Product Introduction



Network Master Flex MT1100A

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- Product Structure
- OTN Metro and Core Network Installation and Maintenance
- <u>Carrier Class Ethernet Installation and Troubleshooting</u>
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- <u>VIP: Video Inspection Probe</u>
- Operation and Presentation
- <u>Report Generation</u>
- <u>Remote Operation</u>
 - <u>Remote Control Scripting</u>
 - <u>Remote Control GUI & Scripting</u>
 - One Button Testing

Network Master Flex MT1100A

Redefining Transport Testing

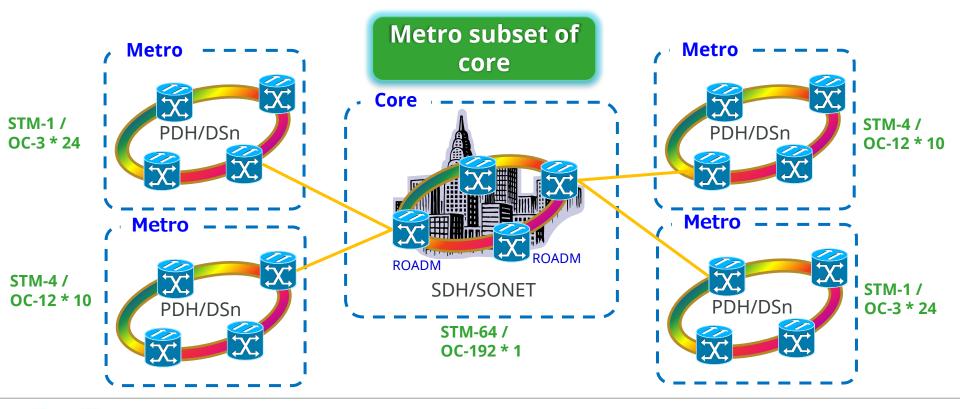


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Market Situation—Historical

- Core network had multiple metro/access network subsets
 - Much of the network coming to the access network was muxed up to a larger metro network which was muxed up to the core network.
 - Not all traffic was transferred to the core, but a large percentage was.
 - To a large extent, the core was the size of the combined metro networks.

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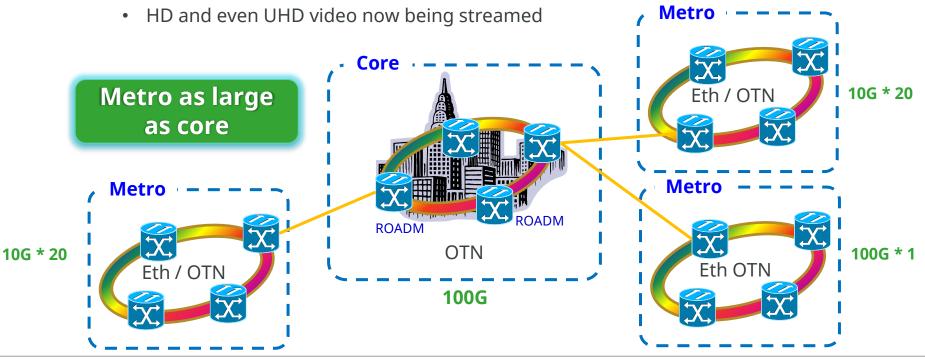


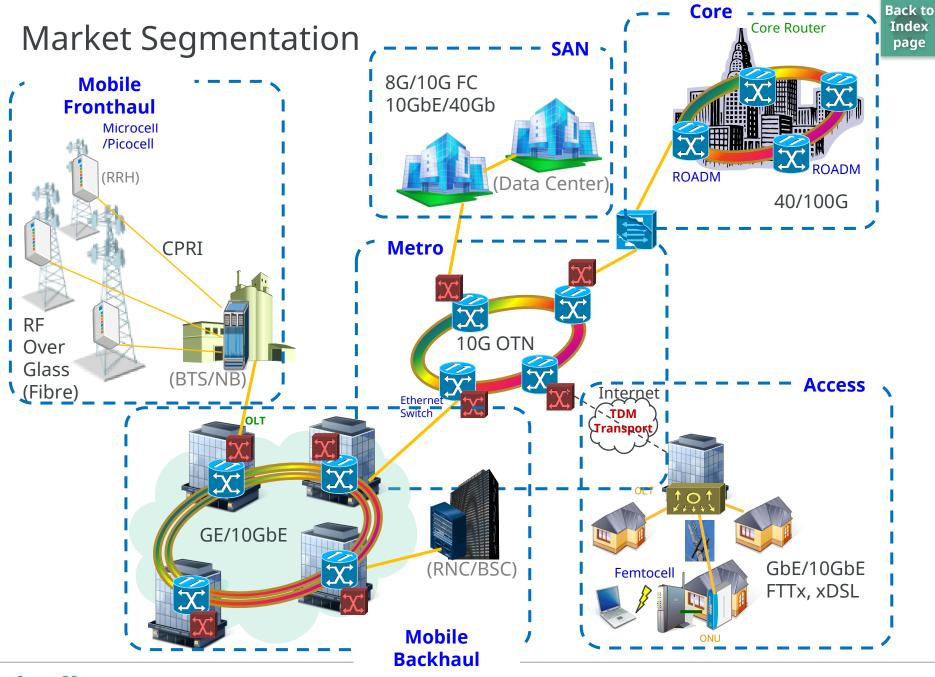
Market Situation—Current and Future

- Metro networks becoming same or larger size than core
 - Many services now require "near" real-time response (simultaneous multiple access to data)

