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, unframed T1, 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.

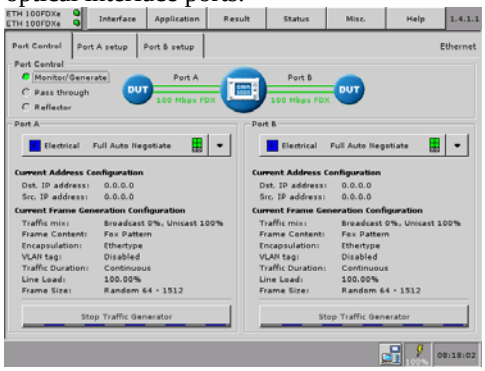

Fig. 1 The operation of the CMA 3000 is made easy through an intuitive graphical user interface.

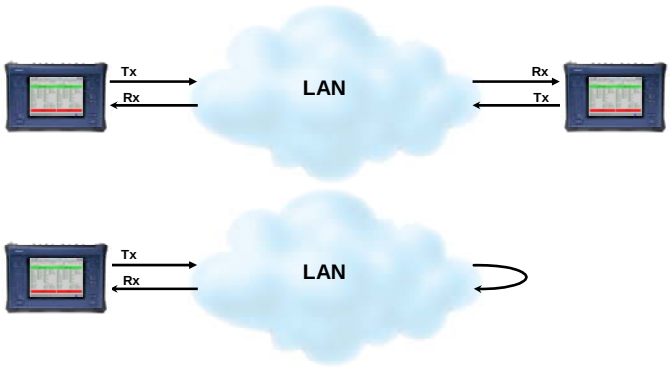

Fig. 2 Out-of-service testing with two instruments or a far-end loop back.

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
• Service Activation Test option
  o Service activation in accordance with ITU-T Y.1564
• Multistream test option
• Stacked VLAN test option
• MPLS test option
• Synchronous Ethernet test option
• VoIP test options
• IP channel statistics option
	• 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.

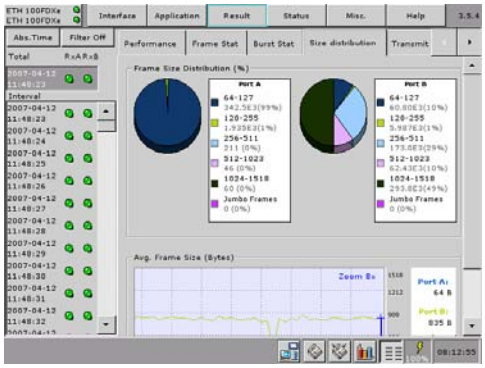

Fig. 3 Statistics are presented in tables and easy to understand graphs.

RFC 2544 analysis

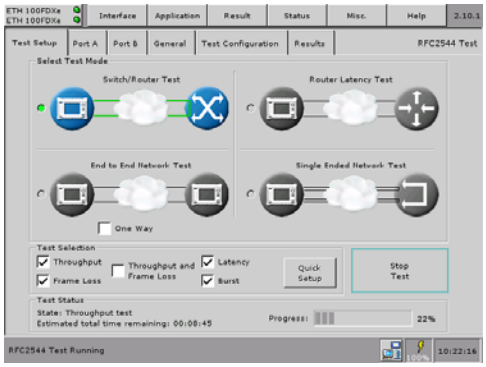

Fig. 4 Intuitive configuration of the RFC 2544 tests

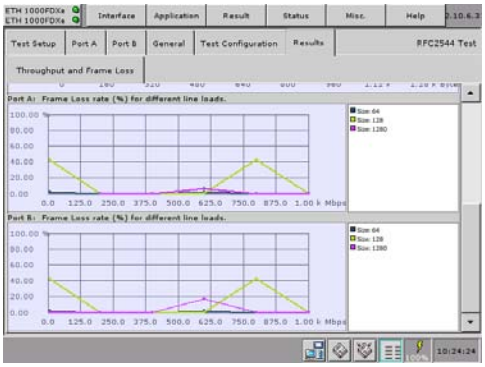

Fig. 5 CMA 3000 presents RFC 2544 results in graphs or tabular format

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 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.

