**Product Introduction** 

# /inritsu

# MU909060A1/A2/A3

**Gigabit Ethernet Tester** 

Network Master Series MT9090A Mainframe





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



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# **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



MU909060A-E-L-1



# **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

Slide 3

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NiMH Or Alkaline

**Dry Batteries** 





1.1	MPC25-	44 Throi	anput 1					
	RF025- RF025- RF025-	44 Bursi 44 Late 44 Late	nty 1 nty 2		Setup			
	Ping 2 Ping 3	44 Burs	12		Result			
•	Ping 4	Gene	rator 1	Result *** * mark** 18:08:43 - ** 14:0 60 80 100 Stimuti				
	Ping 6	1772244 (Jaters) 1.         Setup           1772244 (Jaters) 2.         Setup           1772344 (Jaters) 2.         Result           177244 (Jaters) 2.         Result           17724 (Jaters) 2.         Result		Back				
E.	Ping 7	TX Utilization (%)						
		0	20	40	60	80	100	
		TX Th	roughput ()	Mbps)				Stimuli
		0	200	400	600	800	1000	
		RX U	tilization (*	9			1578.00	
		0	20	40	60	80	100	Port
		RX TI	nroughput (	50			-	
		0	20	40	60	80	100	
	TX Throughput (Mbps) 0 200 400 RX Utilization (%) 0 20 401 Errored Frames (%) 0 20 44	(14)				Stream		
		0	20	40	60	80	100	*



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## **Target Market**

### Mobile backhaul and Carrier Class Ethernet



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## **Applications – out-of-service testing.**

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



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## **Applications – in-service testing.**

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



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## **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

Reflector Send back the received streams IP and MAC address can be swapped.





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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





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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.

Gene	rator 1	1000	👷 🋄 On	03:34:59 🛋	F	
<	Thresholds SDT			Channel Stats	¢	Back
	Key 1	Key 2		Key 3		
	MAC DST	MAC SF	25	IPv4 SRC		Stimuli
Mod	e:	0	rder of	Arrival		
Sort	On:		First I	Кеу		A
Mair	n Counter:		Fram	es		
Gen	erator 1	<u> </u>		03:41:22 🗕	F	
Curre	ent Cumulativ	/e/Graph/S	DT	annel Stats \	_	Back
СН	Fran	nes		MAC SRC	A	
1	88.08	88 k	Overflow		Н	Next
2	90	0	00:0	00:00:00:00:10:10		Columns
3	90	0	00:0	0:00:00:10:1D		
4	90	0	00:00:00:00:10:1E			
5	89	9	00:0	0:00:00:10:1F	11	Port
6	89	9	00:0	0:00:00:10:20	11	A
7	89	9	00:00:00:00:10:21			
Gen	erator 1	¥ <u>1000</u> #		03:41:27 🛋		
Curre	ent Cumulativ	e / Graph / Si	DT) Chi	annel Stats		Back
	(	hannel: 2 c	of 64			
MAC	SRC		00:00	:00:00:10:10		
MAC	DST		00:00:00:00:00:01			
IPv4 SRC			020.0	020.020.002		
Frames			899			
BITS			5.846864 M			Port
[64-127]				26		А
[128-	255]		56			
[256-	·511]		155			
[512-	1023]		335			Mode
[102	4-Jumbo]		327			Current
1>Jun	Jumbol 0					



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## **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**

Item	ITU-T Y.1564	RFC 2544	
Designed for	Service activation	Devices performance	
Concurrent services	Multiple services simultaneously	One service at a time	
Simulates	A realistic network	One service in a network	
Testing time	Short due to simultaneous test /	Long due to serial nature of test	
	service	(assuming completed per full standard)	
Test result	Directly related to SLA requirements	Link performance limit	

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## 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