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- Transferring data long distances to server not ideal
- Many services to many millions of users (apps) now truly global (apps)
 - A single or even two servers (back-up) isn't good enough to handle data
- Many services require very large data from millions of users (video)





Anritsu envision : ensure

Where to Use MT1100A

R&D on 400-Gbps Networks

* 4 x 100G client testing with all-in-one tester

* OTN multi-stage mapping and ODU-flex



Manufacturing 100-Gbps Transport Equipment

- * CFP, CFP2, CFP4, QSFP28, CXP, QSFP+, SFP+, SFP, CAUI, XLAUI interface
- * MDIO control
- * VOD, Pre-Emphasis, Rx Equalizer

<< 100G >>

<< 100G >>

<< 100G >>

<< 100G >>

* Multi-users log-in



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Network Commissioning Tests

* 100G core network to CPRI/OBSAI mobile fronthaul

* GPS-synchronized one-way latency test

- * OTN-mapped client protocol testing
- * Y.1564, RFC 2544, RFC 6349



Master side

Slave side

Troubleshooting

* Simultaneous two-way monitoring

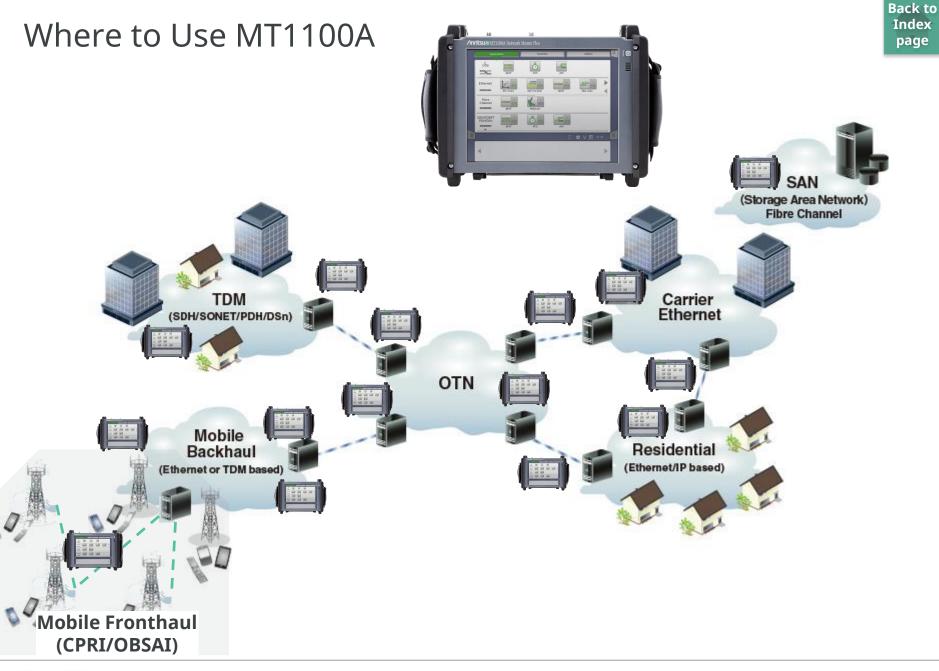
* Channel statistics and Ethernet capture

* Long-term monitoring including remote boot, operation, file transfer and firmware update



Remote

command



Testing Network Equipment for R&D and Manufacturing

- Back to Index page
- Supports performance and functional tests of network equipment from 1.5M to 100G
 - All-in-one support for both latest technologies (such as 100GbE) and existing I/Fs, such as PDH/DSn
 - CFP, CFP2, CFP4 (CFP2/CFP4 adapter required), QSFP28 (CFP2/QSFP28 adapter required), CXP, QSFP+, SFP+, SFP, electrical interfaces including CAUI, XLAUI
 - Multi-user log-in to one instrument using each port independently
- Supports future 400G tests
 - Four 100G ports support 400G client signal (4 x 100G) tests

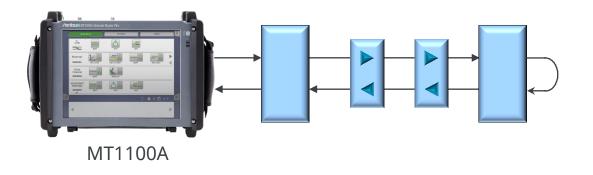


Out-of-Service Installation Testing

- Installing and commissioning new lines
 - Verify new-line quality/performance before service commissioning

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- Troubleshooting with test traffic
 - Test network functions under different loads
- Testing line quality
 - Perform far-end loopback tests using cable or special configuration (protocol dependent)



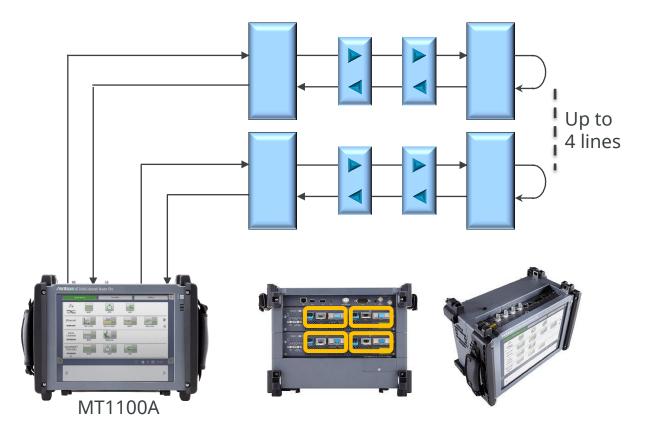
Out-of-Service Installation Testing (2/2)