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

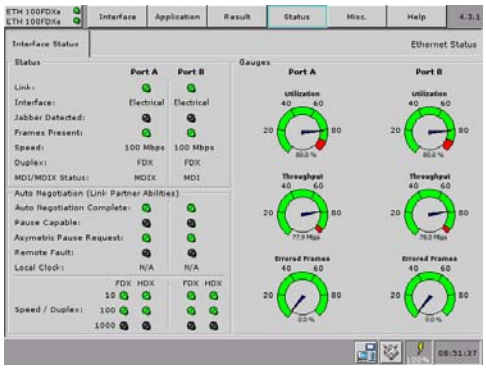

Fig. 6 Interface status indicators for a quick overview of the line's condition.

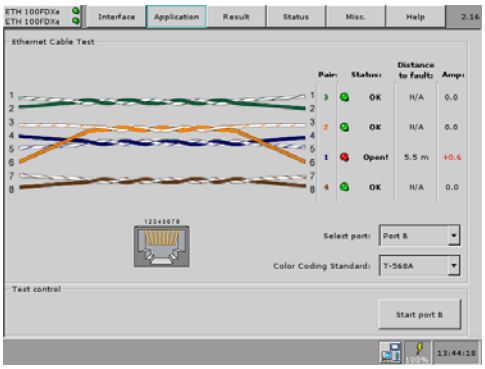

Fig. 7 The CMA 3000s cable test facility makes it easy to identify failures on electrical cables like short circuits or breaks of a wire pair. The cable test facility also indicates the distance from the instrument to the fault.

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.

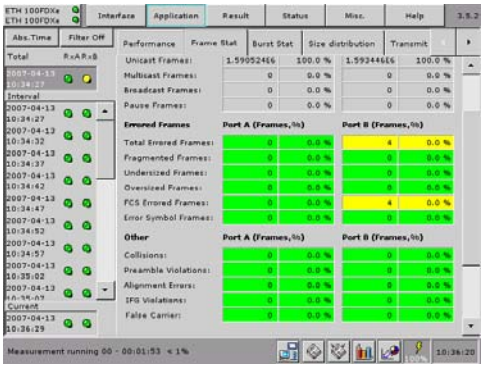

Fig. 8 Tabular presentation of performance statistics.

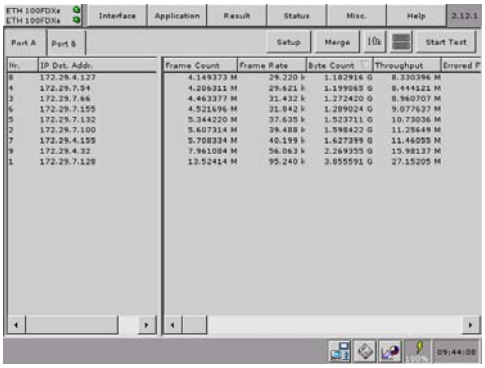

Fig. 9 IP traffic analysis with the IP channel statistics option..

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

Service Activation Test option

The wide deployment of Ethernet technology for many applications in the access and core of telecom networks has caused a need for new testing standards to be developed. Therefore ITU-T has defined a new recommendation Y.1564, which defines a new methodology for testing multiple Ethernet services simultaneously in a network. The recommendation is designed to allow service providers to assess customer end to end network performance. Y.1564 includes the combination of changing end user traffic profiles with multiple frame sizes and streams which require different traffic priorities through the network. The recommendation also defines testing multiple traffic streams (services) simultaneously, confirming the policing per stream, confirming the transfer time and jitter across the network and confirming the network can manage bursts of traffic for short durations.

The Ethernet Service Activation Test option for the CMA 3000 allows the user to conduct tests in accordance with Y.1564 for up to 8 services. The test is typically done with two CMA 3000s performing the Service Activation Test in a Local-Remote setup. It can however also be done with one unit and a far-end loop back device.

