Product Overview Brochure

CMA 3000

All-In-One Field Tester for Fixed and Mobile Networks

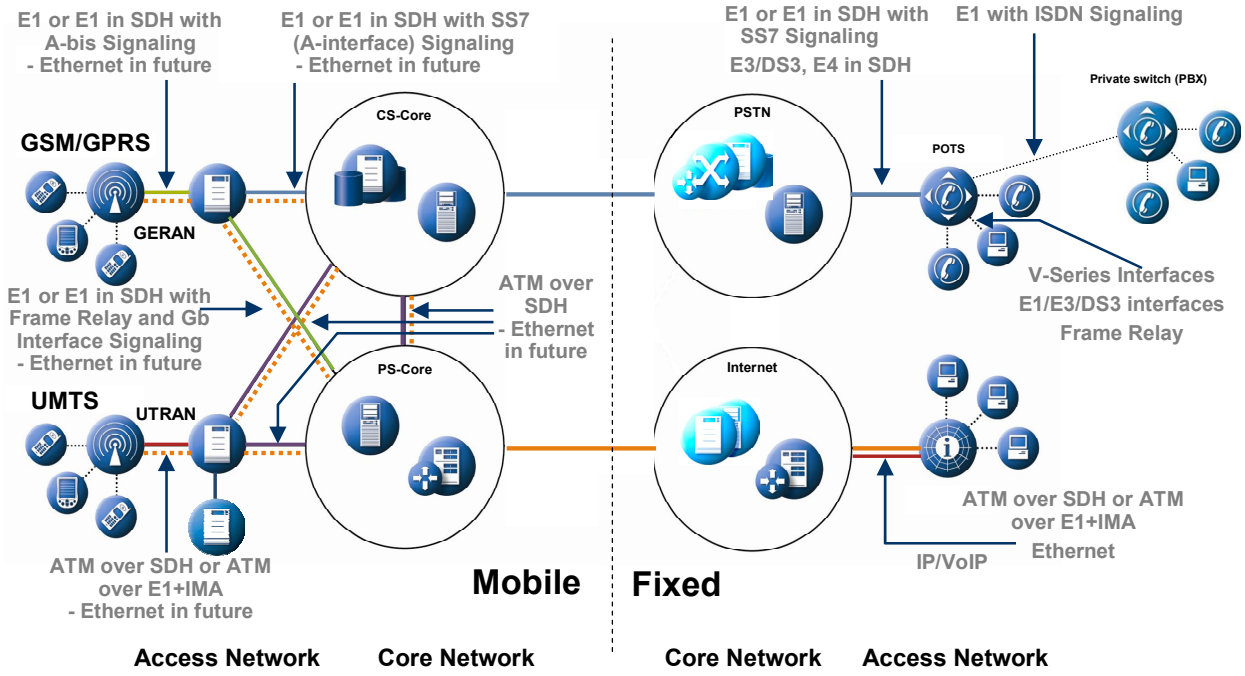


Fig. 1 The CMA 3000 is ideal for testing electrical and optical communication lines in the fixed-line and mobile access networks.

Field Testing Has Never Been Easier

CMA 3000 is Anritsu's next-generation portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks. The CMA 3000 is a powerful tool for a wide range of applications, including fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems. Fault location is greatly facilitated by the high degree of portability of the robust CMA 3000. This allows you make measurements at any suitable measuring point.

Futureproof Design

The modular design provides you with a clear and cost-effective upgrade path. In its basic configuration the CMA 3000 is a full-featured 2 Mbps line transmission quality tester and analyzer. By adding options the CMA 3000 can test a large number of interfaces and technologies, including SDH, ATM, E3, E4, Ethernet, Frame Relay and the Abis interface of GSM and GPRS networks. Other options turn the CMA 3000 into a very powerful signaling analyzer for GSM, GPRS/EDGE, SS7 and ISDN protocols.

Finally options allow the instrument to emulate VoIP or ISDN PRI calls.

Easy-to-use Interface

The intuitive user interface, with a large high-contrast color LCD display and easy-to-understand graphical symbols makes it easy to read and interpret measurement results. Through touch-screen operation you can easily customize measurement setups to fit your personal needs and work routines. You can store setups for particular applications in the instrument. For quick and easy distribution of standardized test setups within the organization you can transfer such setups between CMA 3000s. Remote operation is facilitated through an optional MS Windows® program simulating the instrument's front panel.

The large memory of the CMA 3000 allows storage of a high number of measurement results. With the powerful and flexible report generator you can create .pdf files for selected measurement results. With these files you can provide professional documentation of test results to your customers.

The instrument is powered by rechargeable and replaceable intelligent high-capacity LiIon batteries, providing more than 10 hours of operation between recharges for the instrument in its basic configuration. The CMA 3000 can also be powered via an external mains adapter for long-term operation.

Key Features	Key Applications

• Simultaneous bi-directional monitoring of all supported interfaces
• Powerful testing of framed Nx64 kbps and unframed 2 Mbps systems
• High flexibility through easy-to-install options
  ○ Ethernet interface (10/100/1000 Mbps) testing
  ○ IP channel statistics
  ○ Ethernet multistream test
  ○ Ethernet Stacked VLAN test
  ○ Ethernet MPLS test
  ○ Ethernet VoIP test options
  ○ SDH interface including STM-1, STM-1/-4, STM-1/-4/-16
  ○ E3 interface
  ○ E4 interface
  ○ ATM layer measurements
  ○ V-Series interfaces
  ○ Frame Relay testing
  ○ SS7, Abis and ISDN protocol analysis
  ○ ISDN PRI call emulation
  ○ FrontSim remote control
• LEDs for immediate line state indications
• Large color touch-display
• Battery-powered
	Comprehensive out-of-service testing for:
	• Installation
	• Provisioning
	• Propagation time analysis
	• Performance analysis
	• Physical line monitoring
	In-service monitoring for:
	• Fast troubleshooting
	• In-service error performance measurement

Additional Information

More documentation including detailed specifications on the CMA 3000 and its options are available in electronic form. The following documents are available:

- Basic instrument spec sheet including information on instruments 2 Mbps testing capabilities
- Ethernet options spec sheet including information on the IP channel statistics option, the Ethernet Multistream test option, the Ethernet Stacked VLAN test option, the Ethernet MPLS test option and the Ethernet VoIP test options
- SDH options spec sheet including information on the E3 interface test option and on the E4 interface test option
- TCM option spec sheet
- ATM layer measurements spec sheet
- V-Series interfaces spec sheet
- Frame Relay testing spec sheet
- GSM/GPRS A-bis protocol analysis spec sheet
- ISDN protocol analysis spec sheet
- ISDN PRI call emulation spec sheet
- SS7 protocol analysis spec sheet
- FrontSim remote control spec sheet
- CMA 3000 ordering guide

Please contact your local Anritsu representation for an electronic copy of one or more of these documents. Or visit the Anritsu Web site at www.anritsu.com.

2 Mbps Testing

The basic CMA 3000 configuration, with its two 2 Mbps receivers and transmitters, supports framed and unframed testing and monitoring of 2 Mbps systems. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

To speed troubleshooting the CMA 3000 displays alarms and transmission link status on LED indicators. The instrument's two inputs allow instant monitoring of both sides of a line and comparison of simultaneously recorded results.

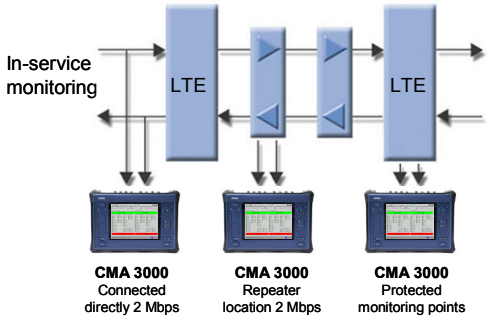


Fig. 2 With CMA 3000 you can perform in-service monitoring of a 2 Mbps line.

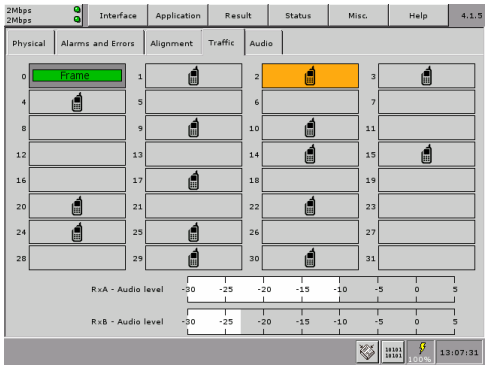


Fig. 3 Fast overview of traffic channel time slots.

The CMA 3000 2 Mbps status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current input frequency and deviation
- Indication of input level
- Traffic channel usage
- Audio level in a traffic channel
- Propagation time monitor
- Listen-in on a traffic channel

Out-of-service or In-service Statistics

For installation/commissioning and troubleshooting of out-of-service of 2 Mbps lines the CMA 3000 provides powerful statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a line. Information on errors and alarms is collected in time-intervals as defined by you, and error-performance parameters (G.821/G.826/M.2100) are calculated.

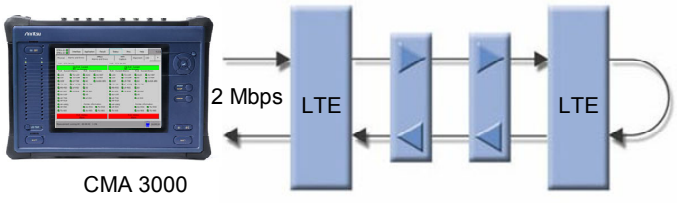


Fig. 4 Out of service testing of a 2 Mbps line with the CMA 3000.

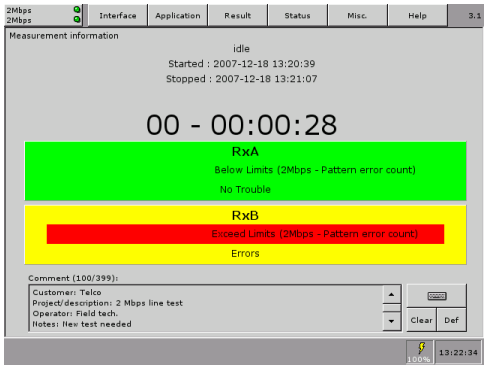


Fig. 5 The OK/Questionable/not-OK indication.

The Measurement Summary function gives you a rapid overview of a measurement via an 'OK/Questionable/not-OK' indication. You may also define thresholds for the 'OK/not-OK' levels. Histograms facilitate the tracing of errors over time.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 basic instrument.

Ethernet Test Options

When outfitted with the Ethernet interface measurement option, the battery-powered, easy-to-use and portable Anritsu CMA 3000 is a comprehensive solution for testing and measuring LAN communication lines. It's easy to configure the CMA 3000 Ethernet options to your requirements. A dual port module is available for testing Ethernet 10/100 interfaces. Or, you can have a dual-port Ethernet 10/100/1000 test module equipped with electrical and optional optical interface ports.

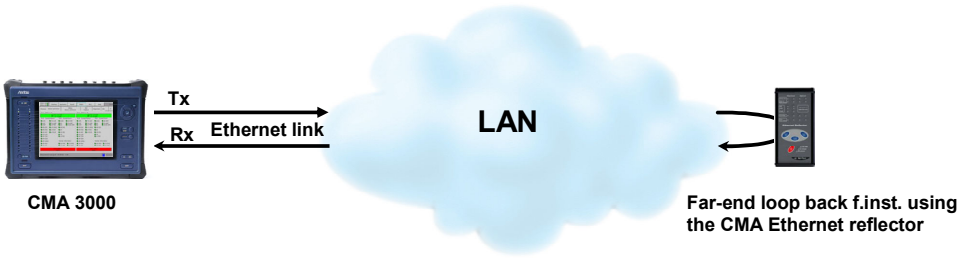


Fig. 6 Out-of-service testing of an Ethernet link using the CMA 3000.

Transmitters and receivers permit out-of-service testing for installation, commissioning and Quality of Service (QoS) verification while a pass-through mode enables in-service monitoring for both fast troubleshooting and detailed analysis of the live traffic on the line. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

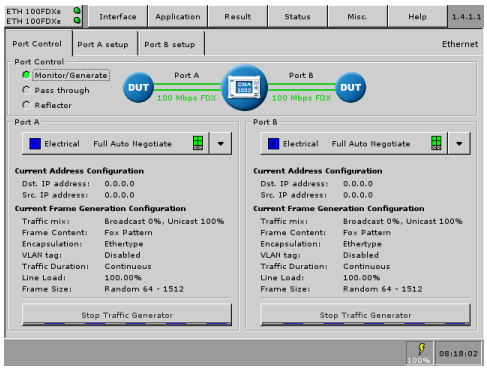


Fig. 7 The operation of the CMA 3000 is made easy through an intuitive graphical user interface.

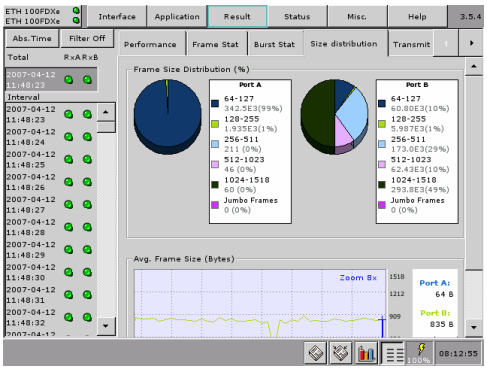


Fig. 8 Statistics are presented in tables and easy to understand graphs.

Installation, Commissioning and QoS Verification

For installation, commissioning and QoS verification CMA 3000 provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. Performance and QoS statistics are presented in tables and graphs facilitating results interpretation. Through preprogrammed thresholds, CMA 3000 can highlight abnormal conditions on the tested line.

RFC 2544 Analysis

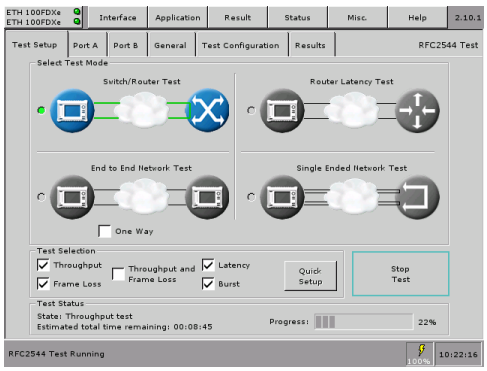


Fig. 9 Intuitive configuration of the RFC 2544 tests

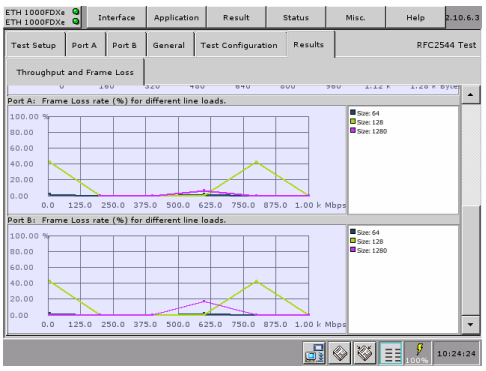


Fig. 10 CMA 3000 presents RFC 2544 results in graphs or tabular format

The IETF RFC 2544 "Benchmarking Methodology for Network Interconnect Devices" defines a number of tests to be used for describing the performance characteristics of these network devices. With the CMA 3000 Ethernet options, testing of performance parameters, such as throughput and frame loss, latency, packet jitter and burstability, in compliance with RFC 2544 is straightforward. CMA 3000 automates the testing procedure while still allowing you to configure the test to be as

meticulous as needed. To get full information on the performance of both sides of a line or to test asymmetrical links like xDSL links, the end-to-end test mode allows two CMA 3000 to work together in a master-slave setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.

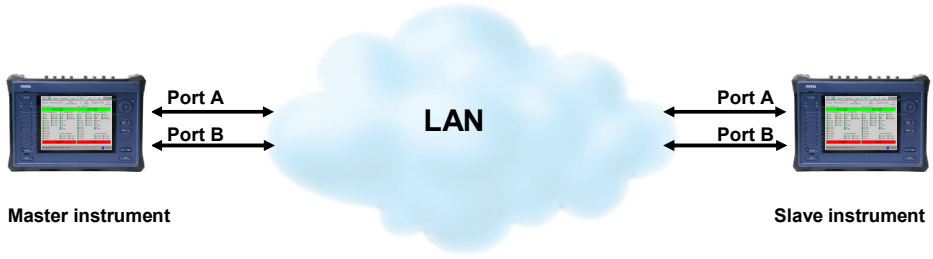


Fig. 11 RFC 2544 testing of asymmetrical Ethernet links using two CMA 3000s. Two links can be tested simultaneously

In-service Troubleshooting

For fast troubleshooting the CMA 3000 status monitor provides essential information on the monitored transmission system, including: Line alarms on LED indicators with a trap facility, display of current line status, electrical cable test facility and indication of main link performance parameters: Utilization, Throughput and Errored frames.

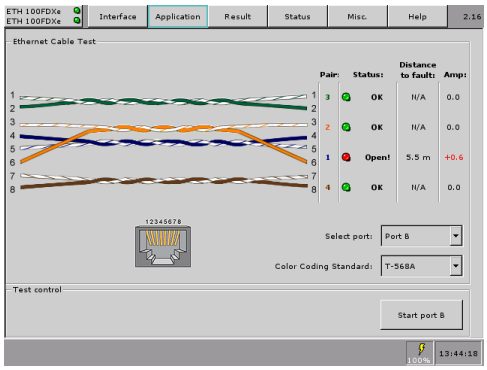


Fig. 12 The CMA 3000s cable test facility makes it easy to identify failures on electrical cables like short circuits or breaks of a wire pair. The cable test facility also indicates the distance from the instrument to the fault.

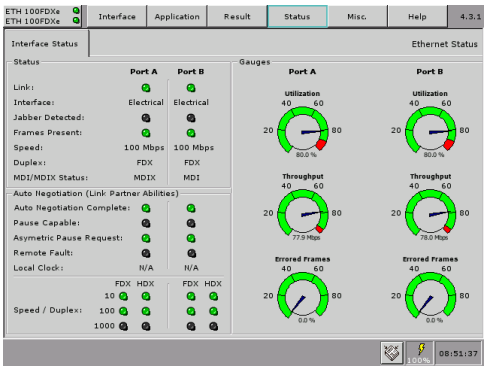


Fig. 13 Interface status indicators for a quick overview of the line's condition.

Detailed In-service analysis

CMA 3000 can analyze live traffic in details by presenting statistics on the main performance indicators for a monitored line. To facilitate the analysis of data it's possible to define threshold values for a number of parameters. CMA 3000 uses the thresholds to color-highlight results outside the acceptable range.

IP Channel Statistics Option

For further analysis of live IP traffic on the Ethernet line CMA 3000 can be equipped with the IP channel statistics option. This option provides detailed information on the traffic on the monitored line for up to 232 individual channels, identified by Ethernet addresses, IP addresses, VLAN tags or MPLS labels. This allows you to identify whether a channel that loads the line heavily, sends many errored frames or uses the line in an inefficient way.

Ethernet Multistream Option

The Ethernet multistream option for the CMA 3000 allows the user to test a congested networks ability to transport high priority traffic rather than lower priority traffic. The user can activate up to 8 streams with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network.

Stacked VLAN Option

Stacked VLAN is increasingly used in several types of Ethernet based networks. With a CMA 3000 equipped with Ethernet and Stacked VLAN options the user has a powerful tool for testing such networks. The Stacked VLAN option supports up to 8 levels of VLAN tags.

MPLS Option

MPLS (Multi Protocol Label Switching) allows efficient routing of traffic in packet based networks. With a CMA 3000 equipped with Ethernet and MPLS the user has a powerful tool for testing with this type of traffic.

VoIP Test Options

The wide deployment of VoIP makes it essential for field technicians to have a tool that can test VoIP connections. When testing VoIP first of all connectivity must be checked. Once this is done, verification of the quality is essential.

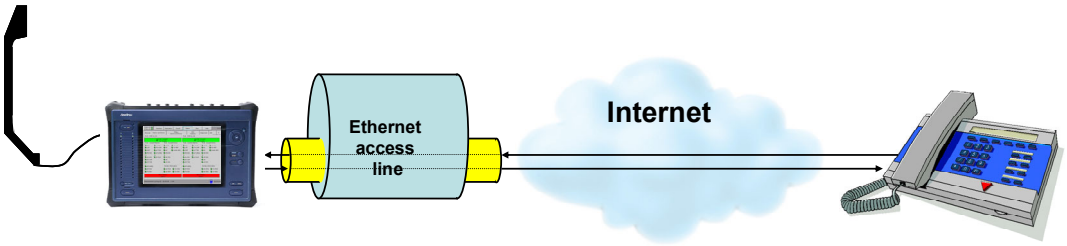


Fig. 14 Basic VoIP connectivity is verified by calling another party using the CMA 3000's VoIP functionality.

For VoIP testing the instrument can establish a call and answer incoming calls. By connecting an analogue telephone to the CMA 3000 the user can make a conversation with the called/calling party. Statistics collected during the call will inform the user on the performance of the communication line used for the call. Based on this an add-on option can present voice quality information in terms of Mean Opinion Score (MOS) and R-factor values for one call at the time.

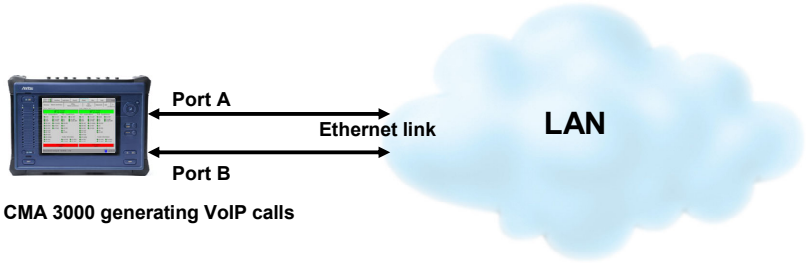


Fig. 15 A total of 8 VoIP calls can be generated through the CMA 3000's two Ethernet test ports.

To make a realistic test case the instrument can generate or receive up to 8 calls simultaneously. These calls can be made on one or both test ports in the Ethernet option. If the instrument is also equipped with the Ethernet Multistream option, each of the 8 calls can be assigned to a stream, f.inst. allowing individual configuration of priority for the calls.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 Ethernet options, the IP channel statistics option, the Ethernet Multistream option, the Ethernet Stacked VLAN test option, the Ethernet MPLS test option and the VoIP options.

SDH Test Options

When equipped with the SDH test option, the CMA 3000 is a powerful and easy-to-use tool for testing SDH and PDH systems. The SDH option is very flexible, with two electrical receivers and one electrical transmitter in its basic form. It can be equipped with one or two optical modules. With two optical modules, the instrument supports simultaneous bi-directional monitoring of SDH lines. This makes CMA 3000 ideal for both in- and out-of-service transmission-quality measurements.

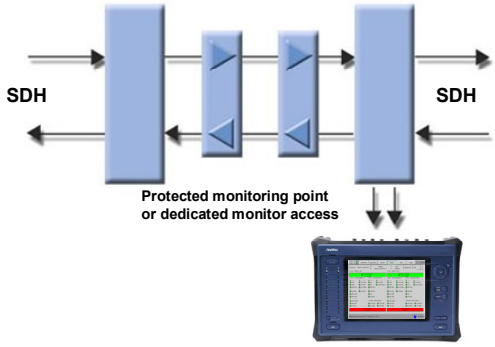


Fig. 16 The dual receive capability on SDH interfaces makes the CMA 3000 ideal for in-service analysis of SDH systems.

The intuitive user interface allows you to easily read and interpret important information from the SDH signal. For fast troubleshooting, the CMA 3000 displays alarms and transmission link status on LED indicators. In addition, the trouble scan feature provides a fast approach to examining the SDH signal for major problems. CMA 3000 automatically configures to the received SDH signal, eliminating lengthy instrument setup. The powerful 2 Mbps analysis capabilities of the basic CMA 3000 enables you to analyze a demultiplexed 2 Mbps signal embedded in an SDH signal.

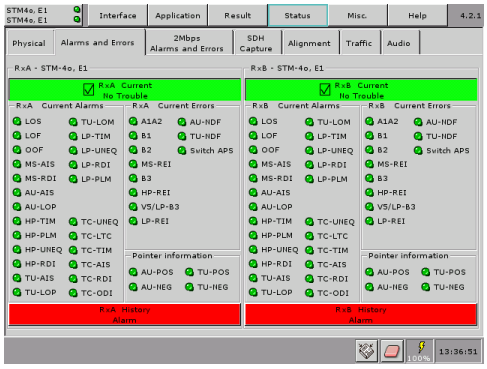


Fig. 17: The CMA 3000 gives you a quick overview of errors and alarms of both sides of the SDH line.

Fig. 18: The tributary scan feature gives you a quick overview of the tributaries of the monitored line with color identification of problems.

Speeds SDH Troubleshooting

The CMA 3000 status monitor allows you to speed troubleshooting, as the status monitor is always active providing essential information on the monitored transmission system. In-depth trouble analysis can be done using the instruments pointer movement graph. A special test feature provides easy testing of APS (Automatic Protective Switching) to allow identification of maximum switchover time during the test. Should the result be above the user-defined threshold you will receive an indication of the problem. For monitoring purposes you may connect the CMA 3000 using optical splitters or special test interfaces. If neither is available, you can use the CMA 3000 through-mode to access the signal.

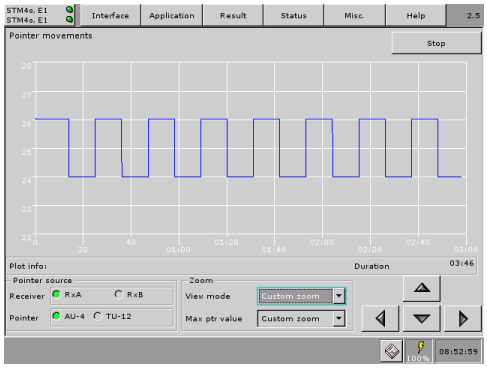


Fig. 19 The pointer graph allows a detailed analysis of pointer movements in the monitored SDH signal.

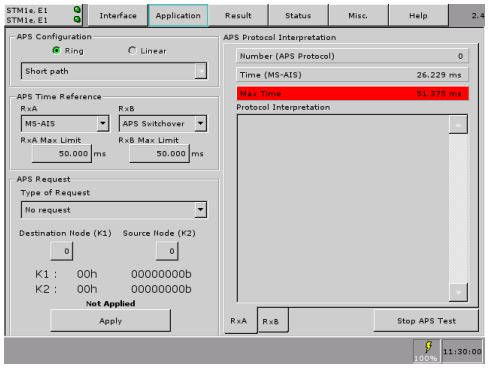


Fig. 20 The dedicated APS test application makes it easy to find the maximum APS switchover time.

Out-of-service or In-service SDH Statistics

For installing/commissioning and out-of-service troubleshooting of SDH lines the CMA 3000 provides powerful statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a line together with information on pointer operations. G.826, G.828, G.829 or M.2100 error-performance parameters are calculated for the measurement. The result is highlighted in easy-to-understand color indications. During installation/commissioning and stress testing of network elements you can control the signal transmitted by the CMA 3000. When generating an SDH signal the instrument provides you with great flexibility for injecting errors, alarms, pointer operations and overhead byte changes into the transmitted signal. In addition, you can deviate the frequency of the transmitted signal from nominal to test a receiver's ability to handle signals that are out of specifications.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 SDH , E4 and E3 options.

TCM Test Option

It's possible to further test SDH systems by adding the Tandem Connection Monitoring (TCM) option to a CMA 3000 with SDH option installed. The TCM option contains very powerful features for testing and monitoring TCM systems in SDH

networks. As CMA 3000 can be outfitted to support bi-directional in-service monitoring you can inspect TCM parameters for both sides of a line simultaneously. This allows you to analyze the overall transmission quality of the monitored part of the line in the fastest way possible. For out-of service testing and verification of the TCM system CMA 3000 includes features to inject the various conditions that provoke TCM events.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 TCM test option.

E4 Test Option

A CMA 3000 equipped with an SDH option can get an E4 option added for testing with E4 streams. The E4 signal can also be mapped into the SDH signal. Installing/commissioning and out-of-service troubleshooting of E4 lines is supported in the CMA 3000 by statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of an E4 line and G.826 or M.2100 error-performance parameters are presented.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 SDH, E4 and E3 options.

E3 Test Option

The CMA 3000 can be equipped with an E3 option for testing with 34 Mbps and unframed 45 Mbps streams. If the E3 option is installed together with the SDH option, the 34/45 Mbps signal can be mapped into the SDH signal. If the SDH option is not installed, installation of the E3 option makes the CMA 3000 a powerful tool for testing at 34 Mbps, 45 Mbps and 2 Mbps rates. Installing/commissioning and out-of-service troubleshooting of E3 lines is supported in the CMA 3000 by statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a 34 Mbps line and G.826 or M.2100 error-performance parameters are presented.

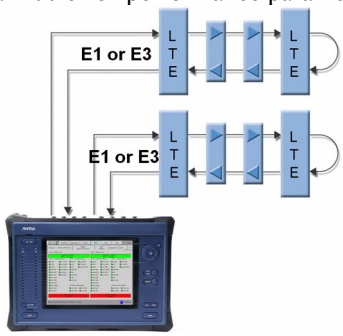


Fig. 21 The CMA 3000 can test two E1 or E3 lines simultaneously.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 SDH, E4 and E3 options.

ATM Test Options

When equipped with the ATM test options, the CMA 3000 is a powerful and easy-to-use tool for testing ATM channels in SDH and PDH systems. The ATM option allows both active testing with one transmitter and one or two receivers and simultaneous bi-directional monitoring of ATM traffic with two receivers. This makes CMA 3000 the ideal instrument for both in- and out-of-service transmission-quality measurements.

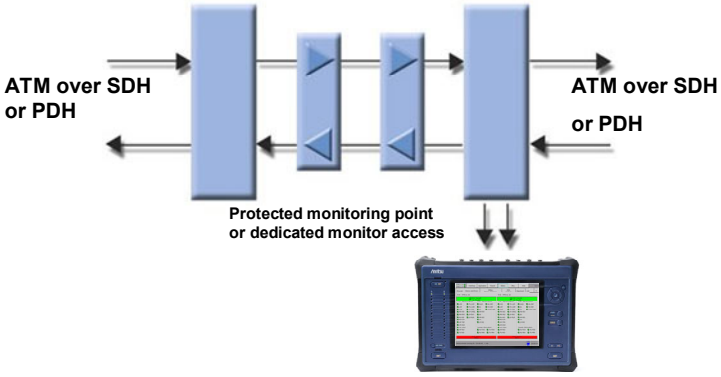


Fig. 22 The bi-directional monitoring capability of the CMA 3000 makes it ideal for in-service troubleshooting of ATM connections.

The CMA 3000 status monitor allows quick troubleshooting, as it is always active providing essential information on the monitored transmission system and ATM traffic on top of that. Through bidirectional monitoring the user can quickly verify

that both sides of the ATM connection are working properly. The ATM scan facility in the CMA 3000 give a quick overview of the active virtual channels in the monitored ATM traffic. Up to 150 channels can be identified.

In-service ATM Statistics

For in -service troubleshooting of ATM channels on SDH links the CMA 3000 provides powerful bidirectional statistical measurements of general ATM alarms and errors and Virtual Path (VP) OAM F4 and Virtual Circuit (VC) OAM F5 alarms for one selected foreground channel.

Fig. 23 The CMA 3000 gives you a quick overview of errors and alarms of both sides of the ATM connection.

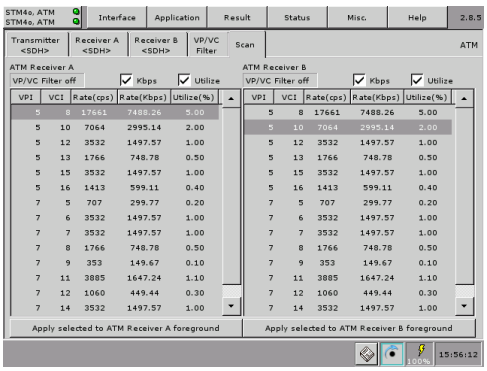


Fig. 24 The user can quickly get an overview of the active virtual channels in the monitored ATM traffic through the ATM scan facility in the CMA 3000.

Statistics are also available for in-service analysis of up to 30 ATM channels, identified by their VP/VC identifiers (VPI/VCI). The user can compare one selected parameter for all channels or see all parameters for one channel. The parameters include User cells, User Congestion cells, OAM cells and Resource Management cells. A number of traffic descriptor parameters are also measured: Peak Cell Rate (PCR), Sustainable Cell Rate (SCR), Minimum Cell Rate (MCR), Maximum Burst Size (MBS) and Cell Delay Variation Tolerance (CDVT).

The instrument can monitor status and synchronization cells for 2 Mbps lines running IMA (Inverse Multiplexing for ATM). Hereby it is easy for the user to check the status of the 2 Mbps lines that are used in the IMA connection.

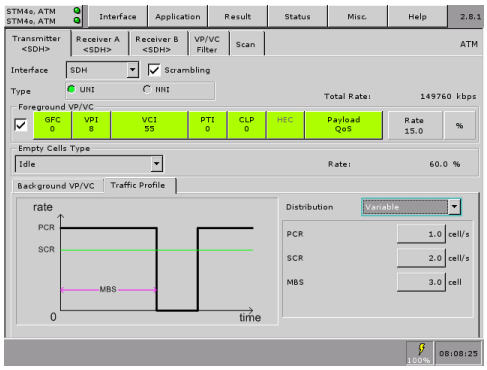


Fig. 25 The intuitive user interface of CMA 3000 facilitates the ATM test setup.

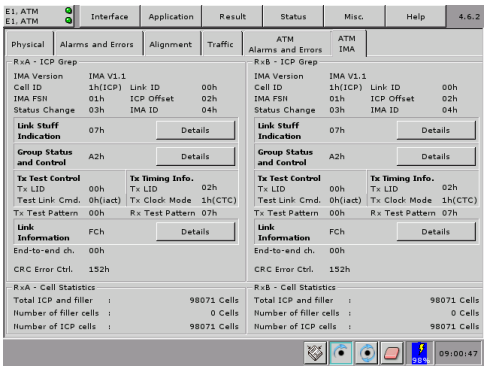


Fig. 26 Presentation of the status of the IMA connection. By clicking “Details” the user gets information bytes presented in decoded format.

Out-of-service ATM Tests

During installation/commissioning and stress testing of network elements you can control the signal transmitted by the CMA 3000. UNI and NNI ATM traffic can be generated from E1 rate up to STM-4 rate (VC4-4c). The instrument can generate ATM cells in one foreground channel for the actual test and add traffic in up to 14 background channels to emulate a realistic signal for testing the ATM network. The instrument offers a selection of traffic profiles in the foreground channel, allowing emulation of different types of traffic.

The instrument can also generate test signals defined in ITU-T rec. O.191 for measurement of Quality of Service (QoS). The QoS parameters include information on lost or misinserted cells, delay and delay variation. For testing of the lower PDH or SDH layer the CMA 3000 provides you with great flexibility for injecting errors and alarms and for SDH making pointer operations and overhead byte changes into the transmitted signal.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 ATM options.

The Easy Way to Test V-series Interfaces – V-series Interface Test Option

When equipped with the V-series interface measurement option, the portable, easy-to-use and compact CMA 3000 offers test and measurement of legacy V-series data transmission lines, in addition to the full-featured 2 Mbps transmission testing provided by the basic instrument. The supported interfaces are: RS-232C/V.24, X.21/V.11, V.35, RS-449/V.36 and RS-530.

Key applications of the V-series test interface option are: Installation testing, rapid in-service diagnostics and troubleshooting, transmission line performance analysis, mux/demux testing and drop-and-insert to other equipment for further analysis. In order to test the data interfaces on a transmission line you may set up the CMA 3000 as a DTE. You may also configure the CMA 3000 as a DCE to test the terminal equipment. The dual-receive setting for the V-series data interfaces allows you to monitor the control circuits on the line. This makes CMA 3000 the ideal solution for both in-service and out-of-service transmission measurements.

Comprehensive Out-of-Service Testing

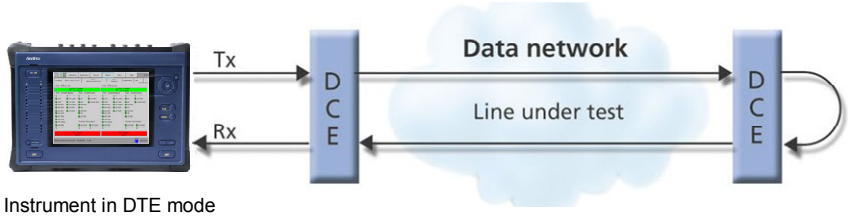


Fig. 27 V-series interface transmission line testing.

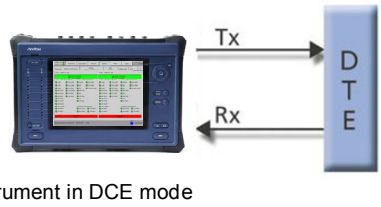


Fig. 28 Data terminal testing.

CMA 3000 supports basic BER testing for installation, commissioning and stability tests. The performance of the system under test is evaluated on the basis of BER measurements, with a loop-back at the far end of the tested line. The graphical histogram presentation provides an overview of a long measurement and makes it easy to identify error periods.

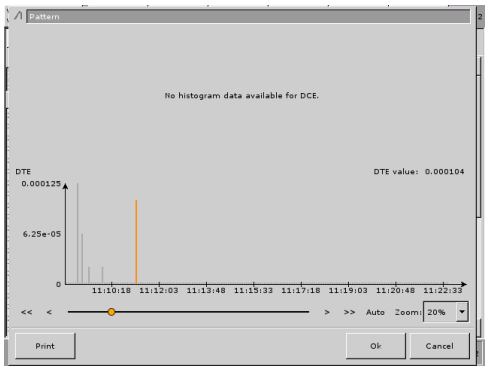


Fig. 29 Histograms facilitate the overview of a statistical measurement.

Mux/Demux Testing

You can use the CMA 3000 for comprehensive testing of multiplexers and demultiplexers that insert and extract data lines to and from 2 Mbps systems. BER testing is used for evaluating the performance of the network element under test with the CMA 3000 connected to both the data line and the 2 Mbps side of the network element.

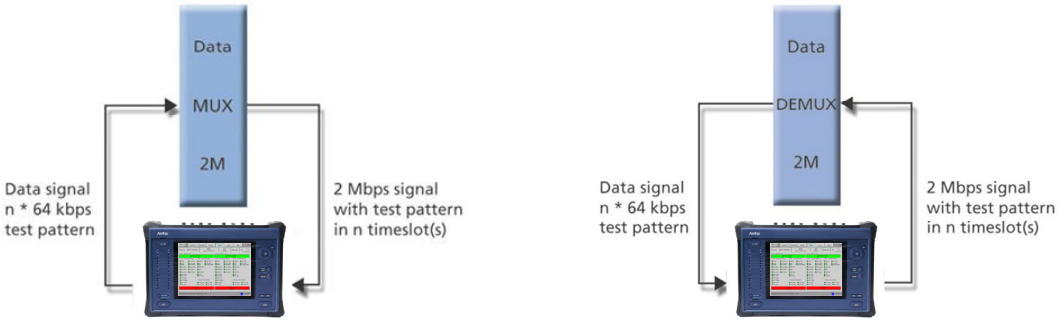


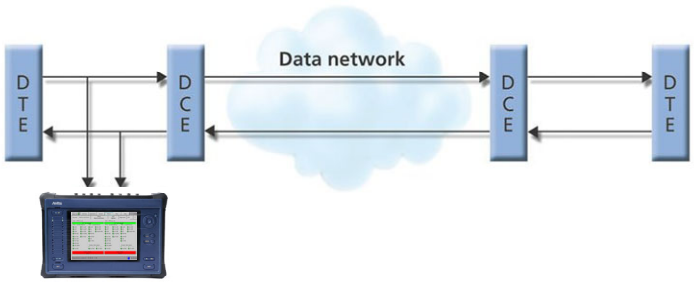
Fig. 30 MUX/DEMUX testing with the CMA 3000.

Propagation Time

Propagation time can be measured when the CMA 3000 transmits a PRBS and the pattern is looped back to the instrument. This enables you to verify that delays introduced by network equipment and transmission lines are below specified limits.

Control Circuit Monitoring and Analysis

For analysis of handshake problems, CMA 3000 can monitor the control circuits on a line. The instrument's LEDs present the current status of the most important control circuits. Current status of all relevant control circuits can be inspected on the color display. For easy examination of timing relations, you can log changes in the control circuit states on the line. When the instrument is in DTE or DCE mode you can define the state of the control circuits output from the instrument.



Instrument in monitor mode

Fig. 31 In-service monitoring of V-series interfaces with the CMA 3000.

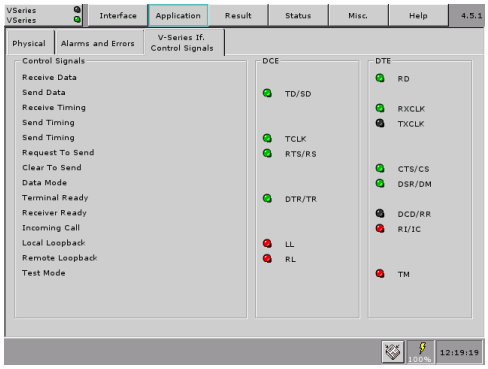


Fig. 32 Detailed information on control circuits is visualized on the display.

Drop-and-insert Testing

For testing with external equipment, the CMA 3000 field tester can drop and insert signals between its 2 Mbps interfaces and a selected data interface. Two modes are available:

- A normal drop-and-insert mode for testing applications
- A dual-drop mode for monitoring applications

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 V-series interface test option.

Rapid Turn up of Frame Relay Lines with the Frame Relay Option!

When outfitted with the frame relay test option, the battery-powered Anritsu CMA 3000 is an easy-to-use, portable field test instrument for the installation, operation and maintenance of frame relay services on 2 Mbps and V-series interface lines. The frame relay option provides you with powerful tools for turn up of frame relay lines through the simulation of frame relay data packets with user-defined characteristics. The measurement facilities gives you essential information on the line quality. For in-service analysis and troubleshooting, you have access to extensive frame relay statistics. Using the the CMA 3000 frame relay channel scan feature you can quickly identify multi-time slot frame relay channels.

DLCI and LMI Information

To establish the logical configuration of the link, CMA 3000 generates a LMI Status Inquiry Message, requesting "Full Status" at user-defined intervals. The response from the network helps you verify the correct setup of activated DLCIs on the link.

CMA 3000 derives network information from the Full Status reports and displays it, allowing you to inspect the network parameters. The CMA 3000 also analyzes the LMI Status messages on the monitored line displaying the results in such way that you can check if the basic surveillance of the frame relay connection works properly.

With the frame relay emulation capability that supports DLCI tests emulation with user-defined setup parameters you can test the frame relay connection for a selected DLCI. These tests allow you to test end-to- end connectivity as well as the network's ability to handle various frames lengths, frame contents and output utilizations.

Bit Error Rate Testing is carried out with a user-defined test pattern in the payload. If required, the emulation testing inserts frame numbering into the test frames in order to determine if frames have been lost. This test can be conducted with or without LMI emulation in the background.

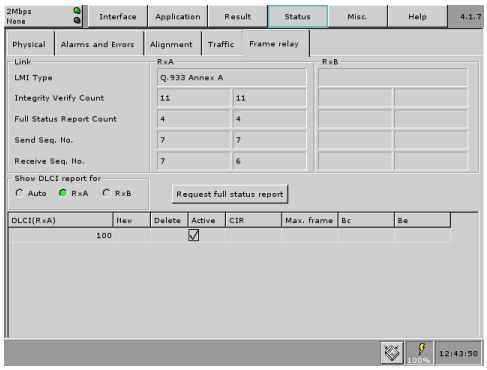


Fig. 33 Frame relay LMI information with LMI counts and sequence numbers for both sides of a frame relay line and status for up to 50 DLCIs.

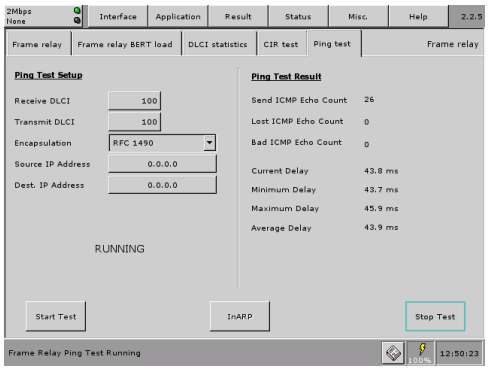


Fig. 34 Ping test of connectivity and delay.

PING Test and InARP

The CMA 3000 can perform a "PING" test, send a proper response to received "PING" patterns and then measure the round-trip delay. It's possible to perform this test with or without LMI emulation in the background. If the IP address of the destination node is unknown, CMA 3000 can send out an InARP IP address request.

Frame Relay Statistics

With CMA 3000's extensive frame relay statistics you can perform in-service analysis and troubleshooting of the monitored frame relay connection. The frame relay statistics provide valuable and detailed information for up to 50 individual DLCIs (of which 8 may be user-defined) and a total for all DLCIs on the monitored line. The CMA 3000 monitors a large number of parameters for these DLCIs simultaneously. For 2 DLCIs and the total for all DLCIs histograms are available, making it easy for you to analyze changes in traffic pattern over time. The frame relay statistics visualizes the frame relay connection.

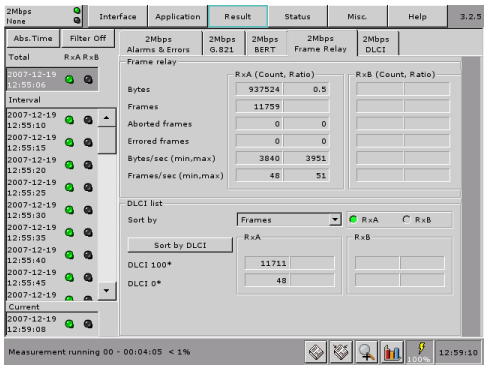


Fig. 35 Extensive statistics provides overview of the traffic during frame relay emulation.

Fig. 36 The CMA 3000 monitors a large number of parameters for up to 50 DLCIs simultaneously.

CIR Test

The Committed Information Ratio (CIR) is agreed between the customer and the frame relay network operator. The CIR establishes the data rate that the network operator commits to transport through the network. It's therefore vital to verify the CIR of a frame relay circuit. The CMA 3000 includes an automatic test of the CIR. The instrument will also estimate the CIR value for the monitored DLCIs when measuring live frame relay traffic.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 Frame Relay option.

Easy Field Testing with GSM/GPRS A-bis Options

Equipped with the GSM/GPRS Abis protocol decode options, the battery-powered CMA 3000 is an easy-to-use, portable field test instrument for the installation, operation and maintenance of Abis interfaces on 2 Mbps lines in GSM/GPRS networks. It's also possible to outfit the CMA 3000 with the Gb interface protocol decode option and the powerful frame relay option to support the installation, operation and maintenance of Gb interfaces on 2 Mbps lines in GPRS/EDGE networks. Yet other options allow you to use the CMA 3000 for analyzing other 2 Mbps interfaces in GSM/GPRS networks.

KEY APPLICATIONS

- Installation testing
- Rapid in-service diagnostics and troubleshooting
- Signaling analysis and troubleshooting
- Identification of frame relay channels on the Gb interface
- Traffic channel usage
- Listen in on a traffic channel
- GSM radio quality parameters

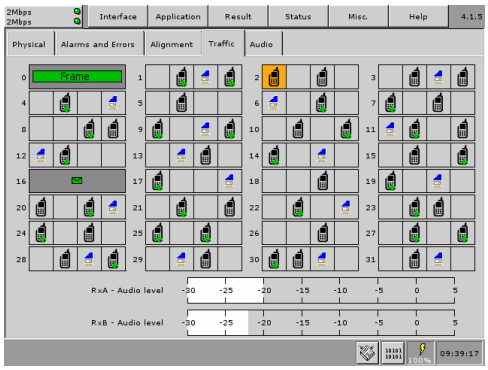


Fig. 37 The Abis status display.

Key features of the GSM/GPRS Abis protocol decode options includes in-depth analysis of GSM/DCS 1800 Abis, GPRS Abis and GPRS/EDGE Gb signaling. Also supported are signaling channel traffic statistics, traffic channel overview and decode of GSM voice encodings. You can automatically configure the CMA 3000 to the monitored 2 Mbps line, including identification of signaling channels. When equipped with SDH interface options you can also analyze GSM/GPRS Abis and Gb interfaces on 2 Mbps lines embedded in SDH signals.

Abis Interface Status Display

With the CMA 3000 you get a quick overview of the activity on the GSM/GPRS Abis interface, as the instrument provides information on the contents of the sub-channels on the monitored Abis interface in the GSM/GPRS Abis status display. Sub-channels used for GPRS and HSCSD are indicated together with traditional GSM speech channels in the GPRS Abis status display. Sub-channels used for AMR encoded speech are also indicated.

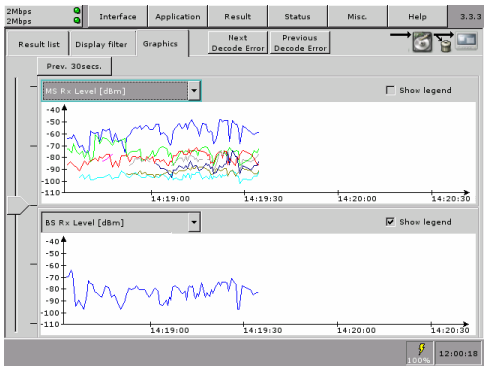


Fig. 38 Graphical presentation of GSM Abis interface MEASUREMENT_RESULT message information.

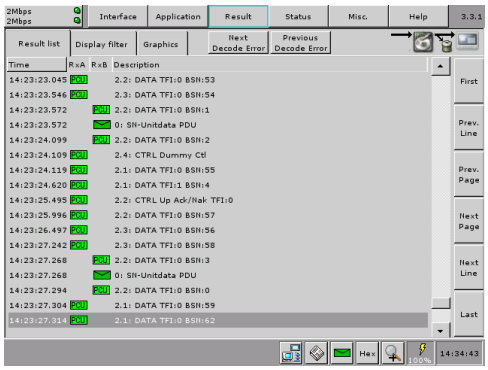


Fig. 39 The result list display of GPRS Abis signaling messages with both PCU frames (marked with PCU) and assembled LLC level messages (marked with a green envelope).

Protocol Analysis

During installation or troubleshooting CMA 3000 provides valuable and detailed information on the signaling by collecting signaling messages from the GSM/GPRS Abis interface and the Gb interface. For GPRS Abis the instrument captures and presents the basic PCUs and the assembled messages at the LLC layer on the GPRS Abis interface. For unencrypted messages all layers of signaling messages (GMM/SM or SMS) are decoded. This allows you to make a detailed analysis of the signaling problems in the network.

The CMA 3000 presents the recorded information in different ways: The Result List gives a one-line indication of each message for a rapid overview of the signaling information. This makes it simple to identify the input on which the message was detected, and subsequently you can easily detect message sequences.

The result list presentation can be expanded to show relevant parts of the messages, making it easy to identify the information carried. The contents of a message can also be shown, either presenting the main information elements or all parts of the signaling message and the hexadecimal values for detailed inspection and analysis.

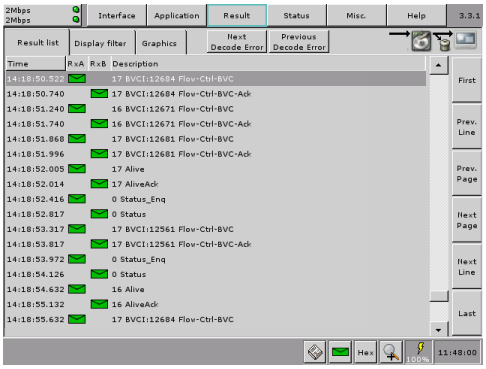


Figure 40 The Result List overview presentation of Gb interface messages.

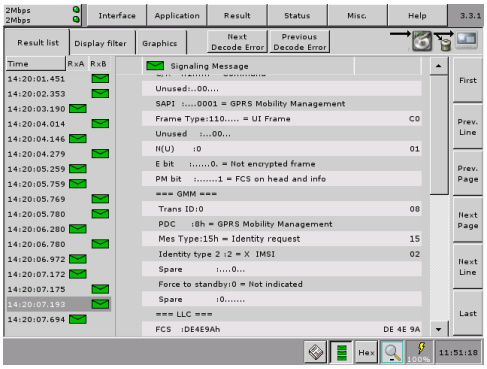


Figure 41 The detailed contents of an unencrypted Gb interface signaling message.

Signaling Statistics

The CMA 3000's signaling statistics provide data on the total traffic load and the quality of the signaling link. For network optimization the GSM Abis Layer 3 and DTAP message type statistics opens many possibilities to the user. Call completion can be examined by comparing the count of SETUP messages on one side of the line with CONNECT messages on the other side of the line. Release cause statistics are also available for the Abis protocols.

On GPRS Abis the load of various PCU frame types can be examined. And for unencrypted messages on the GPRS Abis and on the Gb interface Layer 3 statistics can provide information like *attach request* counts together with information on *attach complete*.

Frame Relay Channel Scanning for Gb Interface

In typical GPRS implementations the Gb interface is a 2 Mbps line carrying several frame relay connections. Each frame relay connection consists of a number of time slots. The CMA 3000 provides a search facility that scans the contents of a monitored 2 Mbps line and identifies the frame relay connections on the line. This way you will easily and rapidly obtain the essential information on the Gb interface configuration.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 GSM/GPRS A-bis options.

ISDN Protocol Analysis Options

The basic ISDN protocol signaling functions include signaling message monitoring with all-level decode, powerful signaling statistics and easy-to-use filter facilities. With this you are able to analyze a range of international and national ISDN, V5.1/V5.2, QSIG protocols and other access protocols. The instrument allows you to capture signaling information from up to four 64 kbps or up to sixteen 16 kbps signaling channels.

Key applications of the ISDN protocol functionality option include Installation testing, rapid in-service diagnostics and troubleshooting, signaling-link performance and load, protocol analysis and troubleshooting plus signaling-message sequence and call completion analysis.

Measurement functions include supervision of the 2 Mbps line and audio access to the traffic channels, as well as line-status and performance measurement. The CMA 3000 transmitter generates test signals for commissioning tests of 2 Mbps PCM systems. The transmitter also allows drop-and-insert testing for in-service measurement of transmission quality.

Protocol Analysis

During installation or troubleshooting, the CMA 3000’s event log provides you with valuable detailed information on the signaling by collecting signaling messages from the connected 2 Mbps line. All layers of the protocol are decoded completely into text (ISDN, V5.x) or mnemonics. The mnemonics can be translated into plain language, and the use and possible values of the field are explained.

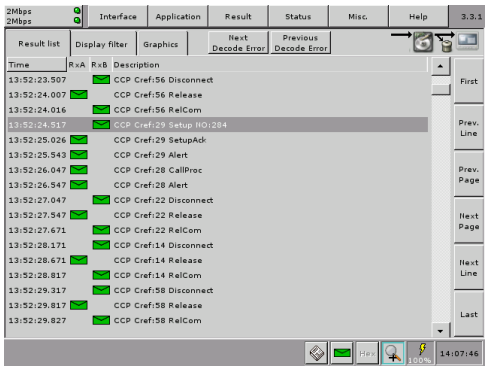


Fig. 42 A Result List presentation of ISDN signaling.