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

QCI	Resource Type	Priority	Packet Delay Budget	Packet Error Loss Rate	Example Services
1		2	100 ms	10 <sup>-2</sup>	Conversational Voice
2	000	4	150 ms	10 <sup>-3</sup>	Conversational Video (Live Streaming)
3	GBR	3	50 ms	10 <sup>-3</sup>	Real Time Gaming
4		5	300 ms	10 <sup>-6</sup>	Non-Conversational Video (Buffered Streaming)
5		1	100 ms	10 <sup>-6</sup>	IMS Signalling
6		6	300 ms	10 <sup>-6</sup>	Video (Buffered Streaming) TCP-based (e.g.,www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
7	Non-GBR	7	100 ms	10 <sup>-3</sup>	Voice, Video (Live Streaming) Interactive Gaming
8		8		10.6	Video (Buffered Streaming)
9		9	300 ms	10 <sup>-6</sup>	I CP-based (e.g.,www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)



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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

File Edit SW Options Help									
Test Mode End to End Network Test  Select Port Both Ports  One way Director: Stave->Master  F Show Estimated One Way FTD									
Port A Port B									
Perform Test	{	SRV#	Enable	Service Name	Service Profile	CIR (Mbps)	EIR (Mbps)	SRC IP	DST IP
Enable Y.1564 Perform		1	~	Anritsu	Voice	0.126	2	192,168,200,2	192.169.200.5
Run Only if Y.1564 Config Test PASS		2	~	Network	Video	3.972	5	192.168.200.4	192.168.200.3
Test Run Time (ddhh:mm:ss):		3	~	Master	OFF	4.2	3	192.168.200.6	192.168.200.7
		4	~	Series	OFF	5.6	4	192.168.200.8	192.168.200.9
Gonfig Test		5	~	MT9090A	Voice	0.126	2	192.168.208.10	192.168.200.11
F Enable Y.1564 Config	-	6	1	plus	OFF	1	10	192.168.200.12	192.168.200.13
CIR CIR		7	~	MU909060	OFF	19	0.001	192.168.200.14	192.168.200.15
Ramped		8	~	Gigabit	OFE	2	6	192.168.200.16	192.168.200.17
I Step 1 CIR (90: 5	{		F	Ethernel	Voice	0.126	0.901	192.100.200.10	192.100.200.19
✓ Step 2 OIR (90: 10 🗮		10	R	Mindule	330	n	a	192 160 200 20	192 160 200 21
V Step 2 CIB (90): 25		11	1.	Y.1584	OFF	7	2	192.188.200.22	192.188.200.23
V Step 4 OIR (%): 50		12	P	test	110	70	1	192.160.200.24	192.160.200.25
I Step 5 CIR (%): 75 Ξ		13	R	option	OFF	19	5	192.168.200.26	192.168.200.27
ER EIR		14	4	Setup	OFF	10	2	102.168.200.28	102.168.200.20
Traffic Police		15	4	Applicat	OFE	15	1	192.168.200.30	192.168.200.31
M (Mbps): 100.000		16	2	on	Voice	0.126	0.001	192.160.200.02	192.160.200.33
CBS Fachled Services at		17	F	Anritsu1	Voice	0.126	2	192 168 200 102	192 169 200 105
EBS X		18	4	Network 1	Video	3.972	5	182.168.200.104	192.168.200.103
Enabled Tests+Steps: 10	{	13	1	Master I	OFF	4.2	3	192.168.200.106	192.168.200.107
X		20	7	Series1	OFE	5.6	4	192 168 200 108	192 168 200 109
Test/Step Time (Sec) 5		21	R	MISUSUAT	Voice	0.126	2	192.168.200.110	192.168.200.111
Estimated Test Time 005320		22	2	plus 1	OFF	1	10	192.168.200.112	192,160,200,113
		23	~	MU909061	OFF	19	0.001	192.168.200.114	192.168.200.115
Tutal OIR (Mbus): \$\$0.552 Calculate		24	2	Gigabit 1	OFF	2	6	192.168.200.116	192.168.200.117
		25		Etherne 1	Voice	0.126	0.001	192,168,200,118	192.168.200.119
		26	2	Module 1	OFF	8	8	192.168.200.120	192.168.200.121
		27	R	Y,15641	OFF	7	2	192,168,200,122	192,168,200,123
		28		test1	OFF	70	1	192.168.200.124	102.168.200.126
		29	2	uption1	OFF	19	6	192,168,200,126	192,168,200,127
	<u> </u>	30	Y	Setup I	OFF	10	2	192 168 200 128	192 168 200 129
	0	31	<b>V</b>	Applica1	OFF	15	0.01	192.168.200.130	192.168.200.131
	<u> </u>	32	2	on1	Voice	0.126	0.001	192.168.200.132	192.168.200.133
	1								



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## **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.