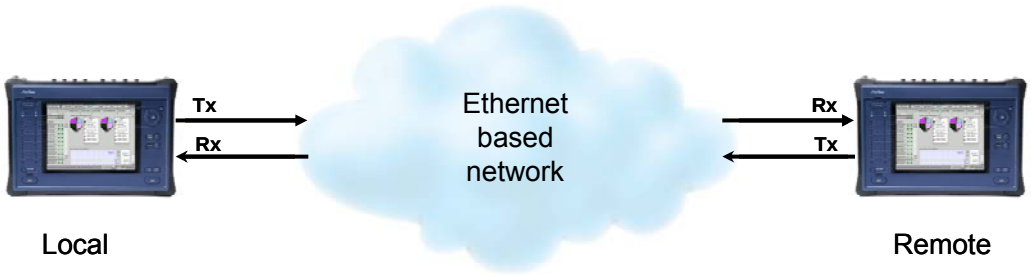

Fig. 10 Two CMA 3000s conducting a Service Activation Test in a Local-Remote setup.

When the service activation test is done in the Local-Remote setup with two CMA 3000s you control the test from the local instrument: It transfers relevant information to the remote unit and after the test is completed you can see results from both units on the local instrument. Easy to understand graphical symbols make it very fast to see if the tests passed. If further analysis is required the information presented can be expanded to show all details of each test.

For measurements of Frame Transfer Delay (FTD) between two CMA 3000s, a GPS add-on option can provide true one-way measurements of Frame Transfer Delay. The GPS option can synchronize the clocks of the two CMA 3000s involved in the measurement, when a GPS signal can be received at the test sites. If GPS synchronization can be achieved prior to moving the

units to the test sites the CMA 3000s will hold the synchronization for a period of time, allowing tests to be made with GPS synchronized instruments.

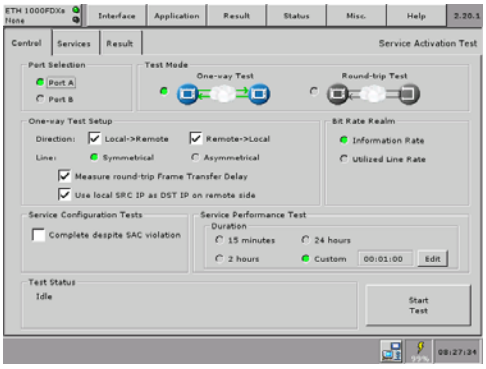

Fig. 11 It is easy to configure the Service Activation Test in the CMA 3000's intuitive User Interface

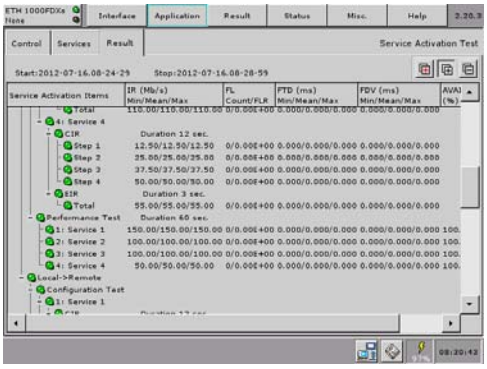

Fig. 12 The Service Activation Test screen gives easy to understand indications on pass/fail of each of the conducted tests.

Synchronous Ethernet Test option

Ethernet is today the dominant technology for data transmission, and legacy networks based on synchronous technology (PDH, SDH/SONET) migrate to packet-switched network based on Ethernet. However, the asynchronous nature of Ethernet provides certain transmission challenges as many existing networks have a strong requirement of frequency synchronization across the entire network. To support this requirement Synchronous Ethernet is introduced.
Two techniques are defined for Synchronous Ethernet:

- Physical synchronization signal forwarding as defined in ITU-T recommendations G.8261, G.8262 and G.8264 (in many cases this is now called SyncE)
- Protocol based synchronization as defined in IEEE1588 v2 (also known as the Precision Time Protocol PTP)

The Synchronous Ethernet Test option for the CMA 3000 allows the user to conduct Test and analysis of both technologies SyncE (ITU-T G.826x) and of IEEE 1588 v2 (PTP) including ITU-T G.8265.1 IEEE 1588 v2 profile for telecommunication. It can be installed on instruments equipped with the Ethernet 10/100/1000 Mbps interface measurement option.

The SyncE (ITU-T G.826x) functionality includes detection and generation of G.826x Synchronization Status Messages (SSM) for verification of the SyncE network. An alarm will indicate if SSMs are not detected. For detailed analysis the instrument can log SSMs for transfer to a PC via the FrontSim option for decode with Wireshark.

