modes:

- test data is generated and then jitter is measured at the same port (see fig. 5.92);
- test data is generated at one port, and then jitter is measured at another one (see fig. 5.93); in this case, destination port could be a port at a remote device (see fig. 5.94).

When generating the test data has been started, all settings in the menu become inaccessible for editing.

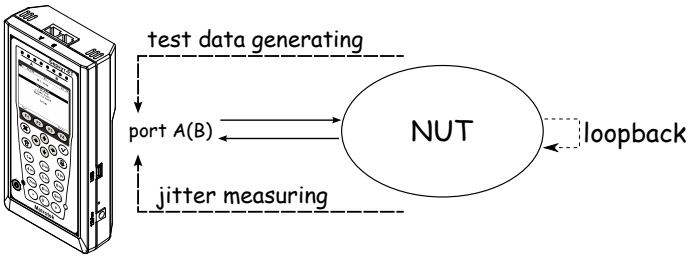


Figure 5.92. Jitter measurements. Scheme 1

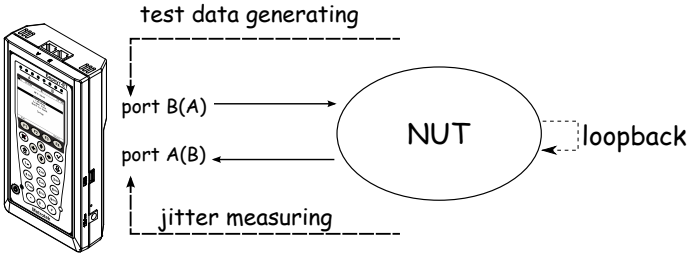


Figure 5.93. Jitter measurements. Scheme 2

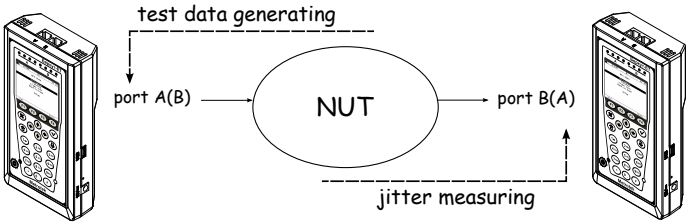


Figure 5.94. Jitter measurements. Scheme 3

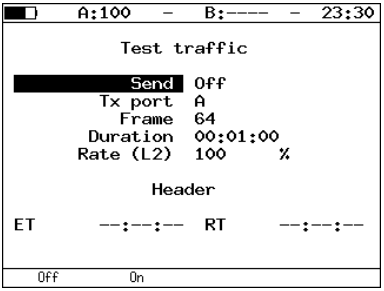


Figure 5.95. Test traffic menu

- **Send** — enable/disable test traffic generating.
- **Tx port** — select the port to generate test traffic at.
- **Frame** — frame size (any value in the range between 64 and 9600 bytes).
- **Duration** — duration of the test traffic generating.
- **Rate (L2)** — framed rate value specified in percent (F1), in kbps (F2) or in Mbps (F3).
- **Header** — switch to the *Header* menu.
- **ET** — time elapsed since the traffic generating has started.
- **RT** — time remained to the traffic generating finish.

5.17.1 Test traffic. MPLS settings

Label stack and reception rules can be specified in the *Label stack* menu: *Tests* ⇒ *Test traffic* ⇒ *Header* ⇒ *Advanced* ⇒ *MPLS*.

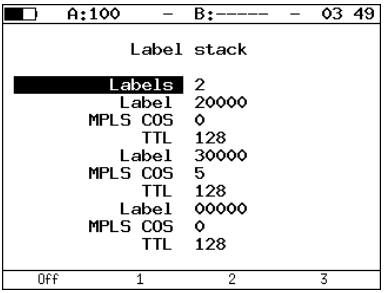


Figure 5.96. Label stack menu

- **Labels** — number of labels (1–3).
- **Label** — label value.
- **MPLS COS** — class of service for datagram.
- **TTL** — time to live for datagram.

5.18 Statistics

To navigate between screens, use ◄/► and F2 / F3 buttons.

Function keys

F1 (*Reset*) — statistics reset.

In all screens apart from *Aggregated statistics* screen, to select port press F4 button.

5.18.1 Aggregated statistics for two ports

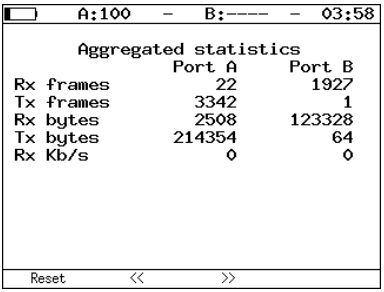


Figure 5.97. Aggregated statistics

- **Rx frames** — number of received frames.
- **Tx frames** — number of transmitted frames.
- **Rx bytes** — number of received bytes.
- **Tx bytes** — number of transmitted bytes.
- **Rx Kb/s** — this field shows the number of kilobits per second received on port.

5.18.2 Stats by frame types

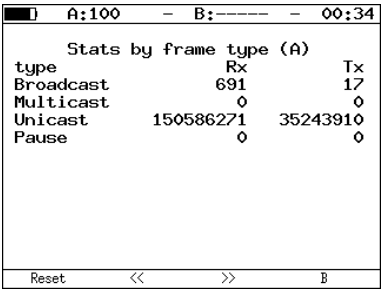


Figure 5.98. Stats by frame type

- **Broadcast** — broadcast frames.
- **Multicast** — multicast frames.
- **Unicast** — unicast frames.
- **Pause** — pause frames.
- **Rx** — number of received frames.
- **Tx** — number of transmitted frames.