• Efficient simultaneous out-of-service testing of one to four lines

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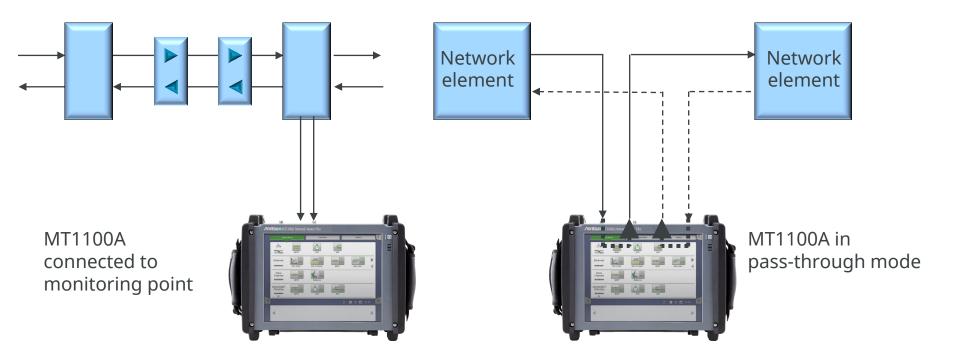
– Supports up to four fully independent ports at all rates



In-Service Troubleshooting and Analysis

- Monitoring both line directions simultaneously to troubleshoot communications path problems
 - Optimum communications requires smooth data transport in both directions

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MT1100A Key Applications

• Core and Metro networks I&M



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- OTN up to OTU4 including mapping of Ethernet/SDH/SONET/Fibre Channel client signals, multistage mapping, FEC (Forward Error Correction) and O.182 Poisson error
- Testing and verification of newer OTN functions: ODU0, ODUflex, ODU2e and ODU4
- Carrier Class Ethernet I&M and troubleshooting
 - Ethernet testing up to 100 Gbps
 - 100GBASE-SR4 FEC Test
 - Include RFC 2544, Y.1564
 - Include RFC 6349 (up to 10 Gbps)
 - Ethernet OAM
 - MPLS-TP and PBB
 - IP Channel statistics (up to 10 GigE)
 - Frame capture for advanced troubleshooting
- Mobile backhaul installation and verification
 - Synchronous Ethernet testing up to 10 GigE (ITU-T G.826x and IEEE 1588 v2)
- Mobile Fronthaul installation and verification
 - CPRI testing up to 10 Gbps
 - OBSAI testing up to 6 Gbps

MT1100A Key Applications



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- Powerful Storage Area Networking (SAN) testing
 - Fibre Channel up to 10 Gbps
 - Supports throughput, latency, and buffer credit performance verification
- Quick and easy testing of SDH/SONET, PDH/DSn Networks
 - SDH/SONET up to STM-256/OC-768
 - PDH/DSn (E1, E3, E4, DS1, DS3)
- Fiber end-face inspection using VIP (Video Inspection Probe)
- Four ports at all rates
 - Reduced testing time by simultaneous testing of 2 lines with one unit
 - In-service bi-directional monitoring

MT1100A Key Benefits and Features

- Easy intuitive GUI
 - Large 12-inch touch screen,
 - Six languages (English, Chinese, French, Russian, Spanish and Japanese)
- WLAN^{*1}/Bluetooth/LAN connectivity
- PDF, CSV and XML report generation for documentation of test results
- Remote operation
 - Using VNC or dedicated GUI operation software
 - Via Ethernet, WLAN
- Remote control (scripting) via Ethernet, WLAN, GPIB
- Portable
- Battery-operated
- High performance in small form factor
 - ^{*1} Available for certified countries, including USA, Canada, Japan, all EU countries



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Network Master Family



• Transport







MT9090A Network Master GigE	MT1000A Network Master Pro	MT1100A Network Master Flex	
Dedicated field test solution for installation and troubleshooting Ethernet links in access network	All-in-one transport tester supporting from 1.5 Mbps to 100 Gbps including OTN, Ethernet, PTP, CPRI/OBSAI, Fibre Channel, SDH/SONET and PDH/DSn.	All-in-one, up to 4-port transport tester supporting from 1.5 Mbps to 100 Gbps including OTN, Ethernet, CPRI/OBSAI, Fibre Channel, SDH/SONET and PDH/DSn	

• Optical





MT9090A Drop Cable Fault Locator	MT9090A Optical Channel Analyzer	MT9090A μOTDR	
Compact fault locator for easy and accurate verification of drop cable installation	Compact CWDM channel analyzer to verify power levels, drift and channel presence of CWDM networks	Compact OTDR for fully automatic verification of optical networks, FTTH PON, metro and core	

Network Master Flex MT1100A

• Instrument Views



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MT1100A Instrument Views



Hand-held rugged design Easy-to-use GUI







Instrument Views

MU110010A: 10G Multirate Module



MU110011A: 100G Multirate Module



MU110013A: 40/100G Advanced Module



Single port: 40 Gbps (CFP) or 100 Gbps (CFP) Up to 2 ports: 10 Mbps to 40 Gbps (QSFP+, SFP/SFP+, RJ45)

Up to 2 ports: 40 Gbps to 100 Gbps (CFP2^{*1}, CXP, QSFP+)

Up to 2 ports: 1.5 Mbps to 10 Gbps

(RJ45, SFP+/SFP, RJ48, BNC, BANTAM)

*1: CFP4 and QSFP28 can be used by attaching an adapter to CFP2.