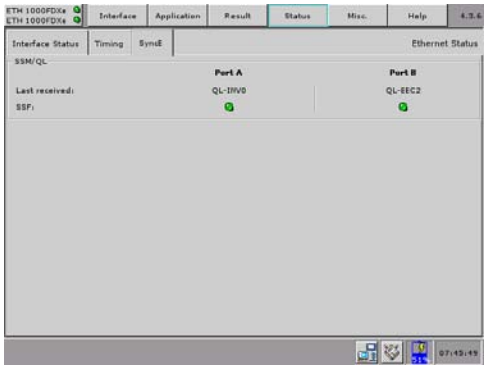

Fig. 13 Read out of the current QL value from the received SSM messages

Fig. 14 Comprehensive statistics on SSM QL messages and values

The IEEE 1588 v2 (PTP) functionality includes the CMA 3000 to act as a master using the internal instrument clock or a GPS signal (when present) as clock source. Alternatively the instrument can act in slave mode, including choosing the best master wall clock and constantly adjusting the clock. During a test the user will get comprehensive statistics on IEEE 1588 v2. An alarm is generated if synchronization messages are not received within a certain time.

Fig. 15 Comprehensive IEEE 1588 v2 statistics on offset and offset variance, path delay variation, messages and clock state transitions.

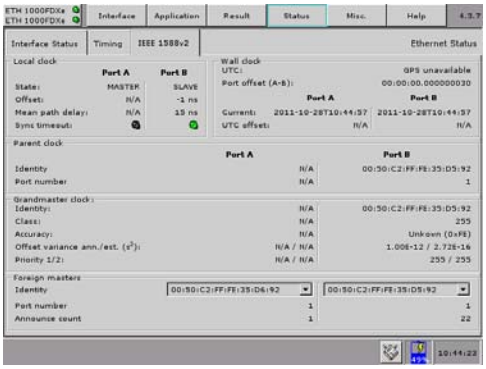

Fig. 16 Detailed information on IEEE 1588 v2 clock status

For quick analysis and troubleshooting of the IEEE 1588 v2 (PTP) signaling the CMA 3000 can log information on the transferred messages and present in on the built-in screen. For detailed analysis the instrument can log PTP message for transfer to a PC via the FrontSim option for decode with Wireshark.

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.

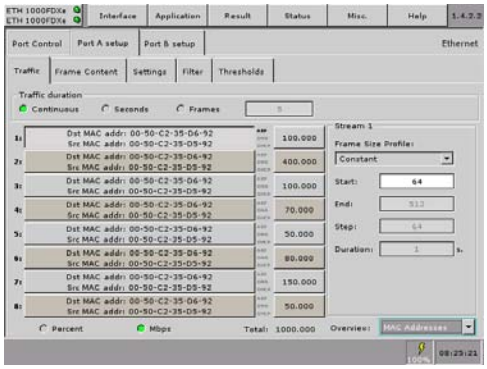

Fig. 17 The CMA 3000 gives an easy overview of the up to 8 streams that it can generate.

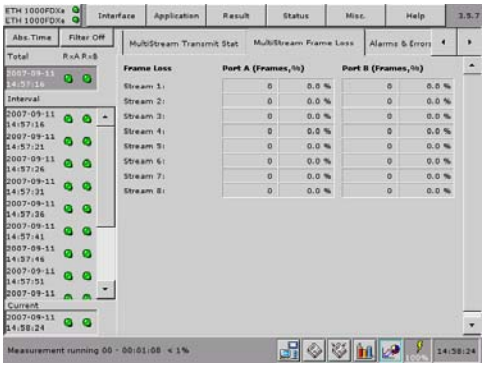

Fig. 18 Information on frame loss in shown for up to 8 streams in one screen to make it easy to compare how the streams are transported through the network.

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.