5.18.3 Stats by frame size

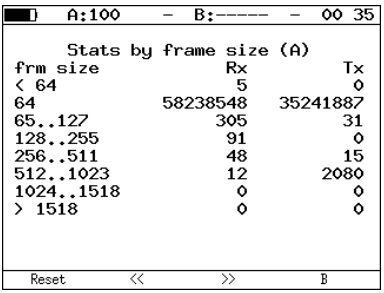


Figure 5.99. Stats by frame size

- **frm size** — frame size (in bytes).
- **Rx** — number of received frames.
- **Tx** — number of transmitted frames.

5.18.4 Stats by layer

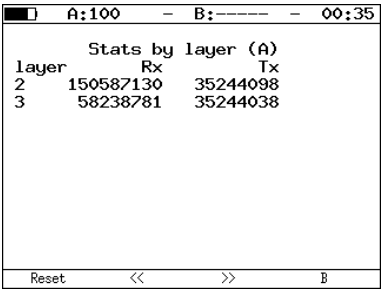


Figure 5.100. Stats by layer

- **layer 2** — number of received (Rx) and transmitted (Tx) frames at the Data Link layer.
- **layer 3** — number of received (Rx) and transmitted (Tx) frames at the Network layer.

5.18.5 Stats by frame errors

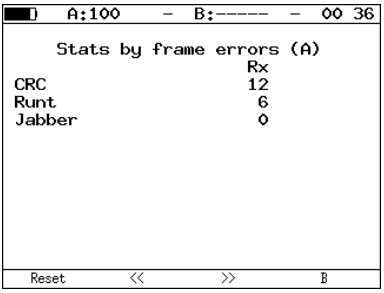


Figure 5.101. Stats by frame errors

- **CRC** — number of frames with FCS error.
- **Runt** — number of packets less then 64 bytes with correct CRC.
- **Jabber** — number of packets larger then 1518 bytes with FCS error.

5.19 Saving test results

Results menu allows to view information about previously saved measurement results (F1), save test settings and results (including statistics) (F2), and to load (F3) or delete (F4) previously saved test configurations and results.

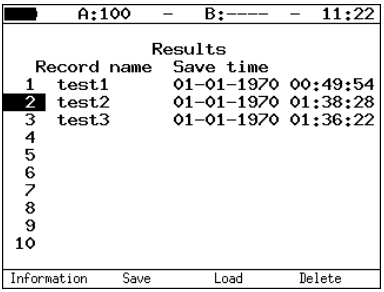


Figure 5.102. Results menu

To view detailed information about previously saved measurement results press (F1) button.

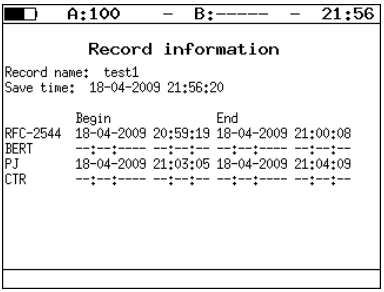


Figure 5.103. Record information menu

To save the data:

- select a number you want to save the entry with;
- press (✓);
- type in a name for the entry to save;
- press (✓);
- press F2 (*Save*).

To load previously saved test results and settings:

- select number of an entry;
- press F3 (*Load*).

To delete previously saved test results:

- select number of an entry;
- press F4 (*Delete*);
- press F3 (*Yes*).

5.20 Network setup

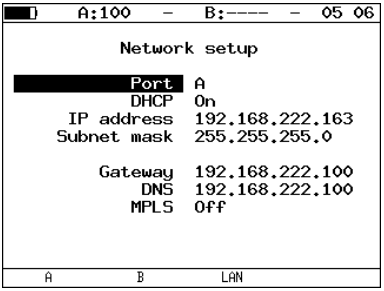


Figure 5.104. Network setup menu

- **Port** — select port (A, B, or LAN).
- **DHCP** — if enabled, all parameters (IP address, subnet mask, gateway IP address, and the DNS server IP address) are provided automatically by the DHCP server;
- **IP address** — port IP address;
- **Subnet mask** — specifies which part of the IP address is the network address and which part is the host address.
- **Gateway** — gateway IP address.
- **DNS** — IP address of the DNS-server.
- **MPLS** — on/off frames with label transmitting for port A (B) (for LAN port MPLS does not supported). If a value of the *MPLS* field will be set to *Off MPLS* field (*Interface setup* menu) will become inaccessible for editing.

5.21 Interface setup

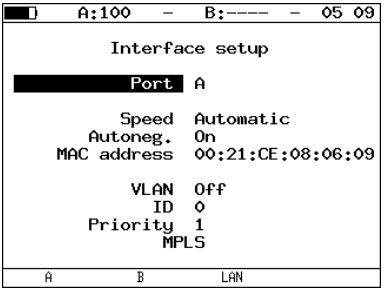


Figure 5.105. Interface setup menu

- **Port** — select the port to customize.
- **Speed** — select transmission rate. If you selected *Automatic*, then transmission rate will be determined automatically (any of the 10/100/1000 Mbit/s values can be used). Also, in this case a value of the *Autoneg.* field will be set to *On* and become inaccessible.
- **Autoneg.** — enabling the *auto-negotiation* mode. If enabled, you need to select the preferable rate (or set *Automatic*, the any of the 10/100/1000 Mbit/s values can be used) and set the *Autoneg.* parameter to *On*.
  The connection will be established only if the auto-negotiation mode is enabled also on remote end, and at least one of the parameters is set to the same value.
- **MAC address** — MAC address of the port (A, B, or LAN), which can be specified[16].
- **VLAN** — enabling/disabling VLAN parameters setup.
- **ID** — 12-bit VLAN identifier (integer in the range 0–4095).
- **Priority** — traffic priority (see Table 5.1).
- **MPLS** — switch to the *MPLS. Interface A* menu (*MPLS. Interface B*).

