Product Introduction

MU909060A1/A2/A3
Gigabit Ethernet Tester

Network Master Series
MT9090A Mainframe
Network Master Gigabit Ethernet Tester

Dedicated field test solution for installation and troubleshooting Ethernet links in the access network and mobile backhaul
Network Master Gigabit Ethernet Tester

Purpose-built for Testing Ethernet Links.

- Perfect solution for installation and commissioning of Ethernet links
  - Compact and handy
- Easy to use
  - Large color screen
  - Test Automator
- Electrical cable test
- Ping test
- Bandwidth verification (RFC2544 and Y.1564 option)
- BER testing
- Traffic generation and reception
- Multistream (option)
- Document your work with PDF and CSV reports
Network Master Gigabit Ethernet Tester

Designed For Highly Portable Field Use.

- Modular
  - Field interchangeable modules
- Highly portable
  - Palm-size (190 mm x 98 mm x 48 mm)
  - Only 700 g
- Rugged/Sealed design
  - No vents or fans
  - Connector port cover
- 4.3 inch, high resolution color display
  - Easy to read indoors or out
- Dual battery operation
  - Rechargeable NiMH or "AA" alkaline

Available 4 x AA Type NiMH or Alkaline Dry Batteries
Network Master Gigabit Ethernet Tester

Target Market
- Mobile backhaul and Carrier Class Ethernet

<table>
<thead>
<tr>
<th>Cell Sites</th>
<th>Mobile Backhaul</th>
<th>Backbone</th>
</tr>
</thead>
<tbody>
<tr>
<td>2G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3G</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>4G</td>
<td>RF over Fiber</td>
<td></td>
</tr>
</tbody>
</table>

- Base Station Node B
- T1/E1
- Central Office
- SDH/SONET
- BSC
- RNC
- Ethernet
- Carrier Class Ethernet

Optical Test MT9090A DCFL
Optical Test MT9090A OCA
Optical Fiber Test MT9090A u-OTDR
Ethernet Test MT9090A GigE

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Applications – out-of-service testing.

- Typical applications:
  - Installation and commissioning testing.
  - QoS verification
  - End-to-end testing

MT9090A has two ports and work simultaneously. It can decrease multi ports deployment.
Applications – in-service testing.

- Typical applications with instrument in pass through mode:
  - Rapid in-service diagnostics
  - In-service troubleshooting
  - Live traffic analysis and statistics

MT9090A has two ports and work for pass through monitoring.
Applications – Loop-back device.

- Far end loop back for applications like:
  - Installation and commissioning testing.
  - QoS verification
  - End-to-end testing
- Instrument in reflector mode

Reflectors, send back the received streams. IP and MAC address can be swapped.

MT9090A in reflector mode
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VALUE...without compromise!

- Cost-effective installation and maintenance tool
  - Soft case, manual, charger, battery are standard
  - Complete Ethernet tester with attractive price

- User configurable (modular) platform
  - 3 configurations
  - Optional SFP modules
  - SW options

- Complete data management
  - Automatic result saving
  - Internal storage of results
  - Easy “drag and drop” transfers to PC
  - Data management via Ethernet and Web browser
  - Reporting in PDF and CSV format

MU909060A1
Ports: 1xRJ45, 1x SFP
Highlights: - For mixed networks (Optical and Electrical interfaces) - Cost effective

MU909060A2
Ports: 2xRJ45
Highlights: - Electrical interfaces only

MU909060A3
Ports: 2xSFP
Highlights: - Optical and Electrical interfaces
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Test Automator

- Easy and quick execution of a series of tests
- Pass/fail indicators makes it easy to use for any skill level, reducing the need for training.
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Channel Stats

- Identifying the root cause of network issues,
  - Filter streams and monitor up to 63 streams,
    - Errored streams,
    - Top talkers,
    - Network attack.
  - Select up to three Filter keys,
    - MAC/IP address,
    - VLAN tag,
    - MPLS label,
    - TCP/UDP port,
    - An more.
- Monitoring values,
  - Frames,
  - Errored frames,
  - Frame size distribution.
ITU-T Y.1564