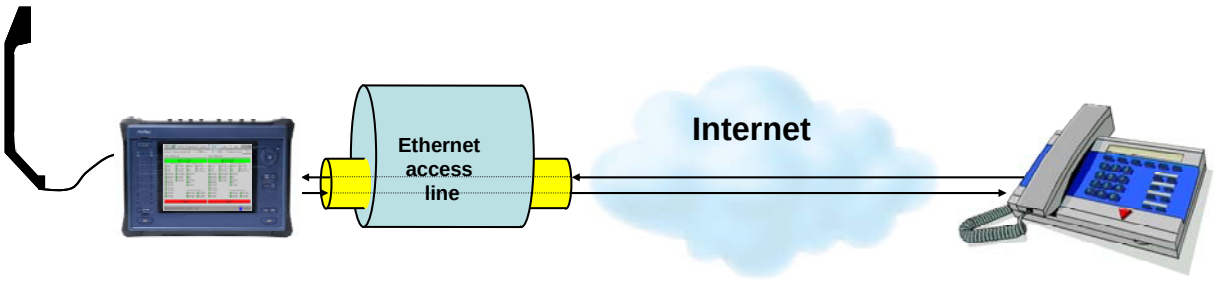

Fig. 19 Basic VoIP connectivity is verified by calling another party using the CMA 3000's VoIP functionality.

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. 20 **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.

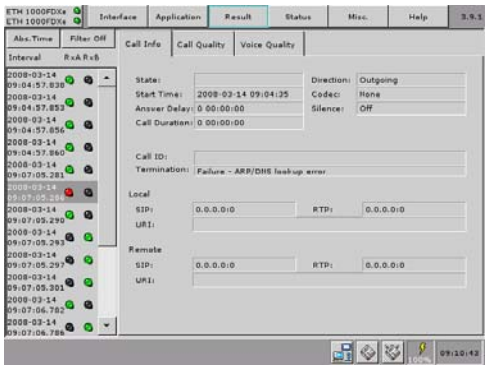

Fig. 21 VoIP call records are stored in memory when a measurement is active. Unsuccessful calls are highlighted with a red indicator in the left column.

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.

<table>
<tr><th colspan="6">Ethernet test interfaces</th></tr>
<tr><td>Hardware option built into basic instrument</td><td colspan="5">• Electrical line interfaces 2 ports 10/100Mbps RJ45 (unshielded and shielded twisted pair cables, category 5, 5E, and 6) FDX and HDX operation</td></tr>
<tr><td>Hardware option attached to basic instrument</td><td colspan="5">• 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):</td></tr>
<tr><td></td><td>Description
(approx. distance)</td><td colspan="2">Min. input sensitivity and wavelength</td><td colspan="2">Output power and wavelength</td></tr>
<tr><td></td><td>1000BASE-SX 850 nm
Multi mode (0.5 km)</td><td>- 17 dBm</td><td>Min. 770 nm
Max. 860 nm</td><td>Between - 9,5 dBm and - 3 dBm</td><td>Between 830 nm and 860 nm</td></tr>
<tr><td></td><td>1000BASE-LX 1310 nm
Single mode (10 km)</td><td>- 20 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 9 dBm and - 3 dBm</td><td>Between 1285 nm and 1343 nm</td></tr>
<tr><td></td><td>1000BASE-ZX 1550 nm
Single mode (80 km)</td><td>- 24 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between 0 dBm and 5 dBm</td><td>Between 1500 nm and 1580 nm</td></tr>
<tr><td></td><td>100BASE-FX 1310 nm
Multi mode (2 km)</td><td>- 31 dBm</td><td>Min. 1260 nm
Max. 1570 nm</td><td>Between - 20 dBm and - 14 dBm</td><td>Between 1270 nm and 1335 nm</td></tr>
<tr><td></td><td>100BASE-LX 1310 nm
Single mode (10 km)</td><td>- 28 dBm</td><td>Min. 1260 nm
Max. 1570 nm</td><td>Between - 15 dBm and - 8 dBm</td><td>Between 1270 nm and 1335 nm</td></tr>
<tr><td></td><td colspan="5">Note: 100BASE modules are Gigabit Ethernet port converter modules to 100BASE optical</td></tr>
<tr><td>Test configurations</td><td colspan="5">• Monitor/generate
• Pass-through
• Reflector</td></tr>
<tr><th colspan="6">Ethernet measurements</th></tr>
<tr><td>Supported encapsulations (frame formats)</td><td colspan="5">• EtherType II (DIX v.2)
• IEEE 802.3 with 802.2 (LLC1)
• IEEE 802.3 with SNAP</td></tr>
<tr><td>Traffic generation</td><td colspan="5">• 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)</td></tr>
</table>