Summary	0ff <sup>001</sup> 10	00 <sup>mbps</sup> 10:13:00 -	
Event Log Statistics	Errors		Back
	Port A	Port B	
Total	0	13.392859 M	
Unicast	0	13.392858 M	
Multicast	0	0	
Broadcast	0	1	
UnTagged Frames	0	0	
Single VLAN Frames	0	0	
Multiple VLAN Frames	0	13.392859 M	
UnLabeled Frames	0	13.392859 M	
Single MPLS Frames	0	0	
Multiple MPLS Frames	0	0	
Pause Frames	0	0	



# **MPLS Tagging**

- Support for MPLS labels (optional),
  - The ITEF 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.

Interface	0	ff	1000 <sup>ER</sup>	11:12	:02 🛋	:	
General Filter Advanced Follow Port A							ck
CA VLAN	LLC1	🚳 S	NAP		PLS		
	LABEL		CoS		ΠL	Next	Tab
- MPLS 1	1000		7		10		
- MPLS 2	2000		4		100		3
- MPLS 3	3000		0	[	200	Stre	am
						1	L

Summary	0ff <sup>001</sup> 100	14:01:50 -C	
Event Log Statistics	Errors		Back
	Port A	Port B	
Total Frames	0	13.392859 M	
Unicast Frames	0	13.392858 M	
Multicast Frames	0	0	
Broadcast Frames	0	1	
UnTagged Frames	0	13.392859 M	
Single VLAN Frames	0	0	
Multiple VLAN Frames	0	0	
UnLabeled Frames	0	2	
Single MPLS Frames	0	0	
Multiple MPLS Frames	0	13.392857 M	
Pause Frames	Ó	0	



# **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.







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## **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.



## **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.

Generator 1	08:34:17 <b>-</b>	
Frame Size	Destination Thresholds	Back
Current Avera Use Log Use	ge Log 🗸 Frames/Sec > 150000000	Stimuli
Generator 1 /Current /Cumulativ	e ∕ Graph ∕ SDT ∕	Back
0 20 TX Throughput (MI	40 60 80 100 ops) 400 600 800 1000	Stimuli
RX Utilization (%) Result overview State Result		Status
PASS C FAIL	RFC2544 Latency 1 RFC2544 Burst 1	Setup
Summary / Event Log \Stat Time Descript	Back	
08:34:37 Wed Sep 08:34:37 Generat 08:34:40 violation 08:34:44 violation 08:34:48 Generat 08:34:51 Wed Sep		



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## **Trace Route**

- Trace to an end IP address viewing all IP addresses it passes to reach the end destination,
   Trace Route 1
   Trace Route
  - 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.

Trace	Route 1 1000 0ff	08:59:46 🛋							
Pol	Port A Trace Route Results								
Hop #	Host IP	Rcvd/Lost							
3	[202.42.33.5]	3/0							
4	[192.169.32.154]	3/0							
5	[203.120.91.4]	3/0							
6	[203.192.168.209]	3/0							
7	[202.147.15.157]	3/0							
8	[202.147.50.161]	3/0							
9	[206.223.116.150]	0/3							
10	[216.115.107.85]	2/1							
11	[67.195.128.247]	3/0	Summary						
12	[98.137.149.56]	1/2							