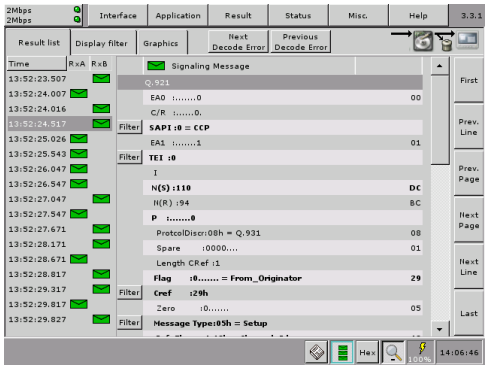


Fig. 43 Detailed presentation of the message contents

The CMA 3000 presents the recorded information in different ways: The Result List gives a one-line indication of each message for a rapid overview of the signaling information. This makes it simple to identify the input on which the message was detected. Intuitive color indications highlight messages that could not be correctly decoded. With the search facility you can easily find such messages. The Result List overview presentation may be expanded to contain a couple of lines per message, stating the most important information in the message. The contents of a message can also be shown, either presenting the main information elements or all parts of the signaling message and the hexadecimal values for detailed inspection and analysis.

Messages are stored in the CMA 3000's memory and can be examined during or after the measurement. Filters can be applied to select the most essential information for storage and display. For ISDN protocols, you may set the filter to display only SETUP messages, providing a quick overview of calls on the line. It's easy to import the Call Reference parameter value to display filters, making the extraction of ISDN messages that belong to the same call a very simple task.

Signaling Statistics

The CMA 3000's signaling statistics provide data on the total traffic load and the quality of the signaling link. For examination of the Layer 2 traffic load on the signaling link, CMA 3000 displays traffic information split into Supervisory (S), Unnumbered (U) and Information frames (I/UI). The ISDN Layer 3 message type statistics provides you with numerous network-optimization opportunities. Call completion can be examined by comparing SETUP messages count on one side of the line with CONNect messages on the other side. Traffic channel load is clearly displayed in a histogram presentation of SETUP message counts. Release cause statistics are also available for the ISDN protocols.

Other Access Protocols

The CMA 3000 supports analysis of other access protocols, such as V5.1/V5.2, QSIG, DPNSS and DASS2. The instrument can capture signaling information from up to four 64 kbps signaling channels. This is particular important when analyzing V5.1/V5.2 systems where the signaling in many cases uses two or three 64 kbps signaling channels.

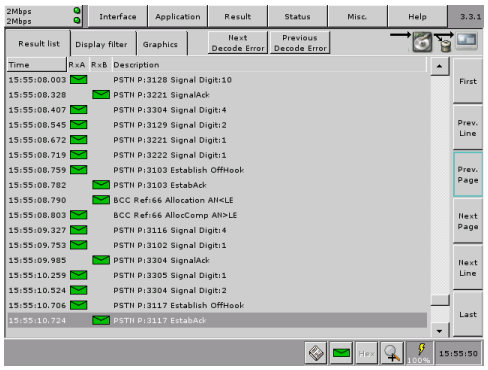


Fig. 44 Overview presentation of V5.2 signaling.

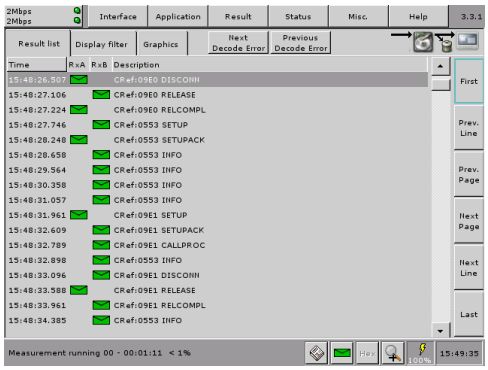


Fig. 45 Overview presentation of QSIG signaling.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 ISDN protocol analysis options.

ISDN PRI Call Emulation

With the ISDN Call Emulation option, the battery-powered CMA 3000 is an easy-to-use, easily transportable test instrument for installation, operation and maintenance of the fixed access network 2 Mbps Primary Rate Interfaces (PRI). The ISDN Call Emulation option provides the necessary functionality for testing ISDN connections. The instrument can setup and receive ISDN calls with user-specified parameters such as called number and facilities. When a connection is setup, a voice call or a BER test can be made. Special facilities allow testing the availability of supplementary services.

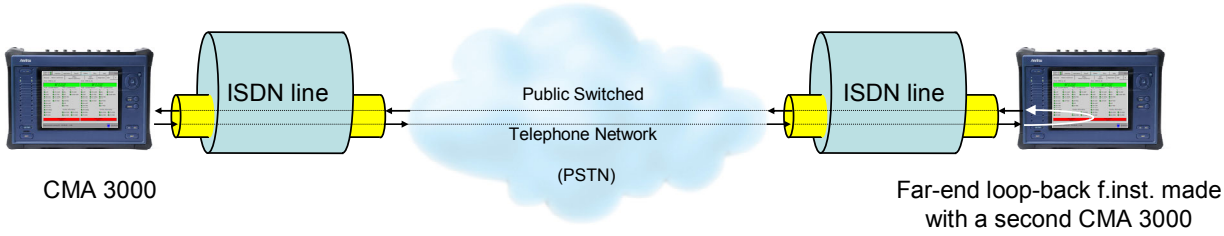


Fig. 46 ISDN call emulation with the CMA 3000.

If ISDN signaling decode options are added, the user gains access to the powerful ISDN protocol functionality of CMA 3000. This includes message monitoring with all-level decode, result presentation in mnemonics, powerful signalling statistics and easy-to-use filter facilities. Measurement functions include supervision of the monitored lines and audio access to the traffic channels, as well as line-status and performance measurement.

Call Emulation

The call emulation function permits the user to setup or answer ISDN calls. The user has numerous call setup options which are all easily configured in the call setup display. The number to be called can either be entered on the instrument itself or the optional telephone set. To load an ISDN PRI connection, up to 30 calls can be active at the same time.

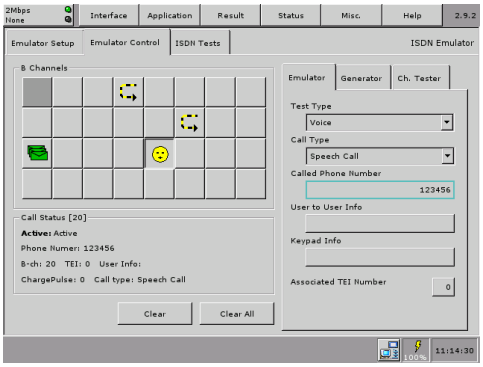


Fig. 47 The status of the emulator will be presented to the user on the Emulator Control page. Calls are activated and answered in the same display.

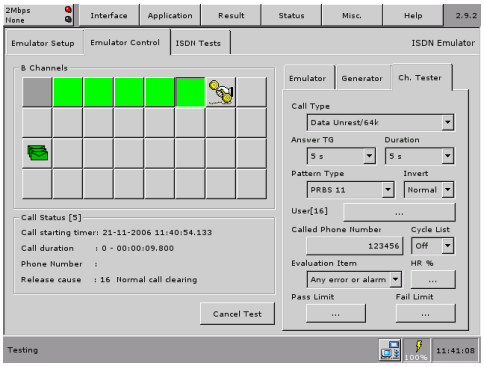


Fig. 48 During and after the channel test the status of the test and the results for the individual channels are displayed in the ISDN channel test status display.

The user has several options for testing an established connection; a conversation with the called party can be carried out on the optional telephone set or by performing a BER test. The BER test can be made with either a far-end loopback or by applying a self-call test. In this case the instrument makes a call to itself using two B-channels.

The user can initiate repeated call setups to a set of telephone numbers with the call generator feature, which generates up to 8 concurrent calls. The number(s) called may be those entered into the phone list of the instrument or one entered when the call generator is started. An automated BER test of each of the traffic channels of an ISDN line can be initiated with the ISDN channel test feature. Hereby all B-channels of the line are easily tested for availability and error performance.

Supplementary Service Test

The instrument allows the user to test the availability of supplementary services on an ISDN line. Calls that require a given supplementary service can be made, and the instrument will inform on the availability of the particular service.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 ISDN PRI call emulation options.

SS7 Protocol Options

Equipped with SS7 protocol options, the CMA 3000 is an easy-to-use, easily transportable test instrument for installation, operation and maintenance of SS7 signaling links. The SS7 protocol options provide the instrument with functions that include message monitoring with decode of all levels, powerful signaling statistics and easy-to-use filter facilities. The decoder options for the instrument supports analysis of wide a range of international (ITU-T, ETSI) and national SS7 protocols including GSM protocols: MAP and A-interface protocols. It captures information from up to four 64 kbps signaling channels in a 2 Mbps link, or if equipped with SDH options, from a 2 Mbps link embedded in the SDH signal.

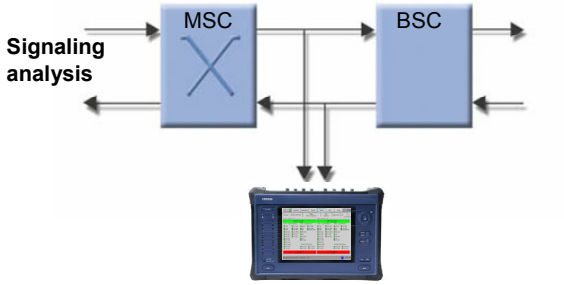


Fig. 49 Bidirectional monitoring of SS7 signaling for protocol analysis with the CMA 3000.

Applications of the SS7 protocol options include installation testing, rapid in-service diagnostics and troubleshooting, signaling-link performance and load measurements, protocol analysis and troubleshooting plus signaling-message sequence and call completion analysis.

Protocol Analysis

During installation or troubleshooting, the CMA 3000's event log provides valuable, detailed information on the signaling by collecting SS7 signaling messages from the connected links. All layers of the protocol are decoded completely into mnemonics. The mnemonics can be translated to plain language and the use and possible values of the field are explained.

The CMA 3000 presents the recorded information in different ways: The Result List gives a one-line indication of each message, providing a quick overview of the signaling information. Intuitive color indications highlight messages that could not be correctly decoded. A search facility makes it easy to find such messages. The Result List overview presentation may be expanded to provide the most important information in the message. The contents of a message can also be shown, either presenting the main information elements or with information on all parts of the signaling message and the hexadecimal values for detailed inspection and analysis. Messages are stored in the CMA 3000's memory and can be examined during or after the measurement. Filters can be applied to select the most essential information for storage and display.

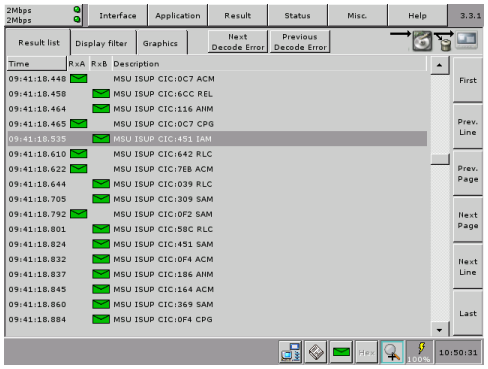


Fig. 50 The Result List presentation of SS7 signaling.

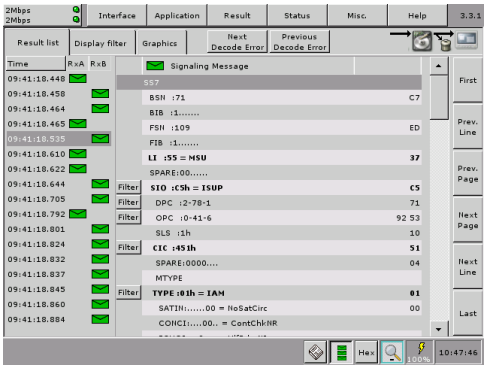


Fig. 51 The detailed presentation of the contents of a SS7 message.

Signaling Statistics

The CMA 3000's signaling statistics provide data on total traffic load and the quality of the signaling link. The instrument can provide information on the SS7 User Parts divided by the SIO value. The SS7 ISUP message statistics open up a vast range of opportunities for network optimization. Call completion in ISUP protocols can be analysed by comparing counts of IAMs on one side of the line with answer messages (ANM) on the other. Release cause statistics are available for ISUP protocols.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 SS7 protocol functionality options.

Remote Access of the CMA 3000

For several applications it is relevant to access the instrument remotely. These applications include:

- Remote operation of the instrument
- Long-term surveillance
- Multi-site surveillance
- Display of screens through a projector
- Documentation and training

These applications are easily achieved by running the FrontSim software option on a PC and the CMA 3000. The FrontSim program presents the screens and alarm indicator LEDS of a remote CMA 3000 on a PC. Likewise mouse-clicks on the PC are transferred to the remote instrument. This allows you to operate the CMA 3000 instrument and view results on a PC exactly as had you been working on the instrument itself, only requirement is that both the PC and the CMA 3000 are connected to a LAN or to the Internet. Furthermore measurement result reports and instrument configuration files can be transferred via FrontSim. Finally upgrade of the instrument SW can be made remotely via FrontSim.

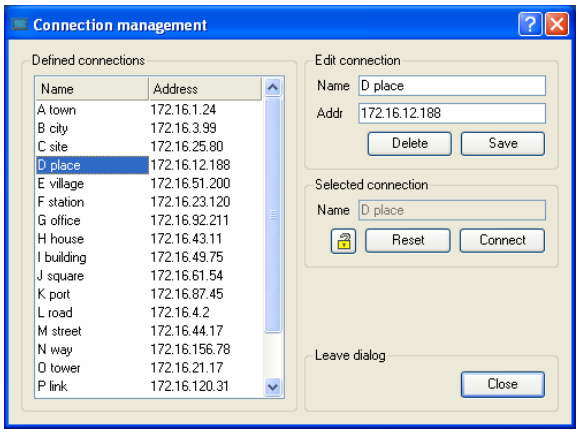


Fig. 52 The connection list provides easy access to instruments located remotely.

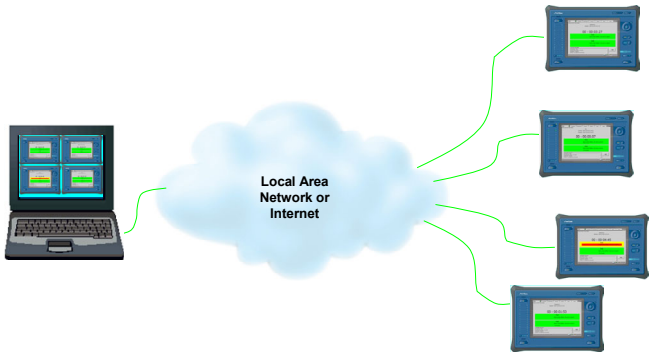


Fig. 53 In compact mode several FrontSim sessions can be monitored simultaneously on the PC screen.

It's possible to open several different FrontSim applications on one PC. This enables you to simultaneously check the results of a number of CMA 3000 instruments from one PC.

With the FrontSim application you can define a list of connections to remote instruments, specifying a connection name and the IP address of each instrument. This is useful when the CMA 3000 instruments have designated fixed IP addresses, making it very easy to access the instruments by simply selecting from the list shown on your PC.

Please refer to the dedicated spec sheet for detailed information on the CMA 3000 Remote access option.

Please refer to the CMA 3000 ordering guide for information on ordering codes and how to configure the the CMA 3000.

Anritsu

Specifications subject to change without notice.

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CMA 3000

SPECIFICATIONS

Basic Instrument

Field testing has never been easier

CMA 3000 is Anritsu's next-generation portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.

The CMA 3000 is a powerful tool for a wide range of applications, including fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.

The basic CMA 3000 configuration, with its two 2 Mbps receivers and transmitters, supports framed and unframed testing and monitoring of 2 Mbps systems. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

Futureproof design

The modular design provides you with a clear and cost-effective upgrade path. This allows you to expand the CMA 3000 from a full-featured transmission line quality tester into an advanced signaling analyzer.

By adding options the CMA 3000 becomes a highly flexible field tester with the ability to test a large number of interfaces and technologies, including Ethernet, SDH, ATM, E3, E4, frame relay lines and the Abis interface of GSM and GPRS networks. Other options turn the CMA 3000 into a very powerful signaling analyzer for GSM, GPRS/EDGE, SS7, and ISDN protocols. Finally, options allow the instrument to emulate VoIP or ISDN PRI calls.

Easy-to-use interface

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret results of measurements.

Key Features	Key Applications
• Simultaneous bi-directional monitoring of 2 Mbps lines • Powerful testing of framed Nx64 kbps and unframed 2 Mbps systems • Simultaneous testing of two 2 Mbps lines • Great flexibility through easy-to-install options • LEDs for immediate line state indications • Large color touch-display • Battery-powered, with more than 10 hours operation between recharges	• Comprehensive out-of-service testing for: o Installation o Provisioning o Propagation time analysis • Performance analysis • Physical line monitoring • In-service monitoring for: o Fast troubleshooting o Traffic monitoring o Identification of synchronization problems o In-service error performance measurement • Drop-and-insert for pseudo in-service testing

Using the high-contrast touch-screen display you can easily customize and store both setup and result screens to fit your personal needs and work routines. You may also configure the CMA 3000 to the received signal, eliminating time-consuming instrument setup. And you can store setups for particular applications in the instrument. To allow quick and easy distribution of standardized test setups within the organization it's also possible to transfer setups to a USB memory stick and subsequently load to other CMA 3000 field testers. With the powerful and flexible report generator you can create .pdf files for selected measurement results. With these files you can provide professional documentation of test results to your customers.

The CMA 3000 has USB ports and a LAN interface for data transfer and external communication to give you full flexibility whether in the field or in the workshop. Remote operation is facilitated through an optional MS Windows® program simulating the instrument's front panel. With another option the CMA 3000 can be remotely controlled with command line scripts, whereby the instrument turns into a fast and reliable tool for automated testing in manufacturing environments.

The instrument is powered by rechargeable and replaceable intelligent high-capacity LiIon batteries, providing more than 10 hours of operation between recharges. The CMA 3000 can also be powered via an external mains adapter for long-term measurements.

Speeds troubleshooting

To speed troubleshooting the CMA 3000 displays alarms and transmission link status on LED indicators. The instrument's two inputs allow instant monitoring of both sides of a line and comparison of simultaneously recorded results.

The CMA 3000 status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current input frequency and deviation
- Indication of input level
- Traffic channel usage
- Audio level in a traffic channel
- Propagation time monitor
- Listen-in on a traffic channel

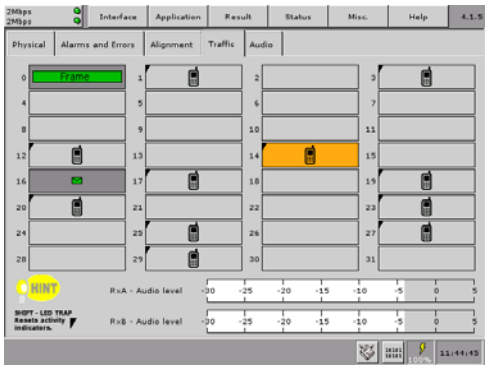

Figure 1 Fast overview of traffic channel time slots.

Fault location is greatly facilitated by the high degree of portability of the robust CMA 3000. This allows you take measurements at any suitable measuring point.

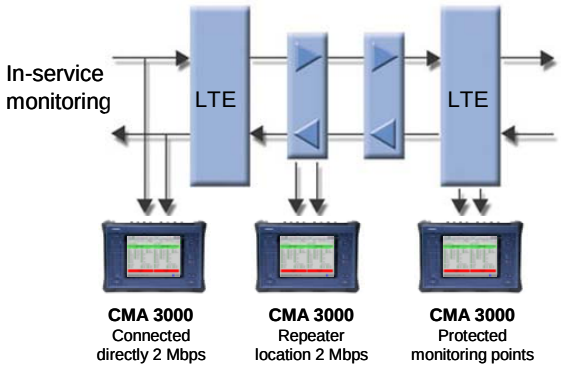

Figure 2 CMA 3000 allows you to perform in-service monitoring of 2 Mbps lines.

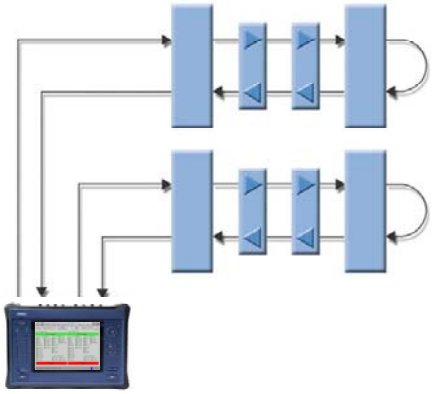

Figure 3 Simultaneous out-of-service testing of up to two 2 Mbps lines.

Out-of-service or in-service statistics

For installation/commissioning and troubleshooting of out-of-service lines the CMA 3000 provides powerful statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a line. Information on errors and alarms is collected in time-intervals as defined by you, and error-performance parameters (G.821/G.826/M.2100) are calculated.

The Measurement Summary function gives you a rapid overview of a measurement via an 'OK/Questionable/not-OK' indication with user defined threshold levels. Histogram presentations facilitate the tracing of errors over time.

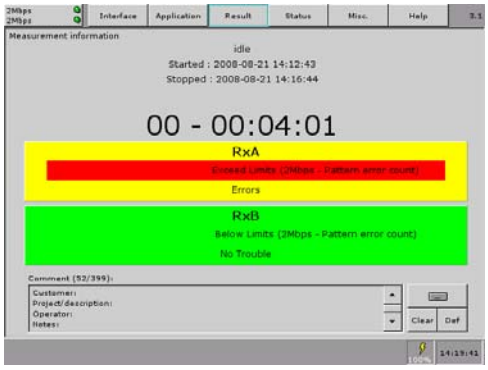

Figure 4 The Measurement Summary function gives you an OK/Questionable/not-OK indication.

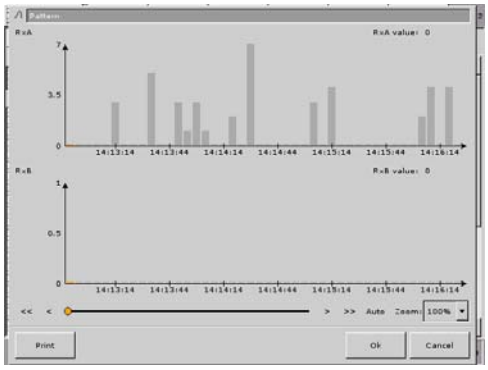

Figure 5 The CMA 3000 histograms facilitate the overview of a statistical measurement.

Out-of-service tests

During installation/commissioning and stress testing of network elements it's possible to control the signal transmitted by the CMA 3000. When generating a 2Mbps signal, the instrument allows you to inject errors and alarms into the transmitted signal. In addition, you may diverge the frequency of the transmitted signal from nominal to test a receiver's ability to handle signals that are out of specifications. For 2 Mbps lines carried through SDH systems you can analyse the APS (Automatic Protection Switching) function of the SDH system with the CMA 3000's APS test and analysis application.

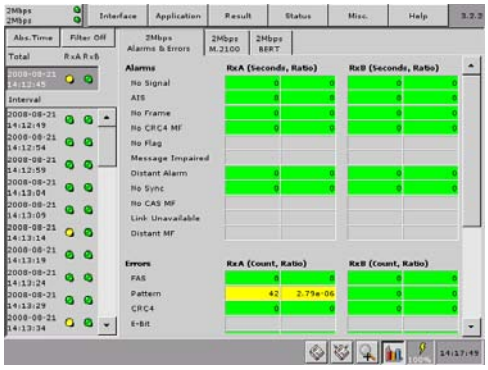

Figure 6 CMA 3000 gives comprehensive statistics on alarms and errors.

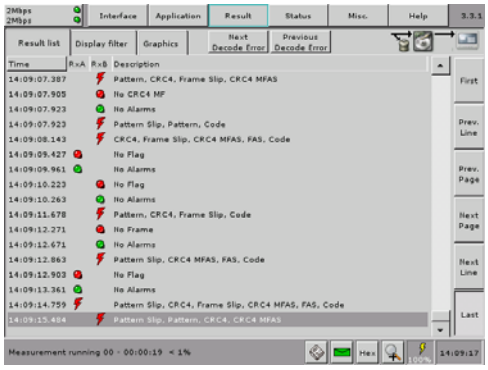

Figure 7 CMA 3000 logs errors and alarms with high-resolution time stamps.

Advanced in-service troubleshooting

Troubleshooting transmission errors may require analysis of timing between events that occur within a few milliseconds. The CMA 3000's high-resolution log makes it easier to analyze timing between errors or alarms. Other events logged are CAS bit changes, Sa bit changes and, depending on the options added, a number of other events types such as GSM, GPRS/EDGE, SS7, and ISDN signaling. This allows you to correlate and observe the different event types. Using filters you may disable the logging and display of individual events, allowing you to view only the most essential information.

Specifications

The specifications table on the following pages covers the functionality of the CMA 3000 basic instrument.

2 Mbps interfaces	
General	The interfaces comply with ITU-T recommendation G.703 for 2 Mbps
Connectors	Unbalanced connector: BNC or Siemens 1.6/5.6 (as specified by the user) Balanced connector: BNO
Port number	Number of transmitters: 2 Number of receivers: 2

Transmitter	
Impedance	Input impedances supported: • 75 Ohms (unbalanced), 120 Ohms (balanced)
Clocks	• Internal 2.048 Mbps clock. Accuracy: 4.6 ppm. Clock may be deviated +/- 125 ppm in 1 ppm steps • Recovered from a receiver • TTL level external 2.048 MHz clock in a D-Sub 15 male connector
Line code	HDB3 or AMI (user-selectable)
Framing	Unframed or framed FAS/nFAS. Sa-bits (non-FAS) are user-programmable
Drop and insert	Supports drop & insert of one or multiple 64 kbps timeslots (TS) within E1
Alarms	Alarm may be generated: • No Signal, AIS, No Frame, CRC4 MF loss, Distant Alarm, CAS MF Loss, Distant MF Alarm
Errors	Errors may be generated: • Bit, code, FAS bit, FAS word, CRC-4, E-bit • Manual: 1-255 consecutive errors (1-16 consecutive FAS word errors) • Continuous 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} • Provoking of G.821, G.826 or M.2100 events (ES, SES etc.) (Bit, FAS, CRC-4, E-bit) Manual slip insertion: frame slip, pattern slip
BER test patterns	Pattern generation: • Unframed of framed n* 64 kbps in contiguous or non-contiguous channel access Test patterns supported: • PRBS 6, PRBS 7, PRBS 9, PRBS 11, PRBS 12, PRBS 15, PRBS 20, PRBS 23, QRSS 11, QRSS 20 • All 0s, All 1s, Alternating (1:1), (1:3), (1:7), (3:1), (7:1), (3:24), Quick brown fox. User-defined up to 16 bits. Length in steps of 1 bit • User-defined up to 2048 bits. Length in steps of 8 bits All patterns, except 'All 0', 'All 1' and 'Fox', can be inverted
Tone and speech signal insertion	Tone in one speech channel on one of the transmitters: • Frequency: 1 Hz to 4 kHz in 1 Hz steps • Level: +3 dBm to -70 dBm in 1 dBm steps Artificial speech signal in one speech channel on one of the transmitters
CAS	CAS signaling bits may be generated

Receivers	
Impedance	Input impedances supported: • 75 Ohms (unbalanced), 120 Ohms (balanced), High (> 10 * nominal)
Jitter tolerance:	In accordance with ITU-T G.823 section 3.1.1
Return loss	Complies with the ITU-T Rec. G.703
Receiver attenuation and impedance modes	TERMINATE: • Up to 40 dB cable attenuation, nominal impedance MONITOR: • Up to 6 dB cable attenuation + 20 dB to 30 dB linear attenuation, nominal impedance BRIDGED: • Up to 40 dB cable attenuation, high impedance
Receiver sensitivity	As stated above. Inputs will tolerate levels up to 3 dB above nominal value
Input level indication	Range: +3 to -42 dB (normal) or - 20 to -32 dB (monitor)
Receive signal rate	• 2048 kbps ± 100 ppm • Frequency deviation indication accuracy: ± 1 ppm
Line Code	HDB3 or AMI (user-selectable)
Framing	Unframed or framed FAS/nFAS
Detectors	• Each input has a no signal detector with levels –20dB, -33dB and full sensitivity • Each input has a signal level detector • Each input has signal frequency detector
Auto configuration	Framing and pattern are automatically determined. Signaling channels are identified if signaling options are installed
Alarms	Alarm detected: • No Signal, AIS, No Frame, CRC4 MF loss, Distant Alarm, CAS MF loss, BERT Pattern Sync Loss, Distant MF Alarm
Errors	Errors detected: • FAS/nFAS errors, Pattern Errors, CRC4 errors, E-bit (FEBE) errors, Code errors, Pattern Slips, Frame Slips
CAS	CAS channel contents (TS16) can be supervised. Whenever a CAS channel contents change, an event is logged and time-stamped
BER test patterns	Same as transmitter. Test patterns are detected in nx64 kbps contiguous or non-contiguous channels (framed) or as an unframed signal
Error performance	G.821, G.826 or M.2100 analysis of a PRBS in the received signal, or based on CRC-4, E-bit or FAS. ES, SES, DM (G.821), BBE (G.826), UAT, EFS, AT % or count. Error performance evaluation for the total measurement: • HR% for a user- defined error performance parameter or programmable OK and not-OK limits for Bit, FAS, CRC-4 or E-bit count or ratio
Round trip delay (propagation time) measurement	• Resolution: 1 µsec (unframed), 0.1 msec framed • Range: 0 - 4 sec
Time-slot monitoring	FAS, NONFAS, CAS signaling, Contents of single time slot incl. positive/negative peak values and coder offset. Level and frequency for encoded tone: • Frequency: 1 Hz to 4 kHz with 1 Hz resolution • Level: +3 dBm to -66 dBm with 1 dBm resolution
Speech decode	64 kbps (ITU-T Rec. G.703): A-law according to ITU-T Rec. G.711

Results	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication • Frequency deviation • Round trip delay • Contents of one time slot • FAS/non-FAS and CAS bits • Traffic overview: Busy/idle indication from all 31 channels
Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Code error count/ratio • Pattern bit, FAS, CRC-4 and E-bit error count/ratio and G.821, G.826 or M.2100 parameters • Frequency deviation information
Event Log	• Events are logged with 1 msec resolution time stamps • Logged events: Detected alarms and errors. Changes in CAS and Sa bits • Filters enable/disable the logging of individual events
APS	APS (Automatic Protection Switching) test and analysis: • APS switching time is measured. Switching time above a user defined threshold is highlighted o Trigger events (user selectable): 2 Mbps alarms (LOS, No Frame or AIS). • Number of switchovers Resolution of APS switching time measurement: • No Frame, AIS : 1 msec • LOS: Undefined

User Interface	
Display	8 ¼ “ active TFT display with VGA resolution (640x480 pixels) and touch screen
LEDs	34 bi-color LEDs (with text on display)

Service interfaces	
USB data Interface	Two USB 1.1 ports. Connector type A. CMA 3000 will operate as host
Ethernet Interface	Ethernet 10/100. One RJ45 connector
V.24 data Interface	DTE. Connector: 9 pin, D-sub, Male

Other interfaces	
Phone Interface	• For connection of an optional telephone set; to insert human voice into a traffic channel and to listen-in using the loud speaker in the telephone set Connector: • RJ11 (1x6) Female
Built-in loudspeaker	• The built-in loudspeaker monitors speech in both directions of a voice channel • Output level: user-controlled from front panel • A 3.5 mm diameter jack provides ear phone access to the audio signal. The built-in loudspeaker is disconnected when a headset is plugged in
Compact Flash	The instrument is equipped with one Compact Flash socket

Miscellaneous	
Battery	10.8 V rechargeable and replaceable intelligent LiIon battery Operating time (basic instrument): • With PowerSave; more than 10 hours • Without PowerSave; more than 6 hours Charging time: Typically 3 to 6 hours Indicator for remaining capacity: % and hours/minutes
Mains adapter	Input: 100-240 V AC, 50-60 Hz Output: 18 V DC, max. 3.4 A
Mechanical	Basic instrument: • Dimensions: Approx. 23 x 33 x 7.5 cm (HxWxD) • Weight: Approx. 3.3 kg
Environmental	Operating temperature: 0°C to +40°C Storage temperature: -25°C to +60°C The CMA 3000 is CE-marked and complies with EN 50081-1 and EN 50082-1
Standard accessories	User's Guide, LiIon battery, Mains adapter with mains cable, Stylus
Options	• Ethernet 10/100 Mbps interface measurement option • Ethernet 10/100/1000 Mbps interface measurement option • Ethernet 10 Mbps / 100 Mbps / 1 Gbps /10 Gbps interface measurement option o Two versions: Single or dual port at 10 Gbps level o 10G LAN PHY and 10G WAN PHY options • IP over Ethernet measurement option (requires an Ethernet option) • Ethernet multistream option (requires an Ethernet option) • Ethernet stacked VLAN option (requires an Ethernet option) • Ethernet MPLS option (requires an Ethernet option) • VoIP Call emulation options (requires an Ethernet option) • SDH test options • E3 interface testing • E4 interface testing (requires an SDH test option) • ATM-over-SDH measurement option (requires an SDH test option) • ATM- over-E1/E3 measurement option (E3 requires E3 test option) • V-series interface measurement option • Frame relay test option • Abis protocols – ETSI and vendor specific[1] • Vendor specific GPRS Abis PCU protocols[1] • GPRS Gb interface protocol decode (requires Frame relay test option) • SS7 protocols[1] • ISDN protocols[1] • ISDN PRI call emulators[1] • FrontSim (remote operation) option • Remote Control – Scripting option
Additional accessories	• Carrying case • Carrying soft bag • Instrument carrying strap • Extra LiIon battery • Stand-alone battery charger • Ear phones • Telephone set • Measurement cables
Service products	• Factory calibration

Notes

[1] Please contact your local Anritsu representative for details on available protocols

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CMA 3000

SPECIFICATIONS

SDH, E3 and E4 test options

Testing SDH networks has never been easier

CMA 3000 is Anritsu's next-generation portable and future proof field tester for the installation and maintenance of access and core networks. The CMA 3000 covers a wide range of applications, from fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.

When equipped with the SDH test option, the CMA 3000 is a powerful and easy-to-use tool for testing SDH and PDH systems. E3 testing is supported if the E3 test option is installed while E4 testing is supported with the E4 interface add-on option for the SDH option. The SDH option has a very flexible configuration, with two electrical receivers and one electrical transmitter in its basic form. It can also be equipped with one or two optical modules. With two optical modules, the instrument supports simultaneous bi-directional monitoring of SDH lines. This makes CMA 3000 the ideal instrument for both in- and out-of-service transmission-quality measurements.

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret important information from the SDH signal. For fast troubleshooting, the CMA 3000 displays alarms and transmission link status on LED indicators.

In addition, the trouble scan feature provides a fast approach to examining the SDH signal for major problems. Furthermore the user can make the CMA 3000 automatically configure to the received SDH signal, eliminating lengthy instrument setup.

The powerful 2 Mbps analysis capabilities of the basic CMA 3000 enables you to analyze a demultiplexed 2 Mbps signal embedded in an SDH signal. Additional CMA 3000 options let you carry out signaling analysis of GSM, GPRS/EDGE, SS7 and ISDN protocols and testing of ATM, Ethernet 10Gbps/1 Gbps/100 Mbps/10 Mbps, VoIP, V-series, E4 and E3 interfaces.

Key Features	Key Applications
• Simultaneous bi-directional monitoring of SDH lines • Powerful testing of SDH systems and embedded PDH systems • Mapping and de-mapping • Comprehensive error and alarm statistics • Overhead byte testing and monitoring • Trouble scan • Pointer event generation and monitoring	• Comprehensive out-of-service testing for: o Installation o Provisioning • Performance analysis • Multiplex testing • Physical line monitoring • In-service monitoring for: o Fast troubleshooting o Overhead byte analysis o Traffic monitoring o In-service error performance measurement

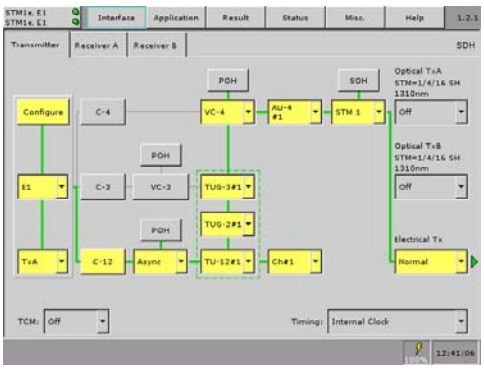

Fig.1: The intuitive user interface of CMA 3000 facilitates the SDH test setup.

Speeds SDH troubleshooting

The CMA 3000 status monitor allows you to speed troubleshooting, as the status monitor is always active providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current input frequency and deviation
- Indication of optical input level
- Display of overhead bytes
- Propagation time monitor
- Traffic channel usage in an embedded 2 Mbps signal
- Audio level in a traffic channel in an embedded 2 Mbps signal
- Listen-in on a traffic channel in an embedded 2 Mbps signal

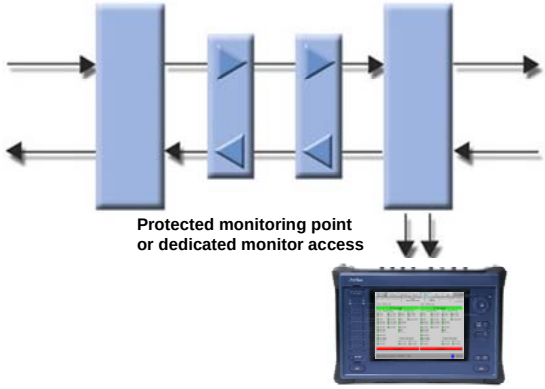

Fig.2: With the CMA 3000 you're able to perform bi-directional in-service monitoring of SDH lines.

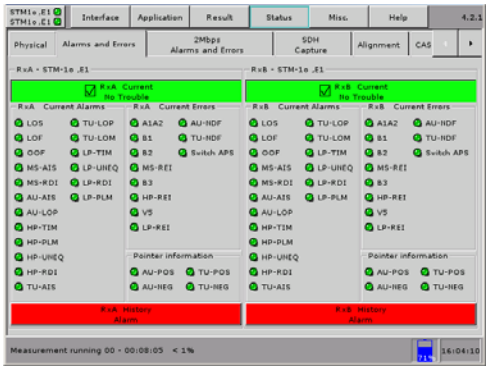

Fig.3: The CMA 3000 gives you a quick overview of errors and alarms of both sides of the SDH line.

Further troubleshooting can be done, using the CMA 3000 Trouble Scan feature. It allows you to examine the SDH signal for major problems and get them highlighted in an easy-to-understand display. In-depth trouble analysis can be done using the instruments pointer movement graph.

Fig.4: The trouble scan feature gives you a quick overview of the tributaries of the monitored line.

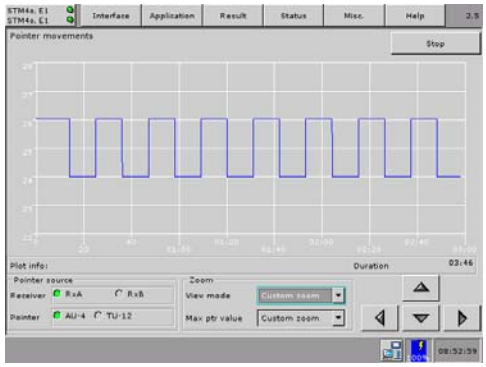

Fig.5: The pointer graph allows a detailed analysis of pointer movements in the monitored SDH signal.

For monitoring purposes you may connect the CMA 3000 using optical splitters or special test interfaces. If neither is available, you can use the CMA 3000 through-mode to access the signal.

Out-of-service or in-service SDH statistics

For installing/commissioning and out-of-service troubleshooting of SDH lines the CMA 3000 provides powerful statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a line together with information on pointer operations. G.826, G.828, G.829 or M.2100 error-performance parameters are calculated for the measurement. The result is highlighted with easy-to-understand color indications.

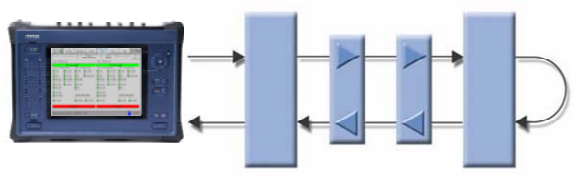

Fig.6: By looping back a test signal from the CMA 3000 at the far end, you can easily test the quality of SDH lines.

Out-of-service SDH tests

During installation/commissioning and stress testing of network elements you can control the signal transmitted by the CMA 3000. When generating an SDH signal the instrument provides you with great flexibility for injecting errors, alarms, pointer

operations and overhead byte changes into the transmitted signal. In addition, you can deviate the frequency of the transmitted signal from nominal to test a receiver's ability to handle signals that are out of specifications.

A special test feature provides easy testing of APS (Automatic Protective Switching) to allow identification of maximum switchover time during the test. Should the result be above the user-defined threshold you will receive an indication of the problem. SDH or 2 Mbps events can be selected to trigger measurement of the switchover time.

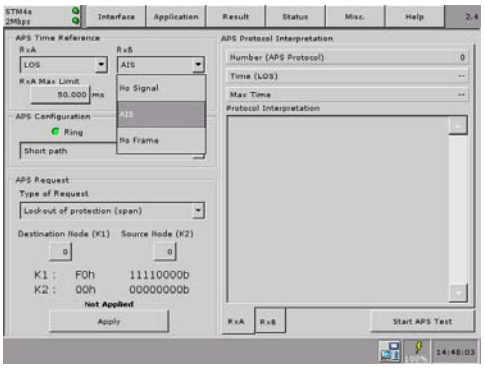

Fig.7: The dedicated APS test application makes it easy to find the maximum APS switchover time.

E4 test option

A CMA 3000 equipped with an SDH option can get an E4 option added for testing with E4 lines. The E4 signal can also be mapped into the SDH signal. Installing/commissioning and out-of-service troubleshooting of E4 lines is supported in the CMA 3000 by statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of an E4 line and G.826 or M.2100 error-performance parameters are presented.

E3 test option

The instrument can be equipped with an E3 option for testing with 34 Mbps and unframed 45 Mbps bit streams. The E3 option can be installed together with the SDH option in which case the 34/45 Mbps signal can be mapped into the SDH signal. If the SDH option is not installed, installation of the E3 option makes the CMA 3000 a powerful tool for testing at 34 Mbps, 45 Mbps and 2 Mbps rates.

Installing/commissioning and out-of-service troubleshooting of E3 lines is supported in the CMA 3000 by statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a 34 Mbps line and G.826 or M.2100 error-performance parameters are calculated for the measurement.

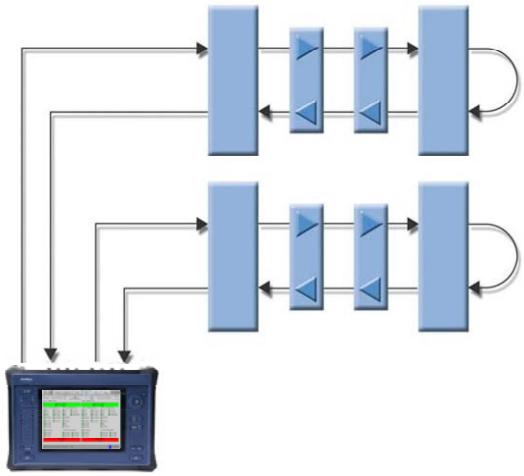

Fig.8: By looping back a CMA 3000 test signal at the far end, you can easily test the quality of E3 lines. Two lines can be tested simultaneously.

Specifications

The specifications below list the functionality for a basic CMA 3000 with SDH, E4 and/or E3 test options installed. For more information on the functionality of the basic configuration please refer to the CMA 3000 basic instrument specifications sheet.

<table>
<tr><th colspan="6">Specifications (SDH test option)</th></tr>
<tr><td>Electrical</td><td colspan="5">
• Available module:
o Enhanced SDH test option incl STM-1 Electrical Interface (supports optional optical STM-1, STM-4 and STM-16 modules)
• Comply with ITU-T recommendation for electrical 155 Mbps interfaces
• Interfaces: STM-1
• Line Code: CMI
• No. of transmitters (Tx): 1; No. of receivers (Rx): 2
• Test configurations: Tx/Rx, Rx/Rx, Tx/Rx/Rx
• Connectors: BNC
• Impedance: 75 Ohms
• The Enhanced SDH test option incl STM-1e provides an electrical level indicator for a received signal
</td></tr>
<tr><td>Attenuation and impedance modes (electrical receivers)</td><td colspan="5">
TERMINATE: Up to 12.7 dB cable attenuation, nominal impedance
MONITOR: Attenuation in accordance with ITU-T recommendations
The two modes are manually selected by the user
</td></tr>
<tr><td>Optical</td><td colspan="5">
Up to 2 optical modules can be installed.
• NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000.
• Safety measures for laser products: Optical modules for the CMA 3000 comply with optical safety standards in IEC 60825-1.
• Specification of optical modules purchased from Anritsu for the CMA 3000 (each with 1 transmitter and 1 receiver) with LC connectors (specifications may be subject to change without further notice):
<table>
<tr><th>Description
(approx. distance)</th><th colspan="2">Min. input
sensitivity and wavelength</th><th colspan="2">Output
power and wavelength</th></tr>
<tr><td>STM-1 short haul,
1310 nm (15 km)</td><td>- 28
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 15 dBm
and -8 dBm</td><td>Between 1261 nm
and 1360 nm</td></tr>
<tr><td>STM-1/-4 short haul,
1310 nm (15 km)</td><td>- 28
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between -15 dBm
and -8 dBm</td><td>Between 1274 nm
and 1356 nm</td></tr>
<tr><td>STM-1/-4/-16 [5] short haul,
1310 nm (15 km)</td><td>-18
dBm</td><td>Min. 1270 nm
Max. 1580 nm</td><td>Between - 5 dBm
and 0 dBm</td><td>Between 1270 nm
and 1360 nm</td></tr>
<tr><td>STM-1 long haul,
1310 nm (40 km)</td><td>- 34
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 5 dBm
and 0 dBm</td><td>Between 1263 nm
and 1360 nm</td></tr>
<tr><td>STM-1 long haul,
1550 nm (80 km)</td><td>- 34
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 5 dBm
and 0 dBm</td><td>Between 1480 nm
and 1580 nm</td></tr>
<tr><td>STM-1/-4 long haul,
1310 nm (40 km)</td><td>- 28
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 3 dBm
and 2 dBm</td><td>Between 1280 nm
and 1335 nm</td></tr>
<tr><td>STM-1/-4 long haul,
1550 nm (80 km)</td><td>- 28
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 3 dBm
and 2 dBm</td><td>Between 1480 nm
and 1580 nm</td></tr>
<tr><td>STM-1/-4/-16 [5] long haul,
1310 nm (40 km)</td><td>-27
dBm</td><td>Min. 1270 nm
Max. 1580 nm</td><td>Between - 2 dBm
and 3 dBm</td><td>Between 1280 nm
and 1335 nm</td></tr>
<tr><td>STM-1/-4/-16 [5] long haul,
1550 nm (80 km)</td><td>-28
dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 2 dBm
and 3 dBm</td><td>Between 1500 nm
and 1580 nm</td></tr>
</table>
• Test configurations: Tx/Rx, with two optical modules also Rx/Rx, Tx/Rx/Rx
• An optical level indicator for a received optical signal is provided
</td></tr>
<tr><td>Input offset range</td><td colspan="5">± 50 ppm</td></tr>
<tr><td>Transmitter clocks</td><td colspan="5">
• Internal clock accuracy: 4.6 ppm. Clock may be deviated up to 50 ppm.
• Recovered from SDH input with same speed
• TTL level external 2 MHz clock
• Recovered from 2Mbps
</td></tr>
<tr><td>Framing</td><td colspan="5">According to ITU-T rec. G.707</td></tr>
<tr><td>Scrambling</td><td colspan="5">According to ITU-T rec. G.707</td></tr>
</table>

SDH mappings	Support of the following mappings in accordance with the ITU-T rec. G.707: VC-12/2 Mbps structure (x=1, 4^3 or 16^6): • STM-x ->AU-4 ->VC4->TUG-3 ->TUG-2 ->TU-12 ->VC-12 ->C-12->2 Mbps PDH (async./sync. mapping) VC-3/34/45 Mbps structure (x=1, 4^3 or 16^6): • STM-x->AU-4->VC4->TUG-3->TU-3->VC-3->C-3->34/45 Mbps PDH[2] VC-4/140 Mbps structure (x=1, 4^3 or 16^6): • STM-x->AU-4->VC4-> C-4->140 Mbps PDH[7] VC-4/Bulk test (x=1, 4^3 or 16^6): • STM-x->AU-4->VC-4->Bulk test pattern VC-4-4c/Bulk test (y=4^3 or 16^6): • STM-y->AU-4-4c-> VC4-4c-> C4-4c->Bulk test pattern VC-4-16c/Bulk test: • STM-16 -> AU-4-16c -> VC4-16c -> C4-16c -> Bulk test pattern[6]
SDH/ATM mappings[4]	VC-4/ATM structure (x=1, 4^3 or 16^6): • STM-x -> AU-4 -> VC-4 -> ATM VC-4-4c/ATM structure (y=4^3 or 16^6): • STM-y -> AU4-4c -> VC4-4c -> ATM
Alarms	Alarms can be detected or generated: • LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-PLM, LP-UNEQ, LP-TIM, LP-RDI, LSS For 2 Mbps alarms supported please refer to the CMA 3000 basic instrument specifications sheet
Errors	Errors can be detected or generated: • B1, A1/A2, B2, MS-REI, B3, HP-REI, LP-B3, LP-REI, V5 Error insertion: • Manual: 1-8000 consecutive errors • Continuous 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, 10^{-9}, 10^{-10} For 2 Mbps errors supported please refer to the CMA 3000 basic instrument specifications sheet
Error performance	• G.826/G.828/G.829/M.2100 analysis of the received signal based on detected errors and alarms: ES, SES, BBE (not M.2100), UAT, EFS, AT • Error performance evaluation for the total measurement: HR% allocation
BER test patterns	Pattern generation and detection for O.181 bulk test pattern: • Test patterns supported: PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31. PRBS patterns can be inverted. All 0s, All 1s, Alternating 1/0, 1000 binary, 1010 binary, 2 in 8, 1 in 8, user-defined 2 bytes For 2 Mbps test patterns supported please refer to the CMA 3000 basic instrument specifications sheet
Pointers	• Support pointer events monitoring and generation • Pointer operations in accordance with G.783 • Events for graphical display of pointer movements
Overhead	• Generation of section and path overhead bytes • Display of current section and path overhead bytes
Round trip delay (propagation time) measurement	• Resolution: 0.1 µsec • Range at STM-1: 0 - 15 sec with PRBS 31 as test pattern • Range at STM-4: 0 - 3.5 sec with PRBS 31 as test pattern [3] • Range at STM-16: 0 - 0.85 sec with PRBS 31 as test pattern [6]
Tributary signals	For E1 signals (one per active receiver) embedded in a selected VC-12, the CMA 3000 basic instrument E1 functionality is available For E3/DS-3 signals (one per active receiver) embedded in a selected VC-3, the E3/DS-3 functionality is available if the E3 test option is installed. For E4 signals (one per active receiver) embedded in a selected VC-4, the E4 functionality is available if the E4 test option is installed.

Results (SDH test option)	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication for optical signals • Input level indication for electrical signals • Actual bit rate • Frequency deviation • Difference between RxA and RxB bit rate (current and accumulated) • Round trip delay
Statistics	User-defined resolution: • 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Errors • Pointer operations
APS	APS (Automatic Protection Switching) test and analysis: • APS switching time is measured. Switching time above a user defined threshold is highlighted o Trigger events (user selectable): SDH alarms and errors; APS switchover, E1 alarms (LOS, No Frame, AIS). • Number of switchovers indicated by APS protocol • K1/K2 bytes can be set and displayed Resolution of APS switching time measurement: • SDH events excl. VC-12 events and LOS (Loss of Signal): 0.125 msec • VC-12 events: 0.5 msec • E1 events: 1 msec • LOS: Undefined

Related options	
ATM-over-SDH test option[4]	Please refer to the spec. sheet on CMA 3000 ATM test options for further information
Tandem connection monitoring[1]	Please refer to the spec. sheet on Tandem Connection Monitoring for further information

Notes

1 Requires installation of a CMA 3000 SDH test option module

2 Requires installation of the E3 test module

3 Requires installation of an STM1/-4 optical module

4 Requires installation of the ATM-over-SDH option

5 Requires installation of the Enhanced SDH test option incl STM-1e

6 Requires installation of an STM-1/-4/-16 optical module and the Enhanced SDH test option incl STM-1e

7 Requires installation of the E4 test option

Specifications (E4 test option – requires installation of an SDH option and the E4 test option)	
Electrical	• Comply with ITU-T rec. G.703 for139264 kbps kbps interfaces • Interfaces: E4 • Line Code: CMI • No. of Transmitters (Tx): 1; No. of Receivers (Rx): 2 • Test configurations: Tx/Rx, Tx/Rx/Rx, Rx/Rx • Connectors: BNC through the connectors also used for electrical STM-1 signals • Impedance: 75 ohms
Attenuation and impedance modes	TERMINATE: Up to 12.7 dB cable attenuation, nominal impedance MONITOR: Attenuation in accordance with ITU-T recommendations • SDH Test Option Incl. STM-1 Electrical Interface: Both modes automatically supported by the electrical receivers • Enhanced SDH test option incl STM-1e: The two modes are manually selected by the user
Transmitter clocks	• Internal. Accuracy: 4.6 ppm. Clock may be deviated up to 50 ppm from nominal. • Recovered from an E4 receiver • TTL level external 2 MHz clock
Framing	According to ITU-T rec. G.751 for E4 signals
Alarms	Alarms can be detected or generated: • No Signal, AIS, No Frame, Distant, No Sync
Errors	Errors can be detected or generated: • FAS, Pattern, Pattern slip Error insertion: • Manual: 1-255 consecutive errors • Continuous 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, ES and SES
Error performance	• G.826/M.2100 analysis of the received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS
BER test patterns	Pattern generation and detection. Test patterns supported: • PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, QRSS • All 0's, All 1's, Alternating 1:1, Alternating 1:3, Alternating 1:7, User 16bits • All patterns except “All 0” and “All 1” can be inverted
Round trip delay (propagation time) measurement	• Resolution: 0.1 µsec • Range: 0 - 15 sec with PRBS 31 as test pattern

Results (E4 test option – requires installation of an SDH option and the E4 test option)	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication (requires installation of the Enhanced SDH test option incl STM-1e) • Actual bit rate • Frequency deviation • Difference between RxA and RxB bit rate (current and accumulated) • Round trip delay
Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Errors • Frequency deviation

Specifications (E3 test option)	
Electrical	• Comply with ITU-T recommendation for 34 368 kbps and 44 736 kbps interfaces (ITU-T rec. G.703). • Interfaces: E3 / DS-3 • Line Code: HDB3 (E3), B3ZS (DS-3) • No. of Transmitters (Tx): 2; No. of Receivers (Rx): 2 • Test configurations: Tx/Rx, dual Tx/Rx, Rx/Rx • Connectors: BNC through the connectors also used for 2 Mbps signals • Impedance: 75 ohms
Attenuation and impedance modes	TERMINATE: Up to 12 dB cable attenuation, nominal impedance MONITOR: Attenuation in accordance with ITU-T recommendations
Transmitter clocks	• Internal. Accuracy: 2.5 ppm. Clock may be deviated up to 40 ppm from nominal. • Recovered from an E3/DS3 receiver
Framing	According to ITU-T rec. G.751 for E3 signals (DS-3 signals are unframed)
Alarms	Alarms can be detected or generated: • No Signal, AIS, No Frame (E3 only), Distant (E3 only), No Sync
Errors	Errors can be detected or generated: • FAS (E3 only), Code, Pattern, Pattern slip Error insertion: • Manual: 1-255 consecutive errors • Continuous 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, ES and SES
Error performance	• G.826/M.2100 analysis of the received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS
BER test patterns	Pattern generation and detection. Test patterns supported: • PRBS 7, PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31 • Fox Pattern, All 0's, All 1's, Alternating 1:1, Alternating 1:3, Alternating 1:7, Alternating 3:24, User 16bits, User 2048bits • All patterns except “All 0”, “All 1” and “Fox” can be inverted
Round trip delay (propagation time) measurement	• Resolution: 0.1 msec • Range: 0 - 15 sec with PRBS 29 as test pattern

Results (E3 test option)	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication • Actual bit rate • Frequency deviation • Difference between RxA and RxB bit rate (current and accumulated) • Round trip delay
Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Errors • Frequency deviation

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CMA 3000

SPECIFICATIONS

10 G interface option

General description

When equipped with the 10G interface and Ethernet measurement options, the battery-powered, easy-to-use and portable Anritsu CMA 3000 is a comprehensive solution for testing and measuring LAN and WAN communication lines up to 10 Gbps, in addition to the full-featured 2 Mbps transmission testing provided by the CMA 3000 basic instrument. Adding additional CMA 3000 options allows you to also test V-series data interface connections, E3, unframed DS3, E4 and SDH lines.