J1665A CFP2-CFP4 Adaptor



J1686B CFP2-QSFP28 Adaptor

Network Master Flex MT1100A

• Product Structure



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Power Modules and Test Module Combination

MU110001A: Battery and AC Power Supply Module

		Module 2			
		No Module 2	MU110010A	MU110011A	MU110013A
Module 1	MU110010A	✓	\checkmark	\checkmark	✓
	MU110011A	✓	\checkmark	-	-
	MU110013A	\checkmark	\checkmark	-	-

MU110002A: AC-only High Power Supply Module

		Module 2			
		No Module 2	MU110010A	MU110011A	MU110013A
Module 1	MU110010A	✓	\checkmark	\checkmark	✓
	MU110011A	✓	\checkmark	\checkmark	✓
	MU110013A	\checkmark	\checkmark	\checkmark	\checkmark

✓ Available

- Not available

Network Master Flex MT1100A

• OTN Metro and Core Network Tests



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OTN Background

 ${}^{\bullet}$

ITU-T defines an Optical Transport Network (OTN) as a set of Optical Network Elements (ONE) connected by optical fiber links, able to provide functions of transport, multiplexing, switching, management, supervision and survivability of optical channels carrying client signals.

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- Typical signals carried by OTN are:
 - SONET/SDH
 - Ethernet
 - Fibre Channel
 - CPRI
- Key OTN functions include:
 - Mapping/demapping of non-OTN signals
 - Multiplexing and demultiplexing of OTN signals
 - Forward Error Correction

OTN Background

- OTN networks first designed for submarine sections
 - Quickly moved to Core \rightarrow Metro \rightarrow Access
 - Operators can implement more services, control and management

DWDM 10G OTN

Core Network

2.7G OTN Access Network Back to Index

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DWDM 10G OTN

Metro Network

10G OTN

Access

Network

DWDM 100G OTN

Core Network

當

LAN Network

DWDM 40/100G OTN ⁴ Submarine Network

Simplifying network management is key for operators

10G OTN

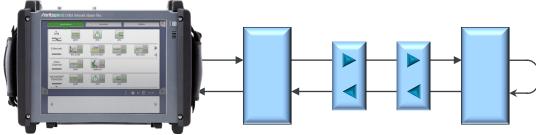
- Control customer traffic from access point and across network (single system single Metro Network management)
- Greater insight about faults quick repair and fewer maintenance issues
- AN Network Single management of all legacy and replacement technologies



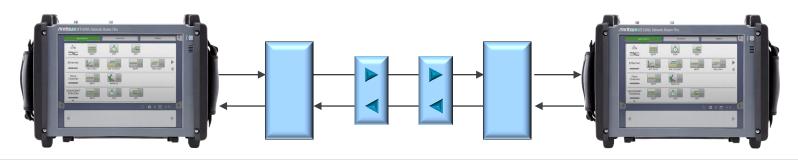
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- Comprehensive OTN testing for metro and core network I&M
 - OTN tests up to OTU4
 - ODU0, ODUflex, multistage mapping
 - Test Ethernet, CPRI, Fibre Channel and SDH/SONET client signals mapped to OTN signal
 - OTN tests with bulk signals at OTN level
 - Comprehensive OTN error and alarm statistics
 - OTN error performance measurement (G.8201 or M.2401)
 - ITU-T 0.182-compliant FEC test
 - Delay measurement
 - OTN header edit and capture
 - OTN TCM monitoring and generation
 - Service disruption analysis using APS application
 - OTN tributary scan

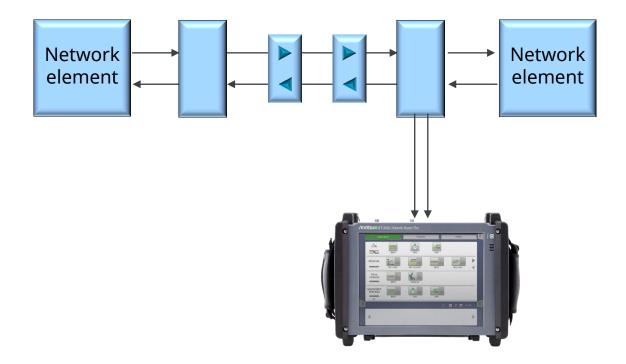
- OTN out-of-service testing
 - For installation and commissioning
 - For troubleshooting
 - OTN testing with far-end loopback



- OTN testing with two instruments
 - Separate results for each side of line

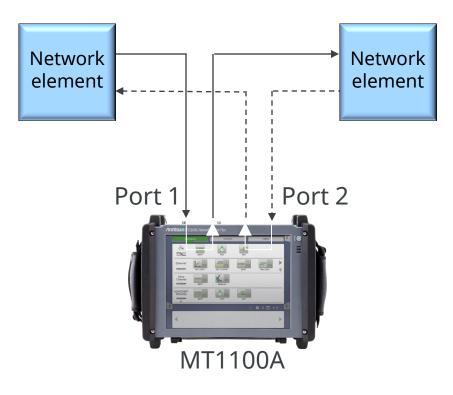


- OTN in-service testing
 - Troubleshooting live traffic
 - Connected at monitoring point