Grace	Route 1	1000 <sup>mbps</sup> 0ff	_ 14:31:15 🛋	,
Por	Back			
Hop #	Min Time [ms]	Max Time [ms]	Avg Time [ms]	
3	7.236	20.473	11.784	
4	38.359	87.368	63.739	
5	9.096	61.834	28.936	
6	9.745	27.046	15.702	
7	10.960	42.418	23.349	
8	183.278	183.739	183.487	
9	*	*	*	
10	185.206	185.951	185.491	
11	185.359	187.435	186.283	Summary
12	186.164	187.489	186.898	



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## Remote GUI and Language support HTTP

- 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 its 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

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lic. Network Maste

**GUI** Emulation

on Remote PC

## **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

Status	1000 <sup>E02</sup>	08:48:27 - C	
/ Basic / ETH /	Status		
	Port A	Port B	
		00	Setup
	1000 BASE-T FDX	1000BASE-LX	
			<b>B H</b>
Utilization			Result
Errored Frames			
MDI/MDIX	MDIX	N/A	
Link Time	0:04:13	0:01:27	
Frames TX	0	0	
Frames RX	17.6 M	0	



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## 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

Cable Test1	L	<u> </u>	1000 Hops 10:	28:36 🛋	
	Port A No Link:				Back
	- Cable a	ttached			
Pair	3	2	1	4	
Pin	1/2	3/6	4/5	7/8	
Status	Open	Open	Open	Open	
Rx/Tx					
Polarity					
Length (m)	2.4	3.2	3.2	2.4	_
Amp	0.86	0.86	0.86	0.86	Summary
Skew (ns)					



## Ping test

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





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## **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
     □ For selected layer
  - Frame Loss
  - Latency
  - Packet jitter
  - Burstability

Throughput 1	<u> </u>	🕅 14:12:27 🛋	
	T× (Port	B)	Back
Repetition:Step	T× Utilization(Mbps)	1000.0000	
4 - 4	T× Frame Size(bytes)	64	
<b>A</b> . <b>A</b>	T× Total Frames	14.880952 M	
1:2	T× Frame Rate(Fps)	1.488095 M	
	R× (Port	B)	
	R× Total Frames	14.880952 M	
	R× Utilization(%)	100.0000	
	R× Throughput(Mbps)	857.1433	
	R× Frames Lost Min	0	
	R× Frames Lost Ma×	0	
	R× Frames Lost Avg	0	
	R× Lost Rate Min(%)	0.0	Summan
	Rx Loss Rate Max(%)	0.0	Summary
	R× Loss Rate Avg(%)	0.0	



## Layered throughput analysis

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

Frame representation	Throughput Calculation	
IFG Pre- MAC VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) head TCP	Data Layer	<> ctivated
IFG Pre- MAC VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) head TCP	Network Layer	nust be a
IFG Pre- MAC VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) head TCP	Link Layer	or TCP n
IFG Pre- MAC VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) head TCP	Physical Layer no preamble	UDP
IFG         Pre- amble         MAC header         VLAN (opt)         LLC         SNAP (opt)         IP head         UDP TCP         PAYLOAD         CRC	Physical Layer	
Included in throughput calculation		

Throughput 1		<b>0</b>		10:43:44 -	
Destination	Frame	Size	Line Load	Advanced	) Back
┌─ Miscellane	Throug	hput te	st 1 Through	put calc. layer	
🔽 Trans			Physical laye	r	
🗌 🗌 Inclu	Ph	ysical	layer (w.out p	oreamble)	
🗌 Acci			Link layer		
Throughput			Network layer	r	
[ Inroughpu			Data layer		
Calculation -			,	· · ·	
Throughput T	ype:		Average	•	



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## 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

Latency 1	<u> </u>	🚆 14:16:18 🛋	
	T× (Port	B)	Back
Repetition:Step	T× Utilization(Mbps)	900.000	
1.1	T× Frame Size(bytes)	64	
<b>1</b> . <b>1</b>	T× Total Frames	13.392857 M	
1:2	T× Frame Rate(Fps)	1.339285 M	
	Rx (Port	B)	
	R× Total Frames	13.392857 M	
	R× Utilization(%)	90.0001	
	R× Throughput(Mbps)	771.4293	
	R× Jitter Min(us)	0.0	
	R× Jitter Ma×(us)	0.0	
	R× Jitter Avg(us)	0.0	
	R× Latency Min(us)	1.5	Summan
	R× Latency Ma×(us)	1.5	Summary
	R× Latency Avg(us)	1.5	