The 10G interface option comes in two versions: a single port and a dual port version at the 10Gbps rate. Optional optical modules can be inserted in the 10G ports. Both versions include a dual-port Ethernet 1000/100/10 Mbps test interface equipped with electrical and optional optical interface ports.

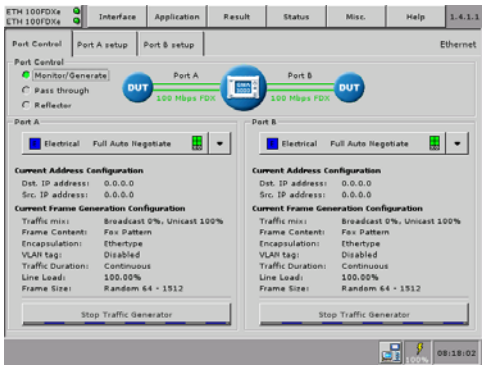

Fig. 1 The operation of the CMA 3000 is made easy through an intuitive graphical user interface.

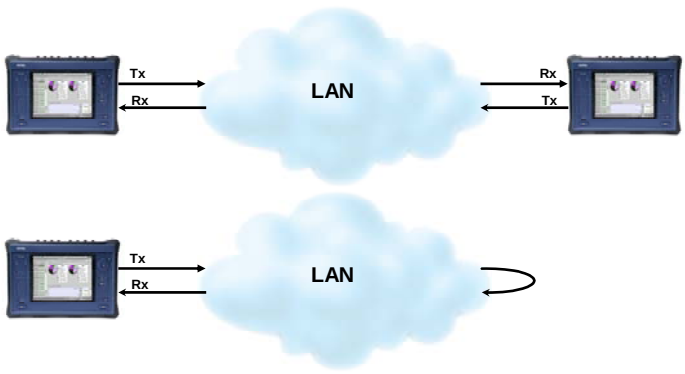

Fig. 2 Out-of-service testing with two instruments or a far-end loop back.

Key Features	Key Applications

• 10G LAN PHY and 10G WAN PHY options
• Single or dual port at the 10G rate
• Dual-port Ethernet 1000/100/100Mbps test interface
• Traffic generation capabilities up to full line rate
• Comprehensive statistics
• Automated RFC 2544 testing of:
  o Throughput
  o Frame loss
  o Latency
  o Packet jitter
  o Burstability
• Simultaneous monitoring of both directions on a line
• IPv4 and IPv6 support
• Multistream, Stacked VLAN, MPLS and VoIP test options
	• Installation and commissioning testing
	• QoS verification
	• End-to-end testing
	• Rapid in-service diagnostics and troubleshooting

The 10G interface option can be equipped with a 10G LAN PHY option. With this the option can test and analyze Ethernet links at rates from 10 Gbps to 10 Mbps. A 10G WAN PHY option can be added to test and analyze Ethernet traffic encapsulated in OC-192/STM-64 frames.

Transmitters and receivers permit out-of-service testing for installation, commissioning and Quality of Service (QoS) verification while a pass-through mode enables in-service monitoring for both fast troubleshooting and detailed analysis of the live traffic on the line. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

You can easily read and interpret information from the tested lines off the large color display with easy-to-understand colors and graphical symbols. For fast troubleshooting, the CMA 3000 displays alarms and transmission link status on LED indicators. And the graphical user interface makes it a simple task to configure and operate the instrument.

Installation, commissioning and QoS verification

For installation, commissioning and QoS verification CMA 3000 provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. Performance and QoS statistics are presented in tables and graphs facilitating results interpretation. Through preprogrammed thresholds, CMA 3000 can isolate abnormal conditions on the tested line.

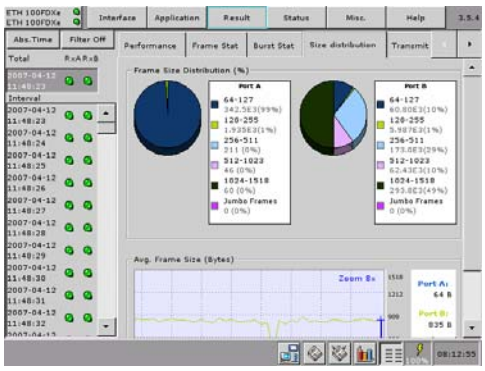

Fig. 3 Statistics are presented in tables and easy to understand graphs.

RFC 2544 analysis

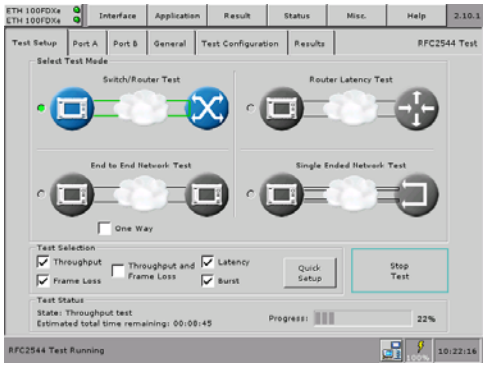

Fig. 4 Intuitive configuration of the RFC 2544 tests

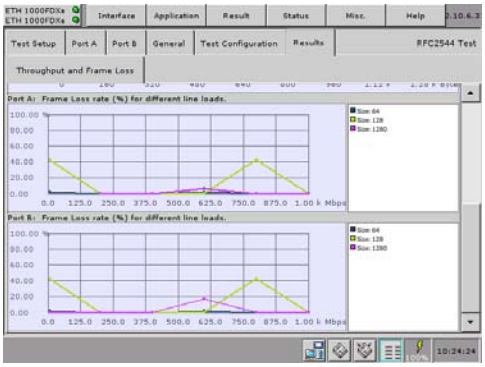

Fig. 5 CMA 3000 presents RFC 2544 results in graphs or tabular format

The IETF RFC 2544 “Benchmarking Methodology for Network Interconnect Devices” defines a number of tests to be used for describing the performance characteristics of these network devices. With the CMA 3000 Ethernet options, testing of performance parameters, such as throughput and frame loss, latency, packet jitter and burstability in compliance with RFC 2544 is straightforward. CMA 3000 automates the testing procedure while still allowing you to configure the test to be as thorough as needed. To get full information on the performance of both sides of a line, the end-to-end test mode allows two CMA 3000 to work together in a master-slave setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.

In-service troubleshooting

For fast troubleshooting the CMA 3000 status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current line status
- Optical level indication
- Electrical cable test facility
- Indication of main link quality parameters : Utilization, Throughput and Errored frames

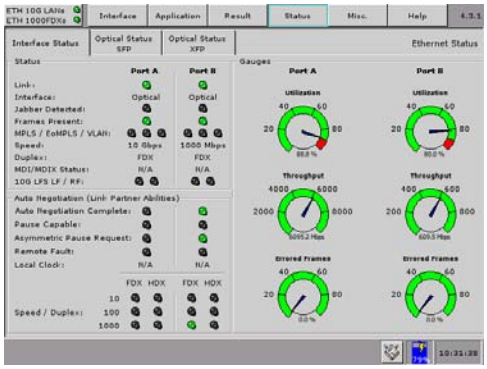

Fig. 6 Interface status indicators for a quick overview of the line’s condition.

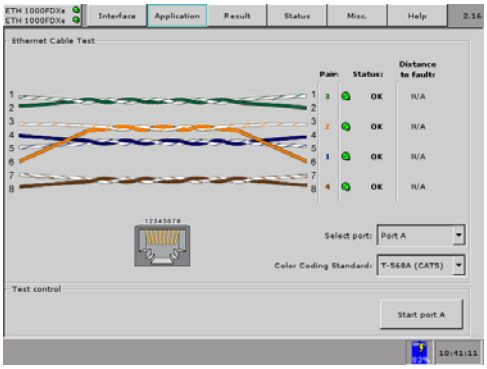

Fig. 7 The CMA 3000s cable test facility makes it easy to identify failures on electrical cables like short circuits or breaks of a wire pair. The cable test facility also indicates the distance from the instrument to the fault.

Detailed in-service analysis

CMA 3000 can analyze live traffic in details by presenting statistics on the main performance indicators for a monitored line. To facilitate the analysis of data it’s possible to define threshold values for a number of parameters. CMA 3000 uses the thresholds to color-highlight results outside the acceptable range. This is also indicated on the LEDs of the instrument.

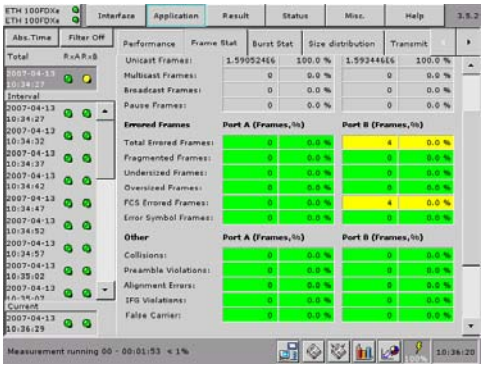

Fig. 8 Tabular presentation of performance statistics.

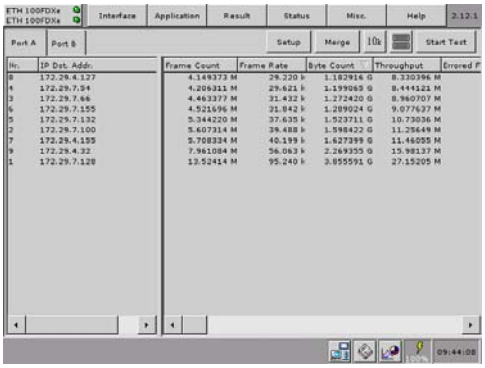

Fig. 9 IP traffic analysis with the IP channel statistics option.

IP channel statistics option

For further analysis of live IP traffic on the Ethernet line CMA 3000 can be equipped with the IP channel statistics option. This option provides detailed information on the traffic on the monitored line for up to 232 individual channels, identified by parameters like Ethernet addresses, IP addresses, VLAN tags or MPLS labels. This allows you to identify whether a channel:

- Loads the line heavily
- Sends many errored frames
- Uses the line in an inefficient way

Ethernet Multistream option

The Ethernet multistream option for the CMA 3000 allows the user to test a congested networks ability to transport high priority traffic rather than lower priority traffic. The user can activate up to 8 streams per port with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network. With the multistream option you also get information on packet jitter and latency per stream, issues that can cause problems for services like VoIP.

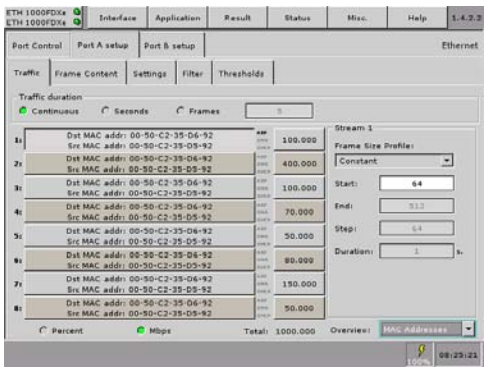

Fig. 10 The CMA 3000 gives an easy overview of the up to 8 streams that it can generate.

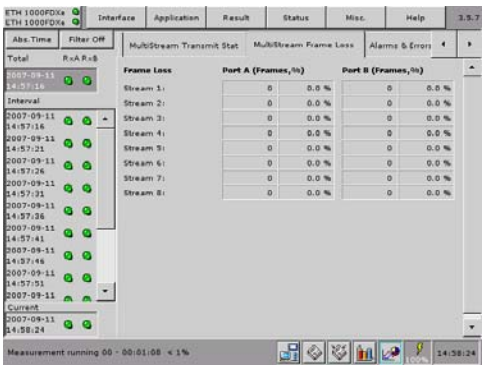

Fig. 11 Information on frame loss in shown for up to 8 streams in one screen to make it easy to compare how the streams are transported through the network.

Stacked VLAN option

Stacked VLAN (Q-in-Q) is increasingly used in several types of Ethernet based networks. With a CMA 3000 equipped with Ethernet and Stacked VLAN options the user has a powerful tool for testing such networks. The Stacked VLAN option supports up to 8 levels of VLAN tags.

MPLS option

MPLS (Multi Protocol Label Switching) allows efficient routing of traffic in packet based networks. With a CMA 3000 equipped with Ethernet and the MPLS option the user has a powerful tool for testing this type of traffic. Up to 8 levels of MPLS labels can be inserted. The MPLS option also supports EoMPLS (Ethernet over MPLS) also known as PWE3 (Pseudo Wire Emulation Edge-to-Edge), which defines transport of layer 2 protocol across an MPLS network.

VoIP test options

With a CMA 3000 equipped with VoIP and Ethernet options the field technician can use the same instrument for testing VoIP services and the basic Ethernet transport system.

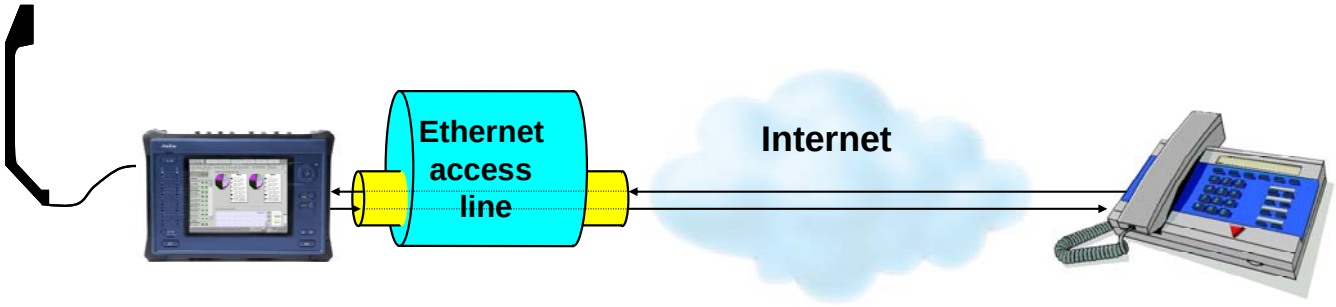

Fig. 12 Basic VoIP connectivity is verified by calling another party using the CMA 3000's VoIP functionality.

For VoIP testing the instrument can establish a call and answer incoming calls. By connecting an analog telephone to the CMA 3000 the user can make a conversation with the called/calling party. Statistics collected during the call will inform the user on the performance of the communication line used for the call. Based on this an add-on option can present voice quality information in terms of Mean Opinion Score (MOS) and R-factor values for one call at the time.

To make a realistic test case the instrument can generate or receive up to 8 calls simultaneously. These calls can be made on one or both test ports in the Ethernet option. If the instrument is also equipped with the Ethernet Multistream option, each of the 8 calls can be assigned to a stream, f.inst. allowing individual configuration of priority for the calls.

Fig. 13 **A total of 8 VoIP calls can be generated through the CMA 3000's two Ethernet test ports**. The voice quality evaluation is presented for one call if the Voice Quality Measurement option is installed.

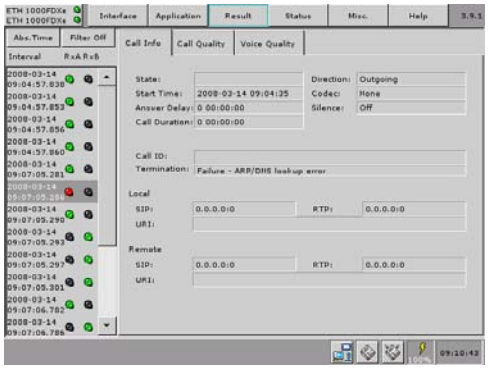

Fig. 14 VoIP call records are stored in memory when a measurement is active. Unsuccessful calls are highlighted with a red indicator in the left column.

10 G WAN PHY option

When the 10G interface is equipped with a 10G WAN PHY option the CMA 3000 can be used for test and analyze of Ethernet traffic encapsulated in OC-192/STM-64 frames. The instrument provides powerful statistics for analysis of the transmission-error performance of a line together with information on pointer operations. G.826, G.828/G.829 or M2101 error-performance parameters are calculated for the measurement. When generating a 10 G WAN PHY the instrument provides you with great flexibility for injecting errors, alarms and overhead byte changes into the transmitted signal.

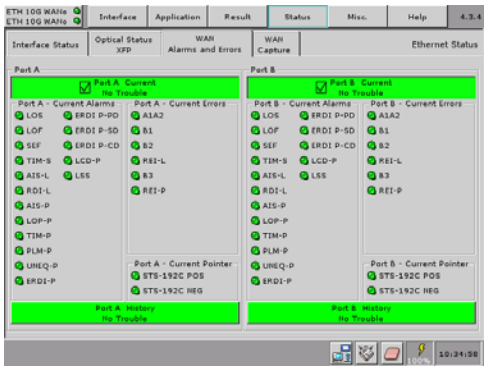

Fig. 15 **A quick overview of the alarm and error status on the line**.

Fig. 16 Statistics for analysis of the transmission-error performance.

Specifications

The specifications below list the functionality for a basic CMA 3000 with 10 G interface option installed. For information on the functionality of the basic configuration please refer to the CMA 3000 basic instrument specifications sheet.

Ethernet test interfaces

Hardware option attached to basic instrument

- Optical line interfaces 1 or 2 ports 10 Gbps, user-selectable optical modules: 850 nm (SR), 1310 nm (LR) and 1550 nm (ER)
  NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000.
- Optical line interfaces 2 ports 1000 Mbps, user-selectable optical modules: 850 nm (SX), 1310 nm (LX) and 1550 nm (ZX) or 100 Mbps 1310 nm (FX or LX)
  NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000.
- Electrical line interfaces 2 ports (in addition to the optical ports) 10/100/1000 Mbps RJ45 (unshielded and shielded twisted pair cables, category 5, 5E, and 6)
- **Safety measures for laser products:** Optical modules for the CMA 3000 comply with optical safety standards in IEC 60825-1.
- Specification of optical modules purchased from Anritsu for the CMA 3000 (each with 1 transmitter and 1 receiver) with LC connectors (specifications may be subject to change without further notice):

Description (approx. distance)	Min. input sensitivity and wavelength		Output power and wavelength	
10GBASE- SR 850 nm Multi mode (0.3 km)	-11.1 dBm	850 nm Center	Between -6.5 dBm and - 1.5 dBm	Between 840 nm and 860 nm
10GBASE - LR 1310 nm Single mode (10 km)	-14 dBm	Min. 1260 nm Max. 1600 nm	Between -6 dBm and -1 dBm	Between 1290 nm and 1330 nm
10GBASE - ER 1550 nm Single mode (40 km)	-16 dBm	Min. 1260 nm Max. 1600 nm	Between -1 dBm and 2 dBm	Between 1530 nm and 1565 nm
10GBASE - ER 1550 nm Single mode (80 km)	-23 dBm	Min. 1260 nm Max. 1575 nm	Between 0 dBm and 4 dBm	Between 1530 nm and 1565 nm
1000BASE-SX 850 nm Multi mode (0.5 km)	-17 dBm	Min. 770 nm Max. 860 nm	Between -9.5 dBm and -3 dBm	Between 830 nm and 860 nm
1000BASE-LX 1310 nm Single mode (10 km)	-20 dBm	Min. 1260 nm Max. 1580 nm	Between -9 dBm and -3 dBm	Between 1285 nm and 1343 nm
1000BASE-ZX 1550 nm Single mode (80 km)	-24 dBm	Min. 1260 nm Max. 1580 nm	Between 0 dBm and 5 dBm	Between 1500 nm and 1580 nm
100BASE-FX 1310 nm Multi mode (2 km)	-31 dBm	Min. 1270 nm Max. 1600 nm	Between -20 dBm and -15 dBm	Between 1280 nm and 1380 nm
100BASE-LX 1310 nm Single mode (10 km)	-31 dBm	Min. 1270 nm Max. 1620 nm	Between -15 dBm and -8 dBm	Between 1261 nm and 1360 nm

Ethernet test configurations (10 G LAN PHY option required)

- Monitor/generate
- Pass-through
- Reflector

Ethernet measurements (10 G LAN PHY option required for support of 10 Gbps Ethernet)

Supported encapsulations (frame formats)

- EtherType II (DIX v.2)
- IEEE 802.3 with 802.2 (LLC1)
- IEEE 802.3 with SNAP

Traffic generation

- Variable line rate traffic generation, up to full line rate
- Line load profile: Constant or ramp
- Traffic duration: Continuous, programmable number of seconds or frames
- Adjustable frame size from 44 bytes to 16000 bytes
- Frame sizes may be set to constant, stepped or random length
- User-defined traffic mix of unicast and broadcast frames
- User-defined VLAN ID and VLAN priority
- Fixed or incremented IP identifier
- Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing). Fixed, DHCP, DNS.
- Generate pause frames

	• Respond to pause frames • Answer incoming ARP and ping requests (On/Off) • User programmable DSCP/TOS byte • User programmable UDP/TCP address • Automatic TCP connect (user selectable) • UDP check sum: automatic or fixed (null). TCP check sum: automatic • Optional Ethernet (MAC) address swapping (reflector mode)
Receiver settings	• User-defined expected preamble length (3 to 15 bytes) • User-defined IFG lower threshold (8 to 15 bytes) for Ethernet 10/100/1000 Mbps • User-defined Jumbo frame size upper limit (1519 to 16000 bytes)
Error generation	• IFG for Ethernet 10/100/1000 Mbps, FCS, Preamble, Error symbol • Wrong IP checksum, fragmented IP, UDP with zero checksum • PRBS bit error, BERT sequence error
Alarm generation	• No link, Remote fault
Cable test	Identifies failures on electrical cables like short circuits or breaks of a wire pair and indicates the distance from the instrument to the fault. • Max distance: 110 m, accuracy: +/- 3 m.
RFC 2544 installation and commissioning	Switch/router test and Single ended network test modes: • Throughput • Frame loss • Latency or packet jitter • Back-to-back frames (burstability) End to end network test mode (two CMA 3000s in a master-slave setup) • Throughput • Frame loss • Back-to-back frames (burstability) Router latency test mode: IP ping based latency test or packet jitter For RFC 2544 throughput measurement the user can choose to make the measurement for: • Utilization layer • Physical layer • Physical layer excl. preamble • Link layer • Network layer • Data layer • Average or maximum values
BER test	Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation: Unframed, framed with IP header or framed with IP header and TCP/UDP header Detection of sequence errors and loss of sequence synchronization. Frame loss count and frame loss seconds Throughput measurement results are calculated for: • Utilization layer • Physical layer • Physical layer excl. preamble • Link layer • Network layer • Data layer • Min, avg. and max. values are presented Test patterns supported: • PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT, 55 Hex, Fox, 16 bit user programmable User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hour
Service disruption measurement	Service disruption measurement that can be activated as a part of the BER test • Max. and avg. service disruption time, resolution 0.1 µsec • Number of service disruptions

Ping test	For connectivity and configuration check • Round Trip Time (RTT) • Supports IPv4 and IPv6 addressing • Answer incoming Ping requests (On/Off)
Traceroute	Trace the IP route over the IP network • User-defined max no. of hops (1 to 255) Information per hop: Min/avg/max ping time and no. of ping time outs
Reflector mode	The following parameters are user selectable: • Swap all MAC addresses or one specific MAC address • Swap IP addresses • Swap port numbers on UDP/TCP frames • Force ACK on TCP frames Maximum internal delay when instrument is in reflector mode: 0.5 µsec @10Gbps, 2.1 µsec @1Gbps, 12.4 µsec @100 Mbps, 113.1 µsec @10 Mbps

Results (10 G LAN PHY option required for support of 10 Gbps Ethernet)	
Status	• Link status • Remote fault • Signal present • Jabber detected • Frames present • Speed • Full or half duplex • Interface type • Local clock (Ethernet 1000) • Pause capable and Asymmetric pause request (not Ethernet 10Gbps) • Link partner capabilities • Indicators for Utilization, throughput and errored frames CMA 3000 indicates the signal level for optical Ethernet interfaces
Resolution	User-defined resolution for statistical measurements: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hour
Performance statistics	• Max/min/avg utilization • Max/min/avg throughput • Max/min/avg frame rate • Max/min/avg Latency • Max/min/avg Packet jitter
Frame statistics	• Total frames • Total valid frames • Unicast/multicast/broadcast frames • Number of pause frames • Total errored frames • Fragmented frames • Number of oversized and undersized (runts) frames • Number of FCS errored frames • Error symbol frames (not Ethernet 10Gbps)/Code violation frames (Ethernet 10Gbps) • Number of collisions (10/100 Mbps half duplex) • Preamble violations • IFG violations (Ethernet 10/100/1000 Mbps) • False carrier • 10G LFS LF (local fault) • 10G LFS RF (remote fault)

Burst statistics	• Total frames in bursts • Max/min/avg burst size
Frame distribution statistics	• Total valid/good frames • 64 - 127 byte frames • 128 - 255 byte frames • 256 - 511 byte frames • 512 - 1023 byte frames • 1024 - 1518 byte frames • Total number of jumbo frames • Max/min/avg frame size
Filters	Up to 8 filter conditions can be defined. Each condition can filter on: • IP or MAC source address • IP or MAC destination address • Broadcast address • IEEE OUI value • Encapsulation type • VLAN ID and VLAN tag priority • MPLS • TPC/UDP source and destination port • User-defined pattern at a defined offset
Adjustable thresholds	• Utilization • Throughput • Collision rate • Unicast frames • Multicast frames • Broadcast frames • Pause frames • Errored frames • Undersized frames (runts) • Oversized frames • FCS errored frames • IFG violations (Ethernet 10/100/1000 Mbps) • Preamble violations
DHCP	• Show source IP address assigned by DHCP • Show current lease expire time • Show IP addresses of primary and secondary DNS server when obtained by DHCP

Ethernet Stacked VLAN option (10 G LAN PHY option required for support of 10 Gbps Ethernet)	
Number of VLAN tags	Up to 8 VLAN tags can be set by the user Only 1 level of VLAN is supported in ping, traceroute and RFC2544 router latency tests
Parameters per VLAN tag	• EtherType 0x8100 (802.1Q), 0x88a8 (802.1ad), 0x9100 or 0x9200 • User-defined VLAN ID, CFI and VLAN priority
Status	Indicator for detection of VLAN tagged frames
Statistics	Available information: • Number of VLAN tagged frames • Max. number of VLAN layers detected

Ethernet Multistream option (10 G LAN PHY option required for support of 10 Gbps Ethernet)	
Number of streams	Up to 8 streams per port can be activated
Parameters per stream	• Encapsulation (frame format) • Line rate traffic load, up to full line rate • Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6) • User-defined traffic mix of unicast and broadcast frames • Adjustable frame size from 44 bytes to 16,000 bytes • Frame sizes may be set to constant, stepped or random length • User programmable VLAN ID and VLAN priority, DSCP/TOS byte and UDP/TCP address In stream 1 a BER test can be made
Statistics	Available information per stream: • Frame loss count/rate • Throughput • Latency • Packet jitter • Frames and bytes received and transmitted

IP channel statistics option (10 G LAN PHY option required for support of 10 Gbps Ethernet)	
Statistics	The statistics are provided for up to 232 channels, identified by user-defined combinations of: • IPv4, IPv6 or MAC address • VLAN ID or MPLS label • Protocol information • IP next header (protocol) • TPC/UDP ports Traffic Capacity: • 10 Mbps line speed, 100 Mbps line speed and 1 Gbps line speed: 100% line load • 10 Gbps line speed: o With average frame size 530 bytes (or higher) and the longest burst of short frames (64 bytes) is 84: 100% line load o For all frame sizes: The traffic capacity is up to 2.20 Mframes per second when the longest burst of short frames (64 bytes) is 84. o If the above conditions are not fulfilled, frames will be discarded from the IP Channel statistics. A special counter will show the number of frames discarded from the IP Channel statistics. Available information per channel: • Frame count/rate • Throughput • Byte count • MPLS frames • Jumbo frames • Errored frames and errored frame rate • Errored throughput • Errored byte count • Frame/packet size distribution • IP header bytes • IP fragments • TTL threshold violations • IP packet count, rate • IP bytes • IP throughput • IP header errors • TCP/UDP bytes • TCP/UDP packet count, rate, throughput • TCP/UDP errored packets

Ethernet MPLS option (10 G LAN PHY option required for support of 10 Gbps Ethernet)	
MPLS supported	MPLS unicast is supported (EtherType 0x8847) Support for MPLS in BERT, RFC 2544 (exculding router latency) Tests and general statistics MPLS can only transport VLAN and VoIP if EoMPLS is activated
Number of MPLS headers	Up to 8 MPLS headers can be set by the user
Parameters per MPLS headers	User-defined label, Exp and TTL fields in the MPLS header
EoMPLS support	An EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo Wire Emulation Edge-to-Edge) label (the RFC4448 Control word) can be added.
Status	Indicator for detection of MPLS frames and EoMPLS
Statistics	Available information: • Number of MPLS frames and EoMPLS frames • Max. number of MPLS layers detected

VoIP Call emulation options (10 G LAN PHY option required for support of 10 Gbps Ethernet)	
Emulation modes	The instrument supports Client/Terminal emulation.
Supported protocols (options)	• SIP RFC 3261 • RTP/RTCP RFC 3550 and RFC 3551 • ITU-T H.323 Full connect • ITU-T H.323 Fast connect The VoIP call emulation options run on IP v4 only.
Settings	The following settings are user selectable: • Calling alias • IP address DHCP/static and Subnet mask • Gateway address and DNS server • DSCP/TOS byte • MAC address • VLAN ID and VLAN priority • RTCP on/off • Silence ringing signal SIP specific parameters (requires SIP call emulator): • Proxy/registrar address and port, User name, password, Registrar expire time H.323 specific parameters (requires H.323 call emulator): • Gate Keeper Mode (No Gate Keeper, Auto Discover Gate Keeper, Static Gate Keeper • Gate Keeper address and port, User name, password, H.245 tunneling
Supported Voice Coding	The following Voice codings are supported: • µ-law/A-law (G.711) • ACELP 5.3, MPC-MLQ 6.3 kbps (G.723.1) • ADPCM 16/24/32/40 kbps (G.726) (only with SIP call emulator) • LD-CELP 16 kbps (G.728) • CS-ACELP 8 kbps (G.729 a,b) • GSM FR • GSM EFR • Fixed codec preference list User selectable • Silence suppression (depends on selected codec) • Jitter buffer delay • Source: Voice conversation (optional telephone), tone, pre-recorded speech signal
Simultaneous calls	Up to 8 calls can manually be generated at a time
Call generator	Up to 8 simultaneous calls can automatically be generated repeatedly.

Call emulation logs	The following information is provided for each call: • IP address/Alias, RTP ports, Answer delay, Duration of call, Encoding (codec), Silence suppression On/Off • Call progress and error messages with 1 msec resolution
Call statistics	• Throughput sent/Throughput received as Bytes and Packets • Out of sequence packets. • Packet loss • Packet jitter (msec, (min/cur/max) • Packet Round Trip Time (RTT) (msec, (min/cur/max)
DTMF detection	Received in-band DTMF (tone signal in the audio stream) can be recorded for one speech channel. DTMF detection can be enabled and disabled.
Voice quality (optional)	Voice quality measurement on one call at the time: • Uses Telchemy's algorithms for achievement of MOS and R-factor values at live traffic end points: • MOS: Conversational, Listening, P.862 estimate, Maximum with selected codec • R-factor: Conversational, Listening, G.107 estimate, Listening during Burst and Gap periods, Maximum with selected codec • Voice quality evaluation summary, based on user defined thresholds
VoIP measurements	When a measurement is running Call emulation logs, call statistics are stored pre call that terminated during the measurement. DTMF information and the optional Voice quality information are stored for calls where they were measured. In addition there is a summary for all calls terminated during the measurement with information on: • Total number of calls. Number of Incoming, Outgoing, succeed, failed calls • Call duration (min/avg/max). Answer delay (min/avg/max) • Throughput sent/Throughput received as Bytes and Packets (min/avg/max/total) • Out of sequence packets. (min/avg/max/total) • Packet loss (min/avg/max/total) • Packet jitter (msec, min/max) • Packet Round Trip Time (RTT) (msec, min/max)
Phone Interface	Interface for connection of an analog telephone AC impedance: Approx. 600Ω. The phone will be supplied with a constant current of approx. 20 mA The phone supports receiving and transmitting speech signals. Connector: RJ-11 (1x6)

10G WAN PHY option (10 G LAN PHY option required)	
WAN modes	10GigE (normal), WAN-PHY with Mixed-frequency test pattern, Square wave pattern, PRBS 31 pattern
Terminology	SONET or SDH
Error insertion	SONET Terminology: • A1A2, B1, B2, REI-L, B3, REI-P SDH Terminology: • B1, A1/A2, B2, MS-REI, B3, HP-REI
Alarm insertion	SONET Terminology: • LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, ERDI P-PD, ERDI P-SD, ERDI P-CD SDH Terminology: • LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD
Error measurement	SONET Terminology: • A1A2, B1, B2, REI-L, B3, REI-P SDH Terminology: • B1, A1/A2, B2, MS-REI, B3, HP-REI G.826, G.828+G.829 or M.2101.1(M.2100) error performance parameters are calculated

Alarm detection	SONET Terminology: • LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, ERDI P-SD, ERDI P-CD, ERDI P-PD, LCD-P, LSS SDH Terminology: • LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD, LSS
Overhead byte functionality	Generation of overhead bytes, defined by the user Capture and display of current overhead bytes
Pointer operation monitor	Positive movements, Negative movements, NDF

Miscellaneous	
Mechanical	The 10G interface option is a module plugged onto the back of the instrument. • Dimensions of 10G interface option module: Approx. 10 x 30.7 x 4.3 cm (HxWxD) • Weight of 10G interface option module: Approx. 1.1 kg

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CMA 3000 SPECIFICATIONS

Ethernet

The user-friendly Ethernet tester from 10 Gbps to 10 Mbps

CMA 3000 Ethernet is Anritsu's portable, compact and user-friendly field tester dedicated to Ethernet testing from 10 Gbps to 10 Mbps. The battery-powered, easy-to-use and portable CMA 3000 Ethernet is a comprehensive solution for testing and measuring LAN and WAN communication lines. Add-on options enable the CMA 3000 Ethernet to perform multistream testing and to test stacked VLAN, MPLS and VoIP services.

The CMA 3000 Ethernet comes in two versions: a single port and a dual port version at the 10 Gbps rate. Optional optical modules can be inserted in the 10 G ports. Both versions include a dual-port Ethernet 1000/100/10 Mbps test interface equipped with electrical ports and ports for optional optical interfaces.

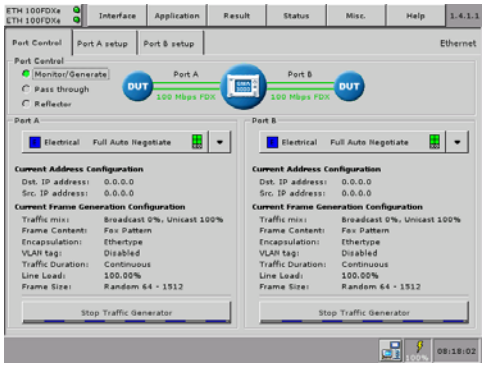

Fig. 1 The operation of the CMA 3000 Ethernet is made easy through an intuitive graphical user interface.

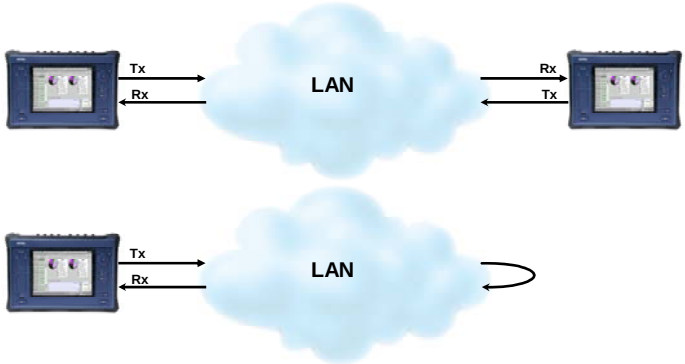

Fig. 2 Out-of-service testing with two instruments or a far-end loop back.

Easy-to-use interface

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret results of measurements. Using the high-contrast touch-screen display you can easily customize and store both setup and result screens to fit your personal needs and work routines. You can store setups for particular applications in the CMA 3000 Ethernet. To allow quick and easy distribution of standardized test setups within the organization it's also possible to transfer setups to a USB memory stick and subsequently load to other instruments. With the powerful and flexible report generator you can create .pdf files for selected measurement results. With these files you can provide professional documentation of test results to your customers.

The CMA 3000 Ethernet has USB ports and a LAN interface for data transfer and external communication to give you full flexibility whether in the field or in the workshop. Remote operation is facilitated through an optional MS Windows® program simulating the instrument's front panel. With another option the CMA 3000 Ethernet can be remotely controlled with command line scripts, whereby the instrument turns into a fast and reliable tool for automated testing in manufacturing environments.

The CMA 3000 Ethernet can test and analyze Ethernet links at rates from 10 Gbps to 10 Mbps. A 10G WAN PHY option can be added to test and analyze Ethernet traffic encapsulated in OC-192/STM-64 frames.

Transmitters and receivers permit out-of-service testing for installation, commissioning and Quality of Service (QoS) verification while a pass-through mode enables in-service monitoring for both fast troubleshooting and detailed analysis of the live traffic on the line. This makes CMA 3000 Ethernet the ideal instrument for measuring in-service and out-of-service transmission quality.

You can easily read and interpret information from the tested lines off the large color display with easy-to-understand colors and graphical symbols. For fast troubleshooting, the CMA 3000 Ethernet displays alarms and transmission link status on LED indicators.

The instrument is powered by a rechargeable and replaceable intelligent high-capacity LiIon battery. The CMA 3000 Ethernet can also be powered via an external mains adapter for long-term measurements.

Key Features	Key Applications

• Single or dual port at the 10G rate
• Dual-port Ethernet 1000/100/10 Mbps test interface
• Supports 10 G LAN PHY
• 10 G WAN PHY option
• Traffic generation capabilities up to full line rate
• Comprehensive statistics
• Automated RFC 2544 testing of:
  o Throughput
  o Frame loss
  o Latency
  o Packet jitter
  o Burstability
• Simultaneous monitoring of both directions on a line
• IPv4 and IPv6 support
• Multistream test option
• Stacked VLAN option
• MPLS option
• VoIP test options
• Large color touch-display
• LEDs for immediate line state indications
	• Comprehensive out-of-service testing for:
	  o Installation
	  o Provisioning
	  o Propagation time analysis
	• QoS verification
	• End-to-end testing
	• Rapid in-service diagnostics and troubleshooting
	• Physical line monitoring

Installation, commissioning and QoS verification

For installation, commissioning and QoS verification CMA 3000 Ethernet provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. Performance and QoS statistics are presented in tables and graphs facilitating results interpretation. Through preprogrammed thresholds, CMA 3000 Ethernet can isolate abnormal conditions on the tested line.

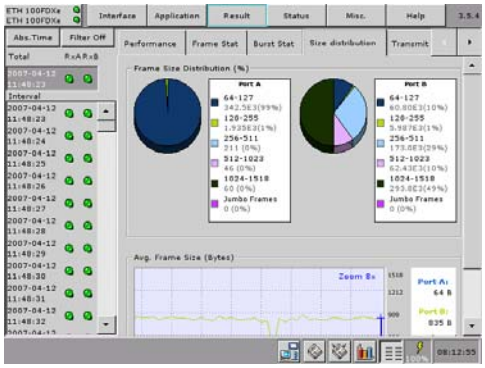

Fig. 3 Statistics are presented in tables and easy to understand graphs.

RFC 2544 analysis

The IETF RFC 2544 “Benchmarking Methodology for Network Interconnect Devices” defines a number of tests to be used for describing the performance characteristics of these network devices. With the CMA 3000 Ethernet, testing of performance parameters, such as throughput and frame loss, latency, packet jitter and burstability in compliance with RFC 2544 is straightforward. CMA 3000 Ethernet automates the testing procedure while still allowing you to configure the test to be as thorough as needed. To get full information on the performance of both sides of a line, the end-to-end test mode allows two CMA 3000 Ethernet to work together in a master-slave setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.

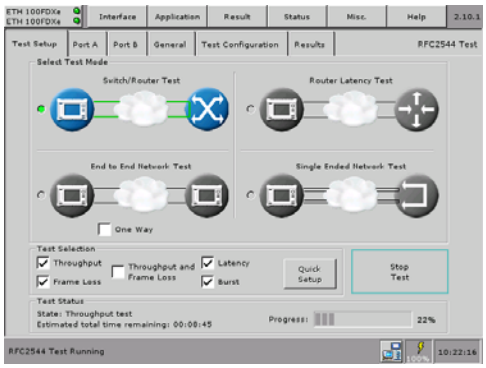

Fig. 4 Intuitive configuration of the RFC 2544 tests

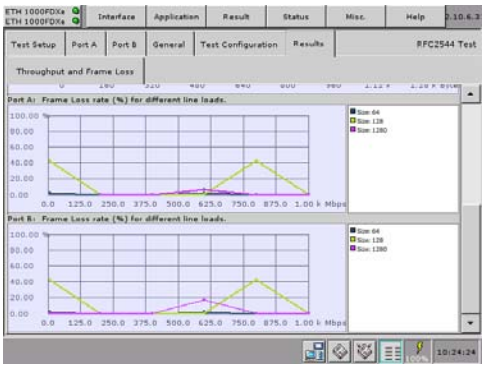

Fig. 5 RFC 2544 results are presented in graphs or tabular format

In-service troubleshooting

For fast troubleshooting the CMA 3000 Ethernet status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current line status
- Optical level indication
- Electrical cable test facility
- Indication of main link quality parameters : Utilization, Throughput and Errored frames

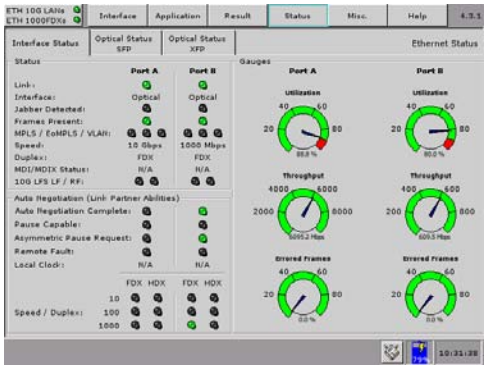

Fig. 6 Interface status indicators for a quick overview of the line's condition.

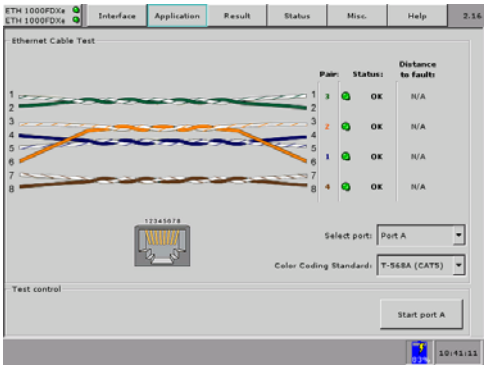

Fig. 7 The CMA 3000 Ethernet cable test facility makes it easy to identify failures on electrical cables like short circuits or breaks of a wire pair. The cable test facility also indicates the distance from the instrument to the fault.

Detailed in-service analysis

CMA 3000 Ethernet can analyze live traffic in details by presenting statistics on the main performance indicators for a monitored line. To facilitate the analysis of data it's possible to define threshold values for a number of parameters. CMA 3000 Ethernet uses the thresholds to color-highlight results outside the acceptable range. This is also indicated on the LEDs of the instrument.

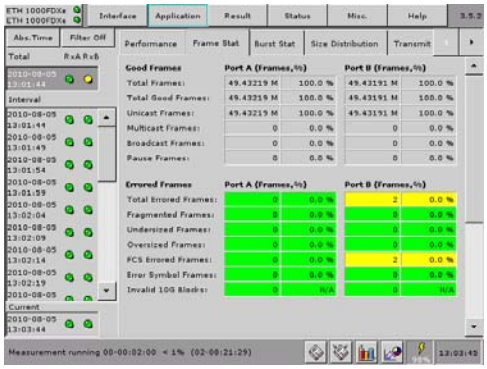

Fig. 8 Tabular presentation of performance statistics.

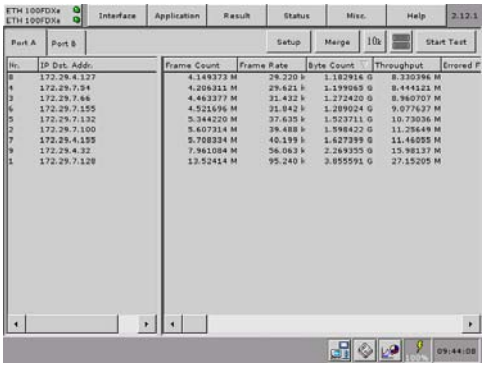

Fig. 9 IP traffic analysis with the IP channel statistics option.

IP channel statistics option

For further analysis of live IP traffic on the Ethernet line CMA 3000 Ethernet can be equipped with the IP channel statistics option. This option provides detailed information on the traffic on the monitored line for up to 232 individual channels, identified by parameters like Ethernet addresses, IP addresses, VLAN tags or MPLS labels. This allows you to identify whether a channel:

- Loads the line heavily
- Sends many errored frames
- Uses the line in an inefficient way

Ethernet Multistream option

The Ethernet multistream option for the CMA 3000 Ethernet allows the user to test a congested networks ability to transport high priority traffic rather than lower priority traffic. The user can activate up to 8 streams per port with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network. With the multistream option you also get information on packet jitter and latency per stream, issues that can cause problems for services like VoIP.

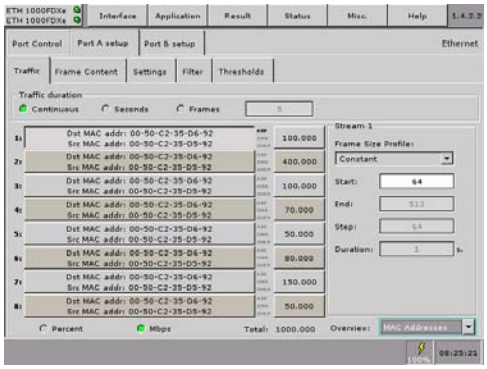

Fig. 10 The CMA 3000 Ethernet gives an easy overview of the up to 8 streams that it can generate.

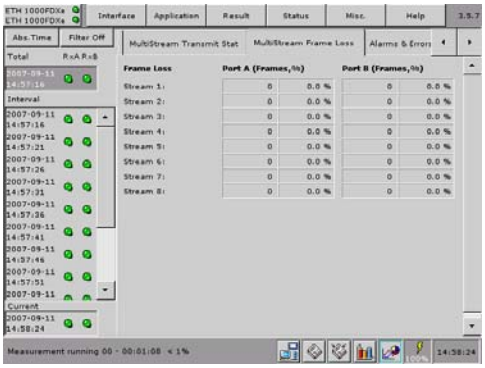

Fig. 11 Information on frame loss in shown for up to 8 streams in one screen to make it easy to compare how the streams are transported through the network.

Stacked VLAN option

Stacked VLAN (Q-in-Q) is increasingly used in several types of Ethernet based networks. With a CMA 3000 Ethernet equipped with the Stacked VLAN options the user has a powerful tool for testing such networks. The Stacked VLAN option supports up to 8 levels of VLAN tags.

MPLS option

MPLS (Multi Protocol Label Switching) allows efficient routing of traffic in packet based networks. With a CMA 3000 Ethernet equipped and the MPLS option the user has a powerful tool for testing this type of traffic. Up to 8 levels of MPLS labels can be inserted. The MPLS option also supports EoMPLS (Ethernet over MPLS) also known as PWE3 (Pseudo Wire Emulation Edge-to-Edge), which defines transport of layer 2 protocol across an MPLS network.

VoIP test options

With a CMA 3000 Ethernet equipped with VoIP options the field technician can use the same instrument for testing VoIP services and the basic Ethernet transport system.

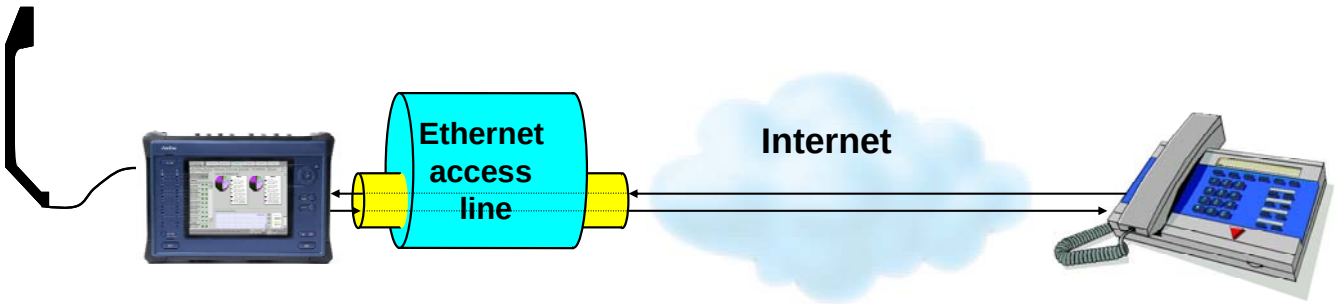

Fig. 12 Basic VoIP connectivity is verified by calling another party using the CMA 3000 Ethernet VoIP functionality.

For VoIP testing the instrument can establish a call and answer incoming calls. By connecting an analog telephone to the CMA 3000 Ethernet the user can make a conversation with the called/calling party. Statistics collected during the call will inform the user on the performance of the communication line used for the call. Based on this an add-on option can present voice quality information in terms of Mean Opinion Score (MOS) and R-factor values for one call at the time.

To make a realistic test case the instrument can generate or receive up to 8 calls simultaneously. These calls can be made on one or both test ports in the Ethernet option. If the instrument is also equipped with the Ethernet Multistream option, each of the 8 calls can be assigned to a stream, f.inst. allowing individual configuration of priority for the calls.

Fig. 13 A total of 8 VoIP calls can be generated through the CMA 3000 Ethernet's two test ports. The voice quality evaluation is presented for one call if the Voice Quality Measurement option is installed.

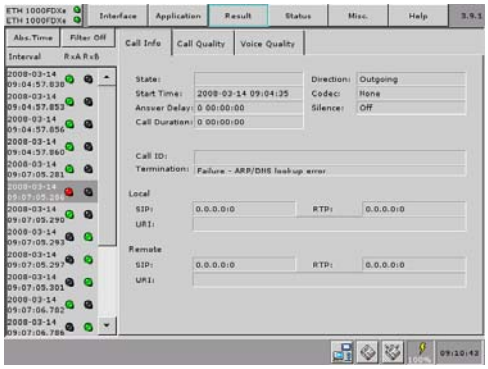

Fig. 14 VoIP call records are stored in memory when a measurement is active. Unsuccessful calls are highlighted with a red indicator in the left column.

10 G WAN PHY option

When the 10G interface is equipped with a 10G WAN PHY option the CMA 3000 Ethernet can be used for test and analyze of Ethernet traffic encapsulated in OC-192/STM-64 frames. The instrument provides powerful statistics for analysis of the transmission-error performance of a line together with information on pointer operations. G.826, G.828/G.829 or M2101 error-performance parameters are calculated for the measurement. When generating a 10 G WAN PHY the instrument provides you with great flexibility for injecting errors, alarms and overhead byte changes into the transmitted signal.

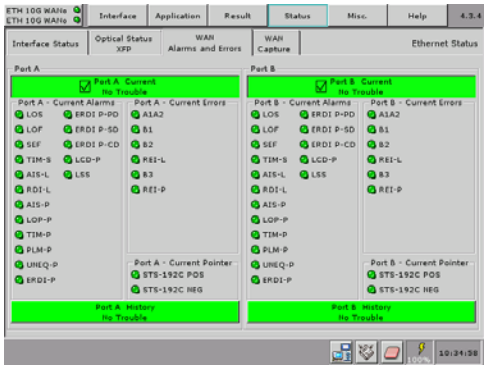

Fig. 15 A quick overview of the alarm and error status on the line.

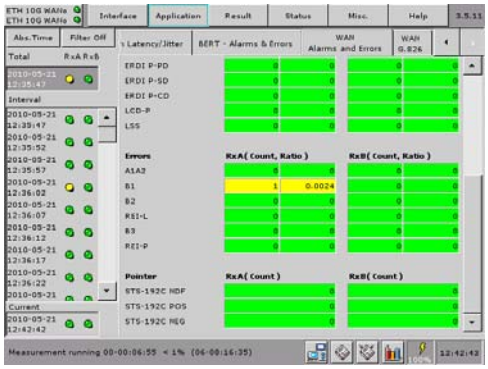

Fig. 16 Statistics for analysis of the transmission-error performance.

Fig. 17 Programming of 10G WAN PHY overhead bytes.

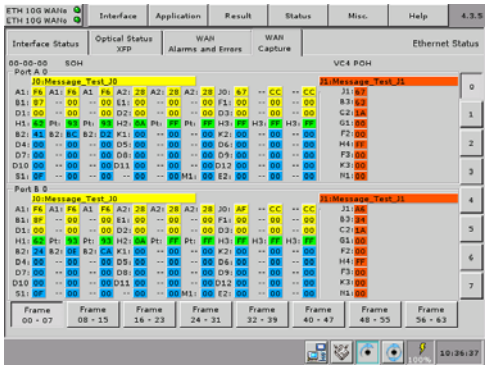

Fig. 18 Capture of 10G WAN PHY overhead bytes.