Note: *if you use SFP-modules, then the Speed should be always set to the 1Gb/s value.*

[16] When pressing F1 (*Default*), the device MAC address value shown in the Information menu is automatically inserted in the field.

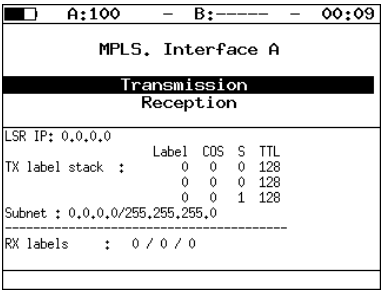


Figure 5.106. MPLS. Interface A menu

- **Transmission** — switch to the *Label stack* menu.
- **Reception** — switch to the *Reception rules* menu.

Values specified in the *Transmission* and *Reception rules* menu are also displayed on the screen.

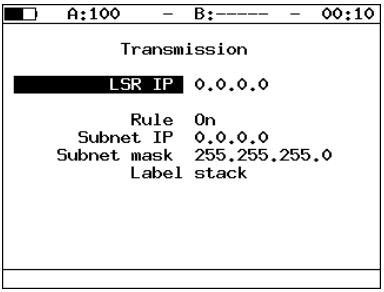


Figure 5.107. Transmission menu

- **LSR IP** — IP address of router interface to which the **Bercut-ET** is connected. LSR realize label switching.
- **Rule** — on/off the rule for sending packets in the subnet parameters of which defines below.
- **Subnet IP** — subnet IP address.
- **Subnet mask** — subnet mask.
- **Label stack** — switch to the *Label stack* menu.

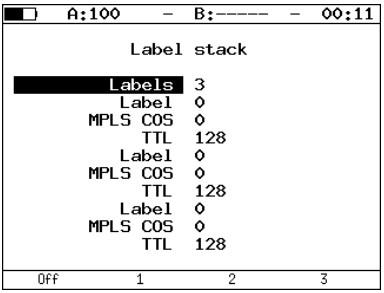


Figure 5.108. Label stack menu

- **Labels** — number of labels (1–3).
- **Label** — label value.
- **MPLS COS** — class of service for datagram.
- **TTL** — time to live for datagram.

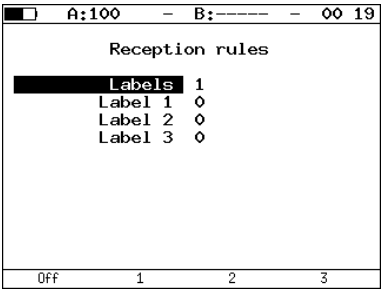


Figure 5.109. Reception rules menu

- **Labels** — number of labels (1–3).
- **Label 1, Label 2, Label 3** — label value.

5.22 Device setup

5.22.1 Display setup

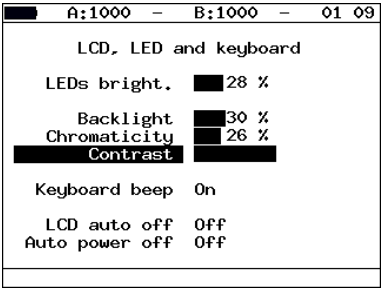


Figure 5.110. LCD, LED and keyboard menu

- **LEDs bright.** — customize LEDs brightness.
- **Backlight** — customize brightness of display backlight.
- **Chromaticity** — customize display chromaticity.
- **Contrast** — customize display contrast.
- **Keyboard beep** — enable/disable keyboard beeping.
- **LCD auto off** — select either of the following values for the automatic display switching off: Off, 20 s, 40 s, or 60 s. To increase the autonomous action period, select the minimum value.
- **Auto power off** — select either of the following values for the tester automatic switching off: Off, 1, 5, or 10 minutes.

5.22.2 Basic settings

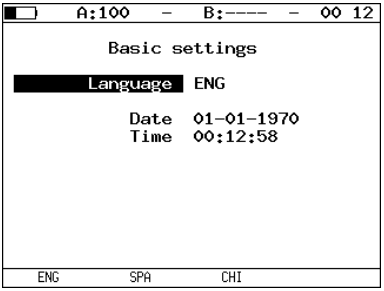


Figure 5.111. Basic settings menu

- **Language** — set the interface language.
- **Date** — enter or select current date.
- **Time** — enter or select current time.

5.22.3 Information

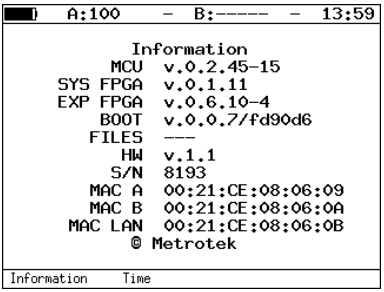


Figure 5.112. Information screen

This screen shows software versions, serial number, and MAC addresses of device ports.

Press F2 button (*Time*) to switch to the *Uptime* menu.