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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 1	0ff 1000 <sup>Hbps</sup>	11:06:43 🛋	
	T× (Port B)	)	Back
Repetition:Step	T× Utilization(kbps)	2.0000	
4 - 4	T× Frame Size(bytes)	64	
±. ±	T× Total Frames	29	
	T× Frame Rate(Fps)	2.000000	
	R× (Port B)	)	
	R× Total Frames	58	
	R× Utilization(%)	0.0019	
	R× Throughput(kbps)	2.5698	
	R× Jitter Min(us)	1631.8	
	R× Jitter Ma×(us)	15553.9	
	R× Jitter Avg(us)	6638.3	
	R× Latency Min(us)	1.5	Summan
	R× Latency Ma×(us)	15555.4	Summary
	R× Latency Avg(us)	15555.4	



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## 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

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## 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



## 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 limitor

Throughput 1 0ff 11:37:08 -	
G Test Mode Duration Destination Frame Size	Back
Select Test Mode	
Port	

fast testing with a limited number of conditions



## **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

BERT 1	Off 1000 Hops 14:16:34 -	
		Back
Poi	rt B Results	
Pattern Bit Count	7.04306 G	
Pattern Errors	0	Stimuli
Pattern Errors(%)	0.00000	Schhun
Seq. Errors	0	
Seq. Sync. Lost	0	
Frame Loss	0	
Frame Loss Seconds	0	

• Errors or alarms may be inserted into the test traffic



## **Generator/Monitor tests**

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

Generator 1	0 <u>ff</u> 0n0	8:38:00		Generator 1		• <u>Off</u> <u>•</u> • On	08:38:26	<b>E E</b> P	
G Mode/Duration	Generator Des	tination	Back	Genera	ator D	estination	Payload		Back
Generator Mode:	Generator+Monitor		Stimuli	Stream Lin	e Load   ize (Bytes) -	OFF	%		Stimuli
Mode:	Seconds			Profile:		Constant			
Value:	10	Seconds	Port	Start:	100	Step:	50		Port
				End:	500	Duration:	1	s	
						-			Etroom
				Total line	load : 0.000	0% with 0 of 8	streams acti	ve	1 1



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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

summary	<u> </u>	14:16:56 - C	
/ Event Log / Statistic	s \		Back
	Port A	Port B	
Total	0	77.385955 M	
Unicast	0	77.385924 M	
Multicast	0	0	
Broadcast	0	31	
FCS Errors	0	0	
Fragmented	0	0	
Oversized	0	0	
Undersized	0	0	
Collisions	0	0	
Preamble violations	0	0	
IFG violations	0	-	
Severe IFG violations	-	0	
Summary		14:18:08 -	
/ Event Log 🗸 Statistic	<u> </u>		Back
/ Event Log \ Statistic Time Description	is \		Back
Event Log Statistic Time Description 14:07:16 Ping test sta	rted	<u> </u>	Back
Event Log Statistic Time Description 14:07:16 Ping test sta 14:07:53 Ping test sto	rted	A	Back
Event Log Statistic Time Description 14:07:16 Ping test sta 14:07:53 Ping test sto 14:07:53 RFC2544 Thi	rted pped roughput test s	started	Back
Event LogStatisticTimeDescription14:07:16Ping test sta14:07:53Ping test sto14:07:53RFC254414:08:23RFC2544	rted pped roughput test s roughput test s	started stopped	Back
Event LogStatisticTimeDescription14:07:16Ping test sta14:07:53Ping test sto14:07:53RFC254414:08:23RFC254414:08:23RFC254414:08:23RFC2544	rted pped roughput test s roughput test s tency test star	started stopped ted	Back
Event LogStatisticTimeDescription14:07:16 Ping test sta14:07:53 Ping test sto14:07:53 RFC2544 The14:08:23 RFC2544 The14:08:23 RFC2544 Lat14:08:53 RFC2544 Lat	rted pped roughput test s roughput test s tency test star tency test star	started stopped ted oped	Back
Event Log         Statistic           Time         Description           14:07:16         Ping test sta           14:07:53         Ping test sto           14:07:53         RFC2544           14:08:23         RFC2544           14:08:23         RFC2544           14:08:53         RFC2544           14:08:53         RFC2544	rted pped roughput test s roughput test s tency test star tency test stor arted	started stopped ted oped	Back
Event LogStatisticTimeDescription14:07:16 Ping test sta14:07:53 Ping test sto14:07:53 RFC2544 Thi14:08:23 RFC2544 Thi14:08:23 RFC2544 Lat14:08:53 RFC2544 Lat14:08:53 RFC2544 Lat14:08:53 BERT test st14:09:15 BERT test st	rted pped roughput test s roughput test s tency test star tency test stor arted opped	started stopped ted oped	Back