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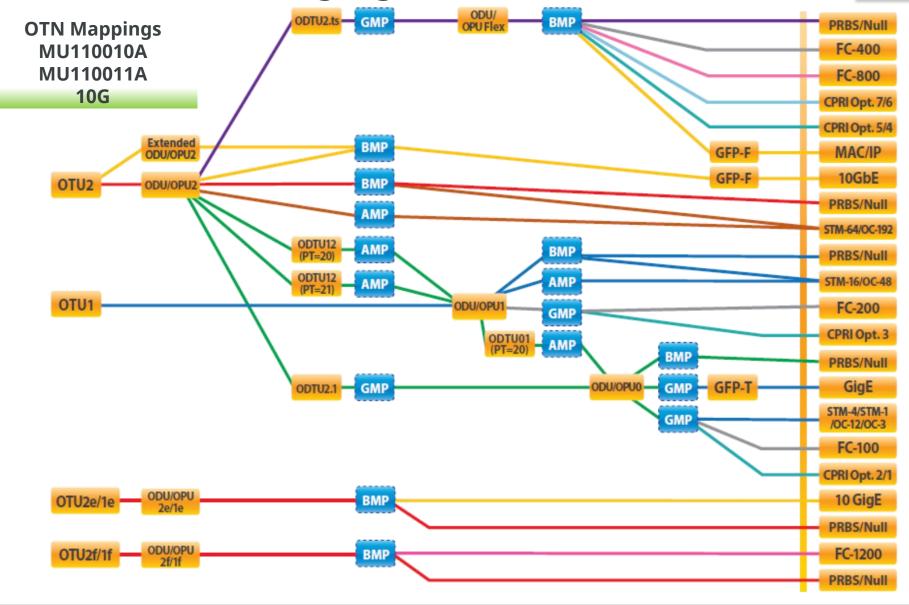
- OTN in-service pass-through testing
 - Troubleshooting live traffic when no monitoring point

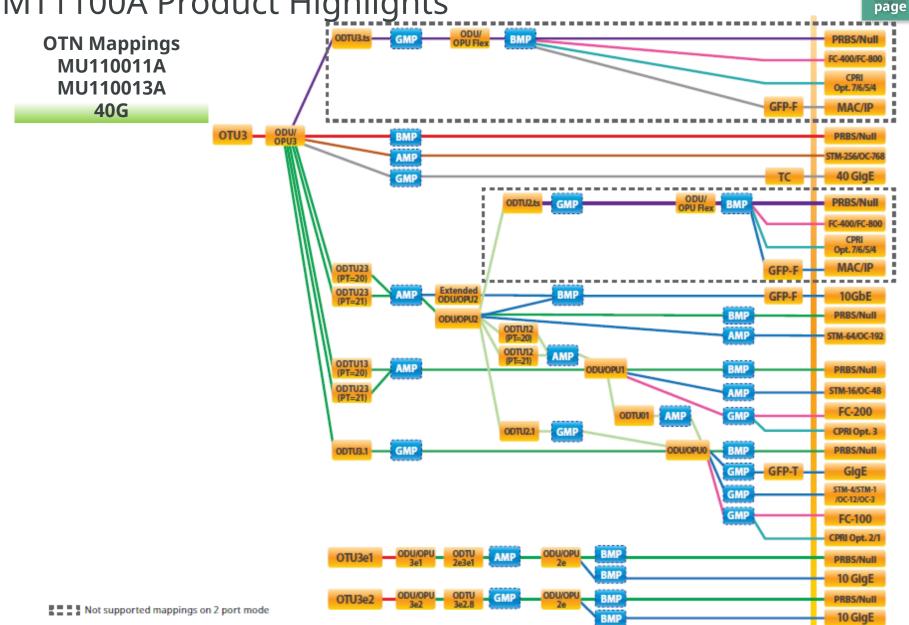


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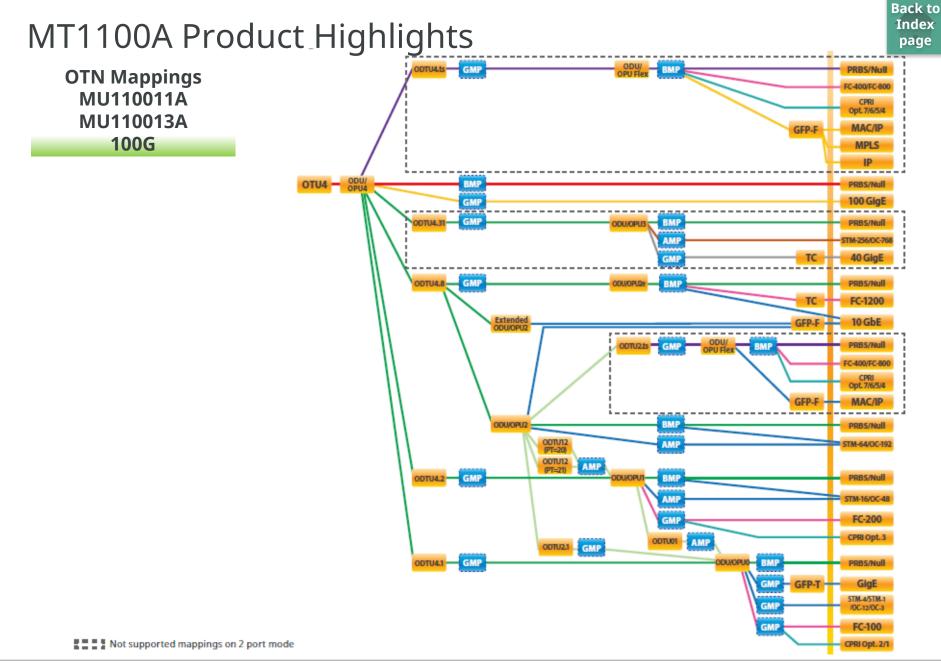
MT1100A Product Highlights