- New methodology to test multiple Ethernet services simultaneously in a network (optional)
- RFC 2544 is the standard commonly used today
  - Originally designed for checking performance of a network device
  - Runs one service at a time,
    - Tests in a serial manner not running all services simultaneously

Comparison of test methodology

<table>
<thead>
<tr>
<th>Item</th>
<th>ITU-T Y.1564</th>
<th>RFC 2544</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed for</td>
<td>Service activation</td>
<td>Devices performance</td>
</tr>
<tr>
<td>Concurrent services</td>
<td>Multiple services simultaneously</td>
<td>One service at a time</td>
</tr>
<tr>
<td>Simulates</td>
<td>A realistic network</td>
<td>One service in a network</td>
</tr>
<tr>
<td>Testing time</td>
<td>Short due to simultaneous test / service</td>
<td>Long due to serial nature of test (assuming completed per full standard)</td>
</tr>
<tr>
<td>Test result</td>
<td>Directly related to SLA requirements</td>
<td>Link performance limit</td>
</tr>
</tbody>
</table>
ITU-T Y.1564
- ITU-T Y.1564 completes the testing in two phases
  - **Service Configuration Test**
    - Confirm each individual service is configured correctly checking, CIR (Committed Information Rate), EIR (Excess Information Rate), FTD (Frame Transfer Delay), FDV (Frame Delay Variation), FLR (Frame Loss Ratio), CBS (Committed Burst Size), EBS (Excess Burst Size).
  - **Service Performance Test**
    - Transmits one or many Service Configuration Tests simultaneously at the CIR confirming all traffic is able to traverse the network under the full service load over time.

RFC 2544 completes tests one after another.

Y.1564 completes a quick per service test followed by the performance test.

Note: to scale - Y.1564 spaced for graphical representation Time
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**ITU-T Y.1564**
- Up to 32 services supported
- 3GPP TS 23.203 defines 9 kinds of QoS Class. MT9090A can simultaneously perform testing on all classes of service.

3GPP TS 23.203 Standardized QoS Class Identifier (QCI) characteristics

<table>
<thead>
<tr>
<th>QCI</th>
<th>Resource Type</th>
<th>Priority</th>
<th>Packet Delay Budget</th>
<th>Packet Error Loss Rate</th>
<th>Example Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GBR</td>
<td>2</td>
<td>100 ms</td>
<td>10^{-2}</td>
<td>Conversational Voice</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>4</td>
<td>150 ms</td>
<td>10^{-3}</td>
<td>Conversational Video (Live Streaming)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3</td>
<td>50 ms</td>
<td>10^{-3}</td>
<td>Real Time Gaming</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5</td>
<td>300 ms</td>
<td>10^{-6}</td>
<td>Non-Conversational Video (Buffered Streaming)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1</td>
<td>100 ms</td>
<td>10^{-6}</td>
<td>IMS Signalling</td>
</tr>
<tr>
<td>6</td>
<td>Non-GBR</td>
<td>6</td>
<td>300 ms</td>
<td>10^{-6}</td>
<td>Video (Buffered Streaming)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>7</td>
<td>100 ms</td>
<td>10^{-3}</td>
<td>Voice, Video (Live Streaming) Interactive Gaming</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>8</td>
<td>300 ms</td>
<td>10^{-6}</td>
<td>Video (Buffered Streaming)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)</td>
</tr>
</tbody>
</table>
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ITU-T Y.1564

- MX909060A ITU-T Y.1564 parameters setup tool
  - Create or modify the configuration for the Y.1564 testing on a PC
  - Overview all of parameters in a PC display screen.
  - Copy and paste the services

- Provided with MU909060Ax-007 Y.1564 test option
IEEE 802.1ad

- Stacked VLAN or QinQ support *(optional)*,
  - The IEEE 802.1ad standard defines VLAN, *(IEEE 802.1q)* VLAN stacked inside VLAN's,
  - MT9090 GigE allows three layers of VLAN's.
- Configure RFC2544 *(optional)* within a stacked VLAN,
- Configure a single stream or MultiStream *(optional)* within stacked VLAN,
- View results relative to VLAN's
  - Untagged frames,
  - Single VLAN frames,
  - Multiple VLAN frames.
- Apply filters based on stacked VLAN's.