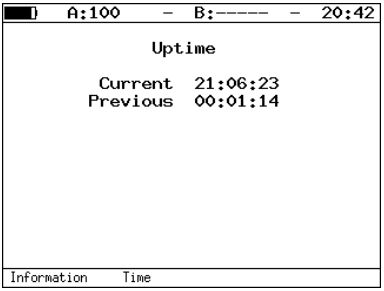


Figure 5.113. Uptime menu

- **Current** — device work period between the last switch on and present moment.
- **Previous** — device work period between the previous switch on and switch off.

5.22.4 SFP information

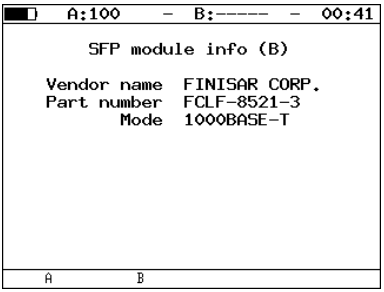


Figure 5.114. SFP module info menu

The screen shows the following information about SFP-module: vendor, part number, and supported data transfer mode. To select the port, press either F1 (*port A*) or F2 (*port B*) buttons.

5.22.5 Battery

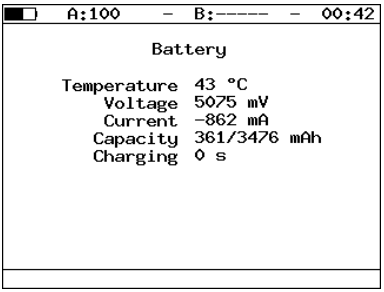


Figure 5.115. Battery screen

The screen shows the following data about the current condition of the internal battery: temperature (°C), voltage (mV), current (mA), current and maximum capacity (mAh), and the charging time (period of time passed after the charging start) in seconds.

5.22.6 Managing options

Option is an extra-functionality of the **Bercut-ET** analyzer that is not bundled in the basic shipment.

To activate an option you need to get an activation key, which is generated for the particular serial number of a device. You should type in the key in the Options menu or via remote control using the *ats* command (see appendix B for details).

Table 5.7. Options

Option	**Description**
ETIP	TCP/IP network diagnostics (routing, nodes availability, DNS).
ETWEB	HTTP-connections testing (requires ETIP option enabled).
ETJT	Packet jitter measurements.
ETRC	Remote control for the **Bercut-ET** via TELNET protocol and WWW-interface.
ETMM	Complex traffic generating.
ETMPLS	MPLS support.
ETAT	Asymmetric test support.

6. Remote control

Bercut-ET analyzer allows to connect to a personal computer (PC) via USB 1.1/2.0 interface or via a LAN-port.

To connect the analyzer to a PC via USB-interface, you have to previously install Virtual COM Port driver.

> ***Attention!*** *Please note that installation of the driver is necessary for the correct initialization of* ***Bercut-ET*** *analyzer in your system.*

Download the latest version of the VCP driver from the official site of *FTDI Chip* company (`http://www.ftdichip.com`) and extract the archive to any suitable folder.

Please refer to the `http://www.ftdichip.com/Drivers/VCP.htm` page for the distribution archives for different operation systems.

6.1 Management in the Terminal mode

An interaction with the analyzer can be performed using `HyperTerminal`, the standard Microsoft Windows 95/98/XP/2000/2003 utility.

To update the **Bercut-ET** microcode, the terminal utility should provide file transmission via the `X-modem` protocol.

6.1.1 Terminal mode connection settings

1. Make sure that the device is switched on.
2. Connect **Bercut-ET** to a USB-port using the USB-cable from the kit.
3. If you use `HyperTerminal` utility, perform the following steps:
   - create new connection (*File* ⇒ *New Connection* menu);
   - in the *Connection Description* dialog box, enter a name and choose an icon you like for the connection, click *OK*;
   - in the *Connect To* dialog box, choose the COM port that **Bercut-ET** is connecting to, click *OK*;
   - set the following properties of the COM-port:

Bits per second	57600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

- click *OK*, and **HyperTerminal** utility will attempt to connect to **Bercut-ET**; to check the connection, type `AT` command — the device should respond with `OK`.

When successfully connected, user can manage the analyzer using commands described in Appendix B.

6.1.2 Updating analyzer software

> ***Attention!*** *False actions during the software update can lead to the device part-malfunctioning which can be repaired in the service-center only.*

The latest versions of the **Bercut-ET** software are available for downloading at `http://www.metrotek.spb.ru` site. Current software versions are shown in the Information menu (***Bercut-ET*** *Settings⇒Information*).

The order of update procedures for FPGA microcode and MCU program does not matter. In addition, only one of those can be updated if there is no new version for another one.

6.1.2.1 Updating FPGA

1. Connect the **Bercut-ET** to PC via USB (see section 6.1.1).
   Check the connection using `AT` command.
2. Type in `ATR` command.
   Select either *system FPGA* or *expansion FPGA*.
   In the *Transfer* ⇒ *Send File* menu of `HyperTerminal` utility, specify the path to FPGA microcode file (with `.rpd` extension) in the *Filename* window and select the `Xmodem` in the *Protocol* window. Click *Send*.
   Estimated duration of the update procedure is 1 minute for the system FPGA and 4 minutes for the Expansion FPGA. If the data previously displayed on the screen has been restored, the update procedure is completed successfully.