Specifications

Ethernet test interfaces

Interfaces

- Optical line interfaces 1 or 2 ports 10 Gbps, user-selectable optical modules: 850 nm (SR), 1310 nm (LR) and 1550 nm (ER)
  NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000 Ethernet.
- Optical line interfaces 2 ports 1000 Mbps, user-selectable optical modules: 850 nm (SX), 1310 nm (LX) and 1550 nm (ZX) or 100 Mbps 1310 nm (FX or LX)
  NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000 Ethernet.
- Electrical line interfaces 2 ports (in addition to the optical ports) 10/100/1000 Mbps RJ45 (unshielded and shielded twisted pair cables, category 5, 5E, and 6)
- **Safety measures for laser products:** Optical modules for the CMA 3000 comply with optical safety standards in IEC 60825-1.
- Specification of optical modules purchased from Anritsu for the CMA 3000 Ethernet (each with 1 transmitter and 1 receiver) with LC connectors (specifications may be subject to change without further notice):

Description (approx. distance)	Min. input sensitivity and wavelength		Output power and wavelength	
10GBASE- SR 850 nm Multi mode (0.3 km)	-11.1 dBm	850 nm Center	Between -6.5 dBm and - 1.5 dBm	Between 840 nm and 860 nm
10GBASE - LR 1310 nm Single mode (10 km)	-14 dBm	Min. 1260 nm Max. 1600 nm	Between -6 dBm and -1 dBm	Between 1290 nm and 1330 nm
10GBASE - ER 1550 nm Single mode (40 km)	-16 dBm	Min. 1260 nm Max. 1600 nm	Between -1 dBm and 2 dBm	Between 1530 nm and 1565 nm
10GBASE - ER 1550 nm Single mode (80 km)	-23 dBm	Min. 1260 nm Max. 1575 nm	Between 0 dBm and 4 dBm	Between 1530 nm and 1565 nm
1000BASE-SX 850 nm Multi mode (0.5 km)	-17 dBm	Min. 770 nm Max. 860 nm	Between -9.5 dBm and -3 dBm	Between 830 nm and 860 nm
1000BASE-LX 1310 nm Single mode (10 km)	-20 dBm	Min. 1260 nm Max. 1580 nm	Between -9 dBm and -3 dBm	Between 1285 nm and 1343 nm
1000BASE-ZX 1550 nm Single mode (80 km)	-24 dBm	Min. 1260 nm Max. 1580 nm	Between 0 dBm and 5 dBm	Between 1500 nm and 1580 nm
100BASE-FX 1310 nm Multi mode (2 km)	-31 dBm	Min. 1270 nm Max. 1600 nm	Between -20 dBm and -15 dBm	Between 1280 nm and 1380 nm
100BASE-LX 1310 nm Single mode (10 km)	-31 dBm	Min. 1270 nm Max. 1620 nm	Between -15 dBm and -8 dBm	Between 1261 nm and 1360 nm

Ethernet test configurations

- Monitor/generate
- Pass-through
- Reflector

Ethernet measurements

Supported encapsulations (frame formats)

- EtherType II (DIX v.2)
- IEEE 802.3 with 802.2 (LLC1)
- IEEE 802.3 with SNAP

Traffic generation

- Variable line rate traffic generation, up to full line rate
- Line load profile: Constant or ramp
- Traffic duration: Continuous, programmable number of seconds or frames
- Adjustable frame size from 44 bytes to 16000 bytes
- Frame sizes may be set to constant, stepped or random length
- User-defined traffic mix of unicast and broadcast frames
- User-defined VLAN ID and VLAN priority
- Fixed or incremented IP identifier
- Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing). Fixed, DHCP, DNS.
- Generate pause frames
- Respond to pause frames

	• Answer incoming ARP and ping requests (On/Off) • User programmable DSCP/TOS byte • User programmable UDP/TCP address • Automatic TCP connect (user selectable) • UDP check sum: automatic or fixed (null). TCP check sum: automatic • Optional Ethernet (MAC) address swapping (reflector mode)
Receiver settings	• User-defined expected preamble length (3 to 15 bytes) • User-defined IFG lower threshold (8 to 15 bytes) for Ethernet 10/100/1000 Mbps • User-defined Jumbo frame size upper limit (1519 to 16000 bytes)
Error generation	• IFG for Ethernet 10/100/1000 Mbps, FCS, Preamble, Error symbol • Wrong IP checksum, fragmented IP, UDP with zero checksum • PRBS bit error, BERT sequence error
Alarm generation	• No link, Remote fault
Cable test	Identifies failures on electrical cables like short circuits or breaks of a wire pair and indicates the distance from the instrument to the fault. • Max distance: 110 m, accuracy: +/- 3 m.
RFC 2544 installation and commissioning	Switch/router test and Single ended network test modes: • Throughput • Frame loss • Latency or packet jitter • Back-to-back frames (burstability) End to end network test mode (two CMA 3000 Ethernets or CMA 3000s in a master-slave setup) • Throughput • Frame loss • Back-to-back frames (burstability) Router latency test mode: IP ping based latency test or packet jitter For RFC 2544 throughput measurement the user can choose to make the measurement for: • Utilization layer • Physical layer • Physical layer excl. preamble • Link layer • Network layer • Data layer • Average or maximum values
BER test	Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation: Unframed, framed with IP header or framed with IP header and TCP/UDP header Detection of sequence errors and loss of sequence synchronization. Frame loss count and frame loss seconds Throughput measurement results are calculated for: • Utilization layer • Physical layer • Physical layer excl. preamble • Link layer • Network layer • Data layer • Min, avg. and max. values are presented Test patterns supported: • PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT, 55 Hex, Fox, 16 bit user programmable User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hour
Service disruption measurement	Service disruption measurement that can be activated as a part of the BER test • Max. and avg. service disruption time, resolution 0.1 µsec • Number of service disruptions

Ping test	For connectivity and configuration check • Round Trip Time (RTT) • Supports IPv4 and IPv6 addressing • Answer incoming Ping requests (On/Off)
Traceroute	Trace the IP route over the IP network • User-defined max no. of hops (1 to 255) Information per hop: Min/avg/max ping time and no. of ping time outs
Reflector mode	The following parameters are user selectable: • Swap all MAC addresses or one specific MAC address • Swap IP addresses • Swap port numbers on UDP/TCP frames • Force ACK on TCP frames Maximum internal delay when instrument is in reflector mode: 0.5 µsec @10Gbps, 2.1 µsec @1Gbps, 12.4 µsec @100 Mbps, 113.1 µsec @10 Mbps

Results	
Status	• Link status • Remote fault • Signal present • Jabber detected • Frames present • Speed • Full or half duplex • Interface type • Local clock (Ethernet 1000) • Pause capable and Asymmetric pause request (not Ethernet 10Gbps) • Link partner capabilities • Indicators for Utilization, throughput and errored frames CMA 3000 Ethernet indicates the signal level for optical Ethernet interfaces
Resolution	User-defined resolution for statistical measurements: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hour
Performance statistics	• Max/min/avg utilization • Max/min/avg throughput • Max/min/avg frame rate • Max/min/avg Latency • Max/min/avg Packet jitter
Frame statistics	• Total frames • Total valid frames • Unicast/multicast/broadcast frames • Number of pause frames • Total errored frames • Fragmented frames • Number of oversized and undersized (runts) frames • Number of FCS errored frames • Error symbol frames (not Ethernet 10Gbps)/Code violation frames (Ethernet 10Gbps) • Number of collisions (10/100 Mbps half duplex) • Preamble violations • IFG violations (Ethernet 10/100/1000 Mbps) • False carrier • 10G LFS LF (local fault) • 10G LFS RF (remote fault)

Burst statistics	• Total frames in bursts • Max/min/avg burst size
Frame distribution statistics	• Total valid/good frames • 64 - 127 byte frames • 128 - 255 byte frames • 256 - 511 byte frames • 512 - 1023 byte frames • 1024 - 1518 byte frames • Total number of jumbo frames • Max/min/avg frame size
Filters	Up to 8 filter conditions can be defined. Each condition can filter on: • IP or MAC source address • IP or MAC destination address • Broadcast address • IEEE OUI value • Encapsulation type • VLAN ID and VLAN tag priority • MPLS • TPC/UDP source and destination port • User-defined pattern at a defined offset
Adjustable thresholds	• Utilization • Throughput • Collision rate • Unicast frames • Multicast frames • Broadcast frames • Pause frames • Errored frames • Undersized frames (runts) • Oversized frames • FCS errored frames • IFG violations (Ethernet 10/100/1000 Mbps) • Preamble violations
DHCP	• Show source IP address assigned by DHCP • Show current lease expire time • Show IP addresses of primary and secondary DNS server when obtained by DHCP

Ethernet Stacked VLAN option	
Number of VLAN tags	Up to 8 VLAN tags can be set by the user Only 1 level of VLAN is supported in ping, traceroute and RFC2544 router latency tests
Parameters per VLAN tag	• EtherType 0x8100 (802.1Q), 0x88a8 (802.1ad), 0x9100 or 0x9200 • User-defined VLAN ID, CFI and VLAN priority
Status	Indicator for detection of VLAN tagged frames
Statistics	Available information: • Number of VLAN tagged frames • Max. number of VLAN layers detected

Ethernet Multistream option	
Number of streams	Up to 8 streams per port can be activated
Parameters per stream	• Encapsulation (frame format) • Line rate traffic load, up to full line rate • Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6) • User-defined traffic mix of unicast and broadcast frames • Adjustable frame size from 44 bytes to 16,000 bytes • Frame sizes may be set to constant, stepped or random length • User programmable VLAN ID and VLAN priority, DSCP/TOS byte and UDP/TCP address In stream 1 a BER test can be made
Statistics	Available information per stream: • Frame loss count/rate • Throughput • Latency • Packet jitter • Frames and bytes received and transmitted

IP channel statistics option	
Statistics	The statistics are provided for up to 232 channels, identified by user-defined combinations of: • IPv4, IPv6 or MAC address • VLAN ID or MPLS label • Protocol information • IP next header (protocol) • TPC/UDP ports Traffic Capacity: • 10 Mbps line speed, 100 Mbps line speed and 1 Gbps line speed: 100% line load • 10 Gbps line speed: o With average frame size 530 bytes (or higher) and the longest burst of short frames (64 bytes) is 84: 100% line load o For all frame sizes: The traffic capacity is up to 2.20 Mframes per second when the longest burst of short frames (64 bytes) is 84. o If the above conditions are not fulfilled, frames will be discarded from the IP Channel statistics. A special counter will show the number of frames discarded from the IP Channel statistics. Available information per channel: • Frame count/rate • Throughput • Byte count • MPLS frames • Jumbo frames • Errored frames and errored frame rate • Errored throughput • Errored byte count • Frame/packet size distribution • IP header bytes • IP fragments • TTL threshold violations • IP packet count, rate • IP bytes • IP throughput • IP header errors • TCP/UDP bytes • TCP/UDP packet count, rate, throughput, TCP/UDP errored packets

Ethernet MPLS option	
MPLS supported	MPLS unicast is supported (EtherType 0x8847) Support for MPLS in BERT, RFC 2544 (exculding router latency) Tests and general statistics MPLS can only transport VLAN and VoIP if EoMPLS is activated
Number of MPLS headers	Up to 8 MPLS headers can be set by the user
Parameters per MPLS headers	User-defined label, Exp and TTL fields in the MPLS header
EoMPLS support	An EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo Wire Emulation Edge-to-Edge) label (the RFC4448 Control word) can be added.
Status	Indicator for detection of MPLS frames and EoMPLS
Statistics	Available information: • Number of MPLS frames and EoMPLS frames • Max. number of MPLS layers detected

VoIP Call emulation options	
Emulation modes	The instrument supports Client/Terminal emulation.
Supported protocols (options)	• SIP RFC 3261 • RTP/RTCP RFC 3550 and RFC 3551 • ITU-T H.323 Full connect • ITU-T H.323 Fast connect The VoIP call emulation options run on IP v4 only.
Settings	The following settings are user selectable: • Calling alias • IP address DHCP/static and Subnet mask • Gateway address and DNS server • DSCP/TOS byte • MAC address • VLAN ID and VLAN priority • RTCP on/off • Silence ringing signal SIP specific parameters (requires SIP call emulator): • Proxy/registrar address and port, User name, password, Registrar expire time H.323 specific parameters (requires H.323 call emulator): • Gate Keeper Mode (No Gate Keeper, Auto Discover Gate Keeper, Static Gate Keeper • Gate Keeper address and port, User name, password, H.245 tunneling
Supported Voice Coding	The following Voice codings are supported: • µ-law/A-law (G.711) • ACELP 5.3, MPC-MLQ 6.3 kbps (G.723.1) • ADPCM 16/24/32/40 kbps (G.726) (only with SIP call emulator) • LD-CELP 16 kbps (G.728) • CS-ACELP 8 kbps (G.729 a,b) • GSM FR • GSM EFR • Fixed codec preference list User selectable • Silence suppression (depends on selected codec) • Jitter buffer delay • Source: Voice conversation (optional telephone), tone, pre-recorded speech signal
Simultaneous calls	Up to 8 calls can manually be generated at a time
Call generator	Up to 8 simultaneous calls can automatically be generated repeatedly.

Call emulation logs	The following information is provided for each call: • IP address/Alias, RTP ports, Answer delay, Duration of call, Encoding (codec), Silence suppression On/Off • Call progress and error messages with 1 msec resolution
Call statistics	• Throughput sent/Throughput received as Bytes and Packets • Out of sequence packets. • Packet loss • Packet jitter (msec, (min/cur/max) • Packet Round Trip Time (RTT) (msec, (min/cur/max)
DTMF detection	Received in-band DTMF (tone signal in the audio stream) can be recorded for one speech channel. DTMF detection can be enabled and disabled.
Voice quality (optional)	Voice quality measurement on one call at the time: • Uses Telchemy's algorithms for achievement of MOS and R-factor values at live traffic end points: • MOS: Conversational, Listening, P.862 estimate, Maximum with selected codec • R-factor: Conversational, Listening, G.107 estimate, Listening during Burst and Gap periods, Maximum with selected codec • Voice quality evaluation summary, based on user defined thresholds
VoIP measurements	When a measurement is running Call emulation logs, call statistics are stored pre call that terminated during the measurement. DTMF information and the optional Voice quality information are stored for calls where they were measured. In addition there is a summary for all calls terminated during the measurement with information on: • Total number of calls. Number of Incoming, Outgoing, succeed, failed calls • Call duration (min/avg/max). Answer delay (min/avg/max) • Throughput sent/Throughput received as Bytes and Packets (min/avg/max/total) • Out of sequence packets. (min/avg/max/total) • Packet loss (min/avg/max/total) • Packet jitter (msec, min/max) • Packet Round Trip Time (RTT) (msec, min/max)
Phone Interface	Interface for connection of an analog telephone AC impedance: Approx. 600Ω. The phone will be supplied with a constant current of approx. 20 mA The phone supports receiving and transmitting speech signals. Connector: RJ11 (1x6) Female

10G WAN PHY option	
WAN modes	10GigE (normal), WAN-PHY with Mixed-frequency test pattern, Square wave pattern, PRBS 31 pattern
Terminology	SONET or SDH
Error insertion	SONET Terminology: • A1A2, B1, B2, REI-L, B3, REI-P SDH Terminology: • B1, A1/A2, B2, MS-REI, B3, HP-REI
Alarm insertion	SONET Terminology: • LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, ERDI P-PD, ERDI P-SD, ERDI P-CD SDH Terminology: • LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD
Error measurement	SONET Terminology: • A1A2, B1, B2, REI-L, B3, REI-P SDH Terminology: • B1, A1/A2, B2, MS-REI, B3, HP-REI G.826, G.828+G.829 or M.2101.1(M.2100) error performance parameters are calculated

Alarm detection	SONET Terminology: • LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, ERDI P-SD, ERDI P-CD, ERDI P-PD, LCD-P, LSS SDH Terminology: • LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD, LSS
Overhead byte functionality	Generation of overhead bytes, defined by the user Capture and display of current overhead bytes
Pointer operation monitor	Positive movements, Negative movements, NDF

User Interface	
Display	8 ¼ " active TFT display with VGA resolution (640x480 pixels) and touch screen
LEDs	34 bi-color LEDs (with text on display)

Service interfaces	
USB data Interface	Two USB 1.1 ports. Connector type A. CMA 3000 Ethernet will operate as host
Ethernet Interface	Ethernet 10/100. One RJ45 connector
V.24 data Interface	DTE. Connector: 9 pin, D-sub, Male

Other interfaces	
Built-in loudspeaker	• The built-in loudspeaker monitors speech in both directions of a voice channel • Output level: user-controlled from front panel • A 3.5 mm diameter jack provides ear phone access to the audio signal. The built-in loudspeaker is disconnected when a headset is plugged in
Compact Flash	The instrument is equipped with one Compact Flash socket

Miscellaneous	
Battery	10.8 V rechargeable and replaceable intelligent LiIon battery • Operating time: Typically 1.5 hours • Charging time: Typically 5 to 6 hours Indicator for remaining capacity: % and hours/minutes
Mains adapter	Input: 100-240 V AC, 50-60 Hz Output: 18 V DC, max. 3.4 A
Mechanical	The CMA 3000 Ethernet consists of a base unit and a 10G module attached to the back of the base unit. • Dimensions: o Base unit approx. 23 x 33 x 7.5 cm (HxWxD) o 10G module approx. 10 x 30.7 x 4.3 cm (HxWxD) Weight: Approx. 4.4 kg
Environmental	Operating temperature: 0°C to +40°C Storage temperature: -25°C to +60°C The CMA 3000 Ethernet is CE-marked and complies with EN 50081-1 and EN 50082-1
Standard accessories	• User's Guide • LiIon battery • Mains adapter with mains cable • Stylus

Options	• 10 Gbps, 1 Gbps and 100 Mbps optical modules • 10G WAN PHY option • Ethernet multistream option • Ethernet stacked VLAN option • Ethernet MPLS option • IP over Ethernet measurement option (planned) • VoIP Call emulation options • FrontSim (remote operation) option • Remote Control – Scripting option
Additional accessories	• Carrying case • Carrying soft bag • Instrument carrying strap • Extra LiIon battery • Stand-alone battery charger • Ear phones • Telephone set • Measurement cables
Service products	• Factory calibration

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CMA 3000 SPECIFICATIONS

Ethernet interface measurement options

General description

When equipped with the Ethernet interface measurement option, the battery-powered, easy-to-use and portable Anritsu CMA 3000 is a comprehensive solution for testing and measuring LAN communication lines, in addition to the full-featured 2 Mbps transmission testing provided by the CMA 3000 basic instrument. Adding additional CMA 3000 options allows you to also test V-series data interface connections, E3, unframed DS3, E4 and SDH lines.

It's easy to configure the CMA 3000 Ethernet options to your requirements. A dual port module is available for testing Ethernet 10/100 interfaces. Or, you can have a dual-port Ethernet 10/100/1000 test module equipped with electrical and optional optical interface ports.

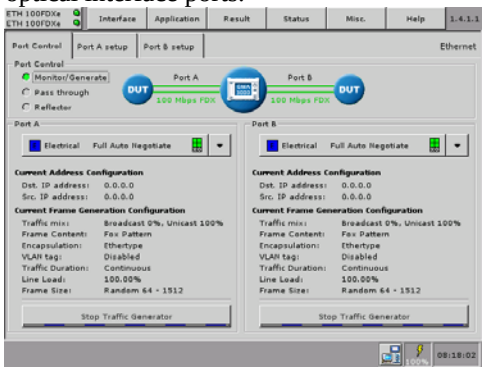

Fig. 1 The operation of the CMA 3000 is made easy through an intuitive graphical user interface.

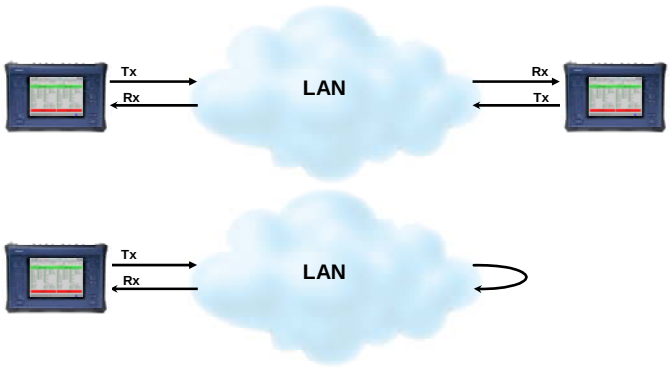

Fig. 2 Out-of-service testing with two instruments or a far-end loop back.

Key Features	Key Applications
• Traffic generation capabilities up to full line rate • Comprehensive statistics • Automated RFC 2544 testing of: o Throughput o Frame loss o Latency o Packet jitter o Burstability • Simultaneous monitoring of both directions on a line • IPv4 and IPv6 support • Multistream, Stacked VLAN, MPLS and VoIP test options	• Installation and commissioning testing • QoS verification • End-to-end testing • Rapid in-service diagnostics and troubleshooting

Transmitters and receivers permit out-of-service testing for installation, commissioning and Quality of Service (QoS) verification while a pass-through mode enables in-service monitoring for both fast troubleshooting and detailed analysis of the live traffic on the line. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

You can easily read and interpret information from the tested lines off the large color display with easy-to-understand colors and graphical symbols. For fast troubleshooting, the CMA 3000 displays alarms and transmission link status on LED indicators. And the graphical user interface makes it a simple task to configure and operate the instrument.

Installation, commissioning and QoS verification

For installation, commissioning and QoS verification CMA 3000 provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. Performance and QoS statistics are presented in tables and graphs facilitating results interpretation. Through preprogrammed thresholds, CMA 3000 can isolate abnormal conditions on the tested line.

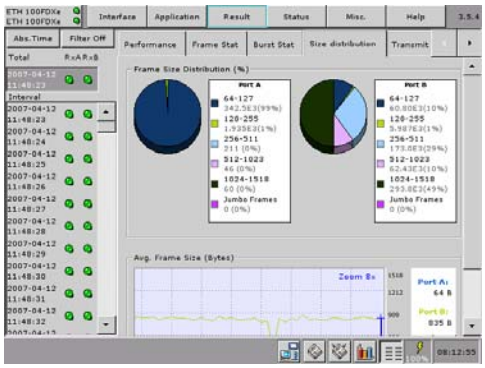

Fig. 3 Statistics are presented in tables and easy to understand graphs.

RFC 2544 analysis

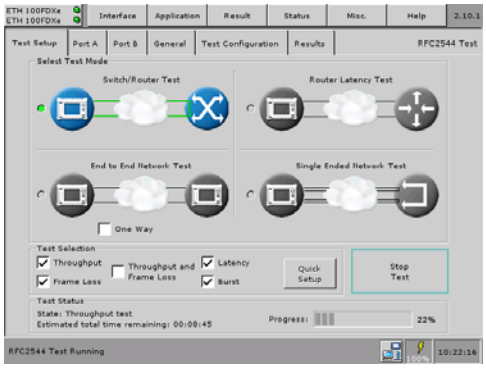

Fig. 4 Intuitive configuration of the RFC 2544 tests

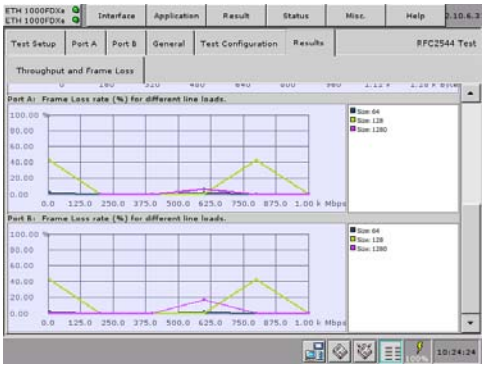

Fig. 5 CMA 3000 presents RFC 2544 results in graphs or tabular format

The IETF RFC 2544 “Benchmarking Methodology for Network Interconnect Devices” defines a number of tests to be used for describing the performance characteristics of these network devices. With the CMA 3000 Ethernet options, testing of performance parameters, such as throughput and frame loss, latency, packet jitter and burstability in compliance with RFC 2544 is straightforward. CMA 3000 automates the testing procedure while still allowing you to configure the test to be as thorough as needed. To get full information on the performance of both sides of a line, the end-to-end test mode allows two CMA 3000 to work together in a master-slave setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.

In-service troubleshooting

For fast troubleshooting the CMA 3000 status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current line status
- Electrical cable test facility
- Indication of main link quality parameters : Utilization, Throughput and Errored frames

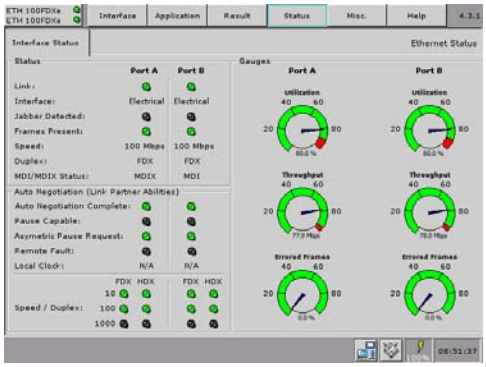

Fig. 6 Interface status indicators for a quick overview of the line’s condition.

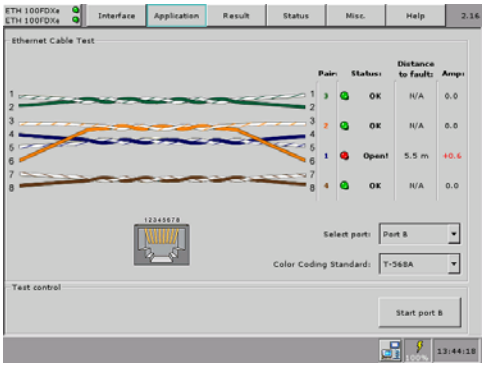

Fig. 7 The CMA 3000s cable test facility makes it easy to identify failures on electrical cables like short circuits or breaks of a wire pair. The cable test facility also indicates the distance from the instrument to the fault.

Detailed in-service analysis

CMA 3000 can analyze live traffic in details by presenting statistics on the main performance indicators for a monitored line. To facilitate the analysis of data it’s possible to define threshold values for a number of parameters. CMA 3000 uses the thresholds to color-highlight results outside the acceptable range. This is also indicated on the LEDs of the instrument.

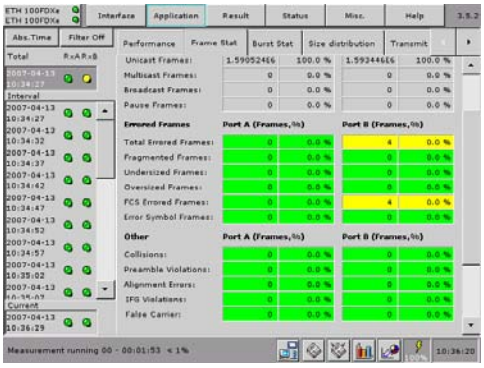

Fig. 8 Tabular presentation of performance statistics.

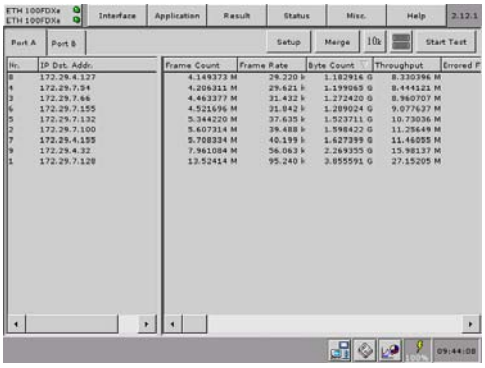

Fig. 9 IP traffic analysis with the IP channel statistics option..

IP channel statistics option

For further analysis of live IP traffic on the Ethernet line CMA 3000 can be equipped with the IP channel statistics option. This option provides detailed information on the traffic on the monitored line for up to 232 individual channels, identified by parameters like Ethernet addresses, IP addresses, VLAN tags or MPLS labels. This allows you to identify whether a channel:

- Loads the line heavily
- Sends many errored frames
- Uses the line in an inefficient way

Ethernet Multistream option

The Ethernet multistream option for the CMA 3000 allows the user to test a congested networks ability to transport high priority traffic rather than lower priority traffic. The user can activate up to 8 streams with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network.

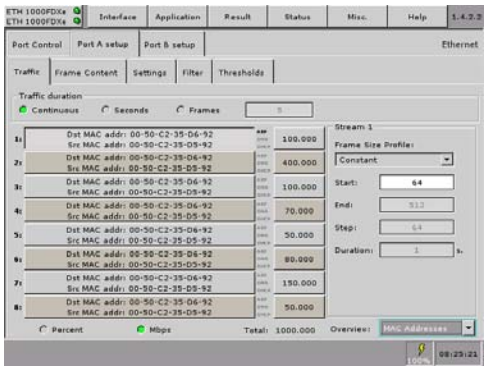

Fig. 10 The CMA 3000 gives an easy overview of the up to 8 streams that it can generate.

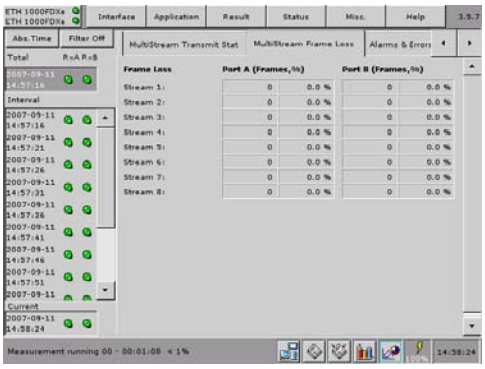

Fig. 11 Information on frame loss in shown for up to 8 streams in one screen to make it easy to compare how the streams are transported through the network.

Stacked VLAN Option

Stacked VLAN (Q-in-Q) is increasingly used in several types of Ethernet based networks. With a CMA 3000 equipped with Ethernet and Stacked VLAN options the user has a powerful tool for testing such networks. The Stacked VLAN option supports up to 8 levels of VLAN tags.

MPLS Option

MPLS (Multi Protocol Label Switching) allows efficient routing of traffic in packet based networks. With a CMA 3000 equipped with Ethernet and the MPLS option the user has a powerful tool for testing this type of traffic. Up to 8 levels of MPLS labels can be inserted. The MPLS option also supports EoMPLS (Ethernet over MPLS) also known as PWE3 (Pseudo Wire Emulation Edge-to-Edge), which defines transport of layer 2 protocol across an MPLS network.

VoIP test options

With a CMA 3000 equipped with VoIP and Ethernet options the field technician can use the same instrument for testing VoIP services and the basic Ethernet transport system.

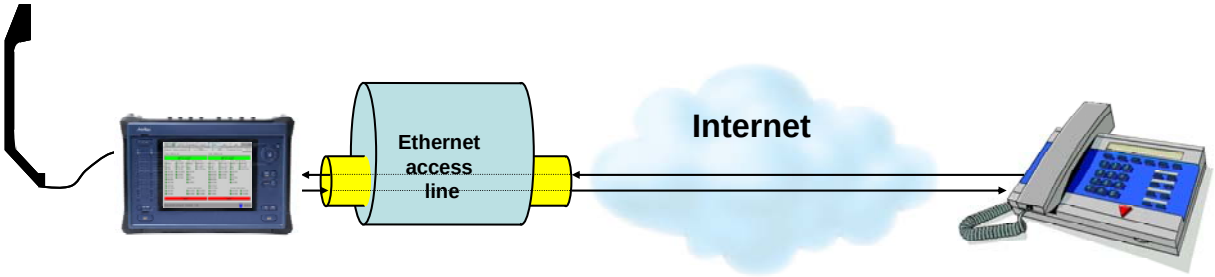

Fig. 12 Basic VoIP connectivity is verified by calling another party using the CMA 3000's VoIP functionality.

For VoIP testing the instrument can establish a call and answer incoming calls. By connecting an analog telephone to the CMA 3000 the user can make a conversation with the called/calling party. Statistics collected during the call will inform the user on the performance of the communication line used for the call. Based on this an add-on option can present voice quality information in terms of Mean Opinion Score (MOS) and R-factor values for one call at the time.

To make a realistic test case the instrument can generate or receive up to 8 calls simultaneously. These calls can be made on one or both test ports in the Ethernet option. If the instrument is also equipped with the Ethernet Multistream option, each of the 8 calls can be assigned to a stream, f.inst. allowing individual configuration of priority for the calls.

Fig. 13 **A total of 8 VoIP calls can be generated through the CMA 3000's two Ethernet test ports**. The voice quality evaluation is presented for one call if the Voice Quality Measurement option is installed.

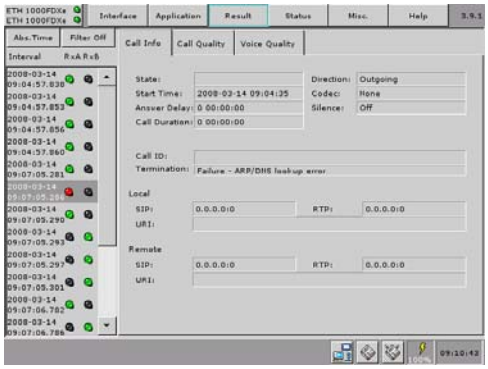

Fig. 14 VoIP call records are stored in memory when a measurement is active. Unsuccessful calls are highlighted with a red indicator in the left column.

Specifications

The specifications below list the functionality for a basic CMA 3000 with installed Ethernet interface measurement option. For information on the functionality of the basic configuration please refer to the CMA 3000 basic instrument specifications sheet.

Ethernet test interfaces				
Hardware option built into basic instrument	• Electrical line interfaces 2 ports 10/100Mbps RJ45 (unshielded and shielded twisted pair cables, category 5, 5E, and 6) FDX and HDX operation			
Hardware option attached to basic instrument	• Optical line interfaces 2 ports 1000 Mbps, user-selectable 850 nm (SX), 1310 nm (LX) and 1550 nm (ZX) or 100 Mbps 1310 nm (FX or LX) *NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000.* • Electrical line interfaces 2 ports (in addition to the optical ports) 10/100/1000 Mbps RJ45 (unshielded and shielded twisted pair cables, category 5, 5E, and 6) • **Safety measures for laser products**: Optical modules for the CMA 3000 comply with optical safety standards in IEC 60825-1. • Specification of optical modules purchased from Anritsu for the CMA 3000 (each with 1 transmitter and 1 receiver) with LC connectors (specifications may be subject to change without further notice):			
	Description (approx. distance)	Min. input sensitivity and wavelength		Output power and wavelength	
	1000BASE-SX 850 nm Multi mode (0.5 km)	- 17 dBm	Min. 770 nm Max. 860 nm	Between - 9,5 dBm and - 3 dBm	Between 830 nm and 860 nm
	1000BASE-LX 1310 nm Single mode (10 km)	- 20 dBm	Min. 1260 nm Max. 1580 nm	Between - 9 dBm and - 3 dBm	Between 1285 nm and 1343 nm
	1000BASE-ZX 1550 nm Single mode (80 km)	- 24 dBm	Min. 1260 nm Max. 1580 nm	Between 0 dBm and 5 dBm	Between 1500 nm and 1580 nm
	100BASE-FX 1310 nm Multi mode (2 km)	- 31 dBm	Min. 1260 nm Max. 1570 nm	Between - 20 dBm and - 14 dBm	Between 1270 nm and 1335 nm
	100BASE-LX 1310 nm Single mode (10 km)	- 28 dBm	Min. 1260 nm Max. 1570 nm	Between - 15 dBm and - 8 dBm	Between 1270 nm and 1335 nm
	Note: 100BASE modules are Gigabit Ethernet port converter modules to 100BASE optical				
Test configurations	• Monitor/generate • Pass-through • Reflector				

Ethernet measurements	
Supported encapsulations (frame formats)	• EtherType II (DIX v.2) • IEEE 802.3 with 802.2 (LLC1) • IEEE 802.3 with SNAP

Traffic generation	• Variable line rate traffic generation, up to full line rate • Line load profile: Constant or ramp • Traffic duration: Continuous, programmable number of seconds or frames • Adjustable frame size from 38 bytes to 10,000 bytes • Frame sizes may be set to constant, stepped or random length • User-defined traffic mix of unicast and broadcast frames • User-defined VLAN ID and VLAN priority • Fixed or incremented IP identifier • Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing). Fixed, DHCP, DNS. • Generate pause frames • Respond to pause frames • Answer incoming ARP and ping requests (On/Off) • User programmable DSCP/TOS byte • User programmable UDP/TCP address • Automatic TCP connect (user selectable) • UDP check sum: automatic or fixed (null). TCP check sum: automatic • Optional Ethernet (MAC) address swapping (reflector mode)
Receiver settings	• User-defined expected preamble length (3 to 15 bytes) • User-defined IFG lower threshold (8 to 15 bytes) • User-defined Jumbo frame size upper limit (1519 to 10000 bytes)
Error generation	• IFG, FCS, Preamble, Error symbol • Alignment (Ethernet 10/100 only) • Wrong IP checksum, fragmented IP, UDP with zero checksum • PRBS bit error, BERT sequence error
Alarm generation	• No link, Remote fault
Cable test	Identifies failures on electrical cables like short circuits or breaks of a wire pair and indicates the distance from the instrument to the fault. • Max distance: 110 m • Accuracy: +/- 1 m On the Ethernet 10/100 Mbps option port A pair 1 (which is not used for the Ethernet data) is reserved for internal applications and is not tested.
RFC 2544 installation and commissioning	Switch/router test and Single ended network test modes: • Throughput • Frame loss • Latency or packet jitter • Back-to-back frames (burstability) End to end network test mode (two CMA 3000s in a master-slave setup) • Throughput • Frame loss • Back-to-back frames (burstability) Router latency test mode: IP ping based latency test or packet jitter For RFC 2544 throughput measurement the user can choose to make the measurement for: • Utilization layer • Physical layer • Physical layer excl. preamble • Link layer • Network layer • Data layer • Average or maximum values
Traceroute	Trace the IP route over the IP network • User-defined max no. of hops (1 to 255) • Information per hop: Min/avg/max ping time and no. of ping time outs

Ping test	For connectivity and configuration check • Round Trip Time (RTT) • Supports IPv4 and IPv6 addressing • Answer incoming Ping requests (On/Off)
BER test	Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation: Unframed, framed with IP header or framed with IP header and TCP/UDP header Detection of sequence errors and loss of sequence synchronization. Frame loss count and frame loss seconds Throughput measurement results are calculated for: • Utilization layer • Physical layer • Physical layer excl. preamble • Link layer • Network layer • Data layer • Min, avg. and max. values are presented Test patterns supported: • PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT, 55 Hex, Fox, 16 bit user programmable
Service disruption measurement	Service disruption measurement that can be activated as a part of the BER test • Max. and avg. service disruption time, resolution 0.1 µsec • Number of service disruptions
Reflector mode	The following parameters are user selectable: • Swap all MAC addresses or one specific MAC address • Swap IP addresses • Swap port numbers on UDP/TCP frames • Force ACK on TCP frames Maximum internal delay when instrument is in reflector mode: 0.8 µsec @1000 Mbps, 2.1 µsec @100 Mbps, 18.7 µsec @10 Mbps

Results	
Status	• Link status • Remote fault • Signal present • Jabber detected • Frames present • Speed • Full or half duplex • Interface type • Local clock (Ethernet 1000) • Pause capable and Asymmetric pause request • Link partner capabilities • Indicators for Utilization, throughput and errored frames CMA 3000 indicates the level for optical Ethernet 1000 Mbps interfaces
Filters	Up to 8 filter conditions can be defined. Each condition can filter on: • IP or MAC source address • IP or MAC destination address • Broadcast address • IEEE OUI value • Encapsulation type • VLAN ID and VLAN tag priority • MPLS • TPC/UDP source and destination port • User-defined pattern at a defined offset

Adjustable thresholds	• Utilization • Throughput • Collision rate • Unicast frames • Multicast frames • Broadcast frames • Pause frames • Errored frames • Undersized frames (runts) • Oversized frames • FCS errored frames • IFG violations • Preamble violations • Alignment errors
Performance statistics	• Max/min/avg utilization • Max/min/avg throughput • Max/min/avg frame rate • Max/min/avg Latency • Max/min/avg Packet jitter
Frame statistics	• Total frames • Total valid frames • Unicast/multicast/broadcast frames • Number of pause frames • Total errored frames • Fragmented frames • Number of oversized and undersized (runts) frames • Number of FCS errored frames • Error symbol frames • Number of collisions (10/100 Mbps half duplex) • Preamble violations • Alignment errors • IFG violations • False carrier
Frame distribution statistics	• Total valid/good frames • 64 - 127 byte frames • 128 - 255 byte frames • 256 - 511 byte frames • 512 - 1023 byte frames • 1024 - 1518 byte frames • Total number of jumbo frames • Max/min/avg frame size
Burst statistics	• Total frames in bursts • Max/min/avg burst size
DHCP	• Show source IP address assigned by DHCP • Show current lease expire time • Show IP addresses of primary and secondary DNS server when obtained by DHCP

IP channel statistics option (requires that an Ethernet option is installed in the CMA 3000)	
Statistics	The statistics are provided for up to 232 channels, identified by user-defined combinations of: • IPv4, IPv6 or MAC address • VLAN ID or MPLS label • Protocol information • IP next header (protocol) • TPC/UDP ports Available information per channel: • Frame count/rate • Throughput • Byte count • MPLS frames • Jumbo frames • Errored frames and errored frame rate • Errored throughput • Errored byte count • Frame/packet size distribution • IP header bytes • IP fragments • TTL threshold violations • IP packet count, rate • IP bytes • IP throughput • IP header errors • TCP/UDP bytes • TCP/UDP packet count, rate, throughput • TCP/UDP errored packets

Ethernet Multistream option (requires that an Ethernet option is installed in the CMA 3000)	
Number of streams	Up to 8 streams can be activated on the Ethernet line
Parameters per stream	• Encapsulation (frame format) • Line rate traffic load, up to full line rate • Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing) • User-defined traffic mix of unicast and broadcast frames • Adjustable frame size from 38 bytes to 10,000 bytes • Frame sizes may be set to constant, stepped or random length • User-defined VLAN ID and VLAN priority • User programmable DSCP/TOS byte • User programmable UDP/TCP address In stream 1 a BER test can be made
Statistics	Available information per stream: • Frame loss count/rate • Throughput • Latency • Packet jitter • Frames and bytes received • Frames and bytes transmitted

Ethernet Stacked VLAN option (requires that an Ethernet option is installed in the CMA 3000)	
Number of VLAN tags	Up to 8 VLAN tags can be set by the user Only 1 level of VLAN is supported in ping, traceroute and RFC2544 router latency tests
Parameters per VLAN tag	• EtherType 0x8100 (802.1Q), 0x88a8 (802.1ad), 0x9100 or 0x9200 • User-defined VLAN ID, CFI and VLAN priority
Status	Indicator for detection of VLAN tagged frames
Statistics	Available information: • Number of VLAN tagged frames • Max. number of VLAN layers detected

Ethernet MPLS option (requires that an Ethernet option is installed in the CMA 3000)	
MPLS supported	MPLS unicast is supported (EtherType 0x8847) Support for MPLS in BERT, RFC 2544 (exculding router latency) Tests and general statistics MPLS can only transport VLAN and VoIP if EoMPLS is activated
Number of MPLS headers	Up to 8 MPLS headers can be set by the user
Parameters per MPLS headers	User-defined label, Exp and TTL fields in the MPLS header
EoMPLS support	An EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo Wire Emulation Edge-to-Edge) label (the RFC4448 Control word) can be added.
Status	Indicator for detection of MPLS frames and EoMPLS
Statistics	Available information: • Number of MPLS frames and EoMPLS frames • Max. number of MPLS layers detected

VoIP Call emulation options (requires that an Ethernet option is installed in the CMA 3000)	
Interfaces	The VoIP options for the CMA 3000 work with the Ethernet test interface options for the instrument: • The 10/100/1000 Mbps Ethernet option with electrical interfaces and optional 100/1000 Mbps optical interfaces • The 10/100 Mbps Ethernet option with electrical interfaces
Emulation modes	The instrument supports Client/Terminal emulation.
Supported protocols (options)	• SIP RFC 3261 • RTP/RTCP RFC 3550 and RFC 3551 • ITU-T H.323 Full connect • ITU-T H.323 Fast connect The VoIP call emulation options run on IP v4 only.
Settings	The following settings are user selectable: • Calling alias • IP address DHCP/static and Subnet mask • Gateway address and DNS server • DSCP/TOS byte • MAC address • VLAN ID and VLAN priority • RTCP on/off • Silence ringing signal SIP specific parameters (requires SIP call emulator): • Proxy/registrar address and port, User name, password, Registrar expire time H.323 specific parameters (requires H.323 call emulator): • Gate Keeper Mode (No Gate Keeper, Auto Discover Gate Keeper, Static Gate Keeper • Gate Keeper address and port, User name, password, H.245 tunneling

Supported Voice Coding	The following Voice codings are supported: • μ-law/A-law (G.711) • ACELP 5.3, MPC-MLQ 6.3 kbps (G.723.1) • ADPCM 16/24/32/40 kbps (G.726) (only with SIP call emulator) • LD-CELP 16 kbps (G.728) • CS-ACELP 8 kbps (G.729 a,b) • GSM FR • GSM EFR • Fixed codec preference list User selectable • Silence suppression (depends on selected codec) • Jitter buffer delay • Source: Voice conversation (optional telephone), tone, pre-recorded speech signal
Simultaneous calls	Up to 8 calls can manually be generated at a time
Call generator	Up to 8 simultaneous calls can automatically be generated repeatedly.
Call emulation logs	The following information is provided for each call: • IP address/Alias, RTP ports, Answer delay, Duration of call, Encoding (codec), Silence suppression On/Off • Call progress and error messages with 1 msec resolution
Call statistics	• Throughput sent/Throughput received as Bytes and Packets • Out of sequence packets. • Packet loss • Packet jitter (msec, (min/cur/max) • Packet Round Trip Time (RTT) (msec, (min/cur/max)
DTMF detection	Received in-band DTMF (tone signal in the audio stream) can be recorded for one speech channel. DTMF detection can be enabled and disabled.
Voice quality (optional)	Voice quality measurement on one call at the time: • Uses Telchemy's algorithms for achievement of MOS and R-factor values at live traffic end points: • MOS: Conversational, Listening, P.862 estimate, Maximum with selected codec • R-factor: Conversational, Listening, G.107 estimate, Listening during Burst and Gap periods, Maximum with selected codec • Voice quality evaluation summary, based on user defined thresholds
VoIP measurements	When a measurement is running Call emulation logs, call statistics are stored pre call that terminated during the measurement. DTMF information and the optional Voice quality information are stored for calls where they were measured. In addition there is a summary for all calls terminated during the measurement with information on: • Total number of calls. Number of Incoming, Outgoing, succeed, failed calls • Call duration (min/avg/max). Answer delay (min/avg/max) • Throughput sent/Throughput received as Bytes and Packets (min/avg/max/total) • Out of sequence packets. (min/avg/max/total) • Packet loss (min/avg/max/total) • Packet jitter (msec, min/max) • Packet Round Trip Time (RTT) (msec, min/max)
Phone Interface	RJ-11 with a 6 slot 4 connector configuration for connection of an analog telephone AC impedance: Approx. 600Ω. The phone will be supplied with a constant current of approx. 20 mA The phone supports receiving and transmitting speech signals.

Miscellaneous	
Mechanical	The electrical 10/100Mbps option is installed inside the basic instrument. The Gigabit Ethernet option module, plugged onto the back of the instrument. • Dimensions of Gigabit module: Approx. 10 x 30.7 x 3.5 cm (HxWxD) • Weight of Gigabit module: Approx. 1.0 kg

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CMA 3000 SPECIFICATIONS

V-series Interface Measurement Option

The easy way to test V-series interfaces

When equipped with the V-series interface measurement option, the portable, easy-to-use and compact CMA 3000 offers test and measurement of V-series data transmission lines, in addition to the full-featured 2 Mbps transmission testing provided by the basic instrument. Additional CMA 3000 options enable you to test Ethernet connections and SDH lines.

In order to test the data interfaces on a transmission line you may set up the CMA 3000 as a DTE. You may also configure the CMA 3000 as a DCE to test the terminal equipment. The dual-receive setting for the V-series data interfaces allows you to monitor the control circuits on the line. This makes CMA 3000 the ideal solution for both in-service and out-of-service transmission measurements.

For fast troubleshooting, CMA 3000 displays alarms, transmission-link and control line status on LED indicators. Detailed analysis and graphical presentations are shown on the instrument's large color display.

Speeds troubleshooting

To accelerate troubleshooting the Line Status LEDs on the CMA 3000 present the current status in relation to alarms and errors. A trap facility saves information on historical alarms and errors, allowing you to detect random errors and operate unattended.

Key Features	Key Applications
• Data interface testing: o RS-232C/V.24 o X.21/V.11 o V.35 o RS-449/V.36 o RS-530 • Full-featured 2 Mbps transmission test set • Drop-and-insert testing • Propagation-time measurements • Simultaneous monitoring of both directions of a line	• Installation testing • Rapid in-service diagnostics and troubleshooting • Transmission line performance analysis • Mux/demux testing • Drop-and-insert to other equipment for further analysis

Comprehensive out-of-service testing

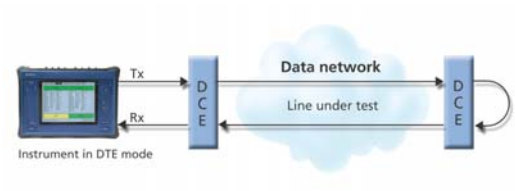

Figure 1 Transmission line testing.

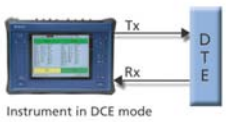

Figure 2 Data terminal testing.

CMA 3000 supports basic BER testing for installation, commissioning and stability tests. The performance of the system under test is evaluated on the basis of BER measurements, with a loop-back at the far end of the tested line. A wide range of test patterns is available for the BER test. The graphical histogram presentation provides an overview of a long measurement and makes it easy to identify error periods.

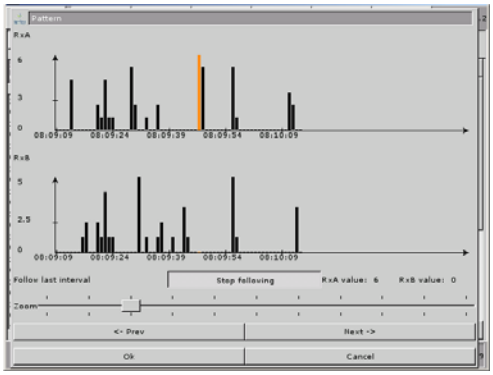

Figure 3 Graphical histogram presentation of pattern bit errors.

Propagation time

Propagation time can be measured when the CMA 3000 transmits a PRBS and the pattern is looped back to the instrument. This enables you to verify that delays introduced by multiplexers, demultiplexers and transmission lines are below specified limits.

Mux/demux testing

You can use the CMA 3000 for comprehensive testing of multiplexers and demultiplexers that insert and extract data lines to and from 2 Mbps systems.

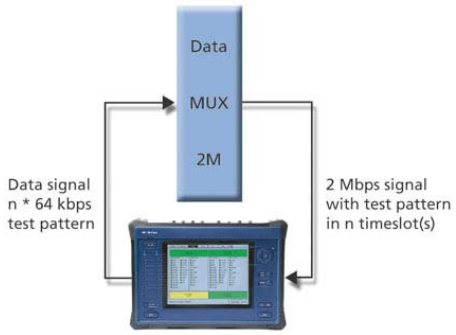

Figure 4 Mux testing using the CMA 3000.

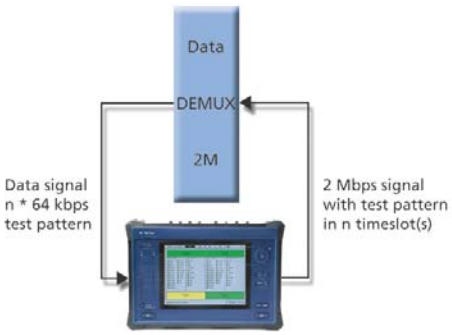

Figure 5 Demux testing with the CMA 3000.

BER testing is used for evaluating the performance of the network element under test with the CMA 3000 connected to both the data line and the 2 Mbps side of the network element.

Control circuit monitoring and analysis

For analysis of handshake problems, CMA 3000 can monitor the control circuits on a line.

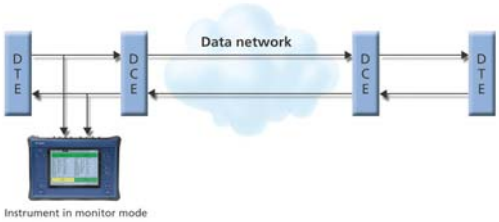

Figure 6 In-service monitoring with the CMA 3000.

The Control Circuit Status LEDs present the current status of the most important control circuits. Current status of all relevant control circuits is visualized on the color display.

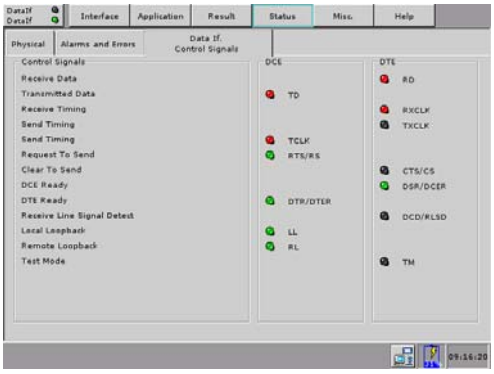

Figure 7 Detailed information on control circuits is visualized on the display.

For detailed timing analysis, you can log changes in the control circuit states on the line. This allows easy examination of timing relations.When the instrument is in DTE or DCE mode you can define the state of the control circuits output from the instrument.

Drop-and-insert testing

For testing with external equipment, the CMA 3000 field tester can drop and insert signals between its 2 Mbps interfaces and a selected data interface.

Two modes are available:

- A normal drop-and-insert mode for testing applications
- A dual-drop mode for monitoring applications

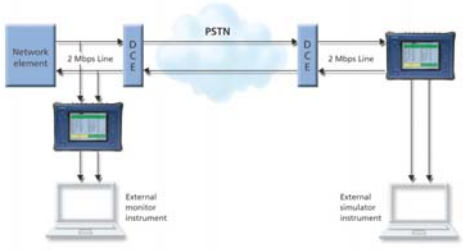

Figure 8 Drop-and-insert testing using the CMA 3000.

Specifications

Below are specifications for a basic CMA 3000 with the V-series interface measurement option. For further information on the basic functionality please consult the CMA 3000 basic instrument specifications sheet.

Data interfaces	
Supported interfaces	RS-232C/V.24 async, RS-232C/V.24 sync., X.21/V.11, V.35, RS-449/V.36, RS-530
Modes of operation	DTE, DCE, Monitor, All Tx (for dual-drop from 2 Mbps)
Data rates for BER tests	• 50, 75, 100, 110, 150, 200, 256, 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 33600, 38400, 57600, 115200 bps • 4928 (77*64) kbps and 4992 (78*64) kbps • m*8000 bps (m=1, 2, 4 or 8) • n*56000 bps, n*64000 bps (n=1 to 32) • q*1024 kbps (q=1 to 10) • Freely programmable bit rate: o X.21/V.11, V.35, RS-449/V.36, RS-530: From 50 bps to 10240000 bps in 1 bps steps o RS-232C/V.24 async.: From 50 bps to 128000 bps in 1 bps steps o RS-232C/V.24 sync.: From 50 bps to 64000 bps in 1 bps steps Drop and Insert to/from the 2 Mbps interfaces is not supported with freely programmable bit rates, even if the bit rate match the relevant value. Drop and Insert must use predefined bit rate settings. • BER test in DTE mode (with incoming clock): any rate up to 10 Mbps • RS-232C/V.24 async., max. data rate: 128000 bps • RS-232C/V.24 sync., max. data rate: 64 kbps
Drop-and-insert	Modes: • Drop and insert between a 2 Mbps receiver/transmitter and a data interface selected by the user • Dual-drop from the two 2 Mbps receivers to a data interface selected by the user. The instrument will operate all circuits as outputs in this mode Number of traffic channels: • n*64 kbps time slots • 8 or 16 kbps sub-channel of a selected time slot

G.703 interfaces	
Supported interfaces	Co-directional in accordance with ITU-T rec. G703 §.1.2.1
Modes of operation	Tx/Rx, Dual Rx, Tx only, Rx only
Data rates for BER tests	n*64000 bps (n=1 to 8)

Results	
Status	Current information on: • Alarms (no signal/no clock) and pattern bit errors on the monitored line • Clock rate and deviation
Statistics	User-defined resolution: • 1, 2, 5, 10, 15, 30s, 1, 5, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms (no signal/no clock) • Pattern bit-error count/ratio and G.821 or M.2100 parameters (ES, SES, UAT, EFS, AT % or count) • Pattern slip
Event log	Events logged with 1 msec resolution time stamps (planned): • Detected alarms and pattern bit errors • Changes in Control Circuit states Filters enable/disable the logging of individual events Control Circuit state changes are shown as text in a table or graphically

Test patterns	
Patterns supported for BERT in DCE or DTE mode	Patterns generated and detected: • PRBS 6 • PRBS 7 (ITU-T V.29) • PRBS 9 (ITU-T O.153/ V.57) • PRBS 11 (ITU-T O.152 or ITU-T O.153/V.57) • PRBS 12 • PRBS 15 (ITU-T O.151 and ANSI T1.403) • PRBS 20 (ITU-T O.153/V.57) • PRBS 23 (ITU-T O.151 and ANSI T1.403) • QRSS 11 – as PRBS 11, but max. 7 consecutive zeros (ITU-T O.152) • QRSS 20 – as PRBS 20, but max. 14 consecutive zeros (ITU-T O.151 and ANSI T1.403) • All 0s, All 1s • Alternating (1:1), (1:3), (1:7), (3:1), (7:1), (3:24) • Quick brown fox (ITU-T O.151 and ANSI T1.403) • User-defined up to 16 bits. Length in steps of 1 bit • User-defined up to 2048 bits. Length in steps of 8 bits • All patterns, except “All 0”, “All 1” and “Fox”, can be inverted
Error insertion	Insertion of pattern errors and slip in generated signal • Manual burst • Burst length: 1-255 consecutive errors • Continuous: burst length * 10-2, 10-3, 10-4, 10-5, 10-6 ,10-7 • Provoking of G.821events (ES, SES) • Slip insertion: manual

Miscellaneous	
Optional accessories for the data interface option	• Converter cables (“Y” cables) for the data interface option. Individual cables are available for each of the supported interfaces. The cables support DTE and DCE emulation for the interface • V.35 converter cable for DTE emulation • Connector box for data interface option. The connector box supports DTE and DCE emulation for all the supported interfaces

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CMA 3000

SPECIFICATIONS

Frame Relay Test Option

Rapid turn up of frame relay lines!