*Image of interface with VLAN and IP settings*
MPLS Tagging

- Support for MPLS labels (optional),
  - The IETF maintain this standard,
  - MT9090 GigE allows three layers of label tags.
- Configure RFC2544 (optional) within a MPLS labels,
- Configure a single stream or MultiStream (optional) within MPLS labels,
- View results relative to MPLS labels,
  - Single MPLS frames,
  - Multiple MPLS frames.
- Apply filters based on MPLS labels.
ISO layer 6 support

- Support HTTP and FTP transfers,
  - Tests the download speed via HTTP or FTP.
  - Full line rate measurement ability (assuming server capable of it),
- Simple one ended test to allow the user to quickly understand network download limits,
  - Able to connect to standard FTP or HTTP server,
  - Single end single engineer test, offering quick proof of network speed for the Telecom operators customer.
SDT time

- **Service Disruption Time (SDT),**
  - Measuring the time between frames looking for larger gaps than normal in the traffic flow and the configured thresholds.
  - Network quality for time-severe streams like voice and video can be measured.
  - Total time of SDT and the number of the counted gaps displayed.

- $T_{gap} < T_{SDTT}$
- $T_{gap} \geq T_{SDTT}$
- $T_{gap} < T_{SDTT}$
- $T_{gap} \geq T_{SDTT}$
- $T_{gap} \geq T_{SDT}$

Test Frame

TSDTT: Threshold to count $T_{gap}$ as SDT

SDT: Time gap between test frames

Tgap: Time gap between test frames
Thresholds

- Set alarm levels on the unit,
  - Configure thresholds for different areas including,
    - Frame rate,
    - Utilization,
    - Throughput,
    - Errors,
    - Frame loss,
    - SDT.
- Results shown,
  - During the test graphically with green or red lines indicating the settings,
  - In the overview window with Pass Fail results.
  - Exceeded thresholds are recorded in the Event log.
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Trace Route

- Trace to an end IP address viewing all IP addresses it passes to reach the end destination,
  - Configure,
    - Number or attempts per IP,
    - Maximum number of hops,
    - Number of pings per host,
    - Timeout per ping.
- Results are seen for each host passed, the number of received and lost pings to/from each host.
- A quick simple and effective way to find the location of network failure.
Remote GUI and Language support

- Remote control the unit via any PC (Option),
  - No software required on the PC,
  - Connect via web browser to the MT9090 GigE,
    - Uses port 80 to initiate the connection.
  - Control the unit as if it's sitting in front of you,
    - MT9090 GigE appears on your PC including control buttons,
    - Control the unit using buttons and menu's the same as the actual unit,
  - Upload configuration settings from the PC to the MT9090 GigE,
  - Download results files and reports from the MT9090 GigE to your PC.

- Expanded Language support including,
  - English, Italian, Chinese (Simplified & Traditional), Portuguese, Spanish, German, Korean and French and Japanese
Network Master Gigabit Ethernet Tester

Technical details

- **Interfaces**
  - 10/100/1000 Mbps Electrical, 100/1000 Mbps Optical
  - FDX / HDX (10/100 El.)