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

Service Activation Test option	
Service Activation Test	Service Activation Test in accordance with ITU-T recommendation Y.1564 • Test up to 8 services • Color-Aware and Non-Color-Aware in combinations (IP DSCP or VLAN PCP) • Supported Ethernet interfaces: 1 Gbps, 100 Mbps,10 Mbps • Test modes: One-way (uni- or bi-directional, symmetrical or asymmetrical), Round-trip • Test port: A or B • Verification against Service Acceptance Criteria: Information Rate, Frame Transfer Delay, Frame Delay Variation, Frame Loss Rate, Availability Optional GPS timing synchronization
Service Configuration Test	• Subtests for: Committed Information Rate, Excess Information Rate, Traffic Policing, Committed Burst Size, Excess Burst Size • Step duration: 1 sec to 60 sec (user programmable) • Number of steps: 1 to 10 (user programmable) • Slope: rising or falling • Results: Pass/Fail indication, IR (Min/Mean/Max), FL (Count/FLR), FTD and FDV (Min/Mean/Max/ Current (during measurement))
Service Performance Test	• All services tested simultaneously at CIR • Duration 15 min, 2 hours, 24 hours or user programmable • Results: Pass/Fail indication, IR (Min/Mean/Max), FL (Count/FLR), FTD and FDV (Min/Mean/Max/ Current (during measurement)), AVAIL (%), Unavail (sec)

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

Synchronous Ethernet Test option (requires Ethernet 10/100/1000 Mbps interface measurement option)	
SyncE (G.826x) functionality:	Specify quality level (QL) of the transmitted Ethernet signal. Analysis of QL indicated in received Ethernet signal. An alarm is raised on missing QL indications. SyncE results: SSM Rx count and rate, SSM Tx count, Indicated QL statistics and SSF seconds. ESMC messages can be captured and exported in a Wireshark compatible format with the FrontSim option. In pass-through mode, the quality level indicated in ESMC messages can be changed on the fly to a given value in both directions independently.
IEEE 1588v2 functionality	Each port of the Ethernet interface can act as a timing master or a timing slave independently. Supported modes: Multicast (native PTP) and Unicast (G.8265.1). When acting as master in Unicast (G.8265.1) mode one slave is accepted at a time; other slaves are ignored. If the slave requires 32, 64, or 128 Sync messages per second the IEEE 1588-2008 paragraph 7.7.2.1 concerning 90% confidence interval is not followed. Configurable parameters (per port): Clock identity, Port number, Priority 1. Priority 2, Domain number, Clock class, Slave only mode, Time source, Encapsulation, Announce receipt timeout, Clock accuracy, Clock step mode, Announce interval, Sync interval, Minimum delay request interval and Unicast duration. A UTC time offset to be used when acting as clock master can be specified. For G.8265.1: Support of stacked VLAN and MPLS (other options required). IEEE 1588 clock results: Clock state, Announce count, Sync count, Follow-up count, Delay request count, Delay response count, Delay follow-up count, Peer delay request/response/response-follow-up counters, Min-/max-/average offset, Min-/max-/average offset deviation, Min-/max-/average offset variance, Min-/max-/average mean path delay, Min-/max-/average peer mean path delay, Min-/max-/average path delay variance, Min-/max-/average path delay variation. With a GPS signal present the offset from UTC time is calculated. The offset time between the two clocks is always shown Parent clock results: Identity and Port number. Grand-master results: Identity, Class, Accuracy, Priority 1, Priority 2, Announced- and observed offset variance. Foreign master clock result (up to five clocks per port): Identity, Port number and Announce count. Logged IEEE 1588 events: Clock state transitions, State transition events, Faults and Changes in grand-master clock.

	IEEE 1588 messages can be captured and exported in a Wireshark compatible format using the FrontSim option. In pass-through mode the CMA 3000 acts as an end-to-end transparent clock in one-step mode.