CMA 3000 is Anritsu's next-generation, portable and futureproof field tester for the installation and maintenance of access and core networks.

The CMA 3000 field tester covers a wide range of applications, from fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.

When outfitted with the frame relay test option, the battery-powered Anritsu CMA 3000 is an easy-to-use, portable field test instrument for the installation, operation and maintenance of frame relay services on 2 Mbps lines.

The frame relay option provides you with powerful tools for turn up of frame relay lines through the simulation of frame relay data packets with user-defined characteristics. The measurement facilities gives you essential information on the line quality. For in-service analysis and troubleshooting, you have access to extensive frame relay statistics. Using the the CMA 3000 frame relay channel scan feature you can quickly identify multi-time slot frame relay channels.

KEY FEATURES

- Extensive frame relay statistics
- Frame relay channel scan
- Out-of-service testing
- In-service bi-directional monitoring
- CIR test
- IP over frame relay ping test

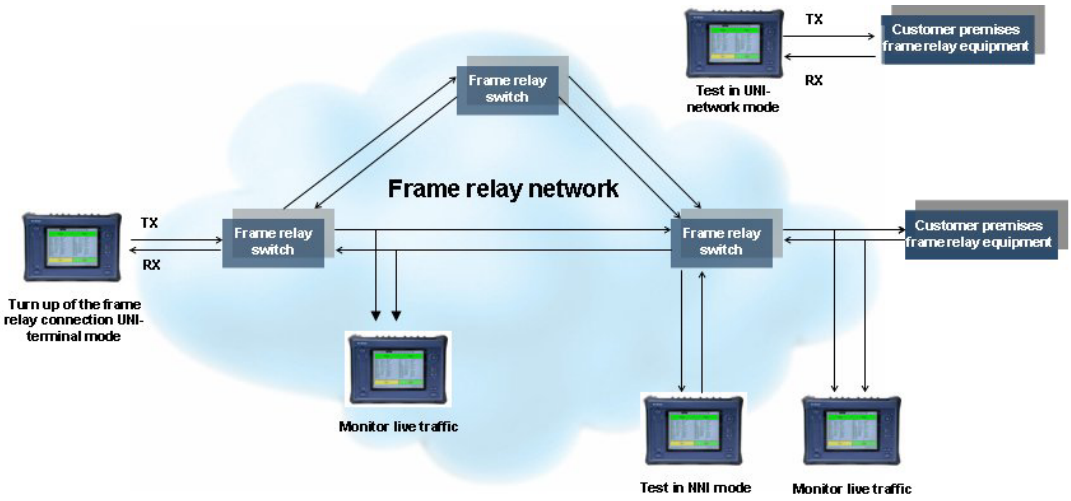

Figure 1 Frame relay network testing with the CMA 3000.

LMI emulation test

To establish the logical configuration of the link, CMA 3000 generates a LMI Status Inquiry Message, requesting "Full Status" at user-defined intervals. The response from the network helps you verify the correct setup of activated DLCIs on the link in question.

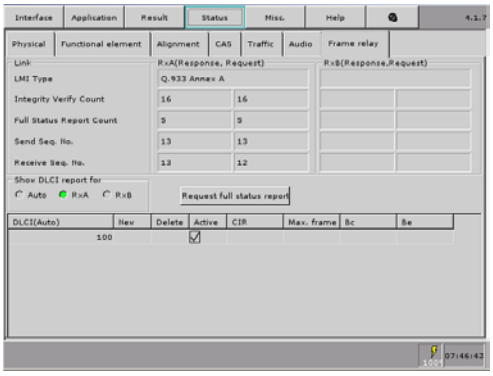

Figure 2 Frame relay LMI information with LMI counts and sequence numbers for both sides of a frame relay line and status for up to 50 DLCIs.

DLCI and LMI information

CMA 3000 derives network information from the Full Status reports and displays it, allowing you to determine if the network parameters are correct or not.

The CMA 3000 also analyzes the LMI Status messages on the monitored line displaying the results in such way that you can check if the basic surveillance of the frame relay connection works properly.

Frame relay emulation

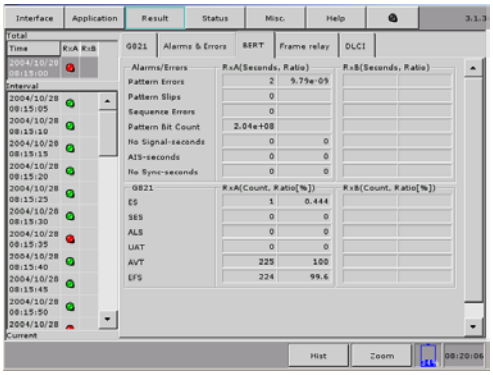

Figure 3 Extensive statistics, including BERT results are available during frame relay emulation.

With the frame relay emulation capability that supports DLCI tests emulation with user-defined setup parameters you can test the frame relay connection for a selected DLCI. These tests allow you to test end-to- end connectivity as well as the network's ability to handle various frames lengths, frame contents and output utilizations.

Bit Error Rate Testing is carried out with a user-defined test pattern in the payload. If required, the emulation testing inserts frame numbering into the test frames in order to determine whether or not frames have been lost. This test can be conducted with or without LMI emulation in the background.

PING test and InARP

The CMA 3000 can perform a "PING" test, send a proper response to received "PING" patterns and then measure the round-trip delay. It’s possible to perform this test with or without LMI emulation in the background. If the IP address of the destination node is unknown, CMA 3000 can send out an InARP IP address request.

Figure 4 Ping test of connectivity and delay.

CIR test

The Committed Information Ratio (CIR) is agreed between the customer and the frame relay network operator. The CIR establishes the data rate that the network operator commits to transport through the network. It’s therefore vital to verify the CIR of a frame relay circuit.

The CMA 3000 includes an automatic test of the CIR. The instrument will also estimate the CIR value for the monitored DLCIs when measuring live frame relay traffic

Frame relay statistics

With CMA 3000’s extensive frame relay statistics you can perform in-service analysis and troubleshooting of the monitored frame relay connection.

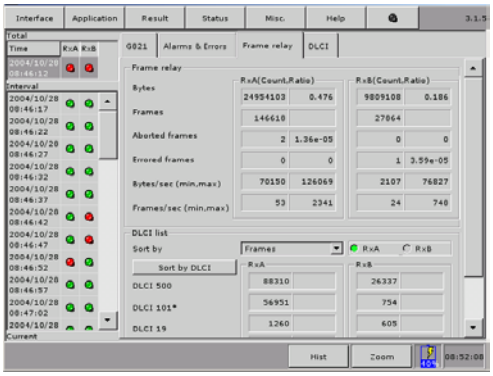

Figure 5 Overview of the frame relay traffic.

The frame relay statistics provide valuable and detailed information for up to 50 individual DLCIs (of which 8 may be user - defined) and a total for all DLCIs on the monitored line. For 2 DLCIs and the total for all DLCIs histograms are available, making it easy for you to analyze changes in traffic pattern over time.

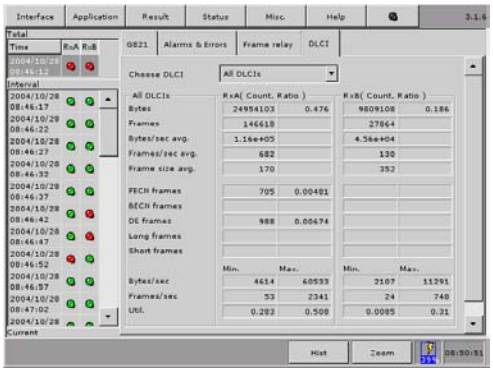

Figure 6 The CMA 3000 monitors a large number of parameters for up to 50 DLCIs simultaneously.

The frame relay statistics visualizes the frame relay connection. The CMA 3000 monitors a large number of parameters for as many as 50 DLCIs simultaneously. This enables you to select which parameter to use as the foundation for the visualization and where to sort. This allows you to quickly and easily analyze the most interesting results. Another display provides all the details for a selected DLCI or for all DLCIs.

Specifications

The specifications below cover the functionality when installing the frame relay test option. Please refer to the CMA 3000 Basic instrument specifications sheet for further information on the basic functionality.

General	The option supports frame relay on Permanent Virtual Circuits (PVC) with HDLC framing with a 16-bit FCS DLCI formats: • 10 bits (2 octets address field format) • 16 bits (3 octets address field format) • 23 bits (4 octets address field format)
Interfaces	Real-time monitoring, analysis and test of frame relay services is supported on the following interfaces: • Single or multiple 64 kbps time slots on a framed 2 Mbps line • Data interfaces (RS-232C/V.24, X.21/V.11, V.35, RS-449/V.36, RS-530) when CMA 3000 is also equipped with the data interface measurement option
Modes of operation	The following modes of operation are supported: • UNI Terminal • UNI Network • NNI
Frame relay statistics	Statistics for 50 individual DLCIs of which 8 may be user-defined and a total for all DLCIs on a monitored line. For 2 DLCIs and the total for all DLCIs, statistics and histograms are available with the following user-selectable resolutions: 1, 2, 5, 10, 15, 30s, 1, 5, 15, 30 minutes, 1, 2, 4, 6, 12 hours The following parameters are measured and presented: • Average, Minimum, Maximum utilisation per second (%) • Average, Minimum, Maximum throughput (kbps) • Average, Minimum, Maximum throughput (frames/s)

Frame relay statistics cont'd	• Average frame size • Total number of frames • FECN frames • BECN frames • DE frames • Short frames • Long frames • Aborted frames • Frames with FCS error • CIR estimate (for individual DLCIs)
DLCI Information	The following DLCI Information is derived from Full Status reports and presented to the user: • Listing of available DLCIs on the facility under test with their status (active, inactive, other) and CIRs and other link information (if available) The instrument will present the latest available information
LMI information	The following LMI information for the entire network is derived from Status messages and presented to the user: • Current sequence numbers for both directions, with a correct/incorrect notation • Total status (and inquiry) messages for keep alive and full status • Detected LMI type
LMI emulation test	LMI implementations: • Q.933 Annex-A • T1.617 Annex-D • Original FRF (Frame Relay Forum) • Automatic detection of the above • None Heart beat interval: • User-programmable from 2 to 40 sec in 1 sec steps Full Status Inquiry Message rate: • User-programmable from 1 to 255 in steps of 1
Frame relay channel scan	Automatic identification of multi time slot frame relay channels
Frame relay emulation	DLCI: • User-defined Control bits (FECN, BECN, DE, C/R) of transmitted signal: • User-programmable Frame lengths: • Up to 4093 bytes (user-definable) Utilization rates: • Up to 100% (user-definable) Dynamic change of payload: • Frame size can automatically be increased during the test Frames may be sent in bursts up to 255 frames Supported payload test patterns: • PRBS 6, PRBS 7, PRBS 9, PRBS 11, PRBS 12, PRBS 15, PRBS 20, PRBS 23 • QRBS 11, QRBS 20 • All 0s, All 1s • Fox pattern • Alternating (1:1), (1:3), (1:7), (3:1), (7:1), (3:24) • User-defined up to 16 bits. Length in steps of 1 bit • User-defined up to 2048 bits. Length in steps of 8 bits All patterns, except "All 0" and "All 1" and Fox may be inverted

Frame relay emulation cont'd	Bit Error Testing functionality:
	• Detection of pattern errors and slip-in received signal
	• Insertion of pattern errors and slip-in generated signal
	• Error insertion:
	  • Manual burst
	  • Burst length: 1-255 consecutive errors
	  • Continuous: burst length * 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}
	  • Provoking of G.821 events (ES, SES etc.)
	• Frame sequence error: manual
	• Slip insertion: manual
	Other measurements:
	• Count of missing (or mis-sequenced) frames
	• Indication of average frame delay if a far-end loop back appears during frame relay emulation

CIR test	The following parameters can be set for the CIR Test: • Transmit/receive DLCI • Min. and max. frame size (frame size is automatically increased during the test) • Burst length • Min. and max. utilization (utilization is automatically increased during the test) • Tc period
PING test	DLCI: • User-defined ICMP message formats in accordance with RFC792 Length of ICPM echo message: 64 bytes Supported IP encapsulations: • RFC1490 • RFC1490 with SNAP • Cisco proprietary IPv4 is supported Repetition rate: • 1 ICPM echo message per second during the PING test The PING test may be conducted with or without LMI emulation in the background Results: • Transmitted echo messages • Lost echo messages • Minimum delay • Maximum delay • Average delay Round-trip delay with accuracy and resolution of 0.1 msec when testing frame relay at 1984 kbps (i.e. 31 time slots of a 2Mbps PCM line)
InARP	Request IP address of a network element in accordance with Inverse Address Resolution Protocol RFC 2390

Miscellaneous	
Options related to the Frame relay option	• Frame relay decode (requires frame relay test option) • GPRS Gb interface decode (requires frame relay test option)

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CMA 3000

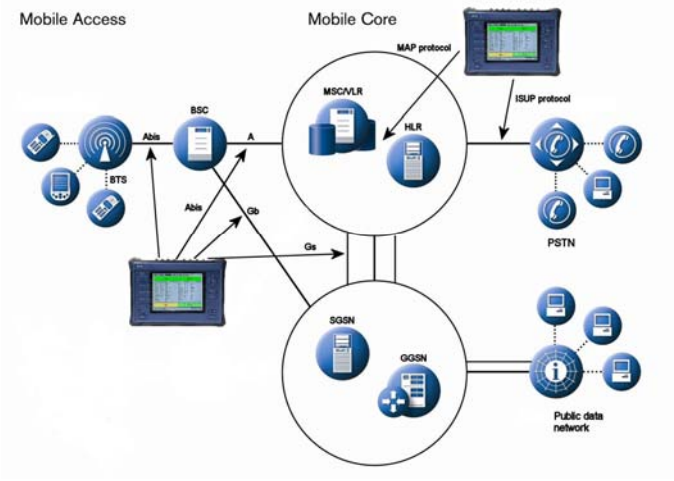
SPECIFICATIONS

GSM/GPRS Test Options

Field testing has never been easier.

CMA 3000 is Anritsu's new portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.

Equipped with the GSM/GPRS Abis protocol decode options, the battery-powered CMA 3000 is an easy-to-use, portable field test instrument for the installation, operation and maintenance of Abis interfaces on 2 Mbps lines in GSM/GPRS networks. It's also possible to outfit the CMA 3000 with the Gb interface protocol decode option and the powerful frame relay option to support the installation, operation and maintenance of Gb interfaces on 2 Mbps lines in GPRS/EDGE networks. Yet other options allow you to use the CMA 3000 for analyzing other 2 Mbps interfaces in GSM/GPRS networks.



KEY FEATURES

- Full-featured 2 Mbps transmission test set
- Dedicated GSM/DCS 1800 Abis test facilities
- Simultaneous monitoring of both directions of a line
- In-depth analysis of GSM/DCS 1800 Abis, GPRS Abis and GPRS/EDGE Gb signaling
- GSM Abis MEASUREMENT_RESULT message filter
- Signaling channel traffic statistics
- Traffic channel overview
- Decode of GSM voice encodings
- Other protocol analysis options for GSM A-interface, GPRS Gs interface, MAP and SS7
- Automatic configuration to the line

KEY APPLICATIONS

- Installation testing
- Rapid in-service diagnostics and troubleshooting
- Transmission quality measurement
- Signaling analysis and troubleshooting
- Identification of frame relay channels on the Gb interface
- Installation testing
- Traffic channel usage
- Speech quality
- GSM radio quality parameters

When equipped with SDH interface options you can also analyze GSM/GPRS Abis and Gb interfaces on 2 Mbps lines embedded in SDH signals.

For in-service analysis and troubleshooting you get access to the all-level decode of the signaling on the supported GSM/GPRS interfaces allowing you to make a detailed analysis of signaling problems in the network.

On the GPRS Abis interface the CMA 3000 collects and presents the basic PCUs and the assembled messages at the LLC layer. For unencrypted messages in-depth signaling decode is available enabling you to analyze the signaling problems in the network in details. The captured data can also be used to analyze the transmission quality on the air interface.

The CMA 3000 Frame Relay option is a powerful tool for turning up the frame relay service on the Gb interface lines through the simulation of frame relay data packets with user-defined characteristics.

As user you can automatically configure the CMA 3000 to the monitored 2 Mbps line, including identification of signaling channels.

Abis interface status display

With the CMA 3000 you get a quick overview of the activity on the GSM/GPRS Abis interface, as the instrument provides information on the contents of the sub-channels on the monitored Abis interface in the GSM/GPRS Abis status display. Sub-channels used for GPRS and HSCSD are indicated together with traditional GSM speech channels in the GPRS Abis status display. Sub-channels used for AMR encoded speech are also indicated.

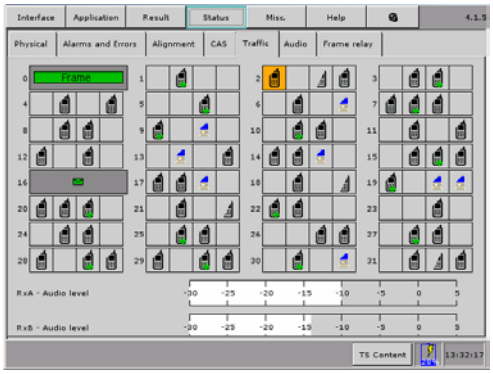


Figure 1 The Abis status display.

Protocol analysis

During installation or troubleshooting CMA 3000 provides valuable and detailed information on the signaling by collecting signaling messages from the GSM/GPRS Abis interface and the Gb interface, in addition to its powerful 2Mbps transmission line testing functionality.

The instrument captures and presents the basic PCUs and the assembled messages at the LLC layer on the GPRS Abis interface. For unencrypted messages all layers of signaling messages (GMM/SM or SMS) are decoded. This allows you to make a detailed analysis of the signaling problems in the network.

The CMA 3000 presents the recorded information in different ways: The Result List gives a one-line indication of each message for a rapid overview of the signaling information. This makes it simple to identify the input on which the message was detected, and subsequently you can easily detect message sequences.

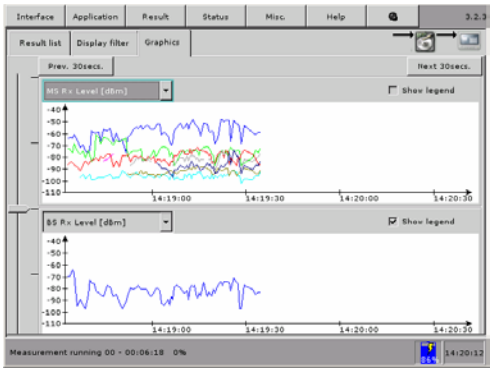


Figure 2 Graphical presentation of GSM Abis interface MEASUREMENT_RESULT message information.

The result list presentation can be expanded to show relevant parts of the messages, making it easy to identify the information carried. The contents of a message can also be shown, either presenting the main information elements or all parts of the signaling message and the hexadecimal values for detailed inspection and analysis.

Signaling statistics

The CMA 3000's signaling statistics provide data on the total traffic load and the quality of the signaling link.

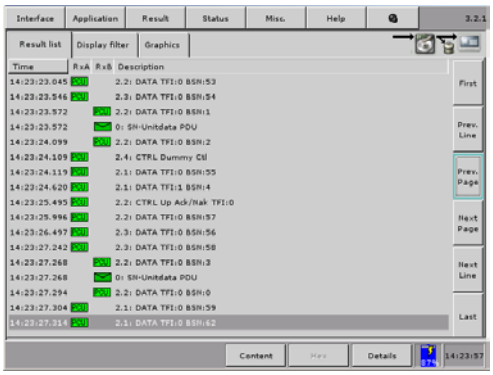


Figure 3 The result list display of GPRS Abis signaling messages with both PCU frames (marked with PCU) and assembled LLC level messages (marked with a green envelope).

For network optimization the GSM Abis Layer 3 and DTAP message type statistics opens many possibilities to the user. Call completion can be examined by comparing the count of SETUP messages on one side of the line with CONNECT messages on the other side of the line. Release cause statistics are also available for the Abis protocols.

On GPRS Abis the load of various PCU frame types can be examined. And for unencrypted messages on the GPRS Abis and on the Gb interface Layer 3 statistics can provide information like *attach request* counts together with information on *attach complete*.

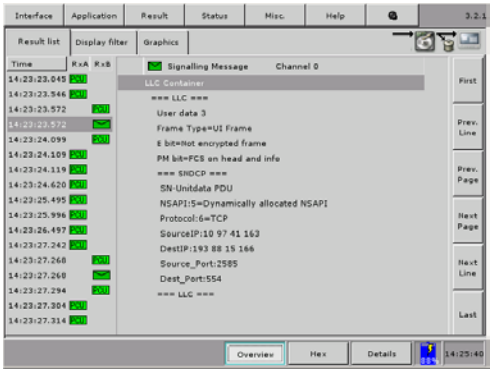


Figure 4 The contents of the higher levels of an encrypted GPRS Abis signaling message.

Frame relay channel scanning for Gb interface

In typical GPRS implementations the Gb interface is a 2 Mbps line carrying several frame relay connections. Each frame relay connection consists of a number of time slots.

The CMA 3000 provides a search facility that scans the contents of a monitored 2 Mbps line and identifies the frame relay connections on the line. This way you will easily and rapidly obtain the essential information on the Gb interface configuration.

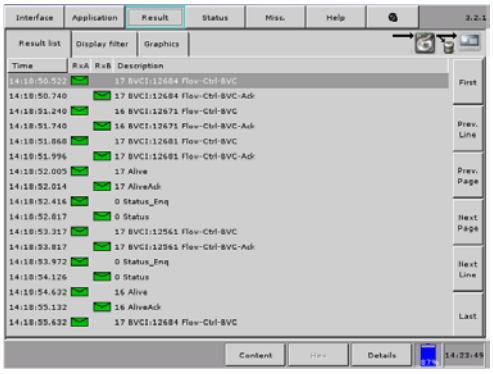


Figure 5 The Result List overview presentation of Gb interface messages.

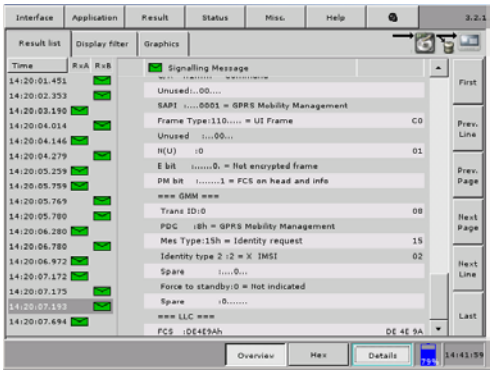


Figure 6 The detailed contents of an unencrypted Gb interface signaling message.

Specifications

The specifications overleaf cover the functionality when installing the basic Abis interface and protocol option, in addition to the GSM and GPRS protocol decode options in the CMA 3000.
For further information on the basic functionality please refer to the CMA 3000 Basic instrument specifications sheet.

General Specifications	
Protocol decoders	GSM Abis (Basic Abis interface and protocol functionality is required): • ETSI GSM Abis protocol • Vendor specific protocols for: - Ericsson (RBS200/RBS2000) - Lucent - Motorola (Mobis) - Nokia - Siemens GPRS Abis (Basic Abis interface and protocol functionality is required): • Vendor specific protocols for: - Ericsson - Lucent - Motorola - Nokia - Nortel - Siemens Gb interface protocol (Frame Relay test option is required): • ETSI GPRS/EDGE Gb interface protocol
Channel access	GSM Abis: • Access to 64 kbps, 16 kbps and 8 kbps sub-channels for traffic • For signaling analysis 1 x 64 kbps, 32 kbps, 16 kbps or 8 kbps can be selected. Alternatively, up to 16 x 16kbps channels or up to 4 x 64 kbps channels can be selected for signaling analysis (access to traffic channels is disabled) GPRS Abis protocols: • Real-time monitoring of GPRS Abis protocols in one signaling channel with up to 16 x 16 kbit sub-channels or 8 x 32 kbit sub-channels Gb interface protocol: • Support of real-time monitoring of GPRS Gb protocols on one frame relay connection in a single or multiple 64 kbps time slots on a framed 2 Mbps line • The GPRS Gb protocol decode option supports frame relay on Permanent Virtual Circuits (PVC) with HDLC framing with a 16-bit FCS. DLCI formats: 10 bits (2 octets address field format), 16 bits (3 octets address field format), and 23 bits (4 octets address field format)
Signal insertion (GSM Abis)	One of the following can be inserted in a selected sub-channel: • Artificial speech (FR, EFR, AMR, HR). • PRBS11. • User-defined 1, 2, 4, 8 or 16-bit pattern. • 1kHz tone
GSM speech decodes	• In 16 kbps sub-channels: Full Rate (FR), Enhanced Full Rate (EFR), Half Rate (HR) and Adaptive Multi Rate (AMR). • In 8 kbps sub-channels: HR
Detected patterns (GSM Abis)	One of the following patterns can be detected in one sub-channel: • PRBS11 • User-defined 1, 2, 4, 8 or 16-bit pattern
Display of logged events	Unencrypted information is decoded GPRS Abis: Messages with both PCU frames and resulting assembled LLC level messages are decoded Max. length of recorded messages: 300 bytes. If a longer message is

	received, the first 300 bytes of the message are recorded and decoded/displayed
	Display modes: • Result List: showing one line with message type • Result List, Details: showing message type and main information elements • Message Contents: showing all information elements • Message Contents, Details: showing all parts of the message (GPRS: Up to the GMM/SM/SMS/SNDCP layers) plus a hex presentation. GPRS data is shown in hex • Plain text help for individual fields • Hex-only presentation of messages GSM Abis TRAU C-bits are shown with mnemonics
Message filter conditions for unencrypted information	GSM Abis (ETSI): • SAPI, TEI, Message Discriminator, Channel Number/TDMA Time Slot, MEASUREMENT_RESULT, DTAP messages. • Up to 8 user-defined layer 3 message types for a selected message discriminator or up to 8 user-defined DTAP message types for a selected protocol discriminator. • Up to 4 digits (display filter only) GPRS Abis: • Show only RLC/MAC PCU frames • MEAS_RESULT: Show only PCU frames that contain information on the transmission quality on the air interface • PCU filter – can allow that SYNC and IDLE messages are stripped away • TFI (display filter only) • Show only LLC level messages (display filter only) • Show GMM/SM/SMS messages (display filter only) • Show user data messages (display filter only) • Up to 4 digits(display filter only) Gb interface: • Reject keep-alive messages • Show User data messages • Show GMM/SM/SMS messages • DLCI, BVCI • TLLI, Up to 4 digits (display filter only)
Signaling statistics for unencrypted information	GSM Abis (ETSI): • Traffic load: total, retransmitted and errored signaling frames • Layer 2 traffic load split into Supervisory (S), Unnumbered (U) and Information frames (I/UI) • Signaling divided by the Message Discriminator • Statistics on up to 32 layer 3 message types or release cause values for a selected Message Discriminator • DTAP signaling divided by the Protocol Discriminator • Statistics on up to 32 DTAP message types or release cause values for a selected Protocol Discriminator GPRS Abis: • Traffic load: total, retransmitted and errored PCU frames • Count of PCU frames types • Count of Layer 3 protocol data (user data messages and GMM/SM/SMS messages) • Count of GMM/SM or SMS messages types Gb interface: • Traffic load: total and errored signaling frames • Count of user data messages and GMM/SM/SMS messages • Count of GMM/SM or SMS messages types

Memory capacity	
Internal memory capacity	32 Mbytes are available for measurement results • Storage capacity for protocols: up to 8 protocols can be installed

Miscellaneous	
Options related to the GSM/GPRS options	• Frame relay test option • Frame relay decode (requires frame relay test option) • MAP protocol decode (requires basic SS7 functionality option) • A-interface protocol decode (requires basic SS7 functionality option) • Gs interface protocol decode (requires basic SS7 functionality option) • Additional options are available. A list can be found in the Basic instrument specification sheet

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CMA 3000

SPECIFICATIONS

ISDN and access protocol functionality option

Effective installation, operation and maintenance of 2 Mbps interfaces

CMA 3000 is Anritsu's new portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.

Equipped with the basic ISDN protocol functionality option, the battery-powered Anritsu CMA 3000 is an easy-to-use, portable field tester for the installation, operation and maintenance of 2 Mbps interfaces in the access network.
The basic ISDN protocol signaling functions include signaling message monitoring with all-level decode, powerful signaling statistics and easy-to-use filter facilities.

With the CMA 3000 you're able to analyze a range of international and national ISDN protocols and other access protocols. The instrument allows you to capture signaling information from up to four 64 kbps or up to sixteen 16 kbps signaling channels.

Measurement functions include supervision of the 2 Mbps line and audio access to the traffic channels, as well as line-status and performance measurement. The CMA 3000 transmitter generates test signals for commissioning tests of 2 Mbps PCM systems. The transmitter also allows drop-and-insert testing for in-service measurement of transmission quality.

KEY FEATURES

- All-layer analysis of ISDN, V5.1/V5.2, QSIG and other access network protocols
- Signaling channel traffic statistics
- Full-featured 2 Mbps transmission test set
- Simultaneous monitoring of both directions on a line
- Traffic channel overview
- Automatic configuration to line, including identification of signaling channels

KEY APPLICATIONS

- Installation testing
- Rapid in-service diagnostics and troubleshooting
- PCM link performance
- Traffic channel usage
- Signaling-link performance and load
- Protocol analysis and troubleshooting
- Signaling-message sequences
- Call completion analysis

Protocol analysis

During installation or troubleshooting, the CMA 3000's event log provides you with valuable detailed information on the signaling by collecting signaling messages from the connected 2 Mbps line.

All layers of the protocol are decoded completely into text (ISDN, V5.x) or mnemonics. The mnemonics can be translated into plain language, and the use and possible values of the field are explained.

The CMA 3000 presents the recorded information in different ways: The Result List gives a one-line indication of each message for a rapid overview of the signaling information. This makes it simple to identify the input on which the message was detected. Intuitive color indications highlight messages that could not be correctly decoded. With the search facility you can easily find such messages. The Result List overview presentation may be expanded to contain a couple of lines per message, stating the most important information in the message.

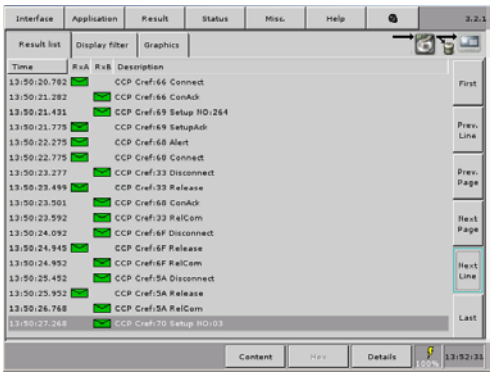

Figure 1 The Result List presentation of signaling.

The contents of a message can also be shown, either presenting the main information elements or all parts of the signaling message and the hexadecimal values for detailed inspection and analysis.

Messages are stored in the CMA 3000's memory and can be examined during or after the measurement. Filters can be applied to select the most essential information for storage and display.

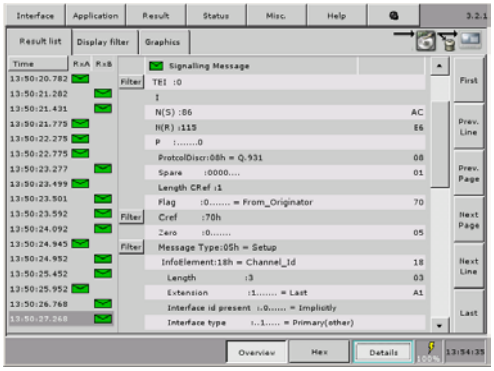

Figure 2 Detailed presentation of the message contents.

For ISDN protocols, you may set the filter to display only SETUP messages, providing a quick overview of calls on the line. It's easy to import the Call Reference parameter value to display filters, making the extraction of ISDN messages that belong to the same call a very simple task.

The CMA 3000 also has a general 4-digit search facility enabling you to extract 4-digit messages. This can be used to identify messages with a particular called party or calling party number.

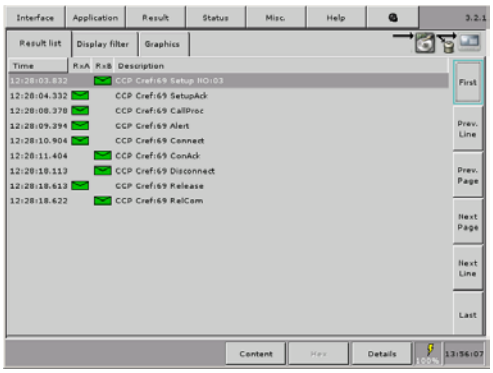

Figure 3 Extract of messages for a call.

Signaling statistics

The CMA 3000's signaling statistics provide data on the total traffic load and the quality of the signaling link.

For examination of the Layer 2 traffic load on the signaling link, CMA 3000 displays traffic information split into Supervisory (S), Unnumbered (U) and Information frames (I/UI).

The ISDN Layer 3 message type statistics provides you with numerous network-optimization opportunities. Call completion can be examined by comparing SETUP messages count on one side of the line with CONNect messages on the other side.

Traffic channel load is clearly displayed in a histogram presentation of SETUP message counts. Release cause statistics are also available for the ISDN protocols.

Other access protocols

The CMA 3000 supports analysis of other access protocols, such as V5.1/V5.2, QSIG, DPNSS and DASS2.

The instrument can capture signaling information from up to four 64 kbps signaling channels. This is particular important when analyzing V5.1/V5.2 systems where the signaling in many cases uses two or three 64 kbps signaling channels.

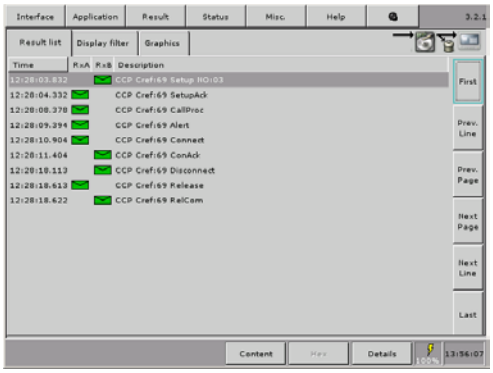

Figure 4 A Result List presentation of V5.2 signaling.

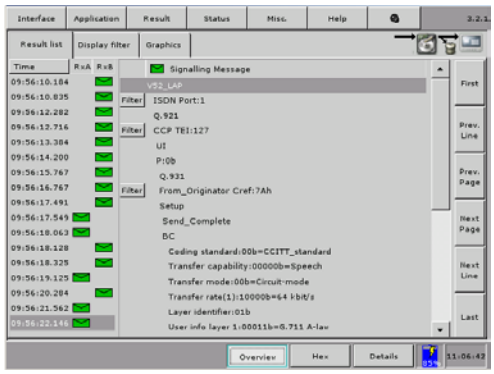

Figure 5 The high level contents of a V5.2 signaling message

Specifications

The specifications below cover the functionality for the CMA 3000 when installing the basic ISDN protocol functionality option. Please refer to the CMA 3000 Basic instrument specifications sheet for further information on the basic functionality.

General	
Optional ISDN and access protocols	Basic ISDN protocol functionality option is required. ISDN protocols: • ETSI EURO-ISDN (equivalent to ITU-T DSS1 - Q.931). • VN6, 1TR6, Australian ISDN Other access network protocols: • DPNSS, DASS 2 • V5.1/V5.2 • QSIG
Signaling channel access	For signaling analysis 1 x 64 kbps channel can be selected. Alternatively, up to 4 x 64 kbps channels or up to 16 x 16 kbps signaling channels can be selected for signaling analysis (audio access to traffic channels is disabled in this case)
Display of logged events	Messages are shown in mnemonics. Display modes: • Result List: showing one line with message type • Result List, Details: showing message type and main information elements • Message Contents: showing all information elements • Message Contents, Details: showing all parts of the message plus a hex presentation • Plain text help for individual fields • Hex-only presentation of messages
Message filter	Message filter conditions: ISDN protocols: SAPI, TEI, Call Reference, up to eight user-defined message types. For display filters also a message filter string of four user-defined digits (4 bit values)
Signaling statistics	• Traffic load: total, retransmitted and errored signaling frames • ISDN Layer 2 traffic load split into Supervisory (S), Unnumbered (U) and Information frames (I/UI) • For ISDN protocols: statistics for up to 32 message types or release cause values

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CMA 3000

SPECIFICATIONS

ISDN PRI Call Emulation options

Fixed access network testing has never been easier

CMA 3000 is Anritsu's next-generation portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.

The CMA 3000 is a powerful tool for a wide range of applications, including fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems. With the ISDN Call Emulation option, the battery-powered CMA 3000 is an easy-to-use, easily transportable test instrument for installation, operation and maintenance of the fixed access network 2 Mbps Primary Rate Interfaces (PRI).

The basic CMA 3000 configuration, with its two 2 Mbps receivers and transmitters, supports framed and unframed testing and monitoring of 2 Mbps systems. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

Futureproof design

The modular design provides you with a clear and cost-effective upgrade path. This allows you to expand the CMA 3000 from a full-featured transmission line quality tester into an advanced signaling analyzer.

By adding options the CMA 3000 becomes a highly flexible field tester with the ability to test a large number of interfaces and technologies, including SDH, ATM, E3/DS3 and Ethernet interfaces, frame relay lines and the Abis interface of GSM and GPRS networks. Other options turn the CMA 3000 into a very powerful signaling analyzer for GSM, GPRS/EDGE, SS7, and ISDN protocols.

Key Features	Key Applications
• Establish speech connection • BER test • Availability of supplementary services • Automated channel test • All-layer protocol analysis options for ISDN and other protocols	• Installation testing • Connectivity testing • Rapid in-service diagnostics and troubleshooting

The ISDN Call Emulation option provides the necessary functionality for testing ISDN connections. The instrument can setup and receive ISDN calls with user-specified parameters such as called number and facilities. When a connection is setup, a voice call or a BER test can be made. Special facilities allow testing the availability of supplementary services.

If ISDN signaling decode options are added, the user gains access to the powerful ISDN protocol functionality of CMA 3000. This includes message monitoring with all-level decode, result presentation in mnemonics, powerful signalling statistics and easy-to-use filter facilities. Measurement functions include supervision of the monitored lines and audio access to the traffic channels, as well as line-status and performance measurement.

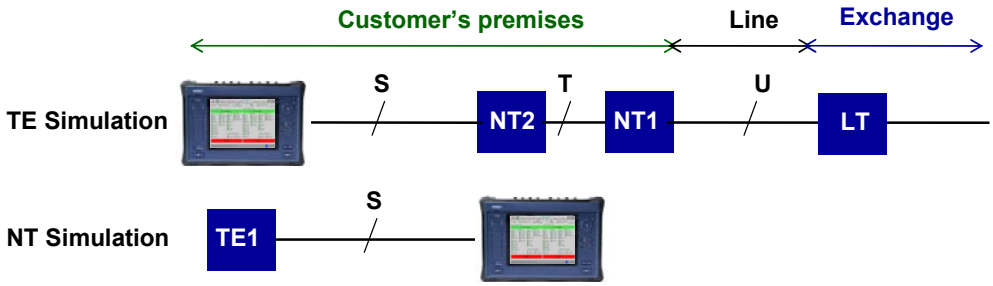

Figure 1 ISDN call emulation configurations.

Call Emulation

The call emulation function permits the user to setup or answer ISDN calls. The user has numerous call setup options which are all easily configured in the call setup display. The number to be called can either be entered on the instrument itself or the optional telephone set. To load an ISDN connection fully, up to 30 calls can be active at the same time.

The user has several options for testing an established connection; a conversation with the called party can be carried out on the optional telephone set or by performing a BER test. The BER test can be made with either a far-end loopback or by applying a self-call test. In this case the instrument makes a call to itself using two B-channels. The test pattern is inserted in one B-channel and transmitted; received, verified and returned in the second B-channel; and finally received and verified in the first B-channel.

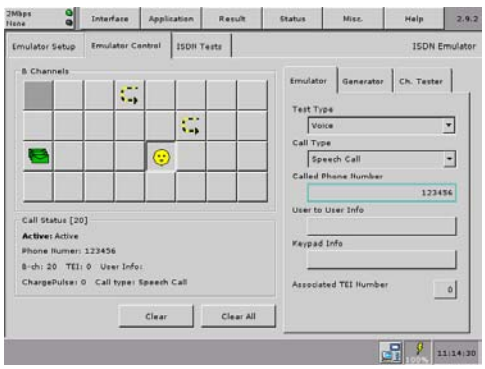

Figure 2 The status of the emulator will be presented to the user on the Emulator Control page. Calls are activated and answered in the same display.

The user can initiate repeated call setups to a set of telephone numbers with the Call Generator feature. The Call generator generates up to 8 concurrent calls. The number(s) called may be those entered into the phone list of the instrument or one entered when the call generator is started.

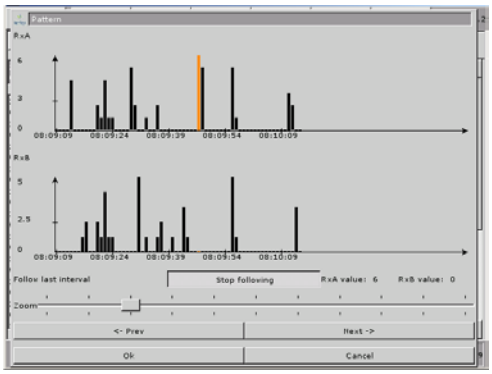

Figure 3 Histogram presentation of the error measurement made on an ISDN connection.

An automated BER test of each of the traffic channels of an ISDN line can be initiated with the ISDN channel test feature. Hereby all B-channels of the line are easily tested for availability and error performance.

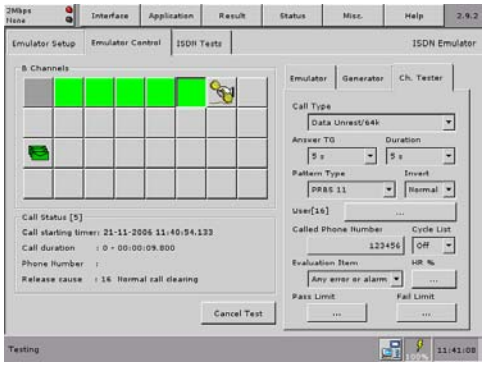

Figure 4 During and after the channel test the status of the test and the results for the individual channels are displayed in the ISDN channel test status display.

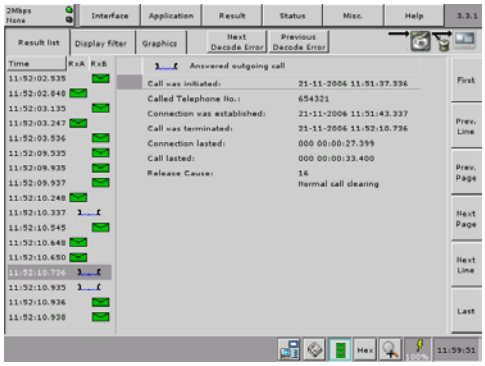

Figure 5 In the log measurement, a Call Data display provides a summary of each call made.

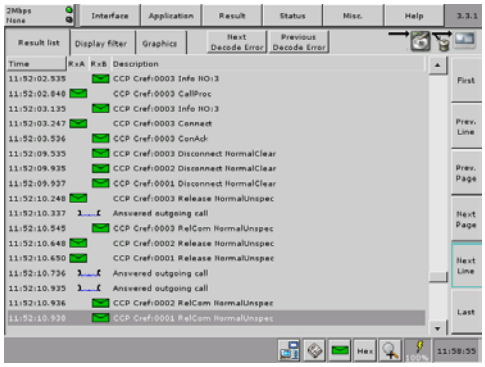

Figure 6 The log list displays signalling details of the call if the CMA 3000 is equipped with the related signalling decode protocol.

Supplementary service test

The instrument allows the user to test the availability of supplementary services on an ISDN line. Calls that require a given supplementary service can be made, and the instrument will inform on the availability of the particular service.

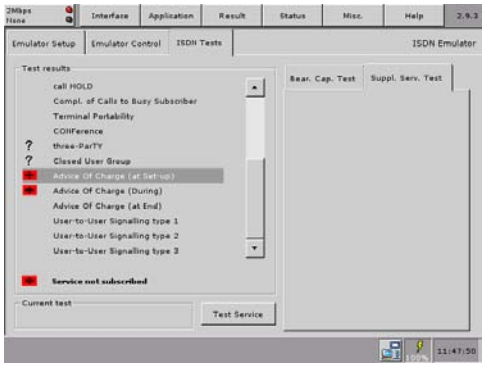

Figure 7 The status display of the CMA 3000 shows the supplementary services detected on the tested line.

Specifications

Below are specifications for a basic CMA 3000 with an ISDN PRI call emulation option. For further information on the basic functionality please consult the CMA 3000 basic instrument specifications sheet.

General	
Emulation modes	The iinstrument supports 2 Mbps PRI: • TE simulation • NT simulation
General functionality	• Setup a call, user conversation through handset, clear call • Setup a call, make an automated BER test, clear call
Emulation settings	• Simulator mode: Emulate terminal, Emulate Network • Configuration: Loopback, self-call, end-to-end • B channel, called number, type of number, numbering plan, calling party number • Test type (e.g. Voice, BERT) • Call type (e.g. speech, data) • Incoming call reply: manual(always), manual(speech), automatic (loopback, pattern, tone), selective (loopback, pattern, tone) • Dial mode: Overlap (digit-by-digit), en-bloc • Answer timer (1, 2, 5, 10, 20, 30, ∞ seconds). • Send charge pulse (off, send in INFO, send in FACILITY), interval (1-50 sec) • TEI: 0 to 63

Called number list	Up to 20 called numbers can be stored in the instruments phone book
Simulator status and result	Each call will provide the following information: • Call state (idle, calling, dialling etc.) • Call type (outgoing, incoming). • Start time: the time the call was initiated. • Release cause. • Call time: the duration of the call. • Connection time: the duration of the connection. • Charging information (if any).
Simultaneous calls	Up to 30 active calls simultaneously
Automatic test of services	General functionality • Setup a call with required service, clear call. After a call, a PASS/FAIL indication will show if the call setup was successful. ISDN bearer capability test: • For ISDN DSS1 (Q.931 etc.) the test includes: Speech call, Data unrestricted/64k, 3.1k audio, 7k call, 3.1k telephony, Fax group 2/3, Fax group 4, Videotext new, Teletext, Mixed mode, OSI, 7k telephony. Supplementary services • For ISDN DSS1 (Q.931 etc.): Call Waiting (CW), Calling-Line Id. Presentation (CLIP), Calling-Line Id. Restriction (CLIR), Multiple Subscriber Number (MSN), SUB-addressing (SUB), Call Forwarding Unconditional/Busy/No Reply (CFU/CFB/CFNR), Malicious Call ID. (MCI), Terminal Portability (SUSPEND/RESUME), Completion of Calls to Busy Subscriber (CCBS), Call Hold (HOLD), Three-PartY service (3TPY), Conference calling (CONF), Closed User Group (CUG), User-to-User Signalling (UUS), Advice Of Charge (AOC)
Measurement of Bit Error Ratio (BERT)	Supported patterns • PRBS 6, PRBS 7, PRBS 9, PRBS 11, PRBS 12, PRBS 15, PRBS 20, PRBS 23 • QRSS 11, QRSS 20 • All 0s, All 1s. • Alternating (1:1), (1:3), (1:7), (3:24). • Quick brown fox • User-defined up to 16 bits. Length in steps of 1 bit. • User-defined up to 2048 bits. Length in steps of 8 bits. • All patterns, except “All 0”, “All 1” and “Fox”, can be inverted. BERT functionality: • Detection of pattern errors and slip-in received signal. • Insertion of pattern errors and slip-in generated signal. Error insertion: • Manual burst. • Burst length: 1-255 consecutive errors. • Continuous: burst length * 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6} ,10^{-7}. • Provoking of G.821events (ES, SES etc.) Slip insertion: manual.
Call Generator	Continuous generation of calls: • Number of concurrent calls: Up to 8 • Call type: User selectable • Answer time out: User selectable • Call duration: User selectable • Time between calls: User selectable • Number to call: Cyclic from the instruments phone book or defined by the user when the call generator is started.

Channel test	Automated test of the available B-channels: • Call type: User selectable • Answer time out: User selectable • Test duration: User selectable • Pattern type: Available test patterns or none • Pass/fail evaluation: on a user defined parameter or HR% • Time between calls: User selectable • Number to call: Cyclic from phone list or defined by the user when the call generator is started.

Results	
Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Code error count/ratio • Pattern bit (BER), FAS, CRC-4 and E-bit error count/ratio and G.821, G.826 or M.2100 parameters • Frequency deviation information
Event Log	Events are logged with 1 msec resolution time stamps Logged events: Detected alarms and errors. Call emulation logs - Each call will provide the following information: • Call state (idle, calling, dialling etc.) • Call type (outgoing, incoming). • Called or calling phone number if applicable • Start time: the time the call was initiated. • Release cause. • Call time: the duration of the call. • Connection time: the duration of the connection. • Charging information (if any). Filters enable/disable the logging of individual events Display of logged events: • Logged events are shown as text in a table

Miscellaneous	
Phone Interface	RJ-11 with a 6 slot 4 connector configuration AC impedance: Approx. 600Ω. The phone will be supplied with a constant current of approx. 20 mA The following functions are supported: • Detection of ON/OFF hook state. • Generation of dial tone. • Reception and recognition of DTMF digits. • Receiving and transmitting speech signals.

Options related to the ISDN PRI call emulation option	
Available call emulators	• ISDN DSS1 (Q.931) call emulation (requires Basic ISDN protocol functionality) • ETSI Euro ISDN call emulation (requires Basic ISDN protocol functionality) • QSIG call emulation (requires Basic ISDN protocol functionality) • VN6 call emulation (requires Basic ISDN protocol functionality) • 1TR6 call emulation (requires Basic ISDN protocol functionality) • DPNSS call emulation (requires Basic ISDN protocol functionality) • DASS-2 call emulation (requires Basic ISDN protocol functionality)
Storage capabillty	Up to 8 call emulator programs or protocols can be stored in the instrument
Other options	• Basic ISDN protocol functionality • National and international ISDN protocols (requires basic ISDN protocol functionality). For details on available protocols, please contact your local Anritsu representative

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CMA 3000

SPECIFICATIONS

SS7 Protocol Functionality Option

Effective installation, operation and maintenance of SS7 signaling links

CMA 3000 is Anritsu's new portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching. With the basic SS7 protocol functionality option and additional decoder options the the battery-powered Anritsu CMA 3000 is an easy-to-use, portable test instrument for the installation, operation and maintenance of SS7 signaling links, capable of analyzing a wide range of international and national SS7 protocols.

CMA 3000 captures signaling information from up to four 64 kbps signaling channels from a 2 Mbps signaling link, or if equipped with optional SDH interfaces, from a 2 Mbps link embedded in the SDH signal. You get powerful functions, such as message monitoring with decode of all levels, result presentation in mnemonics, signaling statistics and easy-to-use filter facilities, for protocol analysisof the captured signaling.

The instrument's transmitter generates the test signals required for commissioning testing of 2 Mbps PCM systems before they are taken into operation as SS7 signaling links. The transmitter also allows drop-and-insert testing for in-service measurement of transmission quality. The basic instrument's measurement functions include traffic channels supervision (together with audio access) as well as line-status and transmission performance measurements.

Key Features	Key Applications

• All-layer analysis of SS7 protocols:
  ○ International SS7 (ITU-T, ETSI) protocols
  ○ A wide range of national SS7 protocols
  ○ GSM protocols: MAP and A-interface
• Signaling channel traffic statistics
• Full-featured 2 Mbps transmission test set
• Simultaneous monitoring of both directions on a line
	• Installation testing
	• Rapid in-service diagnostics and troubleshooting
	• Signaling link performance and load
	• Protocol analysis and troubleshooting
	• Signaling message sequences
	• Call completion analysis

Protocol analysis

During installation or troubleshooting, the CMA 3000's event log provides valuable, detailed information on the signaling by collecting signaling messages from the connected SS7 signaling link.

All protocol layers are decoded completely into mnemonics. The mnemonics can be translated to plain language and the use and possible values of the field are explained. The CMA 3000 presents the recorded information in different ways: The Result List gives a one-line indication of each message for a rapid overview of the signaling information. This makes it simple to identify the input on which the message was detected. Intuitive color indications highlight messages that could not be correctly decoded. With the search facility you can easily find such messages.

The Result List overview presentation may be expanded to contain a couple of lines per message, stating the most important information in the message. The contents of a message can also be shown, either presenting the main information elements or all parts of the signaling message and the hexadecimal values for detailed inspection and analysis.

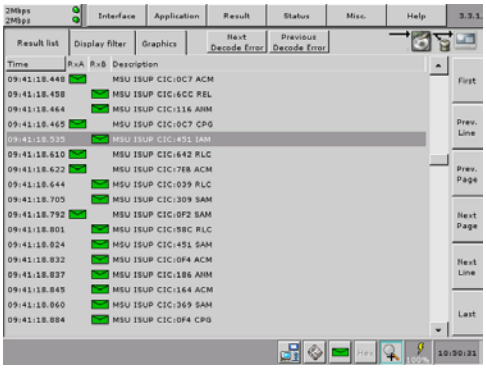

Fig.1 The Result List presentation of the signaling.

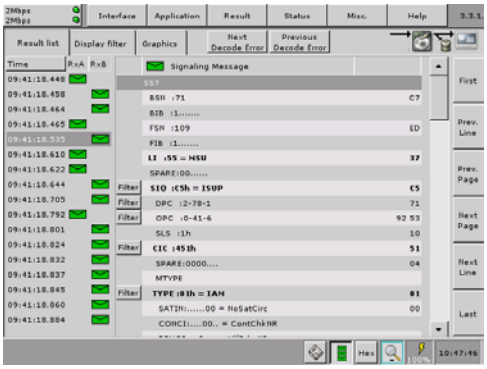

Fig.2 The detailed presentation of the message contents.