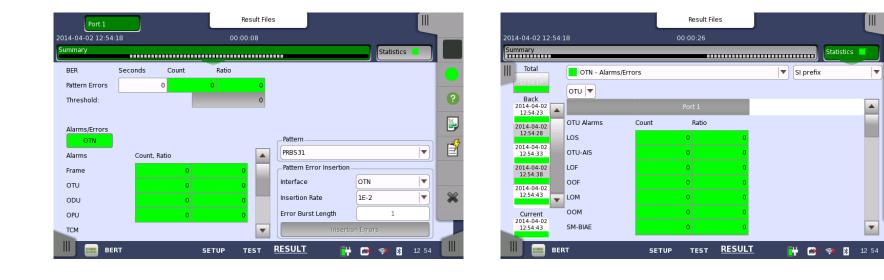


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Ancitsu envision : ensure



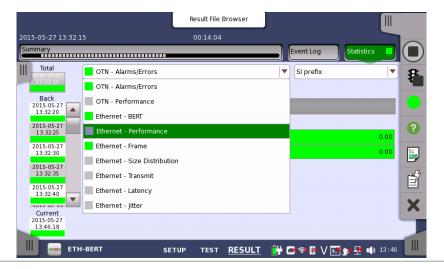
- OTN statistics
 - Summary page with main results
 - Additional pages with detailed statistics
 - GO/NO GO color coding gives easy overview of results

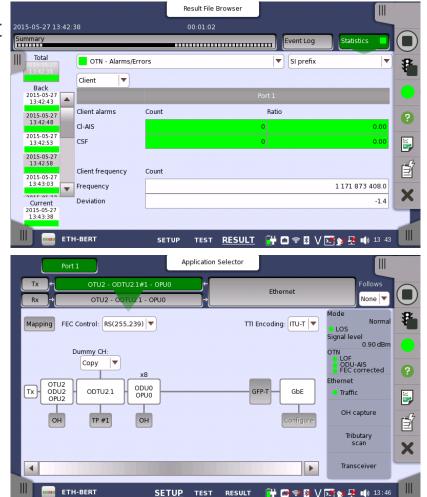


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- Ethernet in OTN
 - Statistics for OTN and embedded
 Ethernet signal in same measurement
 - Client signal frequency
 - Intuitive configuration map





SDH/SONET/DSn/PDH in OTN

 BERT applications and upgraded to switch without closing BERT, APS and RTD applications to improve operation efficiency

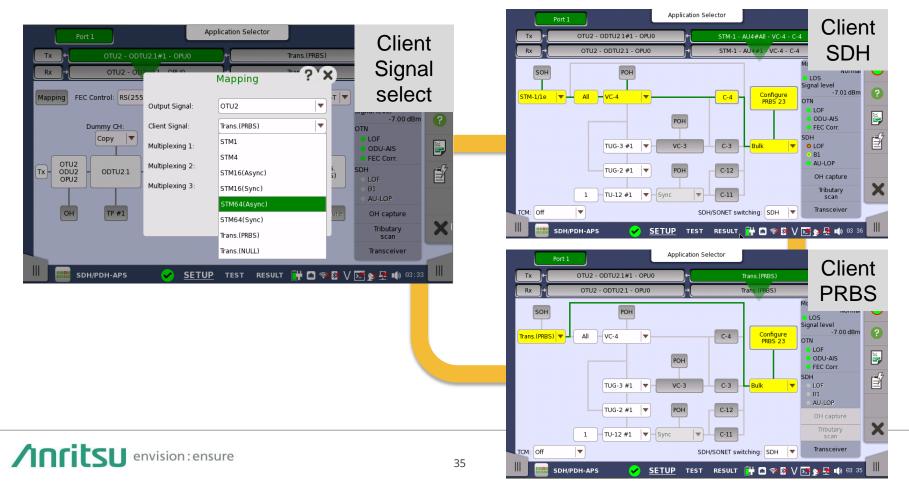
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SDH/SONET in OTN

 Upgraded Client signal selection method used for ATN mappings at SDH-OTN-BERT application, and enabled Client SDH and Client PRBS signal switching without closing applications to improve operation efficiency

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- OTN status information
 - Overview of current status of alarms and errors
 - Optical level and rate information
 - GO/NO GO color coding gives easy overview of line status

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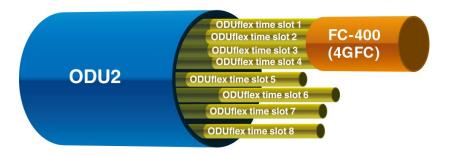


- OTN Over Head (OH) Byte capture
 - Inspect OH bytes for detailed troubleshooting
 - Updates about every 1 second



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- Comprehensive OTN Testing—continued
 - ODUflex testing
 - ODUflex: New feature of OTN
 - Method for flexible allocation of bandwidth to client signal
 - Makes most efficient use of OTN capacity
 - Capacity of ODU2 split into eight 1.25G ODUflex time slots