- **Modes**
  - Ethernet – general Ethernet tester
  - Reflector – act as loop-back device for another tester
  - Pass Through mode – live traffic analysis

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

- **VLAN tagging**

- **Configurable Ethernet (MAC) and IP source and destination addresses (supports IPv4 and IPv6), UDP/TCP port numbers and DSCP/TOS byte**
Check connection

- Status screens
  - Give quick overview on:
    - Port status
    - Autonegotiate results
    - IP addresses used
    - Optical modules:
      - Tx and Rx levels
      - Wavelength
      - Max. reach from Tx
      - Ethernet compliance
      - Vendor name
Network Master Gigabit Ethernet Tester

Cable test feature for electrical Ethernet. (MU909060A1/A2)

- Some problems on an electrical Ethernet connection are basic:
  - Short circuits of a wire pair
  - Breaks of a wire pair
- The cable test facility makes it easy to identify such failures.
- The cable test facility also indicates the distance from the instrument to the fault

<table>
<thead>
<tr>
<th>Pair</th>
<th>Pin Status</th>
<th>Rx/Tx</th>
<th>Polarity</th>
<th>Length (m)</th>
<th>Amp</th>
<th>Skew (ns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1/2</td>
<td>Open</td>
<td>.</td>
<td>2.4</td>
<td>0.86</td>
<td>.</td>
</tr>
<tr>
<td>2</td>
<td>3/6</td>
<td>Open</td>
<td>.</td>
<td>3.2</td>
<td>0.86</td>
<td>.</td>
</tr>
<tr>
<td>1</td>
<td>4/5</td>
<td>Open</td>
<td>.</td>
<td>3.2</td>
<td>0.86</td>
<td>.</td>
</tr>
<tr>
<td>4</td>
<td>7/8</td>
<td>Open</td>
<td>.</td>
<td>2.4</td>
<td>0.86</td>
<td>.</td>
</tr>
</tbody>
</table>
Ping test

- Ping test applications
  - Installation and commissioning
  - Troubleshooting and maintenance
- Well-known tool for testing:
  - Continuity
  - Connectivity
  - Response time
RFC 2544 Test option

- RFC 2544 defines tests to be used for describing the performance characteristics of these network devices
- Typically used for bringing into service
- Tests include measurement of:
  - Throughput
  - Frame Loss
  - Latency
  - Packet jitter
  - Burstability
Layered throughput analysis

- User selects layer for which throughput is calculated
  - To get throughput as perceived by a customer

<table>
<thead>
<tr>
<th>Frame representation</th>
<th>Throughput Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFG</td>
<td>Data Layer</td>
</tr>
<tr>
<td>Preamble</td>
<td>MAC header</td>
</tr>
<tr>
<td>VLAN (opt)</td>
<td>LLC (opt)</td>
</tr>
<tr>
<td>SNAP (opt)</td>
<td>IP head</td>
</tr>
<tr>
<td>UDP</td>
<td>TCP</td>
</tr>
<tr>
<td>PAYLOAD</td>
<td>CRC</td>
</tr>
</tbody>
</table>

Included in throughput calculation

UDP or TCP must be activated

Physical layer
- Physical layer (w/out preamble)
- Link layer
- Network layer
- Data layer

Throughput Type: Average
Packet jitter measurement

- Packet jitter and latency can be a significant problem for services like Voice over IP.
- Packet jitter can be measured in the RFC 2544 tests together with latency.
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RFC 2544 Router Latency test

- Network layer latency testing from the Network Master without use of a reflector
- Based on ping requests

![Latency Test Table]

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Discover What’s Possible™
Why the RFC 2544 end-to-end test?

- Typical test setup with one instrument and reflection or loop-back is OK for symmetrical links:

- For Ethernet links carried over asymmetrical connections (xDSL, WIMAX) throughput tests will only reflect the performance of the direction of the link with lowest capacity.