6.1.2.2 Updating MCU program

1. Connect the **Bercut-ET** to PC via USB (see section 6.1.1).
   Check the connection using `AT` command.

2. Type in `ATR` command.
   Select *MCU*.
   In the *Transfer* ⇒ *Send File* menu of `HyperTerminal` utility, specify the path to a MCU program file (with `.bin` extension) in the *Filename* window; and select the `Xmodem` in the *Protocol* window. Click *Send*.
   Estimated duration of the update procedure is 1 minute. If the data displayed previously on the screen has been restored, the update is completed successfully.

Note: *if MCU program version is not compatible with versions of the system FPGA and expansion FPGA microcodes, then you will get a warning message and the expected version number. In this case, the expected version should be installed instead of the current version.*

Note: *when FPGA microcodes and MCU are updated, it is recommended to press the hardware restart button with any thin blunt pin. The button is next to the 12V power supply connector on the side panel.*

6.1.2.3 Updating file system

1. Connect the **Bercut-ET** to PC via USB (see section 6.1.1).
   Check the connection using `AT` command.
2. Type in `ATR` command.
   Select *FS image*.
   In the *Transfer* ⇒ *Send File* menu of `HyperTerminal` utility, specify the path to a MCU program file (with `.bin` extension) in the *Filename* window; and select the `Xmodem` in the *Protocol* window. Click *Send*.
   Estimated duration of the update procedure is 5 second. If the data displayed previously on the screen has been restored, the update is completed successfully.

6.2 Remote control via TELNET

TELNET (Telecommunication Network) is a protocol to access and interact with a remote network device. To configure test properties, to view the current settings, and to perform measurements, use the commands described in the Appendix B.

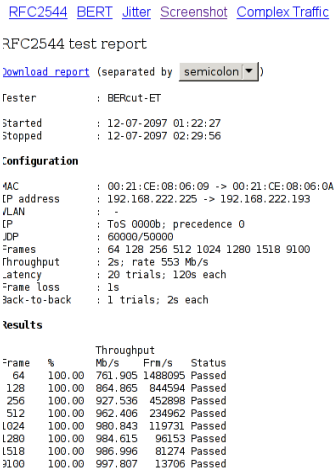
Remote control via TELNET is an optional functionality[1]. To control remotely **Bercut-ET** via TELNET protocol, connect to the device via A(B) port or the LAN port and then type in the following command in a console: `telnet IP-address of the port`. Default user name and password: `admin`.

6.3 Remote control via WWW-interface

Remote control via WWW-interface[2] function allows to view and save on PC all the settings and results of the major tests.

To view results, connect to **Bercut-ET** via A(B) port or the LAN port, and type the IP-address of connected port into the address line of your web-browser.

To save the data press **Download report**. The data will be saved with .csv extension.



RFC2544 BERT Jitter Screenshot Complex Traffic

RFC2544 test report

Download report (separated by semicolon)

Tester : BERcut-ET

Started : 12-07-2097 01:22:27
Stopped : 12-07-2097 02:29:56

Configuration

MAC : 00:21:CE:08:06:09 -> 00:21:CE:08:06:0A
IP address : 192.168.222.225 -> 192.168.222.193
VLAN : -
TOS : ToS 0000b; precedence 0
UDP : 60000/50000
Frames : 64 128 256 512 1024 1280 1518 9100
Throughput : 2s; rate 553 Mb/s
Latency : 20 trials; 120s each
Frame loss : 1s
Back-to-back : 1 trials; 2s each

Results

Frame	%	Throughput Mb/s	Frm/s	Status
64	100.00	761.905	1488095	Passed
128	100.00	864.865	844594	Passed
256	100.00	927.536	452898	Passed
512	100.00	962.406	234962	Passed
1024	100.00	980.843	119731	Passed
1280	100.00	984.615	96153	Passed
1518	100.00	986.996	81274	Passed
9100	100.00	997.807	13706	Passed

Figure 6.1. RFC 2544 test results

[1] Optional functionality. Not available in the basic configuration and should be ordered additionally.

[2] Optional functionality. Not available in the basic configuration and should be ordered additionally.

6.4 Screen shot

To get screen shot, connect to **Bercut-ET** via A(B) port or the LAN port, and type into the address line of your web-browser:
`http://IP-address_of_connected_port/sshot`.