# **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.



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# **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

Generator results	<u>0ff</u>	1000 <sup>mbps</sup> 14:12:05	
			Back
Ty Total Frames	IA ICSUILS	10 412005 M	Duon
Tx Total Princs		1 0412095 M	
TX Dreadcast Frames		1.041209 G	
Tx Broadcast Printes		0	
TX Broaucast Bytes		0	Stimuli
	Rx results		
Rx Total Frames		10.412095 M	
Rx Total Bytes		1 041209 G	
Rx Errored Frames		1.041100 0	Daut
		Ť	Purt
	Frame loss		В
Frames lost		0	
Frame loss(%)		0	
			Stream
			Stream
			1
Generator results	Dff 🛤		
Generator results	Off .	1000 HERE 14:12:22 -	
Generator results	Tx results	1000 HDFS 14:12:22 -	Back
Generator results T× Total Frames	Tx results	14:12:22 -	Back
Generator results T× Total Frames T× Total Bytes	Tx results	1000 14:12:22 -	Back
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames	Tx results	1000 14:12:22 -■ 10.412095 M 1.041209 G 0	Back
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes	Tx results	14:12:22 -■ 10.412095 M 1.041209 G 0 0	Back
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes	Tx results	1000000000000000000000000000000000000	Back
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes	Tx results	1000 (1000	Back Stimuli
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames	Tx results	10:412095 M 10:412095 M 1:041209 G 0 0 10:412095 M	Back Stimuli
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes	Tx results	1000 10.412095 M 1.041209 G 0 0 10.412095 M 10.412095 M 1.041209 G	Back Stimuli
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames	Tx results	10:412095 M 10:412095 M 1:041209 G 0 0 10:412095 M 10:412095 M 1:041209 G 0 0	Back Stimuli Port
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames	Tx results	1000 ₩₩₩ 10.412095 M 1.041209 G 0 0 10.412095 M 10.412095 M 1.041209 G 0 0	Back Stimuli Port
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames	Tx results          Tx results         Rx results         Frame loss	1000 ₩₩₩ 10.412095 M 1.041209 G 0 10.41209 G 0 10.412095 M 1.041209 G 0 1.041209 G	Back Stimuli Port B
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames Frames lost	Tx results          Tx results         Rx results         Frame loss	1000 ₩₩₩ 10.412095 M 1.041209 G 0 10.41209 G 0 10.412095 M 1.041209 G 0 0 0 0 0 0 0 0 0 0 0 0 0	Back Stimuli Port B
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames Frames lost Frame loss(%)	Tx results          Tx results         Rx results         Frame loss	1000 ₩₩₩ 10.412095 M 1.041209 G 0 10.41209 G 0 10.412095 M 1.041209 G 0 0 0 0 0 0 0 0 0 0 0 0 0	Back Stimuli Port B
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames Frames lost Frame loss(%)	Tx results          Tx results         Rx results         Frame loss	1000 ₩₩₩ 10.412095 M 1.041209 G 0 10.41209 G 0 10.412095 M 1.041209 G 0 0 0 0 0 0 0 0 0 0 0 0 0	Back Stimuli Port B Stream
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames Frames lost Frame loss(%)	Tx results          Tx results         Rx results         Frame loss	1000 ₩₩₩ 10.412095 M 1.041209 G 0 10.412095 M 1.0412095 M 1.041209 G 0 0 0 0	Back Stimuli Port B Stream
Generator results T× Total Frames T× Total Bytes T× Broadcast Frames T× Broadcast Bytes R× Total Frames R× Total Bytes R× Errored Frames Frames lost Frame loss(%)	Tx results          Tx results         Rx results         Frame loss	1000 ₩₩₩ 10.412095 M 1.041209 G 0 10.41209 G 0 10.412095 M 1.041209 G 0 0 0 0 0 0	Back Stimuli Port B Stream 2