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

- **United States**

Anritsu Company
1155 East Collins Blvd., Suite 100, Richardson,
TX 75081, U.S.A.
Toll Free: 1-800-267-4878
Phone: +1-972-644-1777
Fax: +1-972-671-1877

- **Canada**

Anritsu Electronics Ltd.
700 Silver Seven Road, Suite 120, Kanata,
Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

- **Brazil**

Anritsu Electrônica Ltda.
Praça Amadeu Amaral, 27 - 1 Andar
01327-010 – Bela Vista - São Paulo - SP - Brasil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

- **Mexico**

Anritsu Company, S.A. de C.V.
Av. Ejército Nacional No. 579 Piso 9, Col. Granada
11520 México, D.F., México
Phone: +52-55-1101-2370
Fax: +52-55-5254-3147

- **United Kingdom**

Anritsu EMEA Ltd.
200 Capability Green, Luton, Bedfordshire LU1 3LU, U.K.
Phone: +44-1582-433200
Fax: +44-1582-731303

- **France**

Anritsu S.A.
12 avenue du Québec, Batiment Iris 1-Silic 612,
91140 VILLEBON SUR YVETTE, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

- **Germany**

Anritsu GmbH
Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49-89-442308-0
Fax: +49-89-442308-55

- **Italy**

Anritsu S.r.l.
Via Elio Vittorini, 129, 00144 Roma, Italy
Phone: +39-6-509-9711
Fax: +39-6-502-2425

- **Sweden**

Anritsu AB
Borgarfjordsgatan 13A, 164 40 KISTA, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

- **Finland**

Anritsu AB
Teknobulevardi 3-5, FI-01530 VANTAA, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

- **Denmark**

Anritsu A/S (Service Assurance)
Anritsu AB (Test & Measurement)
Kay Fiskers Plads 9, 2300 Copenhagen S, Denmark
Phone: +45-7211-2200
Fax: +45-7211-2210

- **Russia**

Anritsu EMEA Ltd.
Representation Office in Russia
Tverskaya str. 16/2, bld. 1, 7th floor.
Russia, 125009, Moscow
Phone: +7-495-363-1694
Fax: +7-495-935-8962

- **United Arab Emirates**

Anritsu EMEA Ltd.
Dubai Liaison Office
PO Box 500413 - Dubai Internet City
Al Thuraya Building, Tower 1, Suit 701, 7th Floor
Dubai, United Arab Emirates
Phone: +971-4-3670352
Fax: +971-4-3688460

- **Singapore**

Anritsu Pte. Ltd.
60 Alexandra Terrace, #02-08, The Comtech (Lobby A)
Singapore 118502
Phone: +65-6282-2400
Fax: +65-6282-2533

- **India**

Anritsu Pte. Ltd.
India Branch Office
2nd & 3rd Floor, #837/1, Binnamangla 1st Stage,
Indiranagar, 100ft Road, Bangalore - 560038, India
Phone: +91-80-4058-1300
Fax: +91-80-4058-1301

- **P.R. China (Shanghai)**

Anritsu (China) Co., Ltd.
Room 1715, Tower A CITY CENTER of Shanghai,
No. 100 Zunyi Road, Chang Ning District,
Shanghai 200051, P.R. China
Phone: +86-21-6237-0898
Fax: +86-21-6237-0899

- **P.R. China (Hong Kong)**

Anritsu Company Ltd.
Unit 1006-7, 10/F., Greenfield Tower, Concordia Plaza,
No. 1 Science Museum Road, Tsim Sha Tsui East,
Kowloon, Hong Kong, P.R. China
Phone: +852-2301-4980
Fax: +852-2301-3545

- **Japan**

Anritsu Corporation
8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016 Japan
Phone: +81-46-296-1221
Fax: +81-46-296-1238

- **Korea**

Anritsu Corporation, Ltd.
502, 5FL H-Square N B/D, 681
Sampyeong-dong, Bundang-gu, Seongnam-si,
Gyeonggi-do, 463-400, Korea
Phone: +82-31-696-7750
Fax: +82-31-696-7751

- **Australia**

Anritsu Pty. Ltd.
Unit 21/270 Ferntree Gully Road, Notting Hill,
Victoria 3168, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

- **Taiwan**

Anritsu Company Inc.
7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817