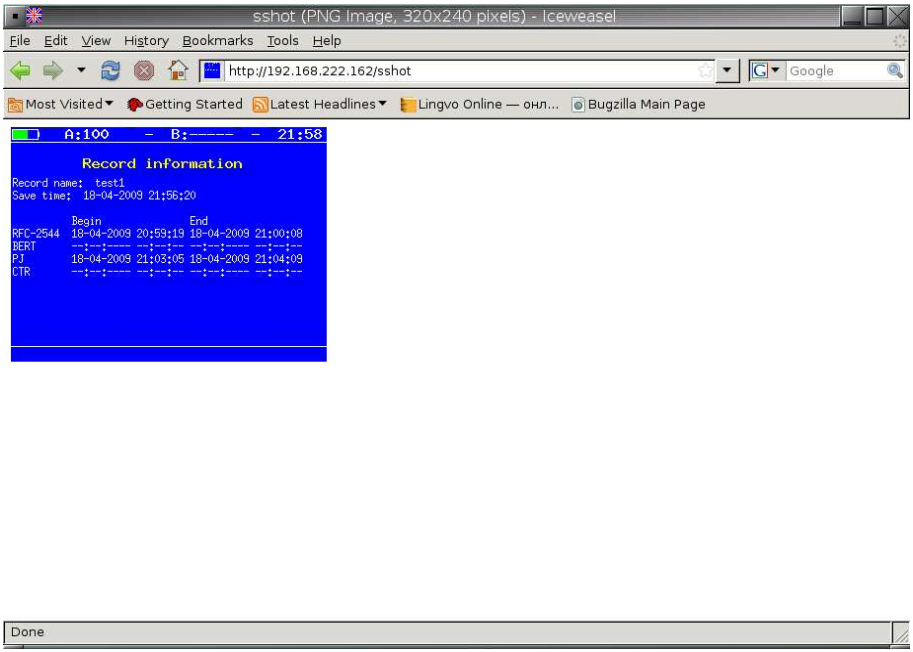


Figure 6.2. Screen shot

A. Ethernet frame structure

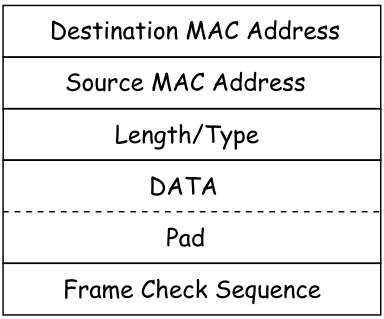


Figure A.1. Ethernet frame structure

- **Destination MAC Address** — 6 bytes field that contains MAC address of the destination network node.
- **Source MAC Address** — 6 bytes field that contains MAC address of the frame source network node.
- **Length/Type** — the field contains 16-bits integer and possesses either of the following values:
  - if the contained number is less than or equal to 1500, the value is set to **Length** and defines the length of the data field;
  - if contained number is more than or equal to 1536, the value is set to **Type** value and specifies type of the protocol used.
- **Data** — data field can contain from 46 or 42 (in the case of a frame with VLAN-tag) to 1500 bytes.
- **Pad** — Padding. If the data field is less than 46 bytes, the containing frame is complemented to the minimum allowed length (64 bytes) with the padding field.
- **Frame Check Sequence** — the 4-bytes field contains the checksum.

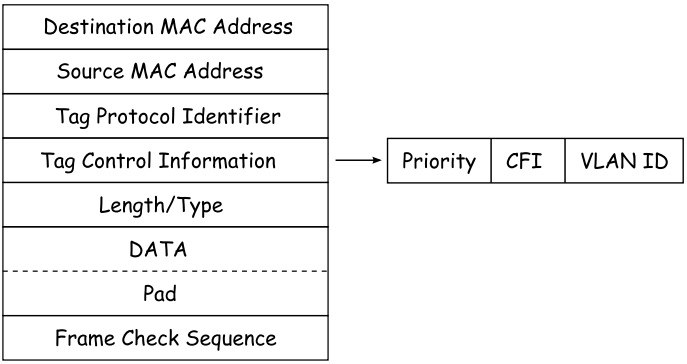


Figure A.2. Ethernet frame with VLAN-tag structure

- **Tag Protocol Identifier** — this 16 bits field defines that the frame belongs to the 802.1Q [1] standard.
- **Tag Control Information** — TCI field contains three following fields.
  - **Priority** — User (VLAN) Priority. Three bits that contain information about the frame priority (eight possible priority values are available [1]).
  - **CFI** — Canonical Format Indicator is an one-byte flag which must be equal to *0* (null) for Ethernet frames.
  - **VLAN ID** — VLAN Identifier (VID) is a 12-bit identifier which is defined in the 802.1Q standard [1]. VID uniquely defines VLAN to which the current frame belongs to.

B. Remote control commands

Table B.1. Remote control commands (console)

Command	Description
AT	empty command, used to check connection
ATR	restart the device (analyzer)
ATM1	RFC 2544 test results and settings output
ATM2	BERT test results and settings output
ATM3	display measurements results and settings for the packet jitter
ATI	display device information
ATH	display command's help
ATS	enter the option activation key. The key is a decimal number which should be typed in right after the *ats* command, without any spaces.
ATC	switch to the test configuring and running mode (optional feature)

Table B.2. Remote management commands (TELNET). Show mode

Command	Information displayed in console
RFC 2544	
show rfc2544 header src udp	source UDP-port number
show rfc2544 header src mac	source MAC address
show rfc2544 header src ip	source IP address
show rfc2544 header dst udp	destination UDP-port number
show rfc2544 header dst mac	destination MAC address
show rfc2544 header dst ip	destination IP address
show rfc2544 header vlan enabled	show whether VLAN parameter is enabled
show rfc2544 header vlan id	VLAN identifier value
show rfc2544 header vlan priority	traffic priority value
show rfc2544 header precedence	frame priority value
show rfc2544 header tos	type of service for the packet
show rfc2544 topology port tx	transmitting port
show rfc2544 topology port rx	receiving port
show rfc2544 throughput duration	throughput trial duration
show rfc2544 throughput enabled	show whether throughput test is enabled
show rfc2544 throughput maxrate	maximum rate for the throughput test