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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

	/inritsu	RFC25	44 T	hrou	ughpu	t 1 - Re	: 201 sult	0-10-08 16:3	6:00
				Por	t B TX				
	Repetition:Step	Total fram	res	Utilizat	ion (Mbps)	Frame rate [	FPS] Fr	ame Size (By	tes]
	1:1	14.8	8095 M		1000.0000	1.488	095 M		64
	1:2	2.34	624 M		1000.0000	234	.962 k	5	512
	1:3	81	2.743 k		1000.0000	81	.274 k	1.5	18 k
				Por	t B RX				
	Repetition:Step	Total frames	Throu	ghput	Utilization	Frame	s lost / Los	s rate [%]	
			[Mb	ps]	[%]	Min	Max	Avg	
	1:1	14.88095 M	857	.1433	100.0000	0 / 0.0	0/0	0.0 0	0.0
	1:2	2.349624 M	977	.4461	100.0000	0/0.0	0/0	0.0	0.0
	1:3	812.743 k	992	2052	100.0000	0/0.0	0/0	0.0 0.0	0.0
Cut	1:3	812.743 k	992 • A	.2052		0/0.0	0 / ( rap Text	0.0 0	( 0.0 eral
Clipboard	1:3 Calibri B Z	812.743 k	992 • A 3 • <u>A</u>	2052 A S	100.0000	0 / 0.0 →→ → → ₩ = = → M Alignment	0 / ( 'rap Text erge & Cer	0.0 0 / nter + \$	ral • % • Number
te Clipboard S51	1:3 Calibri B Z	812.743 k - 11 <u>U</u> -) <u></u> - ) Font <i>f</i> <sub>x</sub>	992 • A	2052		0 / 0.0	0 / ( irap Text erge & Cer	0.0 0 /	ral • % •
Cut Copy Cup Clipboard S51	1:3       at Painter       Galibri       B       Image: Comparison of the second secon	812.743 k ~ 11 <u>U</u> ~ [] ~ ] Font <u>f</u> x	992 • A	2052	100.0000	0/0.0	0 / ( irap Text erge & Cer E	0.0 0 /	ral %, Number
Cut Copy Ste Clipboard S51	Calibri at Painter	812.743 k	992 • A <sup>•</sup> • A	2052	100.0000	0 / 0.0	0 / ( irap Text erge & Cer E	0.0 0 /	eral % , Number G
KFC2544 Thr	Calibri at Painter	812.743 k ▼ 11 <u>U</u> ▼) <u>U</u> ▼) <u>U</u> Font <i>f</i> <sub>x</sub> It	992 • A <sup>*</sup> • A	2052	100.0000	0 / 0.0	0 / ( rap Text erge & Cer E	0.0 0 /	ro.0 • % • • Number
KFC2544 Thr	1:3       at Painter       Galibri       B       Image: Comparison of the second secon	812.743 k v 11 <u>U</u> v) <u>U</u> v) ; Font <u>f_x</u> It	992 • A > • A	2052	100.0000	0 / 0.0	0/( rap Text erge & Cer E	0.0 0	eral % % , Number
te Clipboard S51 RFC2544 Thi Port B TX Repetition:	1:3       at Painter       Galibri       B       Z       A       roughput 1 - Resul       Step	812.743 k v   11 <u>U</u> v) <u>E</u> v) ; Font <u>f</u> k It	992	B al frame	100.0000	0 / 0.0	0 / ( rap Text erge & Cer E Frame Si	0.0 0 /	eral % % , Number
Clipboard S51 RFC2544 Thi Port B TX Repetition:	1:3       at Painter       Galibri       B       Z       A       roughput 1 - Resul       Step	812.743 k	992 A^ - A^ - A - A A A 	B al frame 88095 M	100.0000	0 / 0.0	0 / ( rap Text erge & Cer E Frame Si 6	0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	eral % , Number
Clipboard S51 RFC2544 Thr Port B TX Repetition:	1:3       at Painter       Galibri       B       Z       A       roughput 1 - Result       Step	812.743 k	992 A A 3 - A Tot 01 14.3 02 2.3	2052	100.0000	0 / 0.0 字 译 교 M Alignment Frame rate 1.488095 M 234.962 k	0 / ( rap Text erge & Cer E Frame Si 6 51	22 [Bytes]	eral % , Number G
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Clipboard S51 RFC2544 Thi Port B TX Repetition:	1:3       at Painter       Calibri       B       Z       A       roughput 1 - Resul       Step	812.743 k	992 • A • A • Tot 01 14.1 02 2.3-2 03 812	B al frame 88095 M 49624 M 743 k	100.0000	0 / 0.0	0 / ( rap Text erge & Cer E Frame Si 6 51 1.518 k	0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	rolo eral % , Number G
Cubbard S51 RFC2544 Thr Port B TX Repetition:	1:3       1:3       at Painter       Image: Calibri	812.743 k	992 • A • • • • • • • • • • • • • • • • • •	B al frame 88095 M 49624 M .743 k	100.0000	0 / 0.0	0 / ( rap Text erge & Cer E Frame Si 6 51 1.518 k	5.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	rolo eral Number G
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ke down Clipboard S51 RFC2544 Thr Port B TX Repetition:	1:3       1:3       at Painter       Image: Calibri	812.743 k v 11 Font fx 1: 1: 1: 1: 1: 1: 1: 1	9922 • A* • • • • • • • • • • • • • • • • • • •	2052 A B B B B B B B B C C C C C C C C C C C C C	100.0000	0 / 0.0	0 / ( rap Text erge & Cer E Frame Si 6 51 1.518 k Frames I Min 0 / 0.0 0 / 0.0	0.0         0.0           Inter         Gen           Image: start st	r0.0 eral