Messages are stored in the CMA 3000's memory and can be examined during or after the measurement. Filters can be applied to select the most essential information for storage and display.

For ISUP type protocols, you may set the filter to display only IAM messages, providing a quick overview of calls on the line. It's easy to import OPC, DPC and CIC parameter values to display filters. This turns extraction of messages that belong to the same call into a very simple task.

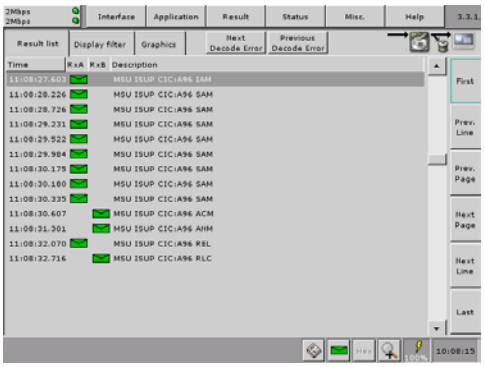

Fig.3 Extraction of messages for a call.

You can automatically configure the CMA 3000 to the monitored 2 Mbps line, including identification of signaling channels.

Signaling statistics

The CMA 3000's signaling statistics provide data on the total traffic load and the quality of the signaling link.

With the CMA 3000 you can get information on the occurrence of and load from the different SS7 User Parts divided by the SIO value. The SS7 ISUP message statistics open up a vast range of opportunities for network optimization.

You can examine call completion in ISUP protocols by comparing counts of IAMs on one side of the line with answer messages (ANM) on the other. In addition, release cause statistics are available for ISUP type protocols.

Specifications

The specifications below cover the functionality when installing the basic SS7 protocol functionality option. Please refer to the CMA 3000 Basic instrument specifications sheet for further information on the basic functionality.

General	
Optional SS7 protocol decoders	Basic SS7 protocol functionality option is required • International SS7 (ITU-T and ETSI) protocols • A wide range of national SS7 protocols • GSM protocols: MAP and A-interface Please contact your local Anritsu representative for detailed information on available protocol decoders
Signaling channel access	For signaling analysis 1 x 64 kbps channel can be selected. Alternatively, up to 4 x 64 kbps channels can be selected for signaling analysis (audio access to traffic channels is disabled in this case)
Display of logged events	Messages are shown in mnemonics. Display modes: • Result List: displays one line with message type • Result List, Details: displays message type and main information elements • Message Contents: displays all information elements • Message Contents, Details: displays all parts of the message plus a hex presentation • Plain text help for individual fields • Hex-only presentation of messages
Message filter	Message filter conditions: • FISU, LSSU, PCR, SIO, OPC, DPC, CIC, up to eight user-defined TUP, ISUP, SCCP, SNM or SNT message types (SS7 white book protocol) For display filters also a message filter string of four user-defined digits (4 bit values)
Signaling statistics	Traffic load: • Total, retransmitted and errored signaling frames. Traffic divided into MSU, LSSU and FISO Configurable statistics: • Up to 32 counters per receiver. 8 counters per receiver may be fixed by the user, the remaining are assigned in the order that the messages occur The user defines the counter usage: • Traffic load per user part (i.e. SIO value) • For ISUP and TUP type protocols: statistics on message types • For ISUP type protocols: statistics on release cause values

Memory capacity	
Internal memory capacity	32 Mbytes are available for measurement results Storage capacity for protocols: up to 8 protocols can be installed

Miscellaneous	
Options related to the SS7 protocol options	• GSM/GPRS Abis and Gb interface protocol options • ISDN and V5.x protocol options

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CMA 3000 SPECIFICATIONS

Tandem Connection Monitoring (TCM) Option

Powerful tool for testing SDH and PDH systems
When equipped with the SDH test option, the CMA 3000 is an easy-to-use, powerful tool for testing SDH and PDH systems.

CMA 3000 spans across a wide range of applications, from fast first aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.

It's possible to further test SDH systems by adding the Tandem Connection Monitoring (TCM) option to a CMA 3000 with SDH option installed. The TCM option contains very powerful features for testing and monitoring TCM systems in SDH networks.

Key Features	Key Applications

• Simultaneous bi-directional monitoring of TCM information on SDH lines
• TCM overhead byte testing and monitoring
• Comprehensive TCM error and alarm statistics
	• Comprehensive out-of-service test of TCM systems for:
	  ○ Installation
	  ○ Provisioning
	• In-service monitoring of TCM systems for:
	  ○ Fast troubleshooting
	  ○ TCM overhead byte analysis
	  ○ In-service error-performance measurement

An SDH system has a number of error detection mechanisms, supporting end-to-end monitoring or section-based monitoring. Today operators may transport SDH traffic through a second operator's networks. Therefore a new system has been added to the original error detection mechanisms of SDH, this being the Tandem Connection Monitoring.

The system is based on in-service error detection of SDH Virtual Containers. By checking the Virtual Containers for errors upon entering the second operator's network and leaving it again you can supervise the transmission quality throughout the second operator's networks.

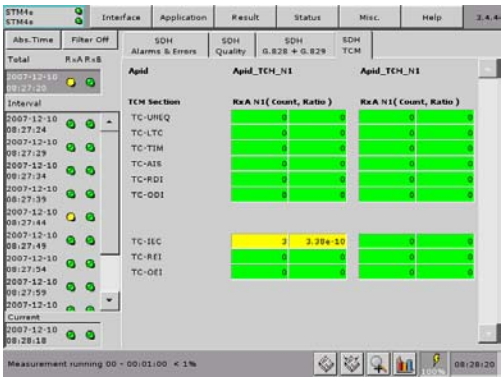

Fig. 1 Result screen with comprehensive statistics on TCM events.

As CMA 3000 can be outfitted to support bi-directional in-service monitoring you can inspect TCM parameters for both sides of a line simultaneously. This allows you to analyze the overall transmission quality of the monitored part of the line in the fastest way possible.

For out-of service testing and verification of the TCM system CMA 3000 includes features to inject the various conditions that provoke TCM events.

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Specifications

The specifications below list the functionality when adding the TCM option to the basic CMA 3000.
For further information on the basic functionality please refer to the CMA 3000 basic instrument specifications sheet.

General	
TCM frame format	ITU-T G 783, G 707 annex D (TCM option 2) and annex E
POH bytes	N1 (VC-4, VC-3) N2 (VC-12)
TCM Access Point Identifier (Apid)	15 bytes ASCII sequence, CRC-7
Alarms	Alarms can be detected and inserted: • TC-LTC, TC-TIM, TC-UNEQ, TC-AIS, TC-RDI, TC-ODI Alarm insertion is manual on/off
Errors	Errors can be detected and inserted: • B3 (VC-4, VC-3), TC-IEC (VC-4, VC-3), V5 (VC-12), TC-REI, TC-OEI Error insertion: • Manual: 1-8000 consecutive errors • Continuous 10-5, 10-6, 10-7, 10-8, 10-9, 10-10

Results	
Status	Current information on TCM alarms and errors on the monitored line
Statistics	User-defined resolution: • 1, 2, 5, 10, 15, 30s, 1, 5, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged on TCM alarms and errors

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CMA 3000

SPECIFICATIONS

ATM Test Options

Testing ATM connections has never been easier

CMA 3000 is Anritsu's next-generation portable and futureproof field tester for the installation and maintenance of fixed line and mobile access networks. The instrument covers a wide range of applications, from fast first-aid troubleshooting to comprehensive in-depth analysis of transmission problems.

When equipped with the ATM test options, the CMA 3000 is a powerful and easy-to-use tool for testing ATM channels in SDH and PDH systems.

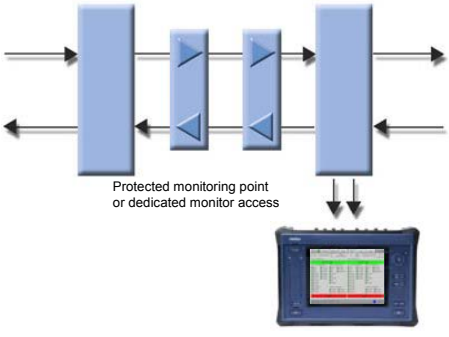

Fig. 1 With the CMA 3000 you're able to perform bi-directional in-service monitoring of ATM traffic.

Key Features	Key Applications

• Simultaneous bi-directional monitoring of ATM streams
• Powerful testing of ATM channels through SDH and PDH systems
• Comprehensive error and alarm statistics
	• Comprehensive out-of-service testing for:
	• Installation
	• Provisioning
	• Performance analysis
	• In-service monitoring for:
	  ○ Fast troubleshooting
	  ○ Traffic monitoring
	  ○ In-service ATM traffic analysis

The ATM option allows both active testing with one transmitter and one or two receivers and simultaneous bi-directional monitoring of ATM traffic with two receivers. This makes CMA 3000 the ideal instrument for both in- and out-of-service transmission-quality measurements.

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret important information from the ATM traffic.

ATM in the access network

ATM is used heavily in the access networks of today. In the mobile environment the 3G (UMTS) access networks (UTRAN) are based on ATM. In the fixed line access networks ATM is used to provide access for ADSL customers. ATM can be carried over SDH lines or in some cases over a set of 2 Mbps lines utilizing the IMA (Inverse Multiplexing for ATM) technique. It is important for field technicians installing and maintaining these types of networks to have an optimal tool to test ATM together with all the other technologies they have to take care of.

Speeds ATM troubleshooting

The CMA 3000 status monitor allows you to speed troubleshooting, as the status monitor is always active providing essential information on the monitored transmission system and ATM traffic on top of that. Through bidirectional monitoring the user can quickly verify that both sides of the ATM connection are working properly. The ATM scan facility in the CMA 3000 give a quick overview of the active virtual channels in the monitored ATM traffic. Up to 150 channels can be identified.

Fig. 2 The CMA 3000 gives you a quick overview of errors and alarms of both sides of the ATM connection.

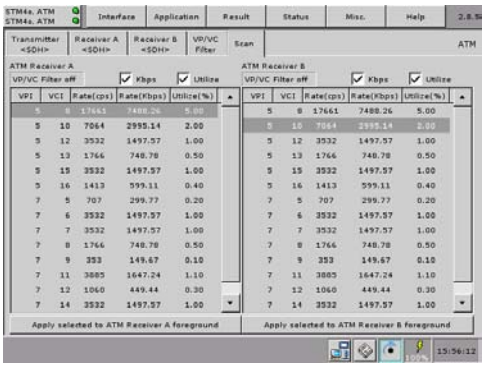

Fig. 3 The user can quickly get an overview of the active virtual channels in the monitored ATM traffic through the ATM scan facility in the CMA 3000.

In-service ATM statistics

For in -service troubleshooting of ATM channels on SDH links the CMA 3000 provides powerful bidirectional statistical measurements of general ATM alarms and errors and Virtual Path (VP) OAM F4 and Virtual Circuit (VC) OAM F5 alarms for one selected foreground channel.

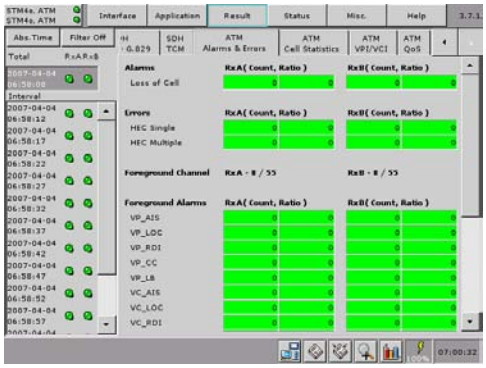

Fig. 4 The CMA 3000's color indications make it easy to identify alarms or errors in the monitored signal

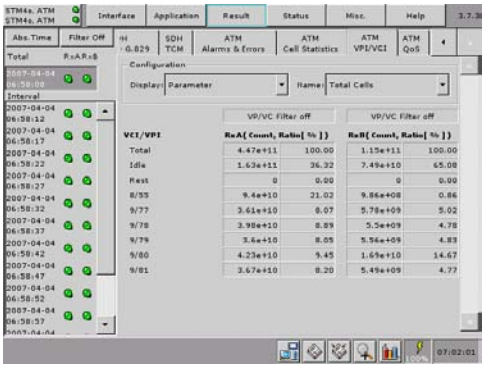

Fig. 5 Comparing total cell count for the monitored VPI/VCI channels

Statistics are also available for in-service analysis of up to 30 ATM channels, identified by their VP/VC identifiers (VPI/VCI). The user can specify a number of ATM channels to be monitored. The instrument will complete the list by identifying active VPI/VCI pairs in the monitored ATM traffic.

The user can compare one selected parameter for all channels or see all parameters for one channel. The parameters include User cells, User Congestion cells, OAM cells and Resource Management cells. A number of traffic descriptor parameters are also measured. The traffic descriptor parameters describe the behavior of an ATM virtual traffic channel: Peak Cell Rate (PCR), Sustainable Cell Rate (SCR), Minimum Cell Rate (MCR), Maximum Burst Size (MBS) and Cell Delay Variation Tolerance (CDVT).

The instrument can monitor status and synchronization cells for 2 Mbps lines running IMA (Inverse Multiplexing for ATM). Hereby it is easy for the user to check the status of the 2 Mbps lines that are used in the IMA connection.

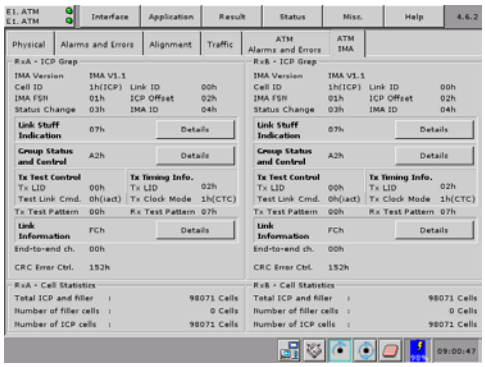

Fig. 6 Presentation of the status of the IMA connection. By clicking "Details" the user gets information bytes presented in decoded format.

Out-of-service ATM tests

During installation/commissioning and stress testing of network elements you can control the signal transmitted by the CMA 3000. UNI and NNI ATM traffic can be generated from E1 rate up to STM-4 rate (VC4-4c). The instrument can generate ATM cells in one foreground channel for the actual test and add traffic in up to 14 background channels to emulate a realistic signal for testing the ATM network. The instrument offers a selection of traffic profiles in the foreground channel, allowing emulation of different types of traffic.

The instrument can also generate test signals defined in ITU-T rec. O.191 for measurement of Quality of Service (QoS). The QoS parameters include information on lost or misinserted cells, delay and delay variation. The instrument measures the parameters whereby the user can verify that the QoS is in accordance with an ATM Traffic Contract.

For testing of the lower PDH or SDH layer the CMA 3000 provides you with great flexibility for injecting errors and alarms and for SDH making pointer operations and overhead byte changes into the transmitted signal.

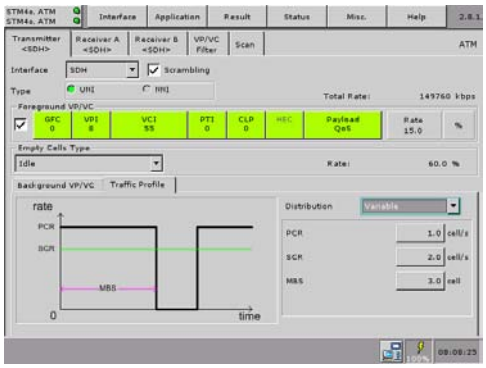

Fig. 7 The intuitive user interface of CMA 3000 facilitates the ATM test setup.

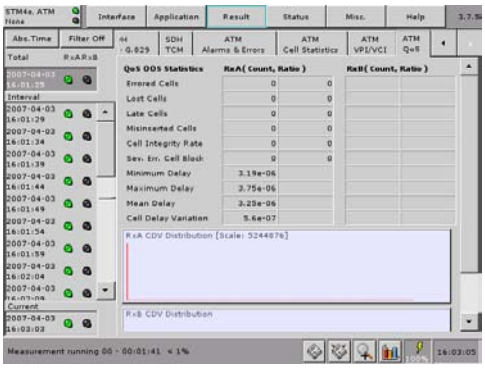

Fig. 8 QoS parameters measured by the CMA 3000.

Specifications

The specifications below list the functionality for a basic CMA 3000 with SDH and/or E3 test module installed together with the ATM option.

For more information on the functionality of the basic configuration please refer to the CMA 3000 basic instrument specifications sheet. For more information on the functionality of the SDH and E3 test modules please refer to the SDH, E3 and E4 test options specifications sheet.

Specifications	
ATM over SDH option	• ATM over STM-1: requires that an SDH test option is installed in the instrument • ATM over STM-4 VC4-4c or in one VC4: requires that an SDH test option and at least one STM-1/-4 optical module is installed in the instrument • ATM over STM-16 in one VC4-4c or in one VC4: requires that the enhanced SDH test option and at least one STM-1/-4/-16 optical module is installed in the instrument
ATM over E1/E3 option	• ATM over E1 and E3. ATM is mapped to E3 in accordance with ITU-T recommendation G.832. ATM over E3 requires that the E3 test option is installed in the instrument

Traffic generation	
No. of transmitters	One transmitter can be activated for generating ATM traffic
Channels	1 foreground channel, 14 background channels
Interface	UNI/NNI
Traffic profiles	Constant, Variable, Burst, Poisson, Binominal, 2 state Markovian
Cell scrambler	User selectable: On/Off
Cell header editing	VPI, VCI, GFC, PTI, CLP
Payload contents	Foreground channel: • PRBS9, PRBS11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, Normal/inverted, • User defined cell • User defined 8 bit word • ITU-T rec. O.191 test cells Background channels: • A fixed 8 bit value selectable for each channel Payload programmable as kbps, cps and %
Error generation	HEC single, HEC multiple, PRBS error insertion, O.191 cell late, O.191 cell loss, O.191 CRC16, O.191 cell out-of sequence.
Alarm generation	Loss of Cell Delineation VP-AIS, VP-LOC, VP-RDI, VP-CC, VP-LB VC-AIS, VC-LOC, VC-RDI VC-CC, VC-LB

ATM Layer Traffic Analysis	
No. of receivers	One or two receivers can be activated for receiving ATM traffic
Auto-detect active VCI/VPIs	Up to 30 VCI/VPI pairs
No. of channels monitored	Up to 30 VCI/VPI pairs + total ATM stream
Channel definition	VCI/VPI
Statistics	Total ATM stream: Idle, Unassigned, HEC correctable, HEC uncorrectable. Total ATM stream and selected VCI/VPI pairs: User, User Congestion, Segmented OAM F5, End-to-end OAM F5, Resource Management, Reserved, Cells with CLP = 1. Selected VCI/VPI pairs: Traffic descriptor parameters: Peak Cell Rate (PCR), Sustainable Cell Rate (SCR) , Minimum Cell Rate (MCR), Maximum Burst Size (MBS), Cell Delay Variation Tolerance (CDVT)
Error detection/statistics	Total ATM stream: HEC correctable, HEC uncorrectable
Alarm detection	Loss of Cell Delineation, VP-AIS, VP-LOC, VP-RDI, VC-AIS, VC-LOC, VC-RDI
O.191 QoS measurements	CER, CLR, CMR, SECBR, CTD max/mean/min, CDVpp, 1-point CDV, 2-point CDV estimated as described in ITU-T rec. O.191 section 7.1.4.
Cell BER tests	Detection of errors in user defined payload in the foreground channel G.826/M.2100 parameters
OAM functionality	Generation of AIS and RDI OAM F4 and F5 frames. Monitoring of AIS and RDI for F4 and F5 level.
ATM Channel Scan	Identification of currently active virtual (VCI/VPI pair) channels. Up to 150 channels can be identified.
IMA Support (E1 only)	IMA versions supported: v1.0 and v1.1 IMA Status monitor: Readout of ICP cell information, including: • IMA version • Cell and Link ID • Link stuff indication • Group status and control • Tx Test control and Timing information • Link information for the up to 32 lines that can be included in an IMA system IMA statistics: • Total cells count • Filler cell count • ICP cell count

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CMA 3000

SPECIFICATIONS

FrontSim software option

Remote access of the CMA 3000

CMA 3000 is Anritsu's next-generation portable and future proof field tester for the installation and maintenance of access and core networks. The CMA 3000 covers a wide range of applications, from fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.

For several applications it is relevant to access the instrument remotely. This is easily achieved by running the FrontSim software option on a PC and the CMA 3000. The FrontSim program carries the screens and alarm indicator LEDS of a remote CMA 3000 to a PC. Likewise mouse-clicks on the PC are transferred to the remote instrument. This allows you to operate the CMA 3000 instrument and view results on a PC exactly as had you been working on the instrument itself, only requirement is that both the PC and the CMA 3000 are connected to a LAN or to the Internet. Furthermore measurement result reports and instrument configuration files can be transferred via FrontSim. Finally upgrade of the instrument SW can be done via FrontSim.

It's possible to open several different FrontSim applications on one PC all at once. This enables you to simultaneously check the results of a number of instruments from one PC.

With the FrontSim application you can define a list of connections to remote instruments, specifying a connection name and the IP address of each instrument. This is useful when the CMA 3000 instruments have designated fixed IP addresses, making it very easy to access the instruments by merely selecting from the list shown on your PC.

Key Features	Key Applications
• Operate the CMA 3000 from a PC • Get CMA 3000 screens and alarm indicator LEDS shown on a remote PC • Simultaneous access to several CMA 3000 instruments • Transfer of measurement result reports to the PC • Exchange of instrument configuration files between the PC and the CMA 3000 • Easy selection of remote instrument from a connection list • Easy grabbing of instrument screens from the PC • Remote upgrade of the basic instrument software	• Remote access • Long-term surveillance • Multi-site surveillance • Display of screens through a projector • Documentation and training

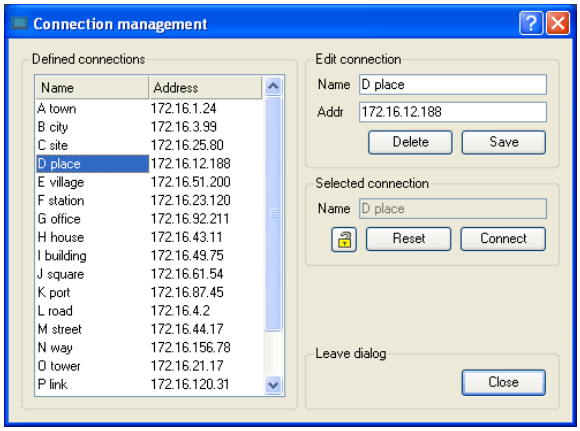

Fig.1: The connection list provides easy access to instruments located remotely.

Long-term surveillance

If there is an intermittent error in a remote part of your telecom network you can initiate a long-term surveillance measurement. But it becomes very costly if a field technician frequently has to drive long distances to check the measurement status and verify that an error has occurred.

The FrontSim application allows you to access the CMA 3000 remotely. This way you can easily check the measurement status and effectively cut time spent on the road. In fact, this means that you only have to travel to the distant location when setting up and taking down the instrument. You can change measurement settings or transfer instrument setting files from PC to instrument and launch of new measurements via FrontSim. After a measurement is completed the measurement result report can be transferred to the PC.

Fig.2: With FrontSim you can operate a remote CMA 3000 from a PC.

Multi-site surveillance

The FrontSim may be used to remotely access a number of CMA 3000 in the network from one PC. This can be used for analysis of network-wide performance or remotely examining a number of individual tests.

Fig.3: In compact mode several FrontSim sessions can be monitored simultaneously on the PC screen.

Accessing a CMA 3000 from your PC

Even if the CMA 3000 is placed in vicinity to your office it can be convenient to have remote access to the instrument directly from a local PC, e.g. if the CMA 3000 is performing measurements in a nearby switch room.

Display of screens on a data projector

If you need to present measurement results to a larger audience it can also be convenient to have remote access to the instrument via a PC. Instrument screens, brought to the PC, can be projected to a large screen through a PC-connected data projector.

Grabbing of screen caps for illustration purposes

In some cases it is useful to grab shots of instrument result and setup screens via the PC and then copy the screen caps into Windows applications like word processing and presentation. This is an easy way to communicate instrument setups for specific applications.

It is also convenient for documentation purposes and for creation of educational material. When a screen is visible in the FrontSim you just press a soft key to grab the screen, place it in the Windows Clipboard and then paste it into the Windows application.

Upgrade instrument SW via FrontSim

The user can remotely upgrade the basic instrument software using the FrontSim option. This is an important benefit for customers using the instrument in far away, unmanned sites, with FrontSim as the normal means of access to measurement results and operation.

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Specifications

The description in this specification sheet and the specifications below list the functionality of the version 1.10 (or higher) of the PC part of FrontSim. In addition the FrontSim option must be installed in the CMA 3000 to enable remote operation of the instrument and it must run SW version 3.32 or higher.

For further information on the functionality of the basic configuration please refer to the CMA 3000 basic instrument specifications sheet.

Specifications	
General	• Displays screens and alarm indicator LEDS of a remote CMA 3000 on the PC screen • Transfers mouse-clicks on the PC to the remote CMA 3000 • Measurement result reports can be transferred from the a remote CMA 3000 to a PC • Instrument setting files can be exchanged between a remote CMA 3000 and a PC • Stored measurement files can be exchanged between a remote CMA 3000 and a PC • Software upgrades of a remote CMA 3000 can be made via FrontSim • A remote CMA 3000 can be reset via FrontSim • Diagnostics files from a remote CMA 3000 can be transferred to a PC
Connection	Connection through LAN or Internet to a specific IP address
Connection list	Up to 100 entries. For each entry a name and the IP address of the remote instrument is specified
Access modes	Direct access: • The user gets immediate access to the instrument and has the access until he disconnects or another user connects to the instrument. Log on with user name: • The user is prompted for a user name at log on • The user has access to the instrument until he disconnects (logs off) or another user logs on with administrator password Log on with user name and password: • A normal and an administrator password must be defined. • The user is prompted for a user name and password at log on • When logging on with the normal password the user has access to the instrument until he disconnects (logs off) or another user logs on with administrator password • When logging on with the normal administrator the user has access to the instrument until log off.
Display modes	Normal mode • The FrontSim application fills up the available screen space Compact mode • The FrontSim application fills up approx. 25% of the available screen space, allowing several FrontSim sessions to be displayed simultaneously
Screen grapping	The current instrument screen shown in FrontSim is placed in the Windows Clipboard by pressing a soft key in the PC part of FrontSim
Additional accessories	• RJ45-RJ45 LAN cable for normal connection through a network • RJ45-RJ45 Crossed network cable for direct PC-to-CMA 3000 connection

Requirements for the PC running the PC part of FrontSim	
PC	• PC with Intel Pentium or compatible processor • CD-ROM disk drive • Ethernet 10/100 LAN interface
Windows version	Windows 95®, Windows 98®, Windows NT®, Windows 2000®, Windows XP®, Windows Vista® or Windows 7®
Hard disk space	Approx. 5 Mbytes
Memory	As required by Windows
Display	• 1280 by 1024, 16 bit colors or better • 1024 by 768, 16 bit colors or better may be used. Approx. 80% of the front panel image will be shown, and both instrument display and all keys will be visible

Other requirements	
Internet connections	The remote instrument must be assigned a fixed IP address in the public Internet
LAN connections	The PC and the remote instrument have to be connected to the same Local Area Network
Bandwidth	A bandwidth of min. 800 kbps is recommended for transport of the data stream from instrument to PC

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CMA 3000

SPECIFICATIONS

Remote Control – Scripting option

Automated testing with the CMA 3000

CMA 3000 is Anritsu's next-generation portable, compact and user-friendly field tester. However the Remote Control – Scripting option turns the instrument into a fast, reliable and powerful tool for automated testing in labs and manufacturing environments.

During development and manufacturing of communication network elements repeated tests are required to ensure and verify the quality of the products. This is most efficiently done by controlling test instruments from a PC with test scripts that set up the relevant tests, read out the results and do further actions depending on the results. With the Remote Control – Scripting option installed the CMA 3000 is a cost effective and flexible tester for such applications.

Futureproof design

The basic CMA 3000 configuration, with its two 2 Mbps receivers and transmitters, supports framed and unframed testing and monitoring of 2 Mbps systems. By adding the Remote Control – Scripting option these tests can be done automatically as part of a manufacturing test.

The modular design provides you with a clear and cost-effective upgrade path. By adding options the CMA 3000 with Remote Control – Scripting option supports automated testing of a large number of interfaces and technologies, including Ethernet, SDH, E3, E4 and V-series interfaces. Also VoIP call emulation is supported by the Remote Control – Scripting option when VoIP options are installed in the instrument.

Key Features	Key Applications
• Testing of: o 2 Mbps interfaces o Ethernet interfaces (10Mbps/100Mbps/1Gps/10Gbps) o VoIP call emulation options o SDH interfaces up to STM-16 (option) o E3 Interfaces (option) o E4 interfaces (option) o V-series interfaces (option) • Great flexibility through easy-to-install options • SCPI compliant • Fast response to commands	• Automated testing in: o Manufacturing environments o Labs

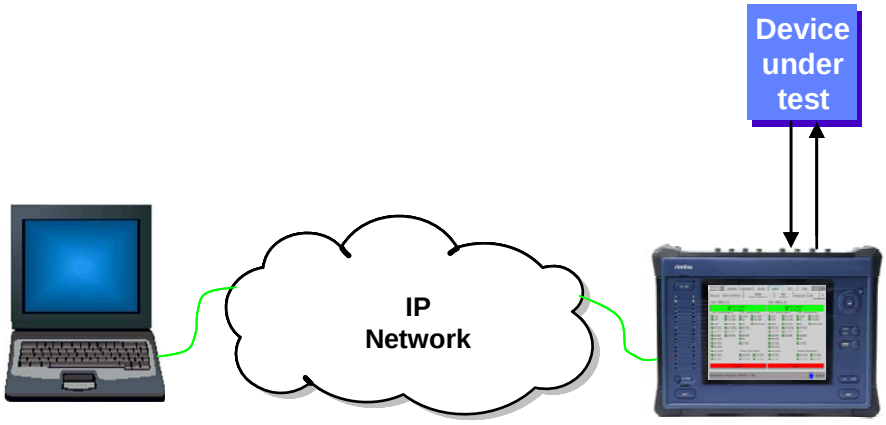

Figure 1 Remote controlling a CMA 3000 for automated testing

Programming interface

The automated testing is programmed using commands/replies that are ASCII formatted strings. With these the settings parameters in the instrument can be set and the results can be read. The Ethernet service interface of the CMA 3000 is used to remote control the instrument. Fast response to commands reduces time required for testing, which is valuable in mass production of communication equipment.

When not used for remote control the CMA 3000's intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols can be used to read and interpret results of measurements. The CMA 3000 has two USB ports and an Ethernet Service interface for data transfer and external communication giving you full flexibility.

Specifications

The specifications table on this page covers the functionality of the CMA 3000 Remote Control – Scripting option. For information on the functionality of the basic instrument and the options for the CMA 3000 please refer to the related specification sheets.

Support of functionality and options by the Remote Control – Scripting option	
Basic instrument	The basic instrument with two 2 Mbps interfaces
Options supported	Ethernet options (10/100 Mbps, 10/100/1000 Mbps and 10Mbps/100Mbps/1Gps/10Gbps) incl.: • RFC 2544 tests • Ping • BERT • IP channel statistics option • Multistream option • Stacked VLAN option • MPLS option • VoIP call emulation options SDH options (STM-1/-4/-16) incl. tests • APS • Pointer movement • Tributary scan E3 option E4 option V-series interfaces option Report generation
Options and functions that will not be supported	Protocol decode options Log measurements Auto configuration Histograms

Remote Control	
Format	Remote Control commands/replies are ASCII formatted strings. • SCPI 1999.0 compliant with support of IEEE 488.2 mandatory common commands
Driver	A LabView driver is available for the CMA 3000 Remote Control – Scripting option
Communication interface	The Ethernet Service Interface of the CMA 3000 is used for the Remote Control • Ethernet 10/100. One RJ45 connector • TCP/IP connection. Port 1024 – 5000.

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Application Note

SDH and PDH stress-testing

CMA 3000

TABLE OF CONTENTS

Introduction 01

1.0 Transmission line out-of-service testing 02

2.0 SDH network element out-of-service testing 03

INTRODUCTION

In an effort to keep telecom networks at peak performance network operator technicians will need to stress-test the SDH and PDH networks. Signals containing special conditions are applied to the network or network elements whereby their ability to handle abnormal signals at or beyond specified limits can be verified.

This is particular relevant when network testing or monitoring indicates problems that require advanced troubleshooting and error detection. It's also relevant when verification of error reporting mechanisms in the network is needed.

To do this special tests applying abnormal signal conditions can be made. For such tests it's very convenient for the user to be able to set up signal conditions in a flexible way while at the same time being able to inspect possible parameters that can show the reaction of the network element(s).

CMA 3000 is Anritsu's new portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching. With its very flexible Stimuli application the CMA 3000 allows user to stimulate the system under test by provoking special or abnormal conditions to a transmitted test signal and simultaneously inspect a related status or result display making SDH and PDH stress-testing fast and easy. This facilitates advanced troubleshooting and behavior verification, as well as basic transmission line testing.

1.0 Transmission line out-of-service testing

1.1. Advanced testing

A BER test with a far end loop-back is typically performed to verify that a PDH or SDH transmission line is working correctly. This can be done as a part of an installation or a commissioning procedure, or in order to troubleshoot the line. In some cases a more advanced test may also be carried to verify the system's ability to handle abnormal conditions through generation of a test signal, including:

- **Alarms:**
  - **Alarms generated in relation to framed signals will provoke responses in the signal returned to the instrument as well as on management interfaces of the network element on the line. You will find more information on this type of tests in the section on maintenance signal interaction testing**
- **Errors:**
  - **As an example: If three consecutive 2 Mbps frame alignment signal (FAS) word indicate errors, the system declares the frame alignment to be lost. By applying errors to 1, 2, 3, 4, etc. consecutive 2 Mbps frame alignment word(s) the user can verify if this happens. Other tests involving error generation may be relevant, however, depending on the specific signal**
- **FAS slips:**
  - **If one FAS word is an error so that a bit is lost (a slip) the system must first declare the frame alignment to be lost and subsequently, the frame synchronization must be recovered. This can be tested by applying a frame slip to the transmitted signal**
- **Frequency offset:**
  - **According to the specifications a 2 Mbps system must be able to handle signals deviating in frequency up to +/- 50 ppm. By e.g. applying double the frequency offset to the transmitted signal it can be verified whether the system can transport the signal error-free**

You can then monitor how the system handles the test signal on the receiver of the test instrument by inspecting maintenance consoles related to the network elements on the line.

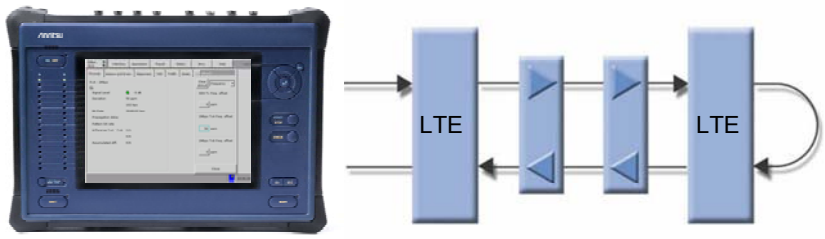

Figure 1 Out-of-service testing of a 2 Mbps line.

1.2. Basic transmission line testing

For basic out-of-service transmission line testing, generation of abnormal conditions are done simply to verify that the connections are made correctly prior to the real test:

- **A bit error may be inserted in the test signal. If a bit error is detected at the receiver in the above setup the instrument is connected to a line with a far-end loop-back rather than another test instrument sending out the same test signal**
- **By offsetting the transmitter frequency you can determine whether the frequency of the received signal follows the deviation of the transmitter frequency**
  - **The frequency of the received signal follows the transmitter frequency: The instrument controls the clocking of the signal and the test must be done using the instrument's internal clock**
  - **The frequency of the received signal does not follow the transmitter frequency: The signal is clocked to a system clock along the transmission path and the test signal must be synchronized to the same clock, e.g. by using the incoming signal as clock reference for the transmitter**

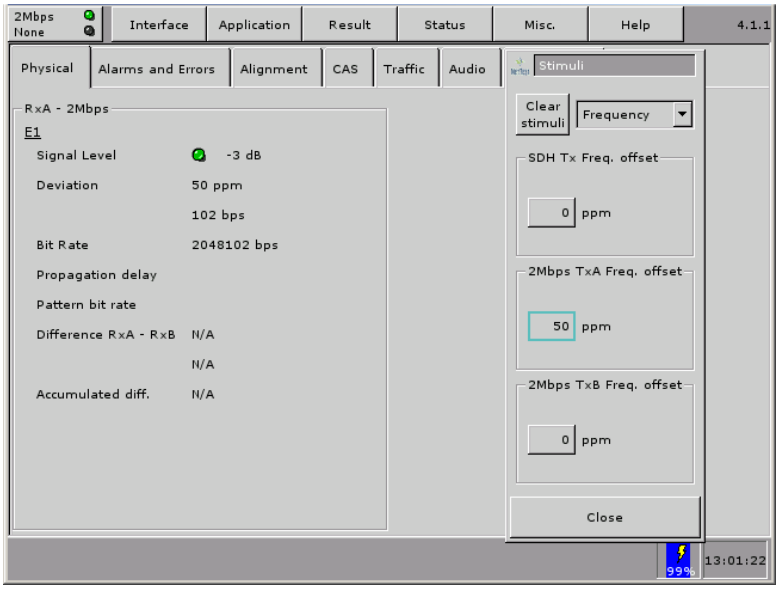

Figure 2 You can observe the frequency of the incoming signal while offsetting the frequency of the transmitted signal.

The CMA 3000 Stimuli application allows you to stimulate the network element under test by generating a test signal with special or abnormal conditions. When used the Stimuli application is on top of other CMA 3000 applications. This allows you to combine the activation of a special or abnormal condition with an immediate view of the reaction on the received signal, making the test quick and simple. You have full flexibility to combine the Stimuli application with the CMA 3000 status and result application in order to examine reactions to the anomaly in the generated test signal.

2.0 SDH network element out-of-service testing

For an out-of-service analysis of an SDH network element, the CMA 3000 with SDH option is a handy tool. The test is made by transmitting an SDH signal with an embedded 2Mbps test signal to the network element and analyzing the related 2 Mbps tributary signal with one of the instrument's receivers. Likewise a 2 Mbps test signal can be generated and the related signal, embedded in the SDH output from the network element can be analyzed.

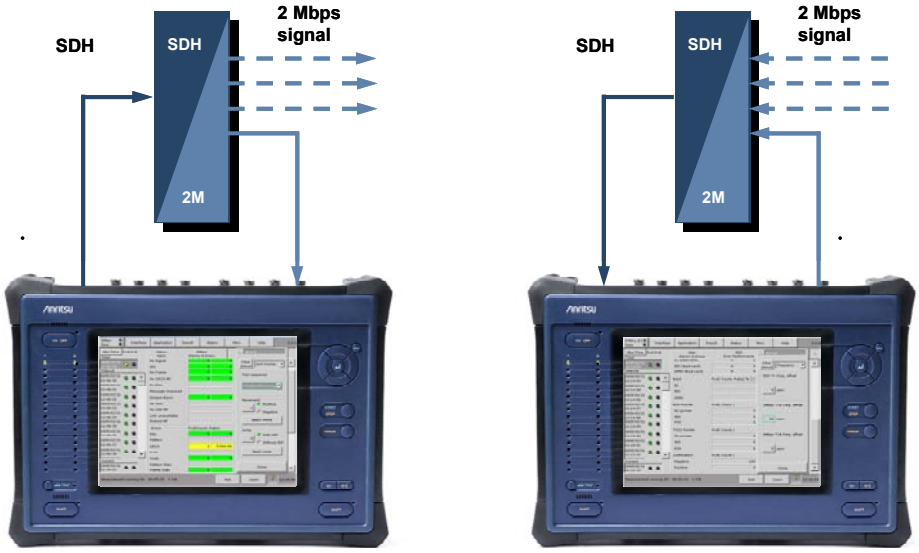

Figure 3 Out-of-service testing of SDH network elements.

Again, the Stimuli application provides a very flexible configuration activation of an abnormal condition with an immediate view of the reaction on the received signal, making the test easier and faster.

You can test several scenarios:

- **Test if pointer operations in the SDH signal causes errors in the 2 Mbps output from the network element**
- **Examine justifications in the SDH signal while offsetting the frequency of the 2 Mbps signal sent from the instrument**
- **Observe the effect on the SDH signal while offsetting the frequency of the 2 Mbps if the network element uses the 2 Mbps signal as reference**

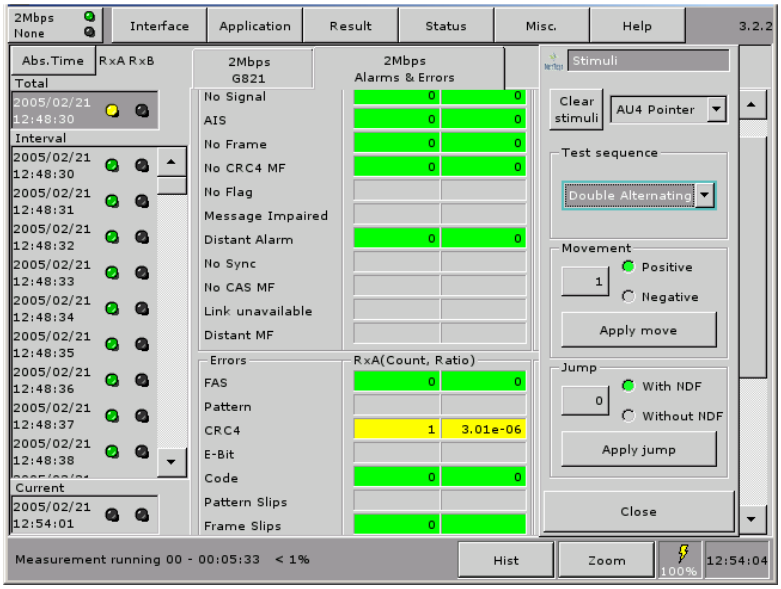

Figure 4 It's possible to observe the effect of pointer operations on a tributary 2 Mbps signal.

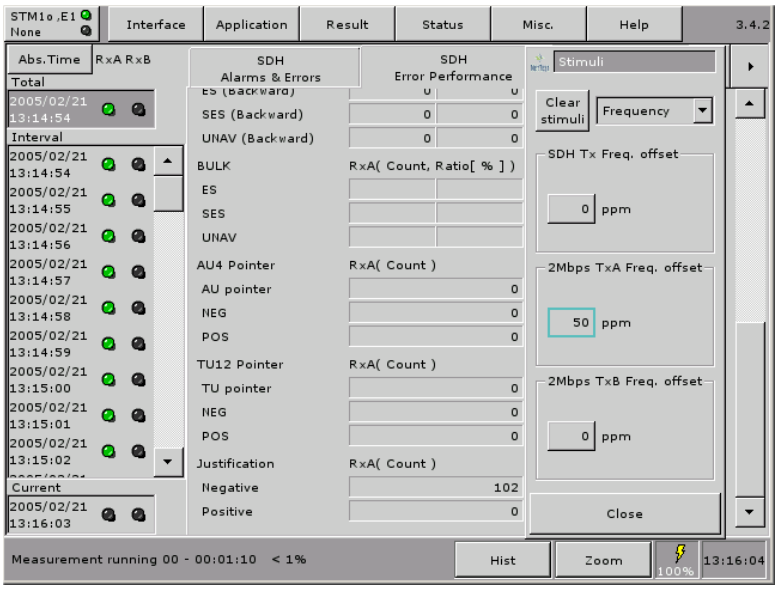

Figure 5 You may view justifications in the SDH signal while offsetting the frequency of the 2 Mbps signal sent from the instrument.

2.1. Maintenance signal interaction testing

You can also check the SDH network element for correct handling of incoming maintenance signals. The SDH signal is divided into levels: The section level, the higher order path level and the lower order path level. If a crucial condition (disrupting the traffic) occurs on one of these levels this is signaled onwards by sending out an SDH maintenance signal: “Alarm Indication Signal” (AIS) while a “Remote Defect Indication” (RDI) is signaled on the line going back to inform the transmitter of the signal that it was distorted on the way.

Likewise there are check sums at each level to detect transmission errors. In case of errors this is signaled back to the transmitter of the signal with a “Remote Error Indication” (REI). The diagram below shows the interaction between some of the SDH maintenance signals at lower order path level.

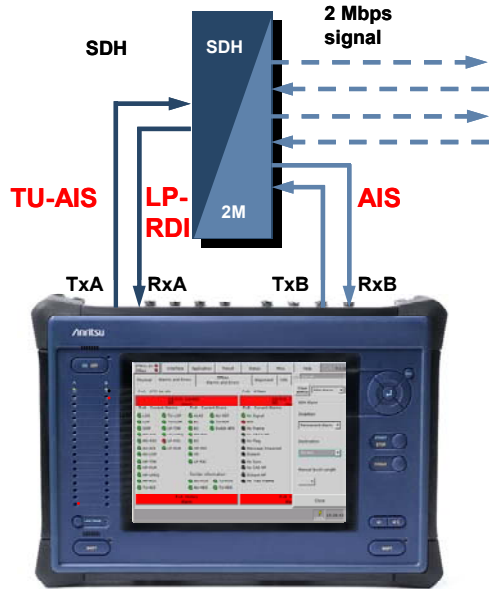

Figure 6 Test of interaction of SDH maintenance signals in a network element.

With the Stimuli application you can easily provoke the maintenance signal (in the example above a TU-AIS) and combine the insertion with the application where alarms and errors on the SDH receiver and the 2 Mbps receiver can be seen side by side. You can move the Stimuli application pop-up over the display positioning it over information not relevant for the current analysis.

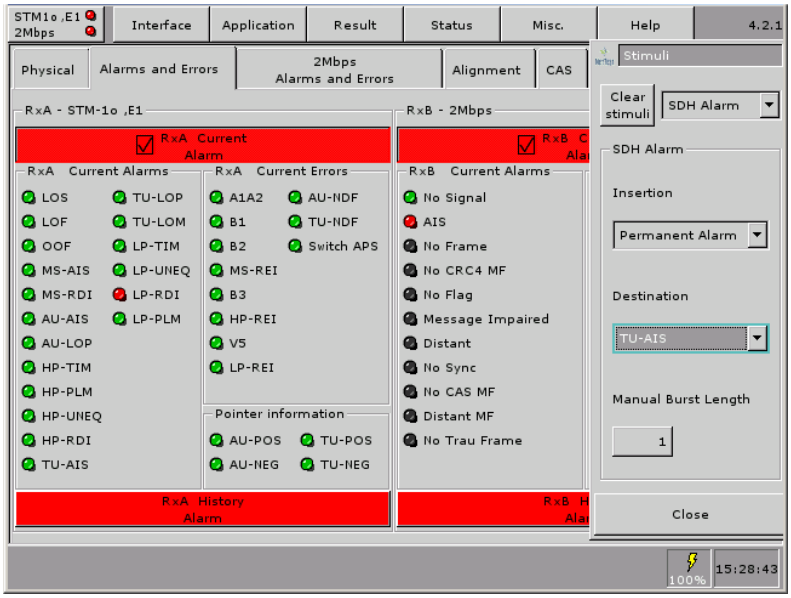

Figure 7 Check the SDH network element for correct handling of incoming maintenance signals.

The CMA 3000 allows a 2 Mbps transmitter to be active together with the SDH transmitter. In this way a valid 2 Mbps signal can be sent to the SDH network element. In turn you avoid any confusion on whether strange behavior on the SDH side of the network element could be caused by a missing PDH signal.

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Application Note

In-service analysis of SDH signals

CMA 3000

TABLE OF CONTENTS

Introduction 01

1.0 Access for bi-directional analysis 02

2.0 Results of bi-directional analysis 04

3.0 Bi-directional analysis of embedded 2 Mbps signals 05

4.0 In-service analysis of SDH network elements 06

5.0 Signaling analysis 07

Introduction

Today network operators are faced with many challenges. Above all, they need to be profitable in a market characterized by increased competition, decreased ARPU and significant churn. Therefore it's vital for operators to ensure peak performance of their network in order to maximize network investments.

Using in-service analysis of the traffic carried in the network will provide operators with the best possible information on the current state of the network as experienced by their customers. However, as traffic by nature is bi-directional the analysis should include both traffic being sent from A to B, as well as the responding traffic.

Large parts of the network are based on SDH technology. This in turn demands of operators to use tools with bi-directional capabilities for SDH for the in-service traffic analysis.

CMA 3000 is Anritsu's next-generation portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.

As CMA 3000 can be equipped with two receivers at all the supported interfaces, including SDH it's an obvious choice for in-service, bi-directional analysis of the traffic.

1.0 Access for bi-directional analysis

To connect to an SDH line for in-service analysis you require a connection in parallel with the SDH line. There are several methods: Protected monitoring points may be available for electrical interfaces, or in some cases the SDH network elements can be configured to present signals to monitor dedicated access points.

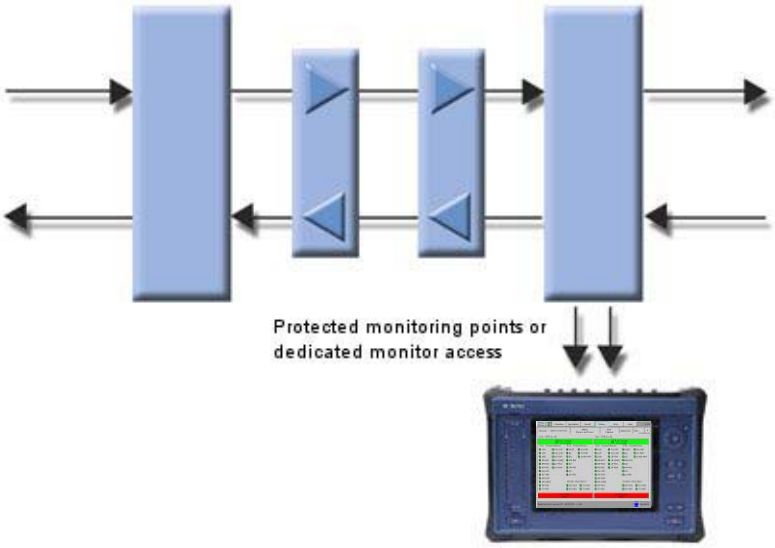

Figure 1 Bi-directional access for in-service analysis.

In case dedicated access points are not available for SDH signals on optical lines you have two other access methods available, either optical splitters or the through mode of the instrument.

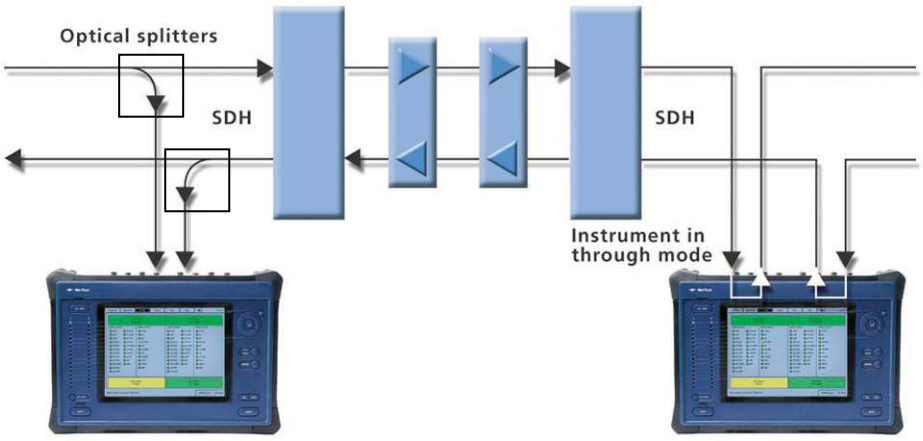

Figure 2 Optical splitters and through mode for in-service analysis access.

The access methods have various benefits and disadvantages:

- **Dedicated access points can be established without disrupting the signal to be monitored, but will typically require that the highest level of the SDH signal (the section overhead) is regenerated and therefore does not directly reflect what's on the monitored line**
- **Optical splitters and protected monitoring points (for electrical signals) require the signal to disrupt in case they have not already been installed already. Once established they represent a more direct view of what's happening on the monitored line compared to dedicated access points. Signal level will be reduced due to the nature of the access type. They may be left on the line after a specific measurement has been done for future investigations**

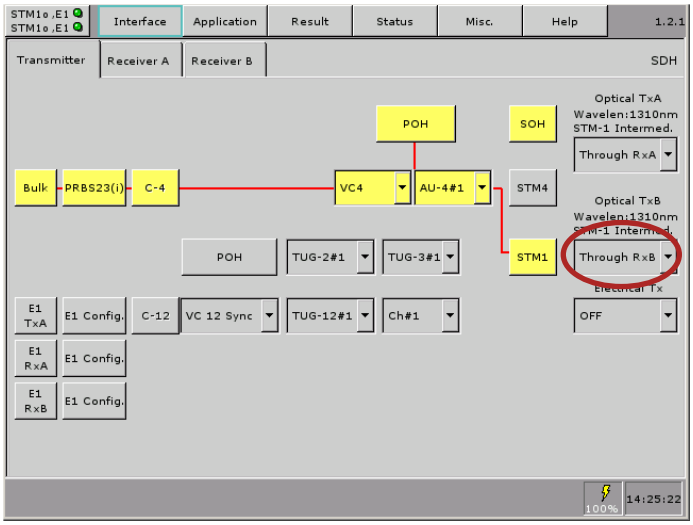

Figure 3 Setting the optical transmitters of the CMA 3000 for through-mode.

- **Utilizing the CMA 3000 through-mode feature for the access enables you to get the largest amount of information on the monitored line. However, in this case it's necessary to disrupt the signal when the instrument is set up and removed again**

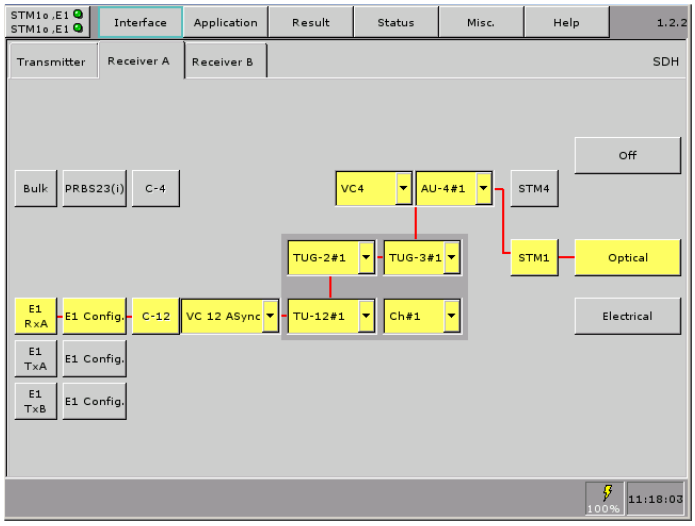

Figure 4 Setting one of the CMA 3000 optical receivers.

2.0 Results of bi-directional analysis

The advantage of the bi-directional analysis is that information of both sides of a communication line is immediately available.