Table B.2. Remote management commands (TELNET). Show mode *(continued)*

show rfc2544 frames 1	user-defined frame size (or standard value in accordance with RFC 2544 methodology)
show rfc2544 frames 2	
show rfc2544 frames 3	
show rfc2544 frames 4	
show rfc2544 frames 5	
show rfc2544 frames 6	
show rfc2544 frames 7	
show rfc2544 frames 8	
show rfc2544 latency enabled	show whether the latency test is enabled
show rfc2544 latency count	number of trials for latency test
show rfc2544 latency duration	trial duration for the latency test
show rfc2544 frameloss enabled	show whether the frameloss test is enabled
show rfc2544 frameloss duration	trial duration for the frameloss test
show rfc2544 backtoback enabled	show whether the back-to-back test is enabled
show rfc2544 backtoback count	number of trials for the back-to-back test
show rfc2544 backtoback duration	trial duration for the back-to-back test
rfc2544 start	start RFC 2544 tests
rfc2544 stop	stop all RFC 2544 tests
rfc2544 show	RFC 2544 test results
BERT	
show bert header src mac	source MAC address
show bert header src ip	source IP address
show bert header src udp	source UDP-port number
show bert header dst mac	destination MAC address
show bert header dst ip	destination IP address
show bert header dst udp	destination UDP-port number
show bert header vlan enabled	show whether VLAN parameter is enabled
show bert header vlan id	VLAN identifier value
show bert header vlan priority	traffic priority value
show bert header precedence	frame priority value
show bert header tos	type of service for the packet
show bert topology port tx	transmitting port
show bert topology port rx	receiving port
show bert level	at which layer of OSI model BERT will be performed
show bert pattern	standard test pattern
show bert user-pattern	user-defined test pattern
show bert frame	user-defined frame size
show bert rate	user-defined rate (Kbps)
show bert duration	trial duration for BERT
bert start	start BERT

Table B.2. Remote management commands (TELNET). Show mode *(continued)*

bert stop	stop BERT
bert show	show BERT results
Packet jitter	
show jitter port	on which port jitter measurements will be performed
show jitter threshold	threshold (ms)
show jitter duration	measurements duration
jitter start	start Packet jitter test
jitter stop	stop Packet jitter test
jitter show	Packet jitter test results
Test traffic	
show txgen header src mac	source MAC address
show txgen header src ip	source IP address
show txgen header src udp	source UDP-port number
show txgen header dst mac	destination MAC address
show txgen header dst ip	destination IP address
show txgen header dst udp	destination UDP-port number
show txgen header vlan enabled	show whether VLAN parameter is enabled
show txgen header vlan id	VLAN identifier value
show txgen header vlan priority	traffic priority value
show txgen header precedence	frame priority value
show txgen header tos	type of service for the packet
show txgen port	transmitting port
show txgen frame	user-defined frame size
show txgen duration	trial duration
show txgen rate	user-defined rate (Kbps or %)
txgen start	start test traffic generating
txgen stop	stop test traffic generating
txgen show	show test traffic results
Interface setup	
show gbe a speed	show transmission rate for the port A
show gbe b speed	show transmission rate for the port B
Network setup	
show network a dhcp	show whether the DHCP function is enabled for the port A
show network a ip	show IP address of the port A
show network a subnetmask	show subnet mask for the port A
show network b dhcp	show whether the DHCP function is enabled for the port B
show network b ip	show IP address of the port B
show network b subnetmask	show subnet mask for the port B

Table B.2. Remote management commands (TELNET). Show mode *(continued)*

show network gateway	show gateway IP address
show network dns	show DNS IP address
TCP/IP testing	
ping	start ping test
Common commands	
exit	exit the command mode
reboot	reboot the analyzer
help	show the list of available commands
configure	switch to the configuration mode
show version	show firmware number

Table B.3. Remote control commands (TELNET). Configuration mode

Command	**Operation**
RFC 2544	
rfc2544 header src udp *text*	set source UDP-port number
rfc2544 header src mac *XX:XX:XX:XX:XX:XX*	set source MAC address
rfc2544 header src ip *i.i.i.i*	set source IP address
rfc2544 header dst udp *text*	set destination UDP-port number
rfc2544 header dst mac *XX:XX:XX:XX:XX:XX*	set destination MAC address
rfc2544 header dst ip *i.i.i.i*	set destination IP address
rfc2544 header vlan enabled *off/on*	enable/disable VLAN parameter
rfc2544 header vlan id *text*	set VLAN identifier
rfc2544 header vlan prior *text*	set traffic priority
rfc2544 header precedence *text*	set frame priority
rfc2544 header tos *0000 / 1000 / 0100 / 0010 / 0001*	set type of service for the packet
rfc2544 topology port tx *a/b*	set data transmitting port
rfc2544 topology port rx *a/b*	set data receiving port
rfc2544 frames user enabled *no/yes*	enable/disable user-defined frame size
rfc2544 frames 1 *text*	set arbitrary frame size
rfc2544 frames 2 *text*	
rfc2544 frames 3 *text*	
rfc2544 frames 4 *text*	
rfc2544 frames 5 *text*	
rfc2544 frames 6 *text*	
rfc2544 frames 7 *text*	
rfc2544 frames 8 *text*	
rfc2544 throughput duration *text*	set trial duration for the throughput analysis
rfc2544 throughput enabled *no/yes*	enable/disable throughput analysis