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## **Internal Storage**

- Save and Load Setups
- Load Results
  - Results are automatically saved when a test stops
- Print screen

Mass Storago Eurotions	Mass Storage	11:29:28 🛋	<b></b>
wass storage Functions	Device: 🚽 Internal 🕨		File
<ul> <li>Select location</li> </ul>	Folder: /Data/results/		Operacions
Internal or USB	Files	Date	Multi-Select
File operations	[]	<b>A</b>	Off
	2009-02-04@17-00-10.res	2009-02-04	
🗆 Сору	2009-02-04@17-06-00.res	2009-02-04	
	2009-02-05@08-28-04.res	2009-02-05	
	2009-02-05@08-44-13.res	2009-02-05	
Rename	2009-02-05@08-58-23.res	2009-02-05	E×it
Create folders	2009-02-09@12-13-21.res	2009-02-09 🖬	

- Integrated soft keyboard for entering of text/names
- Storage of PDF reports

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## **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
- <u>400x</u> images displayed





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## **MT9090A series lineup**

 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.



**GigE** 10M/100M/Gigabit Ethernet Tester



uOTDR OTDR for FTTH



OCA CWDM Optical Channel Analyzer



DCFL Drop Cable Fault Locator



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## Note

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# /incitsu

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#### Specifications are subject to change without notice.

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