In case the instrument is connected in through-mode you can immediately inspect a number of basic parameters of the monitored signal, such as:

- **The optical level, which has to be in a range acceptable by the optical receiver in the network element. Color indications in the instrument will highlight optical levels outside specifications**
- **The frequency of the SDH signal and more importantly, any frequency difference between the two receivers. Within a normal SDH network the two lines should be synchronized to the same frequency reference. Therefore, any difference indicates an anomaly that could lead to a degradation of the transmission performance**
- **As shown in the example, frequency difference information is also available for 2 Mbps signals embedded in the SDH signal. Also, PDH signals are normally synchronized to the same frequency reference and therefore, there should be no frequency difference between the two embedded 2 Mbps signals. A frequency difference will typically result in transmission performance degradation in the form of bit slips**

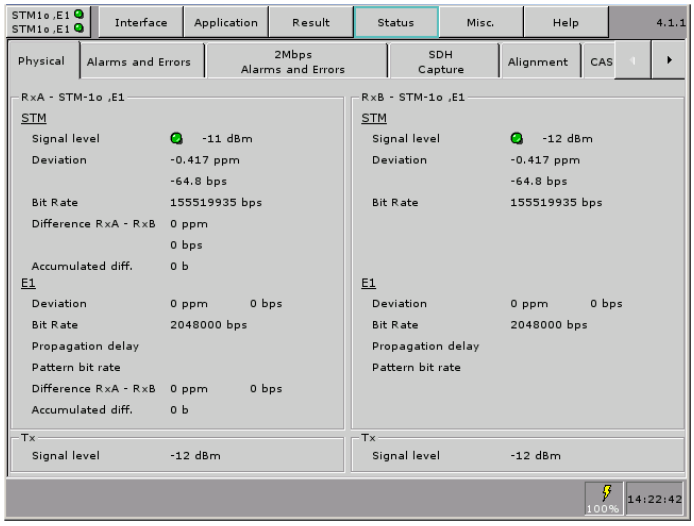

Figure 5 Physical level information in through-mode.

Bi-directional analysis also enhances the level of information you can obtain from the SDH maintenance information. The SDH signal is divided into levels: The section level, the higher order path level and the lower order path level. If a crucial condition (disrupting the traffic) occurs on one of these levels, this is signaled onwards by issuing an SDH maintenance signal: “Alarm Indication Signal” (AIS) while a “Remote Defect Indication” (RDI) is signaled on the line going back to inform the transmitter of the signal that it was lost on the way.

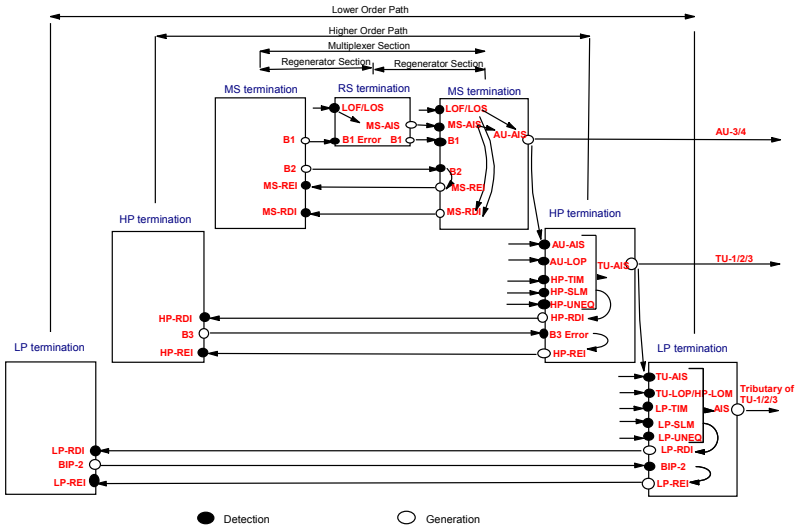

Figure 6 Interaction between SDH maintenance signals.

Likewise there are check sums at each level to detect transmission errors. In case of errors this is signaled back to the transmitter of the signal with a “Remote Error Indication” (REI). The diagram in Figure 6 shows the interaction between the SDH maintenance signals.

When you identify one of these remote indications on one side of the line during simultaneous monitoring of both sides of the line, you can immediately inspect the other side of the line for errors or major defects. If there are no errors on the other side the problem has occurred further down the line while a faulty signal implies that the signal has been distorted on the way to the point where you have connected the measurement instrument.

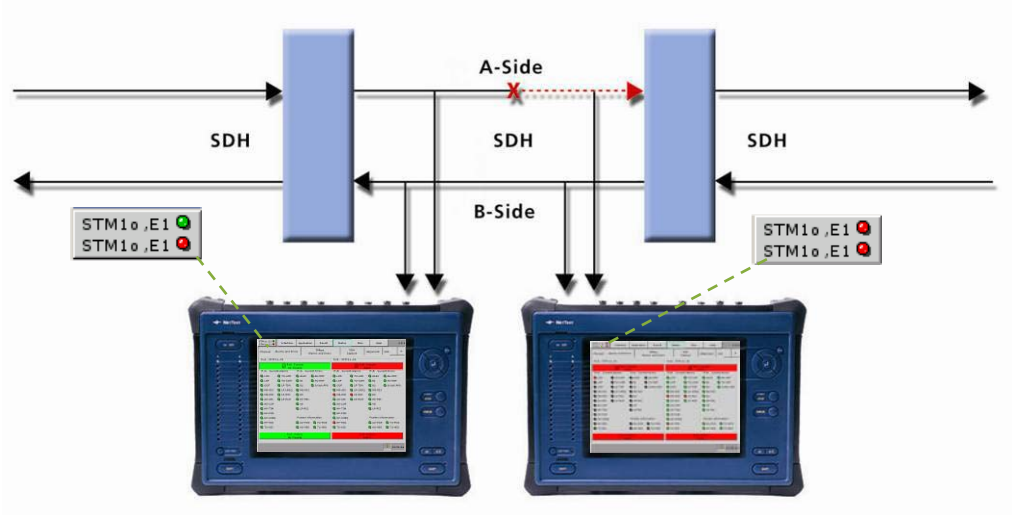

Figure 7 The CMA 3000 bi-directional in-service monitoring provides easy fault detection.

3.0 Bi-directional analysis of embedded 2 Mbps signals

The CMA 3000 can drop out a 2 Mbps signal from each of the monitored SDH signals. You can analyze in details the contents of these 2 Mbps signals and the results can be visualized on the CMA 3000 monitor. Among other things you can view the utilization of the 2 Mbps line time slots. Audio level of a selected time slot is indicated at the bottom of the display and a dedicated display provides more details on the selected time slot. As shown in Figure 8 this can be done for traditional 64 kbps time slots. Compressed GSM speech in sub-channels can also be analyzed with a CMA 3000 outfitted with GSM Abis option.

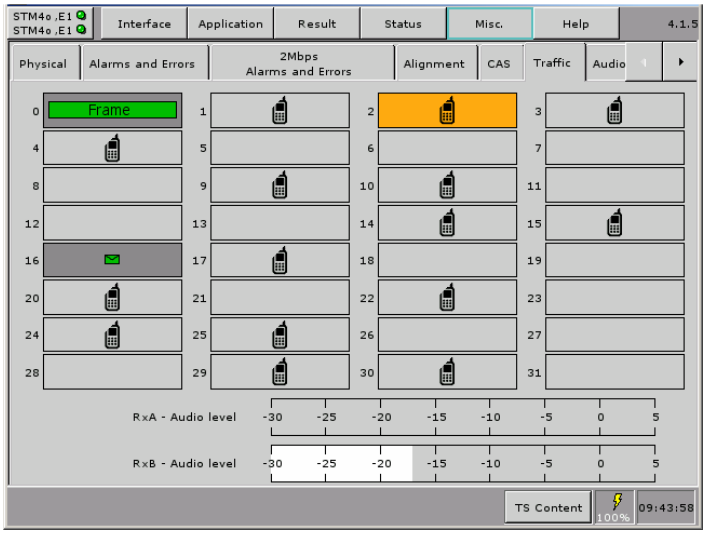

Figure 8 2 Mbps signal time slot utilization.

You can perform a longer term performance-measurement on the embedded 2 Mbps signals. If the 2 Mbps signals are framed this can be done truly in-service, i.e. without allocating part of the signal for a dedicated test signal. The test can be done by looking for errors in the 2 Mbps signals frame alignment signal (FAS), which must always have the same contents to allow receivers to synchronize to the framing structure.

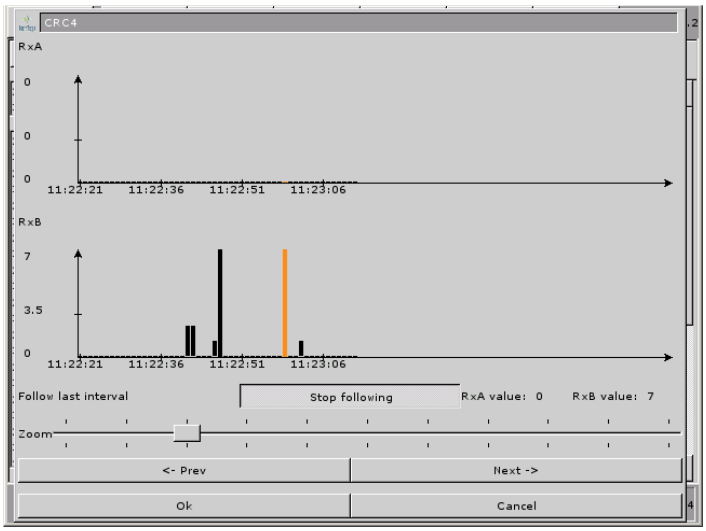

Figure 9 With the CMA 3000 histograms you get a rapid overview of a measurement.

This, however, only allows detection or errors in the FAS itself, not in the carried traffic. Therefore some 2 Mbps systems have added a CRC-4 check sum of the 2 Mbps signal to support detection of errors in the traffic. Measuring CRC-4 errors gives very good information on the degradation in transmission quality of the carried traffic. The bi-directional measurement allows you to relate errors to what happened on the other 2 Mbps line at the same time. The CMA 3000 histogram features provides an easy time-wise overview of the measurement results.

4.0 In-service analysis of SDH network elements

In case a network element is under suspicion for introducing errors into the carried traffic you can use a CMA 3000 connected to both sides on a network element to analyze the behavior of the network element as illustrated in Figure 10.

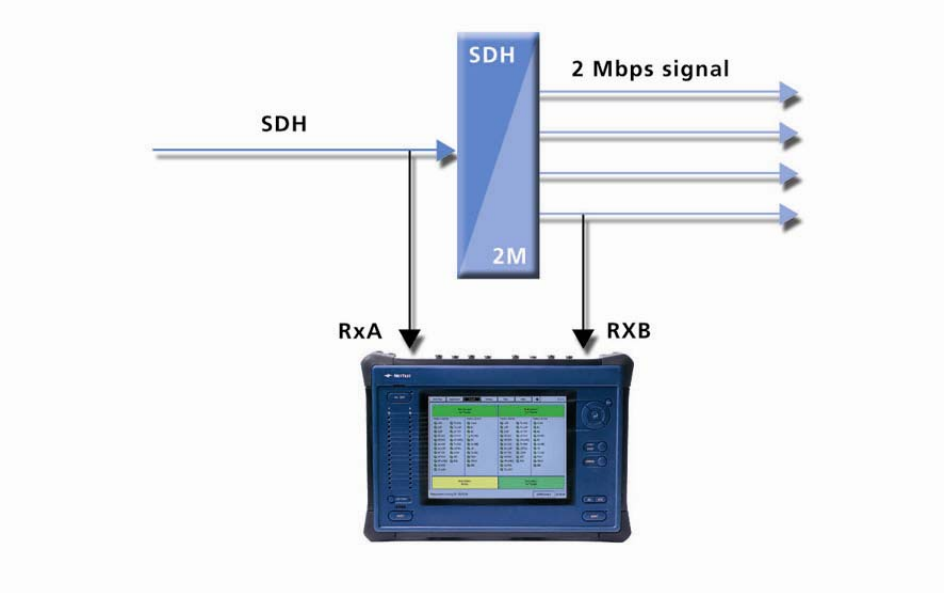

Figure 10 In-service analysis of an SDH network element.

You can analyze the network element behavior by examining errors in the FAS and the CRC-4 check sum (if available) of an embedded 2 Mbps signal in the SDH signal and compare it to what comes out of the network element as a 2 Mbps signal. A similar analysis can be made with SDH signals on both sides of the network element.

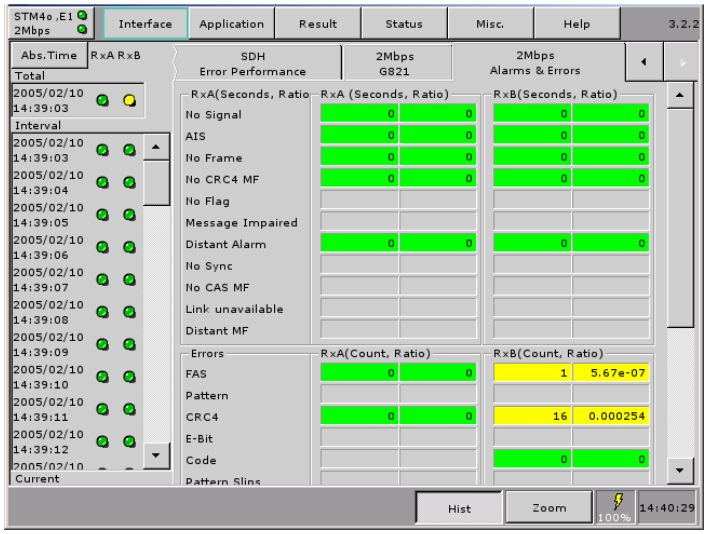

Figure 11 In-service analysis indicating problems in the investigated SDH network element.

5.0 Signaling analysis

Another application of the CMA 3000 bi-directional feature is to use the SDH interfaces to access the signaling links. Most of the existing telecommunication systems are based on 2 Mbps lines in which traffic channels (typically with a 64 kbps bandwidth) can be allocated for network signaling information. The signaling allows the switches in the network to communicate together and with the end user equipment, e.g. in the form of fixed-line or mobile phones. Very often the 2 Mbps lines are embedded in SDH transport systems. When analysis of the signaling is required it may be more convenient to access it through an SDH interface rather than identifying the relevant 2 Mbps line. To do so the CMA 3000 bi-directional capability combined with its wide range of protocol decode options offers a simple and straight-forward solution.

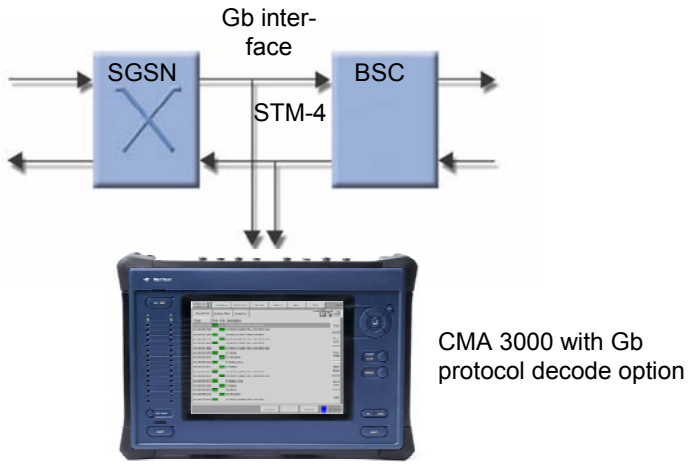

Figure 12 Access to a GPRS Gb interface in 2 Mbps lines embedded in an STM-4.

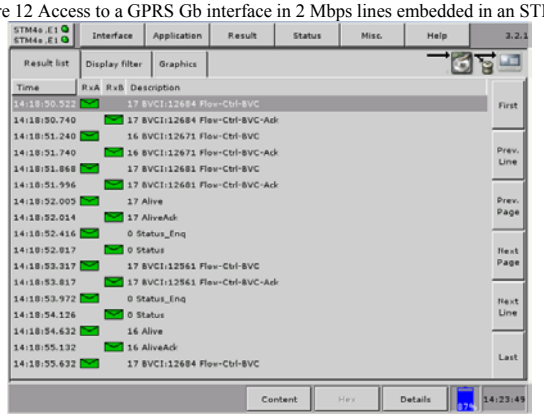

Figure 13 Bi-directional Gb protocol analysis in a 2 Mbps system, embedded in an STM-4 signal.

The CMA 3000 protocol decode options include:

- **Mobile access:**

  International and vendor specific GSM Abis protocols

  Vendor specific GPRS Abis interface PCU protocols

  GPRS/EDGE Gb interface and frame relay protocols

  A-interface protocol

  Gs interface protocol

- **Mobile core:**
  - MAP protocol
- **Fixed line, core:**
  - International SS7 (ITU-T White Book, ETSI protocols)
  - A wide range of national SS7 protocols
- **Fixed line, access:**
  - ETSI ISDN (Q.931), National ISDN versions, QSIG, V5.x, DASS-2/DPNSS protocols

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Application Note

End-to-end RFC 2544 testing of Ethernet lines

CMA 3000

TABLE OF CONTENTS

Introduction 01

1.0 RFC 2544 test with the CMA 3000 02

2.0 Setup of slave instrument 02

3.0 Setup of master instrument 04

4.0 Start the test 07

INTRODUCTION

In many cases it is important to test the performance of the link end to end when service providers deploy Ethernet links. Hereby the service provider ensures efficient turn-up and error free operation and gets the highest customer satisfaction. The Internet Engineering Task Force (IETF) RFC 2544 “Benchmarking Methodology for Network Interconnect Devices” defines tests that describe the performance characteristics of a network interconnecting device. These tests can be used for deploying and commissioning the Ethernet links. Often these tests are done using one test instrument that sends a test signal to a far-end destination, where the test signal is returned to the test instrument by some means of a “reflector” or “loop back”. This test configuration makes the instrument test both the outgoing and incoming side of the link, which may be sufficient if both sides of the link provide the same bandwidth and the results show that the performance is OK.

Unsymmetrical links like xDSL provide different line rates in the two directions. Typically the downlink line rate is significantly higher than the uplink line rate. If you need to verify the traffic capacity of throughput of such links the result will reflect the capacity of the link side with the lowest line rate (i.e. the uplink line rate) if you test using “reflector” or “loop back”. To get information for both the low and the high speed side of the link you need to send a test signal from an instrument at one end of the link to an instrument at the other end of the link and vice versa to test traffic capacity of both sides on the link. The two test instruments have to cooperate, because the tests described in RFC 2544 require that the receiver of a test signal must know the contents of the transmitted test signal in details.

In case you test a symmetrical link, which is not performing OK, it is important to find out if both or only one of the directions is performing badly. In this case you also need to test the link with two instruments to get separate results for the two sides of the link.

1.0 RFC 2544 test with the CMA 3000

The CMA 3000 Ethernet options include an automated RFC 2544 test application. In one of its test modes the RFC 2544 test application allows two CMA 3000s to perform throughput, frame loss and burstability tests in a master-slave constellation. The user sets up the test in the master CMA 3000. When the test is started, the master CMA 3000 transfers the necessary setup information to the far end slave CMA 3000. The information is transferred through the line that is under test. Once the test is completed, the slave CMA 3000 transfers the test results back to the master CMA 3000, so the user can read the results for both directions of the link on the master CMA 3000. If needed the user can initiate a new test without having to access the remote slave CMA 3000 directly. The dual-port capability of the CMA 3000 allows the user to test two links simultaneously.

Figure 1 End-to-end RFC 2544 testing using two 3000's

The test mode, which allows two CMA 3000 units to cooperate to perform an RFC2544 test, is called the "end-to-end" test. The unit that initiates the test is the master instrument while the other unit is the slave instrument. Control information is sent from the master instrument on port A; if port A is turned off, port B is used. When the test is started on the master CMA 3000, the unit will contact the slave instrument using the IP address of the slave unit. When the slave instrument receives the communication on a port with a matching IP address, the test will begin.

2.0 Setup of slave instrument

To set up the slave instrument, first the Ethernet interface needs to be activated. In this case, an electrical interface with auto negotiation is selected. Port A is used in this example – port B is disabled by setting it to Off.

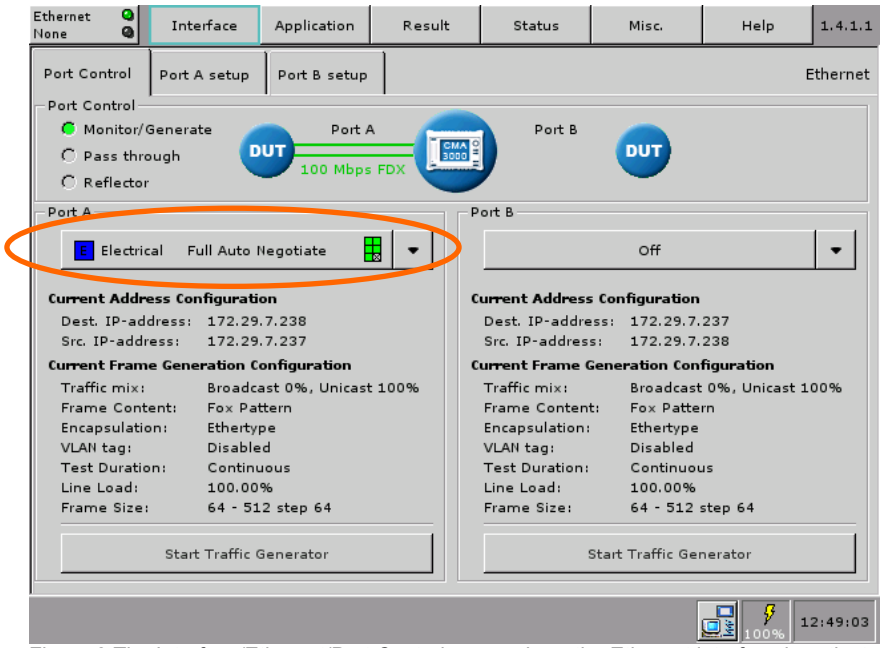


Figure 2 The Interface/Ethernet/Port Control page, where the Ethernet interface is activated.

Two more pages have to be set correctly in the slave instrument to make the test work. In the first page, the IP and MAC addresses are set up.

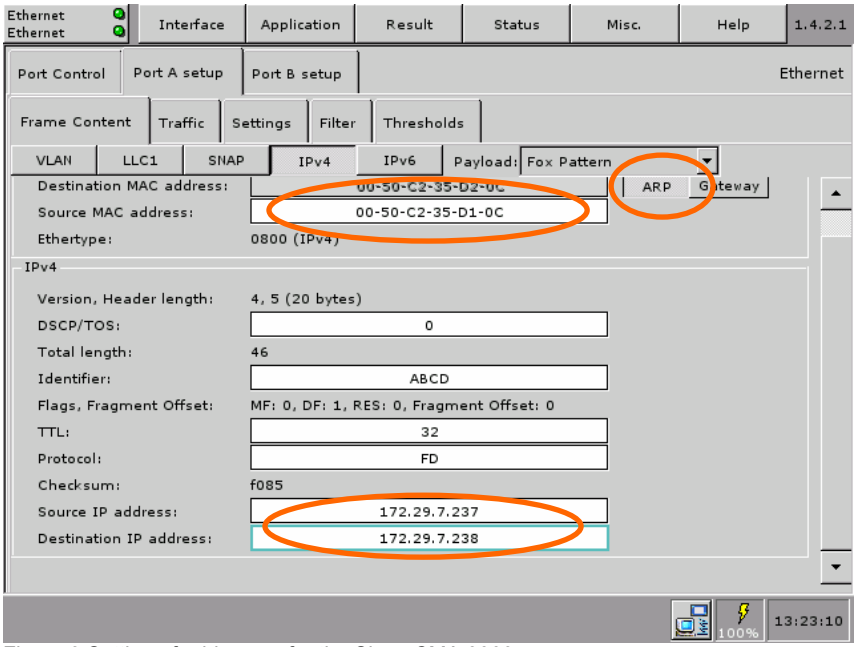


Figure 3 Setting of addresses for the Slave CMA 3000

It is important to set the address of the slave instrument: Source address/IP address and MAC address. The MAC address should be set to the ports default address (this comes as a choice in the setup dialog that appears when the MAC address field is pressed).

Destination address/IP address should be the IP address of the Master CMA 3000. However if that is not known at the time of the setup of the slave instrument, this can be handled from the master instrument (see later). For Destination MAC address it is recommended to click the ARP box, which will make the instrument request the MAC address from the device it is directly communicating with. Otherwise the user will have to identify this address and enter it manually.

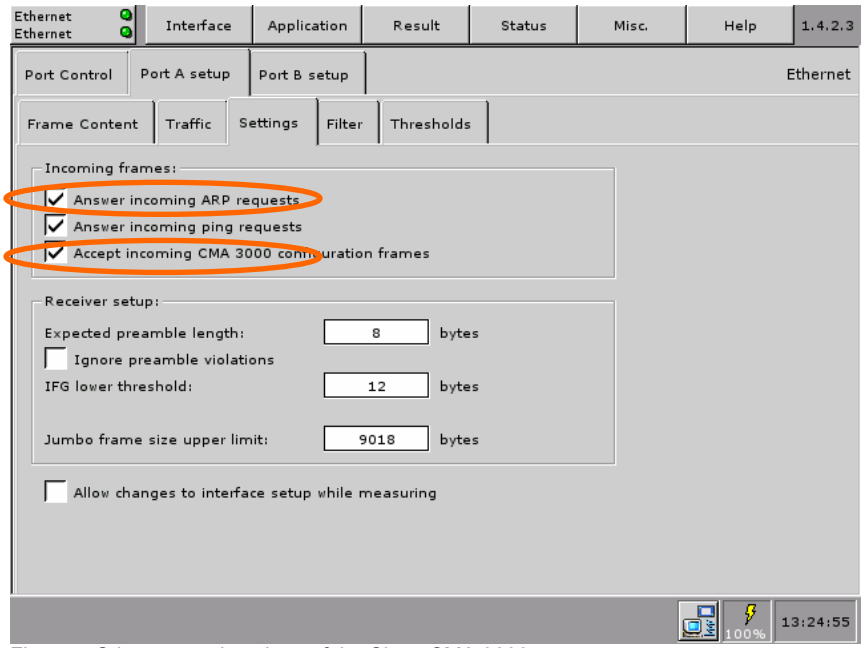


Figure 4 Other general settings of the Slave CMA 3000

In the port A Settings page the “Answer incoming ARP requests” box must be checked. This will allow the instrument to communicate its MAC address to the device it is directly connected to. Also the “Accept incoming CMA 3000 configuration frames” box must be checked. This ensures that the slave CMA 3000 can communicate with the master CMA 3000.

3.0 Setup of master instrument

To set up the master instrument, first the Ethernet interface needs to be activated. In this case, an electrical interface with auto negotiation is selected. Port A is used in this example.

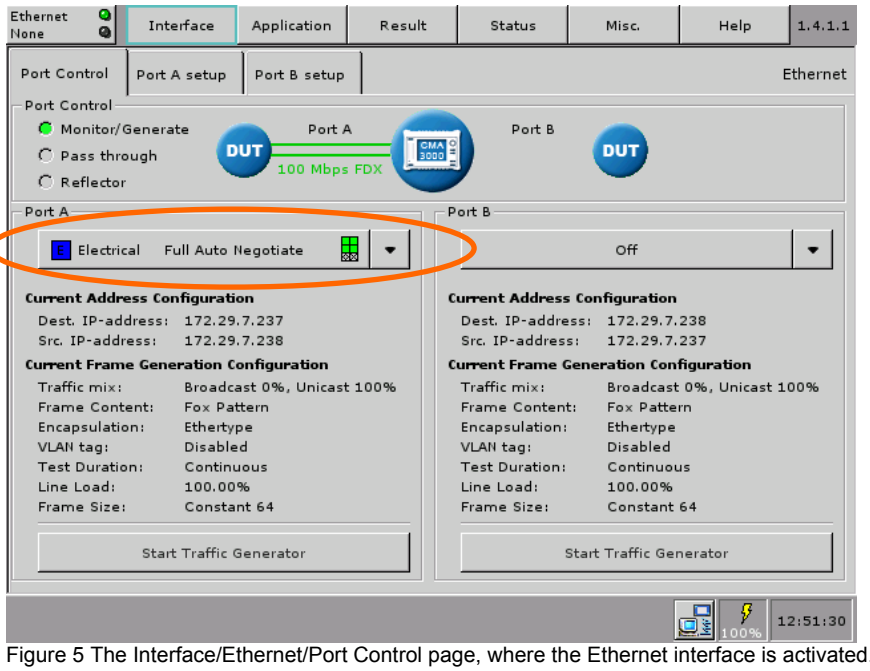


Figure 5 The Interface/Ethernet/Port Control page, where the Ethernet interface is activated.

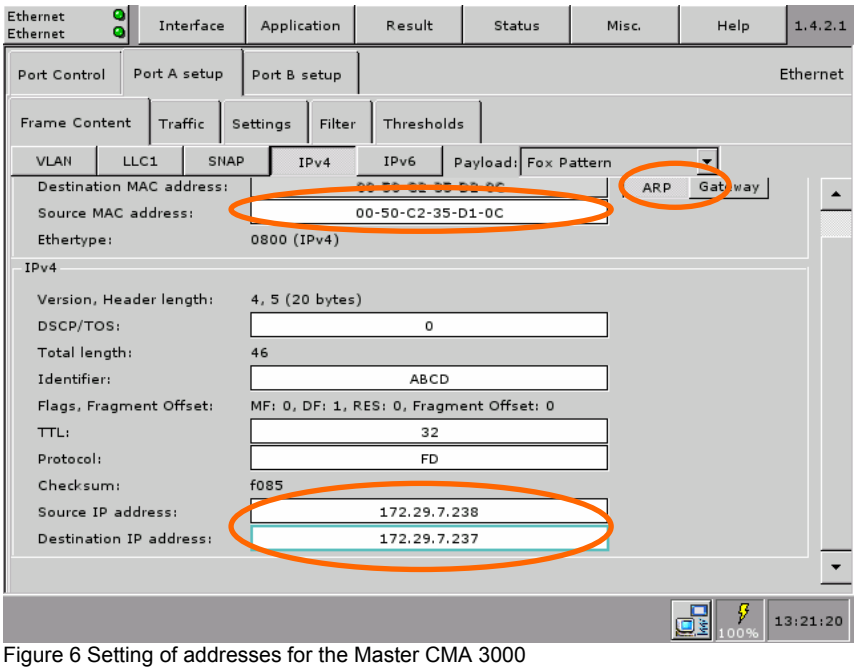


Figure 6 Setting of addresses for the Master CMA 3000

It is necessary to set the address of the master instrument: Source address/IP address and MAC address. The MAC address should be set to the ports default address (this comes as a choice in the setup dialog that appears when the MAC address field is pressed). Destination address/IP address is the IP address of the slave CMA 3000. For Destination MAC address it is recommended to click the ARP box, which will make the instrument request the MAC address from the device it is directly communicating with. Otherwise the user will have to identify this address and enter it manually.

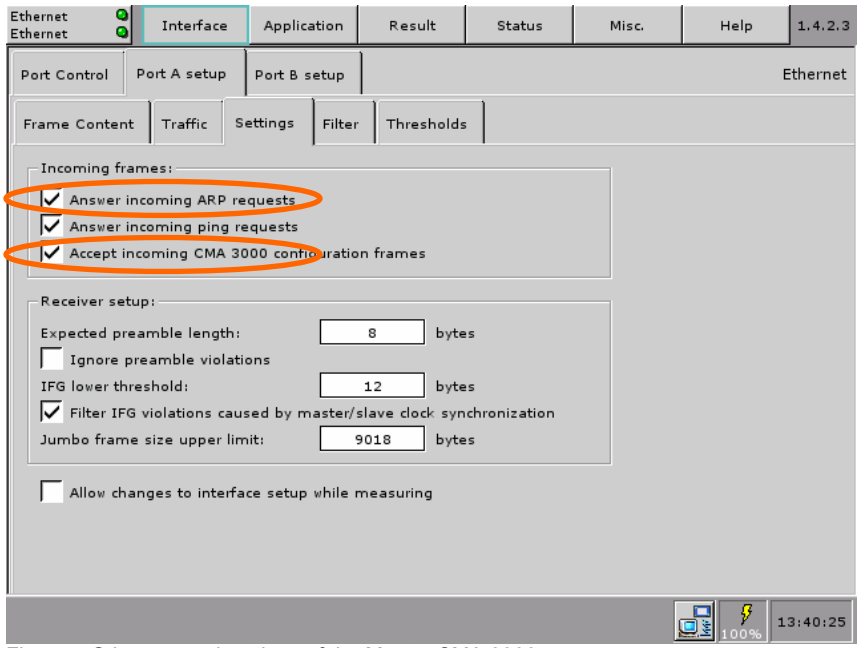


Figure 7 Other general settings of the Master CMA 3000

In the port A Settings page the “Answer incoming ARP requests” box must be checked. This will allow the instrument to communicate its MAC address to the device it is directly connected to. Also the “Accept incoming CMA 3000 configuration frames” box must be checked. This ensures that the master CMA 3000 can communicate with the slave CMA 3000.

The rest of the test setup and the test itself are done in the Application/RFC2544 pages of the master CMA 3000.

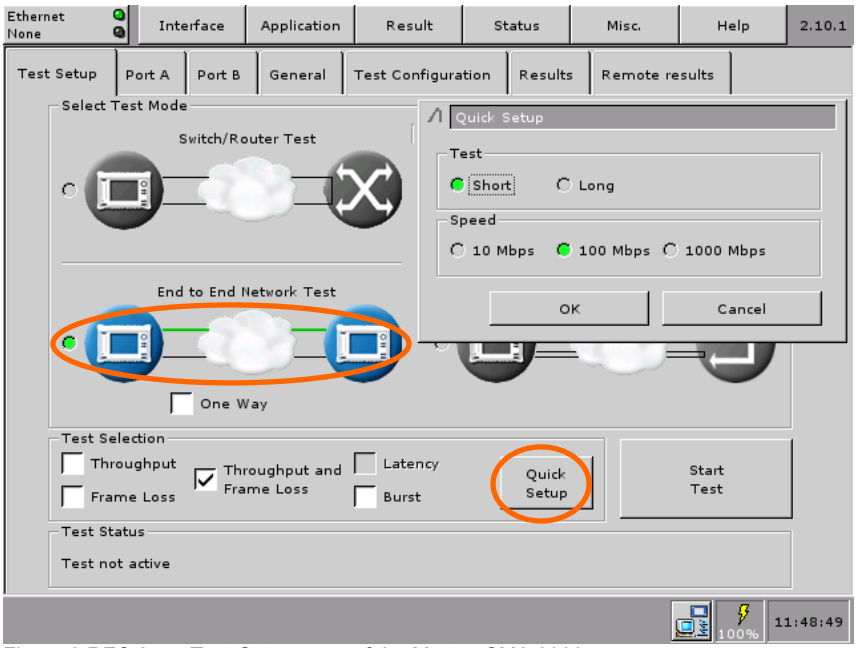


Figure 8 RFC 2544 Test Setup page of the Master CMA 3000

In the test setup page the End to End network test is selected and the needed tests can be chosen by checking the boxes in the Test Selection part of the page. The user can also choose a predefined either short or long test activated by clicking the Quick Setup key. In this case a short test is selected, which sets the instruments to do a combined Throughput and Frame Loss test.

By default a test is done from Master to Slave and from Slave to Master simultaneously. However, in some cases (f.inst. when testing half duplex connections) it can be relevant to test only one of the directions at the time. In that case the user must check the “One Way” box. The direction of the test (from master to slave or from slave to master instrument) is defined in the “General” page.

The detailed configuration of the Throughput and Frame Loss test can be seen in the Test Configuration page. This test use a short, a medium and a long size frame, together with a selection of line loads to test the throughput and frame loss at different loads. The test configured as shown below takes approx. 10 minutes to complete.

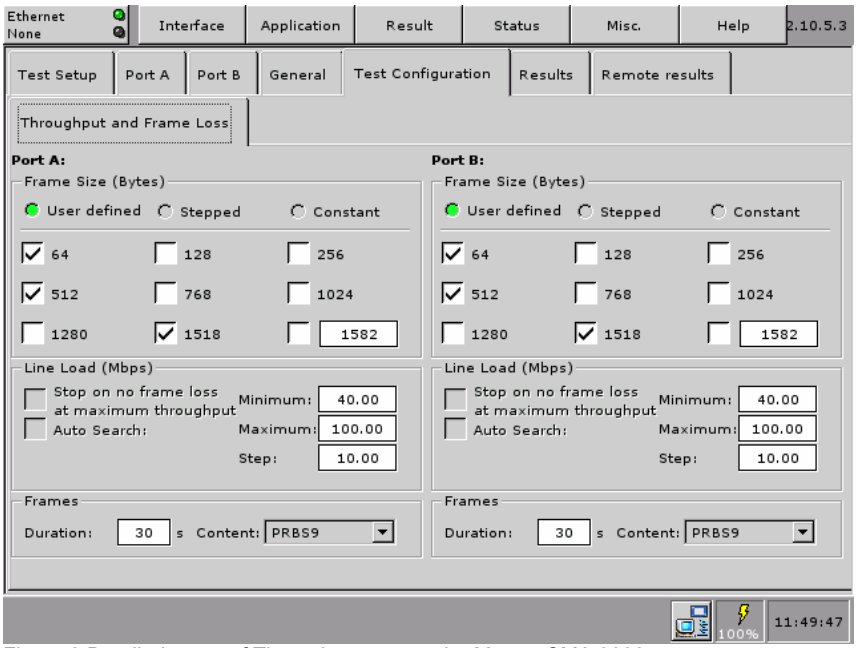


Figure 9 Detailed setup of Throughput test on the Master CMA 3000

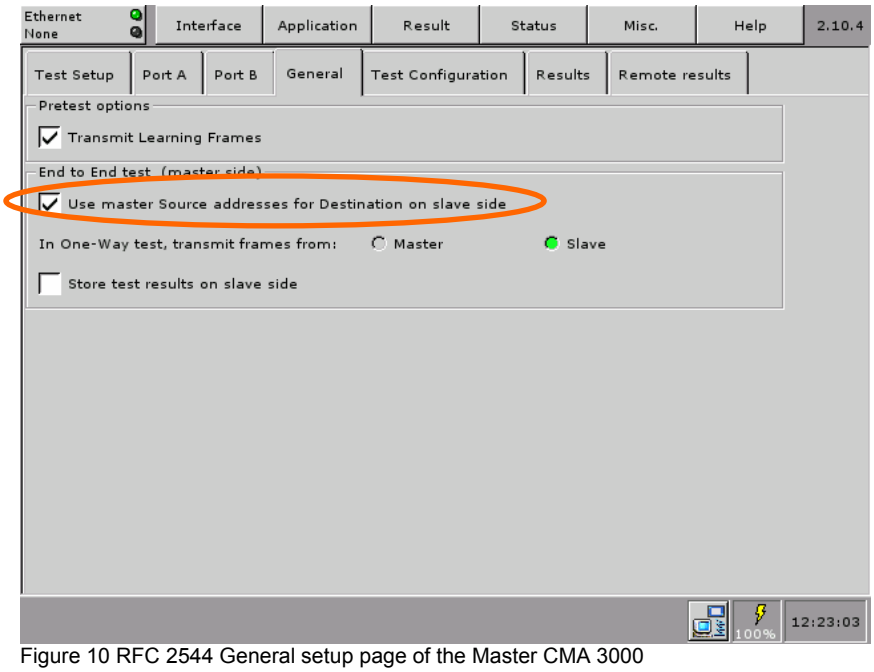


Figure 10 RFC 2544 General setup page of the Master CMA 3000

By checking the “Use master Source addresses for Destination on slave side” the master instrument will, when the test starts, inform the slave instrument to use the source IP address in the incoming CMA 3000 configuration frame (i.e. the address of the master CMA 3000)

In case the test is terminated due to a break of the communication between the two instruments the slave instrument will not be able to transfer test results to the master instrument at the end of the test. To be able to see the slave instruments results anyway, the user can choose to always store the test results in the slave instrument by checking “Store test results on slave side”; then the test results from the slave instrument can be inspected here if they were not transferred to the master instrument

4.0 Start the test

The test is started by pressing Start Test soft key in the RFC 2544 Test setup page of the master CMA 3000. At that time the RFC2544 test setup is transferred from the master to the slave CMA 3000. During the test an indicator on the taps of the test result pages will indicate what test that currently is active. The state of the test and estimated time to complete the test can be seen in the Test Status part of the Test Setup page on the master instrument.

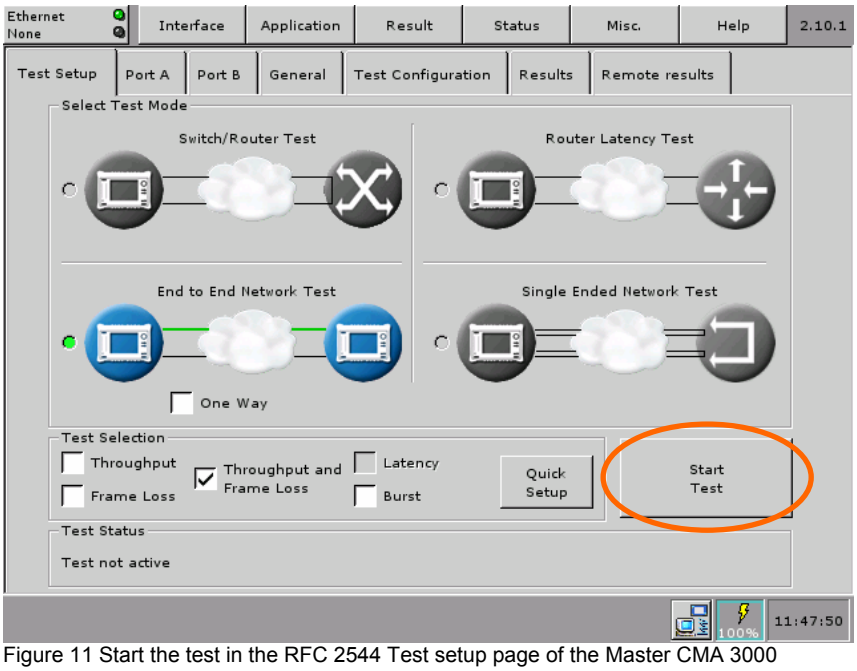


Figure 11 Start the test in the RFC 2544 Test setup page of the Master CMA 3000

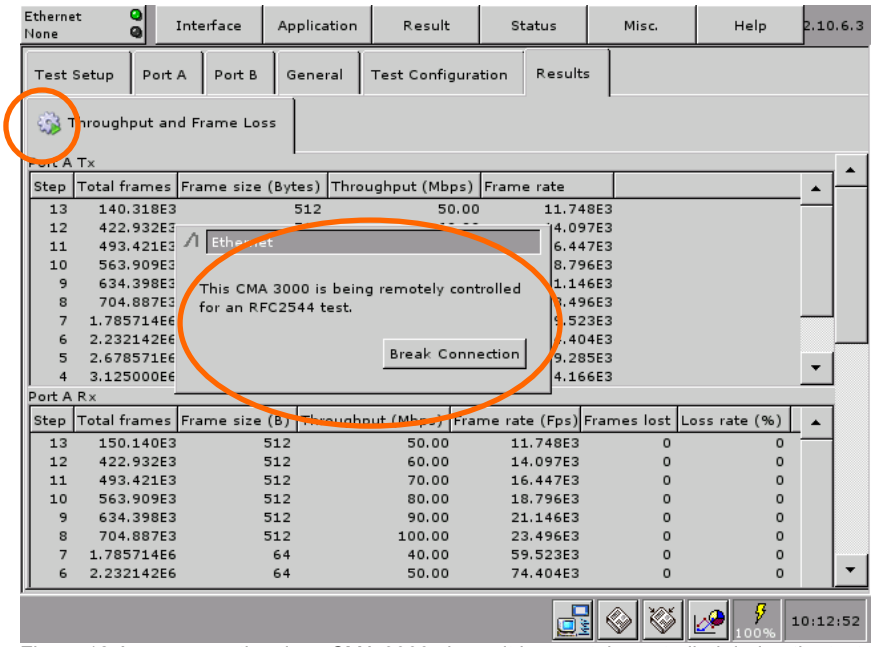


Figure 12 A pop-up on the slave CMA 3000 shows it is remotely controlled during the test. An icon on result page taps indicates the active test

When the test is started on the master CMA 3000, a popup will appear on the slave instrument, stating that the unit is being remotely controlled and providing a ‘break connection’ button. The popup will disappear when the test is completed or stopped on the Master.

5.0 End of the test

When the test is completed, the test results are transferred from the slave to the master CMA 3000 where they appear alongside the RFC2544 results sub-tap under the name RFC2544 remote results. As for the other RFC 2544 test modes, the user can see the results in a tabular format or as graphs. In the master instrument the results from both instruments are stored in the memory for analysis at a later time. The user can from the master CMA 3000 also get the results from both instruments as files in pdf format. The pdf reports can be output to a memory stick inserted in one of the USB ports of the master CMA 3000 or transferred directly to a PC if the master CMA 3000 is equipped with the FrontSim option. Finally the reports can be output to a HP USB printer.

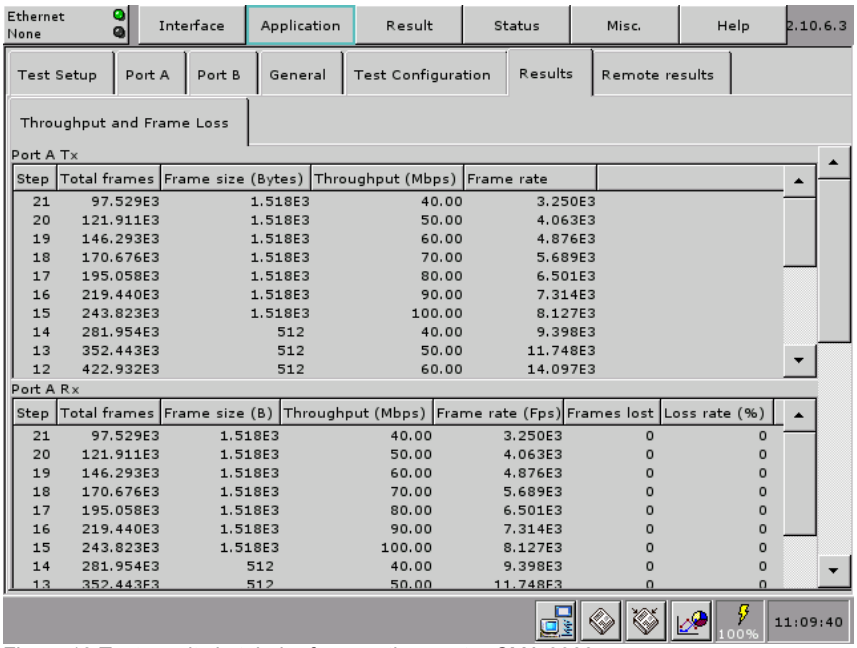


Figure 13 Test results in tabular form on the master CMA 3000

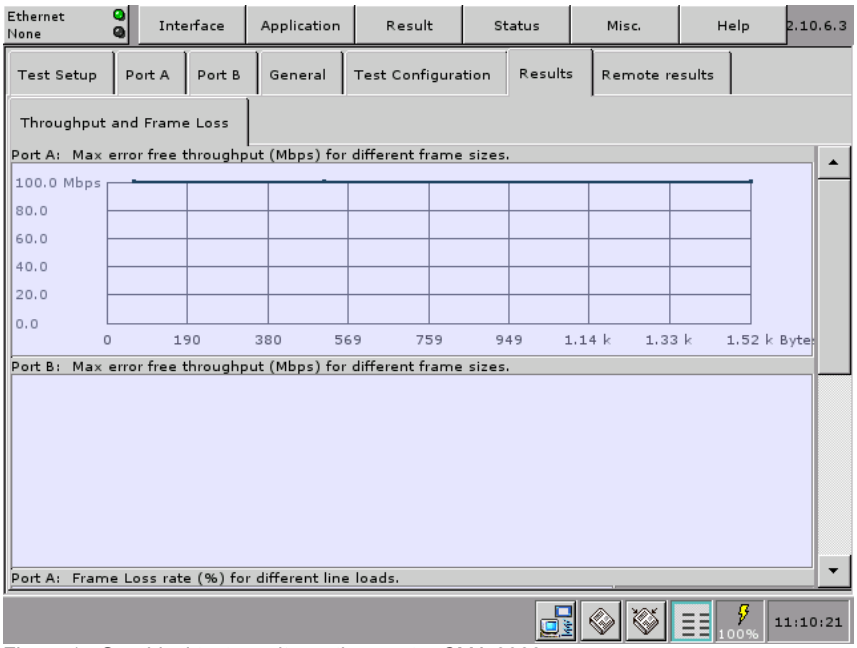
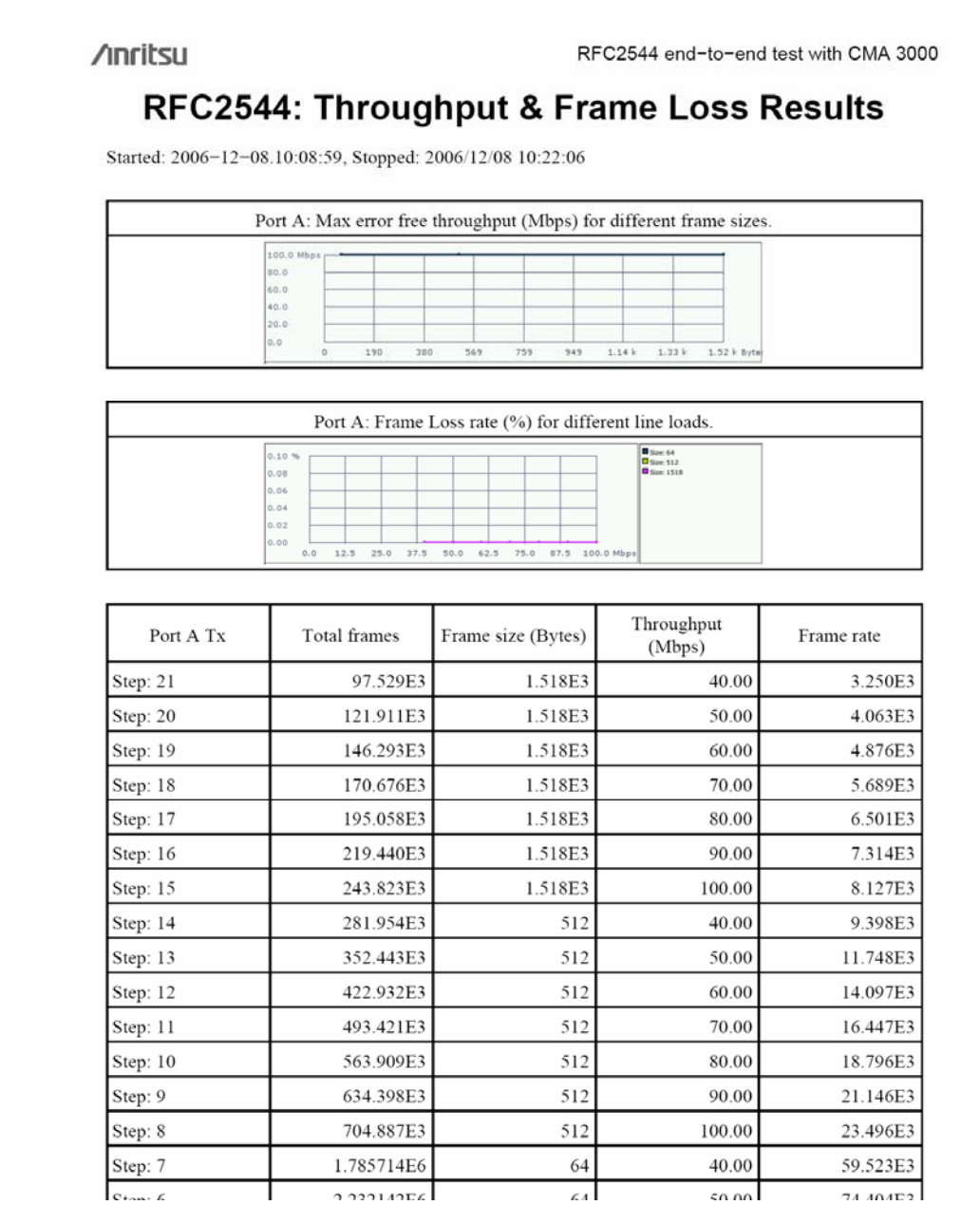


Figure 14 Graphical test results on the master CMA 3000



Anritsu RFC2544 end-to-end test with CMA 3000

RFC2544: Throughput & Frame Loss Results

Started: 2006-12-08.10:08:59, Stopped: 2006/12/08 10:22:06

Port A: Max error free throughput (Mbps) for different frame sizes.

Port A: Frame Loss rate (%) for different line loads.

Port A Tx	Total frames	Frame size (Bytes)	Throughput (Mbps)	Frame rate
Step: 21	97.529E3	1.518E3	40.00	3.250E3
Step: 20	121.911E3	1.518E3	50.00	4.063E3
Step: 19	146.293E3	1.518E3	60.00	4.876E3
Step: 18	170.676E3	1.518E3	70.00	5.689E3
Step: 17	195.058E3	1.518E3	80.00	6.501E3
Step: 16	219.440E3	1.518E3	90.00	7.314E3
Step: 15	243.823E3	1.518E3	100.00	8.127E3
Step: 14	281.954E3	512	40.00	9.398E3
Step: 13	352.443E3	512	50.00	11.748E3
Step: 12	422.932E3	512	60.00	14.097E3
Step: 11	493.421E3	512	70.00	16.447E3
Step: 10	563.909E3	512	80.00	18.796E3
Step: 9	634.398E3	512	90.00	21.146E3
Step: 8	704.887E3	512	100.00	23.496E3
Step: 7	1.785714E6	64	40.00	59.523E3
Step: 6	2.232142E6	64	50.00	74.404E3

Figure 15 A part of the pdf report the CMA 3000 can generate of the end-to-end test as documentation of the test results

Notes

The test described in this application note was made with two CMA 3000s running SW version 3.10

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Application Note

Remote operation with the FrontSim option

CMA 3000

TABLE OF CONTENTS

Introduction 01

1.0 Access the CMA 3000 through a LAN 02

2.0 Access the CMA 3000 through the Internet 03

INTRODUCTION

CMA 3000 is Anritsu's next-generation portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.

The CMA 3000 is optimized for field applications where easy transport is essential. However, there are applications where it can be convenient to connect to the instrument from a PC through a Local Area Network (LAN) or the Internet.

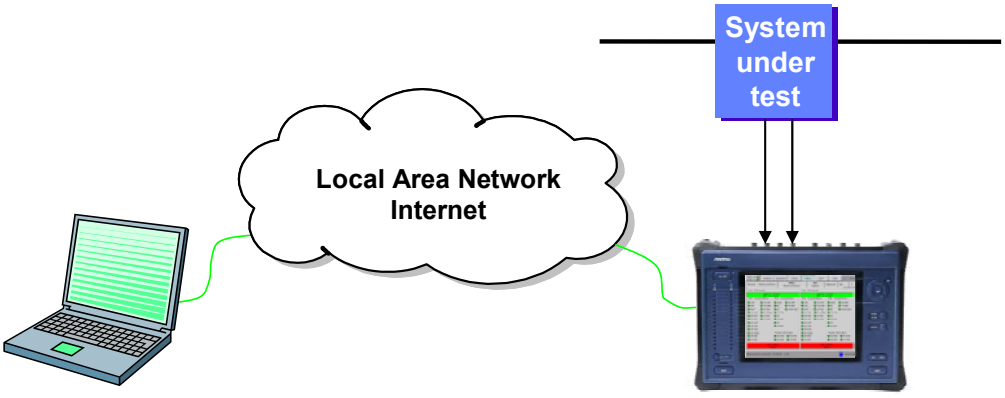

Figure 1 Direct connection between CMA 3000 and a PC.

For such applications the CMA 3000 supports remote access through the FrontSim software option running on a PC and in the instrument. FrontSim simulates the front of a CMA 3000 as accessed from the PC. This allows you to operate the instrument and view results on the PC exactly as if you're working on the instrument itself, as long as both PC and the CMA 3000 are connected to a LAN or to the Internet. From the same PC it's possible to control several instruments remotely.