Table B.3. Remote control commands (TELNET). Configuration mode *(continued)*

rfc2544 throughput maxrate *text*	set maximum rate value for the throughput analysis
rfc2544 latency enabled *no/yes*	enable/disable latency analysis
rfc2544 latency count *text*	set number of trials for the latency analysis
rfc2544 latency duration *text*	set trial duration for the latency analysis
rfc2544 frameloss enabled *no/yes*	enable/disable frameloss test
rfc2544 frameloss duration *text*	set trial duration for the frameloss test
rfc2544 backtoback enabled *no/yes*	enable/disable back-to-back analysis
rfc2544 backtoback count *text*	set number of trials for the back-to-back test
rfc2544 backtoback duration *text*	set trial duration for the back-to-back test
BERT	
bert header src mac *XX:XX:XX:XX:XX:XX*	set source UDP-port number
bert header src ip *i.i.i.i*	set source IP address
bert header src udp *text*	set source UDP-port number
bert header dst mac *XX:XX:XX:XX:XX:XX*	set destination MAC address
bert header dst ip *i.i.i.i*	set destination IP address
bert header dst udp *text*	set destination UDP-port number
bert header vlan enabled *off/on*	enable/disable VLAN parameter
bert header vlan id *text*	set VLAN identifier
bert header vlan priority *text*	set traffic priority
bert header precedence *text*	set frame priority
bert header tos *0000 / 1000 / 0100 / 0010 / 0001*	set type of service for the packet
bert topology port tx *a/b*	set data transmitting port
bert topology port rx *a/b*	set data receiving port
bert level *1/2/3/4*	layer of OSI model at which BERT will be performed
bert pattern *user / crtp / 2e11-1 / 2e15-1 / 2e20-1 / 2e23-1 / 2e29-1 / 2e31-1*	select standard or user-defined test pattern
bert user-pattern hex	set user-defined test pattern
bert frame *int*	set user-defined frame size
bert rate *int*	set user-defined rate (Kbps)
bert duration *hh.mm.ss*	set trial duration for BERT
Packet jitter	
jitter port *a/b*	select port on which jitter measurements will be performed
jitter threshold *int*	set threshold (ms)
jitter duration *hh.mm.ss*	set measurements duration

Table B.3. Remote control commands (TELNET). Configuration mode *(continued)*

Test traffic	
txgen header src mac *XX:XX:XX:XX:XX:XX*	set source MAC address
txgen header src ip *i.i.i.i*	set source IP address
txgen header src udp *text*	set source UDP-port number
txgen header dst mac *XX:XX:XX:XX:XX:XX*	set destination MAC address
txgen header dst ip *i.i.i.i*	set destination IP address
txgen header dst udp *text*	set destination UDP-port number
txgen header vlan enabled *off/on*	enable/disable VLAN parameter
txgen header vlan id *text*	set VLAN identifier
txgen header vlan priority *text*	set traffic priority
txgen header precedence *text*	set frame priority
txgen header tos *0000/1000/0100/0010/0001*	set type of service for the packet
txgen port *a/b*	set transmitting port
txgen frame *int*	set frame size
txgen duration *hh.mm.ss*	set trial duration
txgen rate	set user-defined rate (Kbps or %)
Network setup	
network a dhcp *off/on*	enable/disable DHCP option for port A
network a ip *i.i.i.i*	set IP address for the port A
network a subnetmask *i.i.i.i*	set subnet mask for the port A
network b dhcp *off/on*	enable/disable DHCP option for port B
network b ip *i.i.i.i*	set IP address for the port B
network b subnetmask *i.i.i.i*	set subnet mask for the port B
network gateway *i.i.i.i*	set gateway IP address
network dns *i.i.i.i*	set IP address for the DNS network node
Interface setup	
gbe a speed *automatic/10/100/1000*	select the transmission rate for the port A
gbe b speed *automatic/10/100/1000*	select the transmission rate for the port B
Common commands	
exit	exit from the configuration mode
help	show the list of available commands

C. Specifications and Technical characteristics

Table C.1. **Bercut-ET** Specifications

Display	Color graphic display, 320×240 pixels
Keyboard	Film keyboard (25 keys)
Connect to PC interface	USB-client
External power supply unit voltage	12 V
Operating current	Not more than 1,5 A
Battery	NiMH with 4.8 V rated voltage and capacity of 4300 mAh
Protection elements (power supply)	Overvoltage protection
	internal safety device 5 A
Gigabit Ethernet interfaces	2×10/100/1000Base-T and SFP
Control interfaces	USB, LAN 10/100 Ethernet
Overall size	200×101×44 mm
Weight	0,640 kg

Table C.2. Technical capabilities of **Bercut-ET**

Tests according to RFC 2544	Available tests: Throughput, Frame Loss, Back-to-Back, Latency.
	Frame size: 64, 128, 256, 512, 1024, 1280, 1518 bytes, and user-defined.
IP-tests	Ping, Traceroute, DNS lookup, TCP-client.
Loopback	Loopback at the Physical (PHY), Data Link (MAC), and Network (IP) layers with VLAN support and fields swapping capability.
Cable test	Testing a copper cable for break, short-circuit, estimating the distance to the break point.
BERT	Test is used to determine the major data link quality parameter — *bit error rate*.
Packet jitter	Packet jitter measurements, results are displayed as a table and graph. The test is used to estimate the tested network capability to transmit the latency-sensitive traffic.

Table C.2. Technical capabilities of **Bercut-ET** *(continued)*

Remote control	Remote control of the analyzer in the following modes: terminal, via TELNET protocol, via WWW-interface. With remote control running the tests, parameters set-up, getting test results are supported.

D. Troubleshooting

Table D.1. Troubleshooting

Failure symptom	Possible reason	Repair method
Incorrect system time	Hardware reset has been pressed	Set the system time in the *Basic settings* menu
You cannot power on the device	The buttery is discharged.	Connect the power supply unit and charge the battery.
	Software failure	Press the hardware reset button (the pin-hole next to the 12V connector on the side panel of the device)
The battery is not charged from the external power supply	Power supply unit failure, broken wire, battery failure	Check and replace if necessary the power supply unit or the buttery

Bibliography

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[8] IEEE 802.3ah, *Ethernet in the First Mile Task Force.*

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