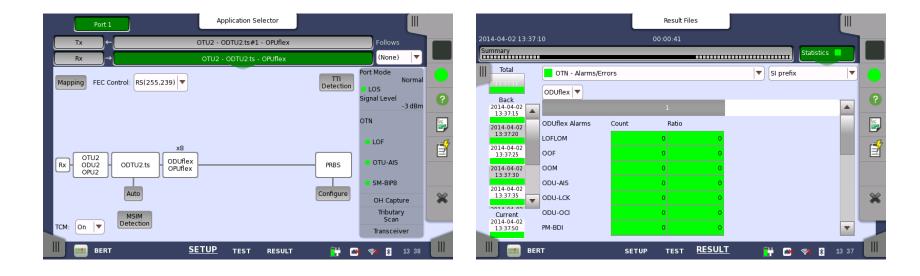
 In above example, FC-400 (4GFC) Fibre Channel signal occupies 4 ODUflex time slots, freeing other four ODUflex time slots in ODU2 for other payloads

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 MT1100A supports ODUflex testing, allowing operators deploying new technology to verify working correctly throughout network

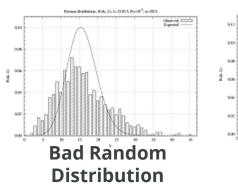
- ODUflex
 - Configuration and results

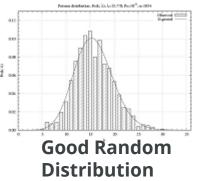


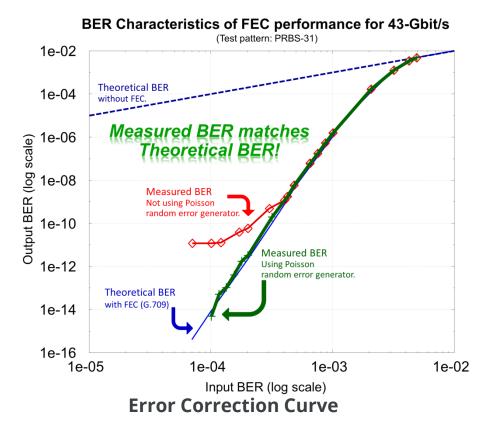
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MT1100A OTN FEC Test

- ITU-T 0.182 Compliant FEC Test
 - Anritsu's proposed FEC performance tests using Poisson distribution random errors adopted by ITU-T 0.182 in July 2007
 - Reproducible/accurate FEC error correction tests by generating random signal errors (Poisson distribution)







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MT1100A OTN FEC Test

ITU-T O.182 Compliant FEC Test
 – FEC error insertion with MT1100A



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Network Master Flex MT1100A

Carrier Class Ethernet Test



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- Easy Ethernet test solution
 - Ethernet testing
 - 100 Gbps, 10 Gbps, 1 Gbps, 100 Mbps and 10 Mbps
 - 400 Gbps client testing with 4 x 100 Gbps configuration
 - Traffic generation up to full line rate
 - 100 GigE RS-FEC Test
 - Supports IPv4 and IPv6
 - Ethernet Service Activation Test (Y.1564)
 - Automated RFC 2544 testing
 - Throughput
 - Frame Loss
 - Latency or Packet Jitter
 - Burstability
 - TCP Throughput option (RFC 6349) up to 10 Gbps
 - BER testing
 - Includes frame loss and sequence error tests
 - Service disruption measurement



- Easy Ethernet test solution—continued
 - Comprehensive statistics including:
 - Performance (utilization, Throughput, frame rate)

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- Frame statistics (frame types and errors)
- Burst statistics
- Frame size distribution
- Latency and Packet Jitter measurements
- Transmitted and received frames and bytes
- Filters to extract relevant parts of traffic
- Thresholds to highlight abnormal situations
- Simultaneous monitoring of both directions on line
- IP Channel Statistics to identify error streams, top talkers, network attacks for up to 230 multiflow counters (up to 10 Gbps)
- Ethernet OAM: IEEE 802.3 (IEEE 802.3ah), IEEE 802.1ag, ITU-T Y.1731

- Easy Ethernet test solution—continued
 - Synchronous Ethernet Test (G.826x and IEEE 1588 v2) (up to 10 Gbps)

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- For Mobile Backhaul testing
- Ethernet Multistream: Up to 16 streams per port
 - Information on Throughput, Frame Loss, Packet Jitter and latency per stream
- Stacked VLAN (Q-in-Q): Up to 8 levels of VLAN tags
- MPLS/MPLS-TP testing: Up to 8 levels of MPLS labels
- PBB testing
- 10G WAN PHY
- Ping testing
- Traceroute test
- Electrical cable test and optical signal level indication
- Frame capture for protocol analysis by Wireshark[®]

MT1100A Applications – Out-of-Service Testing

- Out-of-service Ethernet testing
 - Installation and commissioning of new lines
 - Verification of quality/performance of new lines before commercial operation
 - Troubleshooting with test traffic
 - Functional testing and network behavior at different loads
 - Testing line Quality of Service (QoS)
 - Loop-back MT1100A Ethernet test signal using cable or reflector at far end