1.0 Access the CMA 3000 through a LAN

To control the CMA 3000 remotely you have to assign an IP address to the instrument. To do so connect the CMA 3000 to the LAN. Then select the Misc./System Configuration/Service Interfaces window from where you allot an IP address to the CMA 3000.

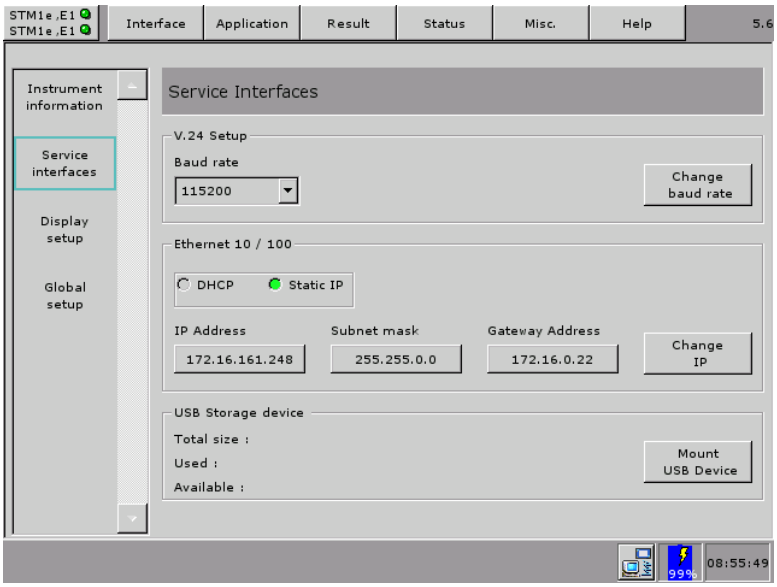

Figure 2 The Service interfaces setup window allows you to allot an IP address to the CMA 3000.

Normally the LAN will automatically give the instrument an IP address, using the Dynamic Host Configuration Protocol (DHCP). You can select this option by pressing the DHCP button; read the allocated IP address, and program that into the FrontSim.

However, as the name indicates the DHCP-allocated IP address is dynamic of nature and in most networks it will change over time. For certain applications it will be convenient to allocate a fixed IP address to the instrument. To get a fixed address you must contact your LAN administrator. Once obtained you can select this by clicking the “Static IP” menu and then click the IP Address field to enter the address into the resulting pop-up dialog box. You will also need to program the Subnet mask and Gateway Address in accordance with your LAN administrator’s instructions. When the relevant information is entered, hit the “Change IP” softkey to activate the new settings.

Once you have assigned an IP address to the CMA 3000 you can access it from FrontSim simply by entering the instrument’s IP address and then click Connect.

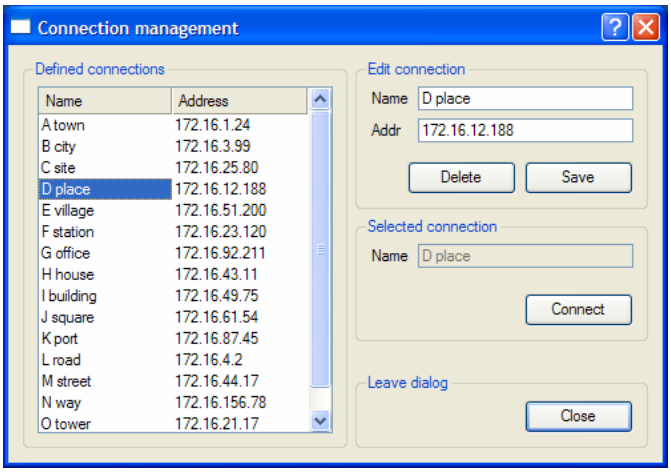

Figure 3 The connection list provides easy access to remote instruments.

2.0 Access the CMA 3000 through the Internet

If you need to access a CMA 3000 through the public Internet you must assign a fixed IP address to the remote instrument. In this case you need to contact your Internet Service Provider. When you have the fixed IP address proceed in the same way as described as for the Fixed IP address in the previous section.

2.1. Stand-alone connection

In some cases it's relevant to connect a CMA 3000 directly to a PC without going through a LAN. This can be done if the instrument and the PC are connected through a crossed Ethernet network cable, such as the Anritsu cable part No. 01463090. In this case you need to allot a fixed IP address to both instrument and PC. For the CMA 3000, please follow the instructions in section 1.0.

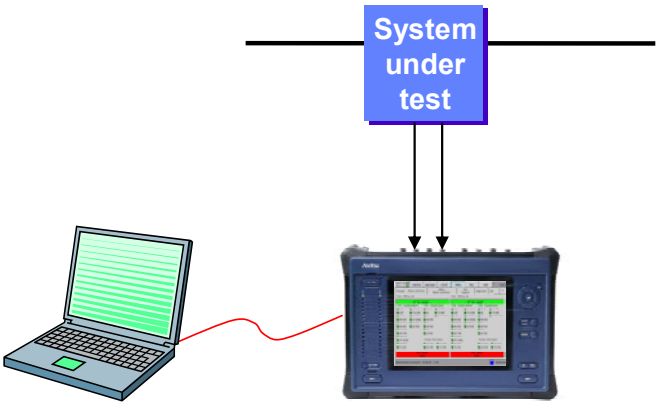

Figure 4 Direct connection between CMA 3000 and a PC.

To set up a PC with Windows XP first make sure that your PC is disconnected from the LAN or the Internet. Then you:

- **Right-click on the "My Network Places" icon on the desktop**
- **Click on properties; you will now get a list of available network connections**
- **In the list "LAN or High Speed Internet" identify the LAN connection you want to use to communicate with the CMA 3000. Right-click on the selected connection**
- **Click on properties; you will now get a list of items used by the selected connection**
- **In the list of items used by the particular connection identify and select the item "Internet Protocol (TCP/IP)"**
- **Click on the Properties softkey**
- **In the appearing setup dialog box select the menu item "Use the following IP address", and then enter an address. To allow communication between CMA 3000 and the PC the most significant parts of the address must be the same. An easy way to handle this is to ensure that the first 3 parts of the IP address are the same on PC and instrument while the last part differs. Assuming CMA 3000 has the same address as designated in the previous section (172.016.161.248), the PC could get the address 172.16.161.200 (leading zeroes omitted). Make sure that the Subnet mask is programmed in the same way as on the instrument. Finally, click OK in this and the previous dialog box**
- **Upon completion of the remote operation of the CMA 3000 make sure to return the TCP/IP properties to the original settings**

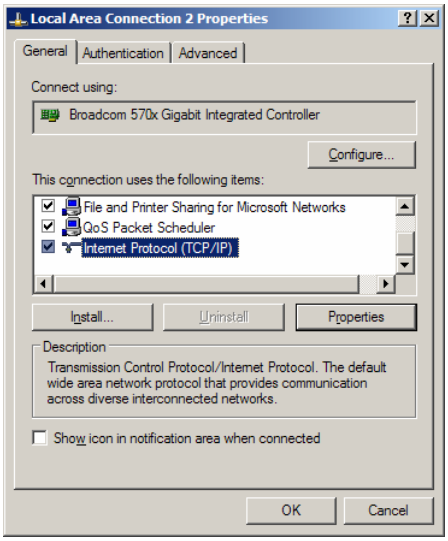

Figure 5 The list of items used by the selected Ethernet connection of the PC.

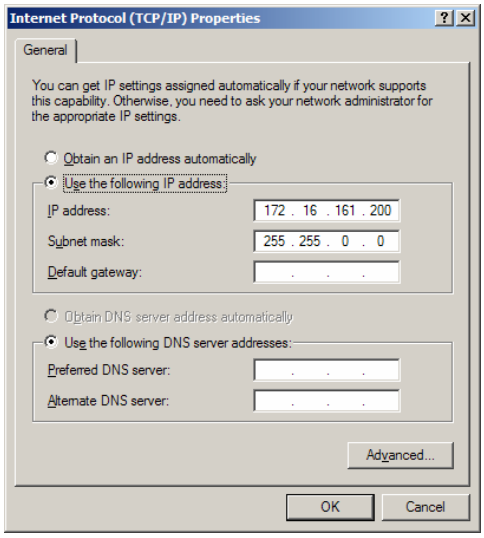

Figure 6 Setting up the fixed IP address for a PC.

The way to access the “Internet Protocol (TCP/IP) Properties” menu differs somewhat for other versions of Windows, but the general principle is the same. The important thing is to allot a fixed IP address to the PC.

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CMA 3000

ORDER GUIDE

The CMA 3000 is designed with multiple interface modules and SW options allowing full flexibility to meet the specifications at optimal price today and in the future.

This ordering guide describes standard deliveries and options and gives instructions on how to configure the All-In-One field tester CMA 3000.

You will find this on the following pages:

- Product Overview
- Ordering Guidelines
- Ordering Checklist
- Ordering Information

The ordering guide also covers the new version of the instrument: CMA 3000 Ethernet, the compact and user-friendly field tester dedicated to Ethernet testing from 10 Gbps to 10 Mbps. Please refer to page 5 and onwards in this document

Product overview CMA 3000

The CMA 3000 Basic instrument

- Basic instrument including touch screen
- Full featured E1 tester
- BNC or 1.6/5.6 connectors for unbalanced interfaces, BNO connector for balanced interfaces
- Battery included
- Standard accessory kit including
  - Users Guide
  - Main adaptor with local power cable.
  - Stylus for touch screen
  - A test certificate in A4 format

Miscellaneous optional accessories

- Soft bag
- Carrying case
- Measurement cables
- USB Memory stick for report storage and transport

Options

- Enhanced SDH interface including STM-1 electrical option (Internal)
  - Optical plug-ins and software drivers for STM-1, STM-4 and STM-16
- Ethernet option
  - 10/100 Mbps electrical (Internal HW option)
  - 10/100/1000 Mbps (Plug-on module)
    - Optical plug-ins for 100 Mbps and 1000 Mbps
  - 10/100/1000/10000 Mbps (Plug-on module)
    - Optical plug-ins for 100 Mbps, 1000 Mbps and 10 Gbps
- V-Series interfaces (Internal HW option)
  - Data interface connection box (External)
- E3 interface (Internal HW option)
- E4 interface (SW add-on option to SDH options)
- ATM layer measurements (SW option)
- IP channel statistics (SW option)
- Ethernet multistream test (SW option)
- Ethernet stacked VLAN test (SW option)
- Ethernet MPLS test (SW option)
- 10 GigE LAN option (SW option)
- 10 GigE WAN option (SW option)
- Frame Relay testing (SW option)
- Basic SS7 protocol functionality (SW option)
- Basic Abis protocol functionality (SW option)
- Basic ISDN protocol functionality (SW option)
- Protocol analysis for fixed and mobile networks (SW options)
- ISDN PRI call emulation (SW options)
- VoIP call emulation (SW options)
- FrontSim remote operation (SW option)
- Remote Control - Scripting (SW option)

All options are available as “Factory installed” when ordered up-front with the CMA 3000 basic instrument or - except for the 10/100/1000/10000 Mbps Ethernet option - as “Field Installed” for post installation by user including a field installation guide. HW option can also be post installed at the factory.

Ordering guide

General guideline for ordering CMA 3000.

Minimum order

As a minimum the following shall be specified:

- CMA 3000 basic instrument (0053100X)
- Accessories Supplied CMA 3000 (075310YY)

Protocols and SW options

When ordering protocols (083###XX), please also order the related Basic protocol functionality option:

- 083026XX Basic Abis Interface and Protocol Functionality
- 083027XX Basic SS7 Protocol Functionality
- 083028XX Basic ISDN Protocol Functionality
- 083354XX Basic VoIP Functionality option
- Basic protocol functionalities should in general not be ordered without protocols (these are not protocols as such, but provide basic, common functionality that allows the actual protocols to run). However one exception is 083026XX Basic Abis Interface and Protocol Functionality, as this provides listen in on 8 or 16 kbps Abis speech channels.

Please observe that if you want to order 2 or 3 of the above options together for one instrument, special ordering codes must be used:

- 083341XX Basic Abis and SS7 Protocol Functionality
  i.e. 083026XX and 083027XX together.
- 083342XX Basic Abis and ISDN Protocol Functionality
  i.e. 083026XX and 083028XX together
- 083343XX Basic SS7 and ISDN Protocol Functionality
  i.e. 083027XX and 083028XX together.
- 083344XX Basic Abis, SS7, and ISDN Protocol Functionality
  i.e. 083026XX, 083027XX and 083028XX together.

When issuing software updates for protocols to latest release, a software update fee will be charged.

When ordering post-installed protocols and SW options (083###90) please also specify delivery information:

- 08399990 On CD-ROM (Default, if nothing is specified)
- 08399995 On CD-ROM and USB memory stick (at extra cost)
- 08399950 By E-mail

If you want to order several protocols for an instrument you may want to use one of our two protocol bundling options:

- 083345XX Protocol Bundling Package No. 1 (5 protocols)
  Any combination of 5 protocols for one CMA 3000 instrument from the protocol lists in the ordering information section below EXCLUDING the 083062XX WLD - Motorola Mobis protocol and 083068XX WLD - GPRS Abis with Motorola PCU Frames. Please specify the 5 protocols
- 083346XX Protocol Bundling Package No. 2 (10 protocols)
  Any combination of 10 protocols for one CMA 3000 instrument from the protocol lists in the ordering information section below EXCLUDING the 083062XX WLD - Motorola Mobis protocol and 083068XX WLD - GPRS Abis with Motorola PCU Frames. Please specify the 10 protocols

Products for the Chinese market

Please observe that due to special requirements for marking of products in China special versions of the instrument and their accessory kits are available for sale in China only. Instruments and accessory kits without these labels are not for sale in China.

SDH

There is one basic SDH option for the CMA 3000:

- 015897ZZ Enhanced SDH Test Option Incl. STM-1 Electrical Interface
  - Supports optional optical modules for STM-1, STM-4 and STM-16

ZZ = 08: Factory installed at initial delivery of instrument
ZZ = 80: Post installed at factory after initial delivery of instrument
ZZ = 90: Field installed by customer

Please observe that we earlier had another basic SDH option for the CMA 3000: 015807XX SDH Test Option Incl. STM-1 Electrical Interface. This product is discontinued and replaced by 015897ZZ.

When ordering SDH options you must always order the above basic option (unless you are upgrading an instrument that already has 015897ZZ or 015807XX installed). It includes the hardware needed to carry the optical modules.

Optical SDH interfaces require a SW driver allowing the SDH option to run at the required rate (STM-1, STM-1/ STM-4 or STM-1/ STM-4/ STM-16) In addition you will need an optical module, supporting the required rates. These can be ordered as bundles (i.e. SW driver and optical modules together) or – if the instrument has software version 4.01 or higher – separated.

When ordering bundles please specify as relevant:

- SW driver and optical modules (one or two) 015zzzYY
  - YY = 00 For port A, Factory installed
  - YY = 01 For port B, Factory installed **NB: requires that a SW driver for port A is already installed**
  - YY = 90 For port A, Field installed
  - YY = 91 For port B, Field installed **NB: requires that a SW driver for port A is already installed**

When ordering SW driver and optical modules separated please specify as relevant:

- SW driver, one port for the required rate 083zzzxx **NB: This SW driver is mandatory for the SDH interface to operate at the required rate unless a SW driver and optical module bundle has been installed in port A.**
- SW driver, second receiver for the required rate 083zzzxx
- Optics for the required rate 012zzzxx

Please remember to order cables for optical modules (minimum two will typically be required).

Please also remember to change xx, zzz, ZZ or YY with the relevant digits as indicated above and in the ordering information section of this order guide – you will find the relevant details in the ordering information section.

As a new feature in SW version 4.01 and higher you can have a SW driver for one port, but optical modules in both ports. In this case only one of the modules can be activated at the time, which should be sufficient for many testing applications. If required you can activate the second receiver by installing another SW driver (or install a bundle with SW driver and optical module in port B). This will typically be relevant for in-service monitoring applications.

Another new feature in SW version 4.01 and higher is that the SDH interface can be used with optical modules not approved for the CMA 3000. You still need to have the relevant SW driver(s) installed. **NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000.** However it is likely that other modules will work for most parts, but some information like optical levels will not be available.

Ethernet options

3 Ethernet options are available:

- 015861XX Ethernet 10/100 Electrical – Internal module
- 015870XX Ethernet 10/100/1000 – Plug-on ("GigE") module (attached to the rear of the CMA 3000 Basic instrument)
- 012003XX/012017XX High speed single or dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports

The modules offer the same Ethernet testing functions. 012003XX/012017XX will require the 083385XX 10 GigE LAN option to do Ethernet testing at 10 Gbps. 012003XX/012017XX can be equipped with the 083386XX 10 GigE WAN option when 083385XX is installed.
The 015870XX, 012003XX and 012017XX plug-on modules offers the same 10/100 electrical interface as the internal module 015861XX. In addition they have 1000Mbps electrical interface and optional optical interfaces.

Ethernet options and carrying cases

If you have a CMA 3000 that you use with the now discontinued 07030499 Carrying Case – Compact and you want to upgrade this instrument with 015870XX or 012003XX/012017XX then please observe that the 07030499 Carrying Case – Compact can no longer be used. Instead the 07030599 Carrying Case - Full Size must be ordered.

V-Series interface option

If the 015835XX V-Series Interface measurement option is ordered either connection cables or 01558600 Data Interface Connection Box should also be ordered

V-Series Interface field installed

When ordering the CMA 3000 V-Series Interface option for field installation, please use the following ordering codes in accordance with the guide lines below:

- 01583591 V-Series Interface Measurement Option. Field installed
  - For instruments delivered after September 2005 and
  - For instruments with 0158619x 10/100 Ethernet Board Option installed regardless of age
- 01583592 V-Series Interface Measurement Option and basic instrument hardware upgrade. Field installed
  - For instruments delivered before September 2005.
- Serial number information required in all cases

Product overview CMA 3000 Ethernet

The CMA 3000 Ethernet product is an instrument for testing Ethernet from 10Mbps to 10 Gbps. It can not be upgraded to support other interfaces like PDH and SDH.

The CMA 3000 Ethernet

- Basic instrument including touch screen
- 10/100 Mbps 1/10 Gbps module
- 10 GigE LAN
- Single or dual port at the 10Gbps rate
- Battery included
- Standard accessory kit including
    - Users Guide
    - Main adaptor with local power cable.
    - Stylus for touch screen
    - A test certificate in A4 format

Miscellaneous optional accessories

- Soft bag
- Carrying case
- Measurement cables
- USB Memory stick for report storage and transport

Options

- 10 GigE WAN option (SW option)
- IP channel statistics (SW option)
- Ethernet multistream test (SW option)
- Ethernet stacked VLAN test (SW option)
- Ethernet MPLS test (SW option)
- VoIP call emulation (SW options)
- FrontSim remote operation (SW option)
- Remote Control - Scripting (SW option)

All options are available as “Factory installed” when ordered up-front with the CMA 3000 Ethernet instrument or as “Field Installed” for post installation by user including a field installation guide.

Ordering guide

General guideline for ordering CMA 3000 Ethernet.

Minimum order

As a minimum the following shall be specified:

- CMA 3000 Ethernet instrument (005311XX)
- Accessories Supplied CMA 3000 Ethernet (075311YY)

Please remember to order SW options and optical modules as required.

Products for the Chinese market

Please observe that due to special requirements for marking of products in China special versions of the instrument and their accessory kits are available for sale in China only. Instruments and accessory kits without these labels are not for sale in China.

Order checklist for CMA 3000 standard version

1. Select CMA 3000 Basic Instrument version BNC or 1.6/5.6 connectors
2. Include the regional accessory kit with the CMA 3000 Basic Instrument
3. Include interface specific options
4. Check for applicable optical interfaces
5. Check that applicable protocol functionality is included when ordering protocols
6. Check SW delivery option for field installation of SW options
7. Check for correct ordering codes for field installation of V-series interface option
8. Include Serial Number when ordering options for field installation

Ordering information

Part Number	CMA 3000	Required Basic SW	Required P/N
	CMA 3000		
0053100X	**CMA 3000 Basic Instrument**		
	NB: These items are **NOT** for sale in China X = 0: BNC connectors for unbalanced and BNO connectors for balanced interfaces X = 1: 1.6/5.6 connectors for unbalanced and BNO connector for balanced interfaces Includes one 01200100 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075310YY "Accessories for CMA 3000", one must be selected.		
00531040	**CMA 3000 Basic Instrument with labels required in the Chinese market**		
	NB: This item is **ONLY** for sale in China BNC connectors for unbalanced and BNO connectors for balanced interfaces Includes one 01200100 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075310YY "Accessories for CMA 3000", one must be selected.		
075310YY	**Accessories for CMA 3000** NB: This item can only be ordered together with a CMA 3000 Basic Instrument (0053100X or 00531040)		0053100X or 00531040
	NB: The following versions are **NOT** for sale in China YY = 00: Europe - includes power cable 01453098 YY = 01: Australia - includes power cable 01453198 YY = 03: UK - includes power cable 01453298 YY = 04: USA - includes power cable 01453398 YY = 09: Japan - without power cable and mains adapter NB: The following versions are **ONLY** for sale in China YY = 11: China - includes power cable 01453098 YY = 12: China - includes power cable 01453398 YY = 13: China - includes power cable 01453198		
00531102	**CMA 3000 Ethernet**		
	10 GigE LAN single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **NOT** for sale in China Includes one 01200100 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
00531103	**CMA 3000 Ethernet – dual**		
	10 GigE LAN dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **NOT** for sale in China Includes one 01200100 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		

Part Number	CMA 3000	Required Basic SW	Required P/N
00531141	**CMA 3000 Ethernet – with labels required in the Chinese market**		
	10 GigE LAN single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **ONLY** for sale in China Includes one 01200100 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
00531142	**CMA 3000 Ethernet – dual – with labels required in the Chinese market**		
	10 GigE LAN dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **ONLY** for sale in China Includes one 01200100 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
075311YY	**Accessories for CMA 3000 Ethernet** NB: This item can only be ordered together with a CMA 3000 Ethernet (0053110X or 0053114X)		0053110X or 0053114X
	NB: The following versions are **NOT** for sale in China YY = 00: Europe - includes power cable 01453098 YY = 01: Australia - includes power cable 01453198 YY = 03: UK - includes power cable 01453298 YY = 04: USA - includes power cable 01453398 YY = 09: Japan - without power cable and mains adapter NB: The following versions are **ONLY** for sale in China YY = 11: China - includes power cable 01453098 YY = 12: China - includes power cable 01453398 YY = 13: China - includes power cable 01453198		
	Calibration and Test Certificates		
00880947	**Factory calibration for CMA 3000, including factory-installed options**		
	Including detailed result form. NB: This only applies to already sold instruments. If test certificate including detailed result form is required when a new instrument is ordered, please order 00880945.		
00880945	**Test Certificate for Function Test, including factory-installed options**		
	Including detailed result form Only available if ordered at the same time as the instrument		
	HW Options for CMA 3000		
01586100	**Ethernet 10/100 Electrical Interface Test Option, Factory installed at initial delivery of instrument**		
01586180	**Ethernet 10/100 Electrical Interface Test Option, Post installed at factory after initial delivery of instrument**	V2.10 or higher	
01586191	**Ethernet 10/100 Electrical Interface Test Option, Field installed by customer**	V2.10 or higher	
	Serial number information required		
	Requires SW version 2.10 or higher		
01587000	**Ethernet 10/100/1000 Interface Testing incl 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument**		
01587080	**Ethernet 10/100/1000 Interface Testing incl 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument**	V2.34 or higher	
01587090	**Ethernet 10/100/1000 Interface Testing incl 2 RJ-45 Electrical Ports, Field installed by customer**	V2.34 or higher	
	Requires SW version 2.34 or higher		
01200300	**High speed single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument**	V4.00 or higher	
01200380	**High speed single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument**	V4.00 or higher	
01200390	**High speed single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports, Post installed at authorized Anritsu Service center after initial delivery of instrument**	V4.00 or higher	
	Requires SW version 4.00 or higher		
01201700	**High speed dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument**	V4.00 or higher	

Part Number	CMA 3000	Required Basic SW	Required P/N
01201780	**High speed dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument**	V4.00 or higher	
01201790	**High speed dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports, Post installed at authorized Anritsu Service center after initial delivery of instrument**	V4.00 or higher	
	Requires SW version 4.00 or higher		
	015870XX, 012003XX, 012017XX and 005311XX can be equipped with two optical modules:		
	Optical modules for 015870XX, 012003XX, 012017XX and 005311XX:		
015941XX	**1 Gbps 850 nm (SX) (one module), LC connector**		015870XX or 012003XX or 012017XX or 005311XX
015942XX	**1 Gbps 1310 nm (LX) (one module), LC connector**		015870XX or 012003XX or 012017XX or 005311XX
015943XX	**1 Gbps 1550 nm (ZX) (one module), LC connector**		015870XX or 012003XX or 012017XX or 005311XX
	Optical modules for 015870XX only:		
015980XX	**Gigabit Ethernet port converter module to 100BASE-FX (1310 nm multimode), LC connector**	V3.20 or higher	015870XX
	Requires SW version 3.20 or higher		
015982XX	**Gigabit Ethernet port converter module to 100BASE-LX (1310 nm single mode), LC connector**	V3.31 or higher	015870XX
	Requires SW version 3.31 or higher		
	Optical modules for 012003XX, 012017XX and 005311XX only:		
012006XX	**10 Gbps optical module SR/SW (850 nm), LC connector**	V4.00 or higher	012003XX or 012017XX or 005311XX
012007XX	**10 Gbps optical module LR/LW (1310 nm), LC connector**	V4.00 or higher	012003XX or 012017XX or 005311XX
012008XX	**10 Gbps optical module ER/EW (1550 nm , 40km), LC connector**	V4.00 or higher	012003XX or 012017XX or 005311XX
012010XX	**10 Gbps optical module ER/EW (1550 nm , 80km), LC connector**	V4.00 or higher	012003XX or 012017XX or 005311XX
012004XX	**100 Mbps optical module FX (1310 nm MM), LC connector**	V4.00 or higher	012003XX or 012017XX or 005311XX
012005XX	**100 Mbps optical module LX (1310 nm SM), LC connector**	V4.00 or higher	012003XX or 012017XX or 005311XX
	Note: XX = 00 Factory installed XX = 90 Field installed. Please specify serial No of the target instrument		
01583308	**E3 Interface, Factory installed at initial delivery of instrument**		
01583380	**E3 Interface, Post installed at factory after initial delivery of instrument**	V2.40 or higher	
01583390	**E3 Interface, Field installed by customer**	V2.40 or higher	
	Requires SW version 2.40 or higher		

Part Number	CMA 3000	Required Basic SW	Required P/N
01589708	**Enhanced SDH Test Option Incl. STM-1 Electrical Interface, Factory installed at initial delivery of instrument**		
01589780	**Enhanced SDH Test Option Incl. STM-1 Electrical Interface, Post installed at factory after initial delivery of instrument**	V3.50 or higher	
01589790	**Enhanced SDH Test Option Incl. STM-1 Electrical Interface, Field installed by customer**	V3.50 or higher	
	Requires SW version 3.50 or higher		
	Optical modules for SDH test option bundled with the software drivers needed to support them. Up to two modules can be installed.		
015845YY	**SW driver and optics for STM-1 1310 nm, short haul, LC connector**		015807XX or 015897XX
015846YY	**SW driver and optics for STM-1/-4 1310 nm, short haul, LC connector**		015807XX or 015897XX
015990YY	**SW driver and optics for STM-1/-4/-16 1310 nm, short haul, LC connector**	V3.50 or higher	015897XX
015847YY	**SW driver and optics for STM-1 1310 nm, long haul, LC connector**		015807XX or 015897XX
015848YY	**SW driver and optics for STM-1 1550 nm, long haul, LC connector**		015807XX or 015897XX
015849YY	**SW driver and optics for STM-1/-4 1310 nm, long haul, LC connector**		015807XX or 015897XX
015850YY	**SW driver and optics for STM-1/-4 1550 nm, long haul, LC connector**		015807XX or 015897XX
015991YY	**SW driver and optics for STM-1/-4/-16 1310 nm, long haul, LC connector**	V3.50 or higher	015897XX
015993YY	**SW driver and optics for STM-1/-4/-16 1550 nm, long haul, LC connector**	V3.50 or higher	015897XX
	Note: Includes the software needed to support them (one license for one instrument) YY = 00 For port A, Factory installed YY = 01 For port B, Factory installed *NB: requires that a SW driver for port A is installed* YY = 90 For port A, Field installed by customer YY = 91 For port B, Field installed by customer *NB: requires that a SW driver for port A is installed*		
	Software drivers for the SDH test option's optical modules NB: Optical module is <u>NOT</u> included		
083104xx	**SW driver STM-1, one port**	V4.01 or higher	015807XX or 015897XX
	NB: Requires SW version 4.01 or higher		
083106xx	**SW driver STM-1/-4, one port**	V4.01 or higher	015807XX or 015897XX
	NB: Requires SW version 4.01 or higher		
083363xx	**SW driver STM-1/-4/-16, one port**	V4.01 or higher	015897XX
	NB: Requires SW version 4.01 or higher		
083105xx	**SW driver STM-1, second receiver**	V4.01 or higher	083104xx
	NB: Requires that 083104xx SW driver STM-1, one port is installed		
083107xx	**SW driver STM-1/-4, second receiver**	V4.01 or higher	083106xx
	NB: Requires that 083106xx SW driver STM-1/-4, one port is installed		
083364xx	**SW driver STM-1/-4/-16, second receiver**	V4.01 or higher	083363xx
	NB: Requires that 083363xx SW driver STM-1/-4/-16, one port is installed		
	Note: xx = 00: Factory-installed. xx = 90: Field-installed by customer. Please specify serial number of the target instrument.		
	SW Delivery Options		
	When ordering field-installed SW options and protocols, one of the delivery options below must also be ordered. If nothing is specified, option 08399990 - Delivery on CD will be assumed. Only one delivery option is required per instrument.		
08399990	**SW is delivered on CD-ROM**		
08399995	**SW is delivered on a CD-ROM and on a USB memory stick**		
08399950	**The SW is delivered via E-mail. Please specify recipients E-mail address.**		

Part Number	CMA 3000	Required Basic SW	Required P/N
	Optical modules for the SDH test option **NB: Software drivers are required to make the optical modules operational** **Up to two modules can be installed.**		
012023xx	**Optics for STM-1 1310 nm, short haul, LC connector**	V4.01 or higher	083104xx
	NB: Requires that 083104xx SW driver STM-1, one port is installed		
012024xx	**Optics for STM-1/4 1310 nm, short haul, LC connector**	V4.01 or higher	083106xx
	NB: Requires that 083106zxx SW driver STM-1/-4, one port is installed		
012025xx	**Optics for STM-1/-4/-16 1310 nm, short haul, LC connector**	V4.01 or higher	083363xx
	NB: Requires that 083363xx SW driver STM-1/-4/-16, one port is installed		
012026xx	**Optics for STM-1 1310 nm, long haul, LC connector**	V4.01 or higher	083104xx
	NB: Requires that 083104xx SW driver STM-1, one port is installed		
012027xx	**Optics for STM-1 1550 nm, long haul, LC connector**	V4.01 or higher	083104xx
	NB: Requires that 083104xx SW driver STM-1, one port is installed		
012028xx	**Optics for STM-1/4 1310 nm, long haul, LC connector**	V4.01 or higher	083106xx
	NB: Requires that 083106zxx SW driver STM-1/-4, one port is installed		
012029xx	**Optics for STM-1/4 1550 nm, long haul, LC connector**	V4.01 or higher	083106xx
	NB: Requires that 083106zxx SW driver STM-1/-4, one port is installed		
012030xx	**Optics for STM-1/-4/-16 1310 nm, long haul, LC connector**	V4.01 or higher	083363xx
	NB: Requires that 083363xx SW driver STM-1/-4/-16, one port is installed		
012031xx	**Optics for STM-1/-4/-16 1550 nm, long haul, LC connector**	V4.01 or higher	083363xx
	NB: Requires that 083363xx SW driver STM-1/-4/-16, one port is installed		
	Note: xx = 00: Factory-installed. xx = 90: Field-installed by customer. Please specify serial number of the target instrument.		
	Single Fiber Cables for Optical Modules		
	The optical cables in this section are single fiber cables		
01460198	**Cable, optical, singlemode LC/PC to SC/PC, 3 meter**		
01463190	**Cable, optical, singlemode LC/PC to Radiall VFO/straight, 3 meter**		
01463298	**Cable, optical, singlemode LC/PC to FC/APC, 3 meter**		
01463390	**Cable, optical, singlemode LC/PC to DIN47256, 3 meter**		
01463498	**Cable, optical, singlemode LC/PC to FC/PC, 3 meter**		
01463598	**Cable, optical, singlemode LC/PC to E-2000/PC, 3 meter**		
01463698	**Cable, optical, singlemode LC/PC to E-2000/APC, 3 meter**		
01463798	**Cable, optical, singlemode LC/PC to ST/PC, 3 meter**		
01464090	**Cable, optical, singlemode LC/PC to LX.5, 3 meter**		
01463898	**Cable, optical, singlemode LC/PC to LC/PC, 3 meter**		
01468990	**Cable, optical, multimode LC/PC to SC/PC, 3 meter**		
01468890	**Cable, optical, multimode LC/PC to LC/PC, 3 meter**		
	Dual Fiber (Duplex) Cable for Optical Modules		
	The optical cable in this section is a dual fiber cable		
01474398	**Cable, optical, singlemode LC/PC to LC/APC, Duplex, 3 meter**		
	Optical Attenuator		
01463990	**Optical Attenuator 10dB LC/PC to LC/PC**		

Part Number	CMA 3000	Required Basic SW	Required P/N
	V- Series Interface		
01583500	**V-Series Interface Option, Factory installed at initial delivery of instrument**		
	Please see below for available connection and extender cables		
01583580	**V-Series Interface Option, Post installed at factory after initial delivery of instrument**	V2.10 or higher	
	Please see below for available connection and extender cables		
01583591	**V-Series Interface Option, Field installed by customer**	V2.10 or higher	
	• For instruments delivered after September 2005 and • For instruments with 015861XX 10/100 Ethernet Board Option installed regardless of age		
	Please see below for available connection and extender cables		
	Serial number information required		
	Requires SW version 2.10 or higher		
01583592	**V-Series Interface Option and basic instrument hardware upgrade. Field installed by customer**	V2.10 or higher	
	• For instruments delivered before September 2005, without the 015861XX Ethernet 10/100 option installed.		
	Please see below for available connection and extender cables		
	Serial number information required		
	Requires SW version 2.10 or higher		
	Connection Cables for V-Series Interface Option		
01442290	**RS-530 DCE/DTE**		015835XX
01442398	**RS-449, V.36 DCE/DTE**		015835XX
01442498	**RS 232C, V.24 DCE/DTE (25 pin)**		015835XX
01442598	**V.11, X.21 DCE/DTE**		015835XX
01442698	**V.35 DCE/DTE**		015835XX
01442790	**V.35 DTE**		015835XX
01443098	**RS 232C, V.24 DCE/DTE (9 pin)**		015835XX
01442898	**Codir. (G.703)**		015835XX
01558600	**Data Interface Connector Box** Includes cable between instrument and Data Interface Connector Box		015835XX
01448208	**Replacement for cable between instrument and Data Interface Connector Box**		015835XX 01558600
	Extender Cables for V-Series Interface Option		
01445790	**RS 530, RS 232C, V.24 Extender Cable (25 pin)**		
01445898	**V.35 Extender Cable**		
01445990	**RS-449, V.36 Extender Cable**		
01446090	**V.11, X.21 Extender Cable**		
01446190	**RS 232C, V.24 Extender Cable (9 pin)**		
	Option: FrontSim for CMA 3000 (Note: for one license for one instrument)		
083101XX	**FrontSim for CMA 3000**		
	XX=00: Instrument part factory installed; PC-part delivered on CD-ROM XX=90: Field installed by customer; Instrument part delivered on CD-ROM; PC-part delivered on CD-ROM XX=50: Field installed by customer; Instrument part delivered by E-mail; PC-part can be downloaded from ftp-site		
08310195	**FrontSim for CMA 3000**		
	Field installed by customer; Instrument part delivered on both CD-ROM and USB memory stick; PC-part delivered on CD-ROM		

Part Number	CMA 3000	Required Basic SW	Required P/N
	Option: Remote Control – Scripting for CMA 3000 (Note: for one license for one instrument)		
083384XX	**Remote Control – Scripting for CMA 3000**	V3.80 or higher	
	XX=00: Instrument part factory installed; documentation delivered on CD-ROM XX=90: Field installed by customer; Instrument part delivered on CD-ROM; documentation delivered on CD-ROM XX=50: Field installed by customer; Instrument part delivered by E-mail; documentation can be downloaded from ftp-site		
	Requires SW version 3.80 or higher Serial number information required when field installed		
08338495	**Remote Control – Scripting for CMA 3000**	V3.80 or higher	
	Field installed by customer; Instrument part delivered on both CD-ROM and USB memory stick; documentation delivered on CD-ROM		
	Requires SW version 3.80 or higher Serial number information required		
	SW Delivery Options		
	When ordering field-installed SW options and protocols, one of the delivery options below must also be ordered. If nothing is specified, option 08399990 - Delivery on CD will be assumed. Only one delivery option is required per instrument.		
08399990	**SW is delivered on CD-ROM**		
08399995	**SW is delivered on a CD-ROM and on a USB memory stick**		
08399950	**The SW is delivered via E-mail. Please specify recipients E-mail address.**		
	SW Options for CMA 3000 (Note: for one license for one instrument)		
083026XX	**Basic Abis Interface and Protocol Functionality**		
083027XX	**Basic SS7 Protocol Functionality**		
083028XX	**Basic ISDN Protocol Functionality**		
083341XX	**Basic Abis and SS7 Protocol Functionality**		
	i.e. 083026XX and 083027XX together.		
083342XX	**Basic Abis and ISDN Protocol Functionality**		
	i.e. 083026XX and 083028XX together		
083343XX	**Basic SS7 and ISDN Protocol Functionality**		
	I.e. 083027XX and 083028XX together.		
083344XX	**Basic Abis, SS7, and ISDN Protocol Functionality**		
	I.e. 083026XX, 083027XX and 083028XX together.		
083354XX	**Basic VoIP Functionality option**	V3.40 or higher	015861XX or 015870XX or 012003XX or 012017XX or 005311XX
	Requires P/N 015861XX, 015870XX, 012003XX, 012017XX or 005311XX. Requires SW version 3.40 or higher		
083029XX	**GPRS Gb interface protocol decode for CMA 3000**		083084XX
	Requires that P/N 083084XX - Frame Relay test option is installed.		
083084XX	**Frame Relay Test**		
083030XX	**Frame Relay Decode**		083084XX
	Requires that P/N 083084XX - Frame Relay test option is installed.		
083086XX	**Tandem Connection Monitoring**	V2.10 or higher	015807XX or 015897XX
	Requires that P/N 015807XX or P/N 015897XX is installed. Requires SW version 2.10 or higher		
083376XX	**E4 Interface**	V3.60 or higher	015807XX or 015897XX
	Requires that P/N 015807XX or P/N 015897XX is installed. Requires SW version 3.60 or higher		

Part Number	CMA 3000	Required Basic SW	Required P/N
083088XX	**ATM layer measurement - over SDH (up to STM-4 depending on optical modules installed)**	V3.00 or higher	015807XX or 015897XX
	Requires that P/N 015807XX or P/N 015897XX is installed. Requires SW version 3.00 or higher		
083087XX	**ATM layer measurement - over E1/E3**	V3.10 or higher	ATM over E3: 015833XX
	ATM over E3 requires that P/N 015833XX – E3 Interface option is installed. This option includes an IMA-over-E1 status monitor facility Requires SW version 3.10 or higher		
083089XX	**IP over Ethernet channel statistics** Requires P/N 015861XX, 015870XX, 012003XX, 012017XX or 005311XX. Requires SW version 4.01 or higher	V4.01 or higher	015861XX or 015870XX or 012003XX or 012017XX or 005311XX
083333XX	**Ethernet Multistream option** Requires P/N 015861XX, 015870XX, 012003XX, 012017XX or 005311XX. Requires SW version 3.30 or higher	V3.30 or higher	015861XX or 015870XX or 012003XX or 012017XX or 005311XX
083377XX	**Ethernet Stacked VLAN option** Requires P/N 015861XX, 015870XX, 012003XX, 012017XX or 005311XX. Requires SW version 3.60 or higher	V3.60 or higher	015861XX or 015870XX or 012003XX or 012017XX or 005311XX
083378XX	**Ethernet MPLS option** Requires P/N 015861XX, 015870XX, 012003XX, 012017XX or 005311XX. Requires SW version 3.60 or higher	V3.60 or higher	015861XX or 015870XX or 012003XX or 012017XX or 005311XX
083385XX	**10 GigE LAN**	V4.00 or higher	012003XX or 012017XX
	Requires that P/N 012003XX or 012017XX option is installed. Information on serial number of P/N 02003XX or 012017XX is required if post installed Requires SW version 4.00 or higher		
083386XX	**10 GigE WAN**	V4.00 or higher	083385XX or 005311XX
	Requires 005311XX or that P/N 083385XX option is installed Information on serial number of P/N 012003XX 012017XX or 10G module of 005311XX is required if post installed Requires SW version 4.00 or higher		
083329XX	**LED Invert SW Option**	V3.20 or higher	015835XX
	Only for customers who have a CMA 3000 with the 015835XX V-Series Interface Option installed Requires SW version 3.20 or higher		
083330XX	**LED Normal SW Option**	V3.20 or higher	015835XX
	Only for customers who have a CMA 3000 with the 015835XX V-Series Interface Option installed Requires SW version 3.20 or higher		
083362XX	**CMA 3000 FrontSim extensions**	V3.32 or higher	083101XX
	Only for customers who have a CMA 3000 with the 083101XX FrontSim Option installed		
	Note: XX = 00 Factory installed XX = 90 Field installed by customer. Please specify serial No of the target instrument		
	CMA 3000 Software Kits for Updating to Latest Release		
08309190	**WLD**		
	Please specify serial number of target instrument The SW is delivered on a CD-ROM		
08309195	**WLD**		
	Please specify serial number of target instrument The SW is delivered on a CD-ROM and on a USB memory stick		

Part Number	CMA 3000	Required Basic SW	Required P/N
	CMA 3000 Ethernet Software Kits for Updating to Latest Release		
08339590	**WLD**		
	Please specify serial number of target instrument The SW is delivered on a CD-ROM		
08339595	**WLD**		
	Please specify serial number of target instrument The SW is delivered on a CD-ROM and on a USB memory stick		
Note x1:	Software Updates		
	When issuing software updates for protocols to latest release, a software update fee will be charged.		
	Miscellaneous		
07030599	**Carrying Case - Full Size**		
	Has room for a CMA 3000 equipped with the 015870XX Ethernet 10/100/1000 Interface Testing option		
070306WW	**Softbag**		
	WW = 90: When ordered separately. WW = 99: When ordered together with an instrument.		
09108200	**CMA 3000 User's Guide (Latest Release)**		
09108700	**CMA 3000 Ethernet User's Guide (Latest Release)**		
84704100	**USB Memory stick (2 Gbytes)**		
01200100	**Li-Ion Battery**		
97600800	**Stylus for Touch Screen**		
01582600	**Mains Adapter without Mains Cable**		
01453098	**Power Cable for AC Mains - Europe**		
01453198	**Power Cable for AC Mains - Australia**		
01453298	**Power Cable for AC Mains - UK**		
01453398	**Power Cable for AC Mains - US**		
07030000	**Instrument Carrying Strap**		
0753102Y	**Stand-Alone Charger for Battery including Mains Adapter**		
	Y = 0: Europe - includes power cable 01453098 Y = 1: Australia - includes power cable 01453198 Y = 3: UK - includes power cable 01453298 Y = 4: USA - includes power cable 01453398		
01592500	**Car 12 Vdc adapter for CMA 3000**		
07530010	**Telephone Set**		
80701200	**Earphone**		
01467898	**Clock in/clock out cable**		
01474198	**USB extender cable (male to female) 1.8 m**		
01467990	**Network cable RJ45 male to RJ45 male - 3 m**		
01450298	**Balanced Cable (BNO to Crocodile Clips) 3 m**		
01459998	**Balanced Cable (BNO to Crocodile Clips - 20 dB attenuated) 3 m**		
01451098	**Balanced Cable (2*BNO to RJ45 Male/Female)**		
01453498	**Balanced Cable (BNO - Krone LSA 2 pol Break) 2 m**		
01453598	**Balanced Cable (BNO - Krone LSA 2 pol) 2 m**		
01453698	**Balanced Cable (BNO - Krone LSA 2 pol 20dB) 2m**		
01438798	**Balanced Cable (BNO to Bantam) 3 m**		
86500317	**BNO Connector for Own Cable Assembly**		
	Protocol Bundling		
083345XX	**Protocol Bundling Package No. 1 (5 protocols)**		
	Any combination of 5 protocols for one CMA instrument from the lists below EXCLUDING the 083062XX WLD - Motorola Mobis protocol and 083068XX WLD - GPRS Abis with Motorola PCU Frames. Please specify the 5 protocols		
083346XX	**Protocol Bundling Package No. 2 (10 protocols)**		
	Any combination of 10 protocols for one CMA instrument from the lists below EXCLUDING the 083062XX WLD - Motorola Mobis protocol and 083068XX WLD - GPRS Abis with Motorola PCU Frames. Please specify the 10 protocols		

Part Number	CMA 3000	Required Basic SW	Required P/N
	SW Delivery Options		
	When ordering field-installed SW options and protocols, one of the delivery options below must also be ordered. If nothing is specified, option 08399990 - Delivery on CD will be assumed. Only one delivery option is required per instrument.		
08399990	**SW is delivered on CD-ROM**		
08399995	**SW is delivered on a CD-ROM and on a USB memory stick**		
08399950	**The SW is delivered via E-mail. Please specify recipients E-mail address.**		
	VoIP Call Emulation SW Options for CMA 3000		
	Requires basic VoIP Functionality option 083354XX. Note: for one license for one instrument		
083355XX	**SIP call emulator option**	V3.40 or higher	083354XX
083357XX	**H.323 call emulator option**	V3.60 or higher	083354XX
083356XX	**Voice quality measurement option**	V3.40 or higher	083354XX 083355XX or 083357XX
	ISDN Call Emulation SW Options for CMA 3000		
	Requires basic ISDN protocol functionality option 083028XX. Note: for one license for one instrument		
083308XX	**WLD - ISDN DSS1 (Q.931) Call Emulation**	V3.10 or higher	083028XX
083309XX	**WLD - ETSI Euro ISDN Call Emulation**	V3.10 or higher	083028XX
083310XX	**WLD - QSIG Call Emulation**	V3.10 or higher	083028XX
083311XX	**France - VN6 Call Emulation**	V3.10 or higher	083028XX
083312XX	**Germany - 1TR6 Call Emulation**	V3.10 or higher	083028XX
083313XX	**UK - DPNSS Call Emulation**	V3.10 or higher	083028XX
083314XX	**UK - DASS-2 Call Emulation**	V3.10 or higher	083028XX
	SS7 Protocols		
	Requires basic SS7 protocol functionality 083027XX. Note: for one license for one instrument		
083031XX	**WLD - ETSI Core INAP CS1**		083027XX
083032XX	**WLD - ETSI Core INAP CS1 and CAMEL (CAP) ph2**		083027XX
083033XX	**WLD - CAP (CAMEL) v3**		083027XX
083034XX	**WLD - GSM Phase 2+ A interface**		083027XX
083035XX	**WLD - GSM Phase 2+ MAP**		083027XX
083036XX	**WLD - GSM Phase 2+ GPRS Gs interface**		083027XX
083037XX	**WLD - ITU-T White Book ISUP (R99) and ANS.1 Decoding of TCAP - OPC: 3-8-3**		083027XX
083038XX	**WLD - ITU-T White Book ISUP (R99) and ANS.1 Decoding of TCAP - OPC: in decimal**		083027XX
083039XX	**WLD - ITU-T Q.767**		083027XX
083126XX	**WLD - ITU-T Blue Book SS7**		083027XX
083040XX	**WLD - ETSI ISUP v3**		083027XX
083041XX	**WLD - ETSI ISUP v4**		083027XX
083042XX	**WLD-IS 41C with 24 bit OPC/DPC**		083027XX
083043XX	**WLD-IS 41C with 14 bit OPC/DPC**		083027XX
083044XX	**Brazil - Brazilian TUP and ISUP**		083027XX
083045XX	**China - White 24 bit SNM, SNT, SCCP, TCAP, TUP and ISUP**		083027XX
083046XX	**Czech - ISUP 2**		083027XX
083047XX	**France -TUP SSUTR2 VN7**		083027XX
083048XX	**France - SPIROU**		083027XX
083049XX	**France - SSURN**		083027XX
083050XX	**Germany - ETSI ISUP v.3 with AOC99**		083027XX
083051XX	**Greece - ISUP**		083027XX

Part Number	CMA 3000	Required Basic SW	Required P/N
083052XX	**Italy - ISUP and CS2**		083027XX
083053XX	**Mexico - Mexican ISUP**		083027XX
083054XX	**Poland - Polish ISUP v2**		083027XX
083055XX	**Russia - ISUP EOCC 12.3**		083027XX
083056XX	**UK - IUP and Enveloped ISUP (1999)**		083027XX
	Abis Protocols		
	Requires basic Abis interface and protocol functionality option 083026XX. Note: for one license for one instrument		
083057XX	**WLD - GSM900/DCS1800 Phase 2+ Abis**		083026XX
083058XX	**WLD - Ericsson GSM RBS 200**		083026XX
083059XX	**WLD - Ericsson GSM RBS 2000**		083026XX
083061XX	**WLD - Lucent LM 6.0 incl. Abis Phase 2+**		083026XX
083062XX	**WLD - Motorola GSM Mobis**		083026XX
083063XX	**WLD - Motorola GSM Mobis**		083026XX
	Only when customer is Motorola.		083026XX
083064XX	**WLD - Nokia Abis O&M**		083026XX
083065XX	**WLD - Siemens Abis O&M and GSM Phase 2+**		083026XX
	GPRS Abis Protocols		
	Requires basic Abis interface and protocol functionality option 083026XX. Note: for one license for one instrument		
083066XX	**WLD - GPRS Abis with Ericsson PCU Frames**		083026XX
083067XX	**WLD - GPRS Abis with Lucent PCU Frames**		083026XX
083068XX	**WLD - GPRS Abis with Motorola PCU Frames**		083026XX
083069XX	**WLD - GPRS Abis with Motorola PCU Frames**		083026XX
	Only when customer is Motorola.		083026XX
083070XX	**WLD - GPRS Abis with Nokia PCU Frames**		083026XX
083071XX	**WLD - GPRS Abis with Nortel PCU Frames**		083026XX
083072XX	**WLD - GPRS Abis with Siemens PCU Frames**		083026XX
	ISDN Protocols		
	Requires basic ISDN protocol functionality option 083028XX. Note: for one license for one instrument		
083073XX	**WLD - EURO-ISDN (ETSI) including Supplementary Services and X.25**		083028XX
	This protocol also supports ITU-T Q.931		
083074XX	**WLD - QSIG**		083028XX
083075XX	**Australia - ISDN**		083028XX
083076XX	**France VN6 ISDN**		083028XX
083077XX	**Germany - 1TR6 ISDN**		083028XX
	Other Protocols		
	Requires basic ISDN protocol functionality option 083028XX Note: for one license for one instrument		
083078XX	**WLD - X.25 Modulus 8**		083028XX
083079XX	**WLD - X.25 Modulus 128**		083028XX
083080XX	**UK - DPNSS**		083028XX
083081XX	**UK - DASS-2**		083028XX
	Remote Subscriber		
	Requires basic ISDN protocol functionality option 083028XX Note: for one license for one instrument		
083082XX	**WLD - ETSI V5.1/5.2**		083028XX
	Note: XX = 00: Factory-installed. XX = 90: Field-installed by customer. Please specify serial number of the target instrument.		

Part Number	CMA 3000	Required Basic SW	Required P/N
	Extended Warranties		
	Anritsu provides a standard, one year warranty with each new instrument purchased at no additional charge. In addition, Anritsu also offers the following 1 year and 2 year Extended Warranty products. These products include all features and benefits of the standard warranty for an extended duration.		
00880738	**12 month Extended Warranty available for CMA 3000 not including Software.**		
00880739	**24 month Extended Warranty available for CMA 3000 not including Software.**		
	These programs are available at the time of initial instrument purchase or anytime throughout the warranty coverage period.		
	Maintenance Agreements		
	Anritsu provides a standard, one year warranty with each new instrument purchased at no additional charge. In addition, Anritsu also offers the following 1 year and 2 year Maintenance Agreement products. These products include all features and benefits of the standard warranty for an extended duration and automatic delivery of SW upgrades in the standard warranty period and the extension periods.		
00880625	**CMA 3000 12 Months Maintenance agreement**		
	Covers upgrades of basic instrument software and upgrades of purchased software options. The upgrades will be shipped automatically after release of new SW versions. It also includes 00880738 12 months extended HW warranty.		
00880626	**CMA 3000 24 Months Maintenance agreement**		
	Covers upgrades of basic instrument software and upgrades of purchased software options. The upgrades will be shipped automatically after release of new SW versions. It also includes 00880739 24 months extended HW warranty.		
	These programs are available at the time of initial instrument purchase or anytime throughout the warranty coverage period.		

Part Number	CMA 3000	Required Basic SW	Required P/N
	General Cables and Adaptors for CMA 3000 and Lite 3000/3000E		
01407490	**Coax Cable (1.6/5.6 male to 1.6/5.6 male)**		
01415998	**Coax Cable (BNC male to BNC male)**		
01427198	**Coax Cable (BNC male to BNC male) double shield**		
01413798	**Coax Cable (BNC male to 1.6/5.6 male)**		
01427090	**Coax Cable (1.6/5.6 male to 1.6/5.6 male) double shield**		
01416890	**Coax Cable (BNC male to open end)**		
01473298	**Coax Cable (BNC Male to M4 Ericsson Male)**		
01418698	**Coax Cable 20 dB Attenuation (BNC male to BNC male)**		
01436300	**Balanced Cable (BNO - BNO), 2,5 m**		
01436498	**Balanced Cable (BNO - 3-pin banana plug), 2,5 m**		
01458398	**Balanced Cable (BNO to 3 individual Banana Plugs), 2,5 m**		
01451098	**Balanced Cable (2*BNO to RJ45 male/female)**		
01468190	**Balanced Cable (2 x BNO Rx+Tx to D-Sub9)**		
01450298	**Balanced Cable (BNO to crocodile clips) 3 m**		
01459998	**Balanced Cable (BNO to Crocodile Clips - 20 dB attenuated) 3 m**		
01468098	**Balanced Cable (BNO - Krone LSA 2 pol Break) 6 m**		
01453498	**Balanced Cable (BNO - Krone LSA 2 pol Break) 2 m**		
01453598	**Balanced Cable (BNO - Krone LSA 2 pol) 2 m**		
01453698	**Balanced Cable (BNO-Krone LSA 2 pol 20dB) 2 m**		
01422990	**Cable Adaptor, 1.6/5.6 to balanced 120 Ohms/1200 Ohms**		
01423090	**Cable Adaptor, BNC to balanced 120 Ohms/1200 Ohms**		
86500317	**BNO Connector for Own Cable Assembly**		
01448398	**Cable, BNO to Open End**		
01407690	**Adapter Connector (1.6/5.6 male to BNC female)**		
01417990	**Adapter Connector (BNC male to 1.6/5.6 female)**		
01427998	**V.24 Interface Cable (9 pin to 9 pin)**		

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