- For symmetrical the typical test setup will not identify transmission performance differences between the two directions in a link.
RFC 2544 end-to-end test

- RFC 2544 end-to-end test with master/slave relation
  - Needed for test of Ethernet links carried over asymmetrical connections
  - Will identify transmission performance differences between the two directions in a link
  - The user sets up the test in the master instrument which exchanges setup and result with the remote slave instrument.
  - Test of Throughput, Frame Loss and Burstability
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RFC 2544 setup

- Graphical overview of the selected test mode
  - Throughput and Burst tests:
    - Switch/Router test
    - Single-ended network test
    - End-to-end
  - Latency tests:
    - Switch/Router test
    - Single-ended network test
    - Router latency
- Versatile test condition setup – supports from very thorough testing to fast testing with a limited number of conditions
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BER tests

- Traditional test of physical connection
- Generation and detection of test patterns
  - Framed with IP header and maybe UDP/TCP header
  - Count of errors in received test pattern
- Unframed
- Count of:
  - Pattern errors
  - Sequence errors
  - Loss of sequence synchronization.
  - Frame loss
  - Frame loss seconds
- Errors or alarms may be inserted into the test traffic

<table>
<thead>
<tr>
<th>BERT 1</th>
<th>Off</th>
<th>14:16:34</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern Bit Count</td>
<td>7.04386 G</td>
<td></td>
</tr>
<tr>
<td>Pattern Errors</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pattern Errors(%)</td>
<td>0.00000</td>
<td></td>
</tr>
<tr>
<td>Seq. Errors</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Seq. Sync. Lost</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Frame Loss</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Frame Loss Seconds</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Generator/Monitor tests

- Generation of Ethernet traffic
- Configuration of streams if multistream option is installed
- Monitor-only for analyzing live traffic
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**Ethernet Summary**

- **Statistics:**
  - Total frames
  - Unicast, Multicast
  - Broadcast breakdown
  - Frames with various errors

- **Event log**
  - Information on major events during the execution of a test sequence

![Statistics Table]

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:07:16</td>
<td>Ping test started</td>
</tr>
<tr>
<td>14:07:53</td>
<td>Ping test stopped</td>
</tr>
<tr>
<td>14:07:53</td>
<td>RFC2544 Throughput test started</td>
</tr>
<tr>
<td>14:08:23</td>
<td>RFC2544 Throughput test stopped</td>
</tr>
<tr>
<td>14:08:23</td>
<td>RFC2544 Latency test started</td>
</tr>
<tr>
<td>14:08:53</td>
<td>RFC2544 Latency test stopped</td>
</tr>
<tr>
<td>14:08:53</td>
<td>BERT test started</td>
</tr>
<tr>
<td>14:06:15</td>
<td>BERT test stopped</td>
</tr>
<tr>
<td>14:09:17</td>
<td>Mon Feb 09 2009 Test stopped</td>
</tr>
</tbody>
</table>
Multistream option

- With Multistream option, the instrument can generate up to 8 streams on the Ethernet link.
- Individual settings of traffic load and header information for the streams, including VLAN priority, DSCP/TOS byte and TCP/UDP port numbers for each stream.
Multistream option

- With Multistream option, the instrument shows frame loss for the defined up to 8 streams making it easy to see if high priority traffic has lower frame loss than low priority traffic.
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Report generation (PDF and CSV)

- PDF: De facto standard document format
- Customer logo can be inserted
- Comments on the test can be added
- CSV: Easily editable format
Internal Storage

- Save and Load Setups
- Load Results
  - Results are automatically saved when a test stops
- Print screen
- Mass Storage Functions
  - Select location
    - Internal or USB
  - File operations
    - Copy
    - Delete
    - Rename
    - Create folders
- Integrated soft keyboard for entering of text/names
- Storage of PDF reports
Visual Inspection Probe

- Inspection microscope for optical fiber connectors
- 75% of network failure comes from poor connector quality
- All software pre-loaded in MT9090A

Option-545 VIP
- 5 kinds of tips with the scope
- 200x or 400x images displayed

G0293A VIP Lite
- 8 kinds of tips are with the scope
- 400x images displayed
Weighing only 700 to 800 g (2 lbs.), Anritsu’s pocket-size MT9090A Network Master series makes child’s play of daily network installation and maintenance. Its innovative GUI design uses a 4.3-inch high resolution display for easy viewing both indoors and in direct sunlight.
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Note