Ethernet testing with far-end reflector

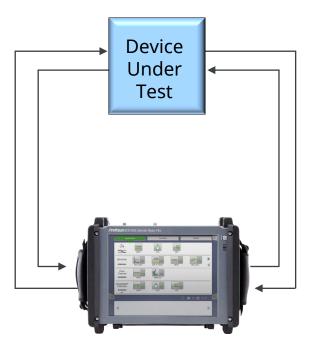
MT1100A Applications – Out-of-Service Testing

- Ethernet end-to-end testing
 - Due to nature of IP/Ethernet networks key parameters like Throughput, Frame Loss and Packet Jitter may differ in two directions of connection
 - Two instruments needed to capture data for each direction



MT1100A Applications – Out-of-Service Testing

- Typical applications^{*1}:
 - Dual-port testing of networks or network elements
 - One-way latency measurements
 - Router testing
 - QoS verification



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*1 Requires 10 Gbps dual-port option

MT1100A Applications – In-Service Monitoring

Network

element

- Typical applications^{*1}:
 - Rapid in-service diagnostics
 - In-service troubleshooting
 - Live traffic analysis and statistics



MT1100A in pass-through mode

Network

element

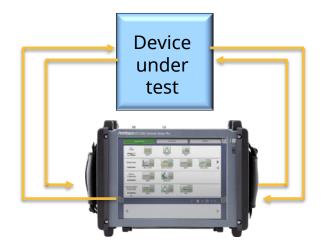
RS-FEC for 100GBASE-SR4 (MU110013A-023)

- Added RS-FEC function^{*1} to MU110013A Generate and Measure FEC 100GbE signal Supports FEC Code: RS (528, 514, 7, 10)
 - Dual-Port Test: DUT Insertion Test^{*2}
 - Single-Port Test: 100GigE+RS-FEC Confirmation/BER Test

RS-FEC Error Correction Check

• Set RS-FEC for either CFP2 or QSFP28*3

O CFP2	Forced	100 Gbps	•
_Clock Configurati	on		
Timing source:		Internal	▼ ●
Ref. Port:	Off	Rate:	1/16
FEC enable:		Off	



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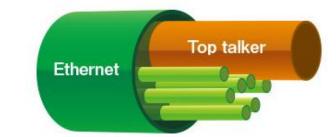
*1 Operation Results: 100GBASE-SR4, 100GBASE-ER4-lite

*2 Requires Dual-Port Option

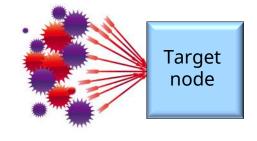
*3 Add PCS Error/Alarm and PCS skew selection when RS-FEC enabled

MT1100A IP Channel Statistics (up to 10 Gbps)

- IP Channel Statistics
 - Typical root causes of network issues
 - Top talker
 - Top talker occupies major bandwidth slowing it down
 - Network attack
 - One node accessed from many sites, occupying network
 - Error Frames
 - Error frames causes re-transmission and wasted network capacity



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MT1100A IP Channel Statistics (up to 10 Gbps)

- IP Channel Statistics
 - Finding top talker, network attack, and error frames quickly decreases downtime and recovers network performance
 - IP Channel Statistics offers simple method to "top talker, network attack, and error frames just by selecting and starting filters
 - Field technicians analyze network easily without training

Analysis	IP Channel Stats Filter
Top talker	Source IP address
Network attack	Destination IP address
Error frames	(any parameter OK)

MT1100A IP Channel Statistics (up to 10 Gbps)

- IP Channel Statistics
 - Combination of filters
 - IPv4, IPv6 or MAC address, VLAN ID or MPLS label, IP next header (protocol), TCP/UDP ports
 - Monitoring values
 - Frame counts/rate, Throughput, Error frames, Size distribution, IPv4/IPv6 statistics, TCP/UDP statistics, etc.

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- Added value of IP Channel Statistics
 - VLAN scan
 - Throughput per VLAN ID monitored by selecting VLAN ID as filter

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MT1100A IP Channel Statistics (up to 10 Gbps)

- Setup screen for configuring channel definitions and displayed columns
- Result screen
 - Easy switching between results from two ports

	Modify shown colur	? X						
2014-10 Definitions	Statistics							
Summa 🗷 Channel No.	Frame statistics	X All of this category						
Modi MAC source address	IP size distribution	🕱 Frame count	4					
No.	MPLS statistics	🕱 Frame rate (fps)						
7 Protocol Info	IP statistics	🕱 Byte count (bytes)						
8 🗌 VLAN tag	IPv4 statistics	🕱 Throughput (bytes/s)						
9 🔲 MPLS label	IPv6 statistics	🕱 Undersize frames	?					
10 🗷 IP source address	TCP statistics	🕱 Oversize frames						
🗌 IP destination address	UDP statistics		E					
No.			-					
g 🔲 TCP/UDP source port			Ē					
9 🗌 TCP/UDP destination port			Y					
			~					
	All result will be reset after changing the active definitions.							
Select All Clear All		Cancel OK (Will reset all result)						



MT1100A Ethernet Line Status

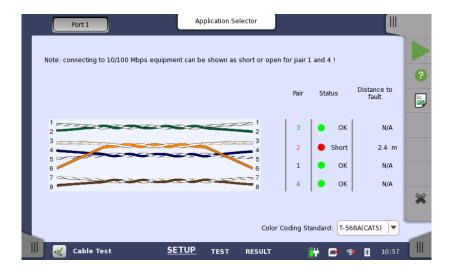
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- Line alarms as LED indicators
- Displays current line status



MT1100A Cable Test for Electrical Ethernet

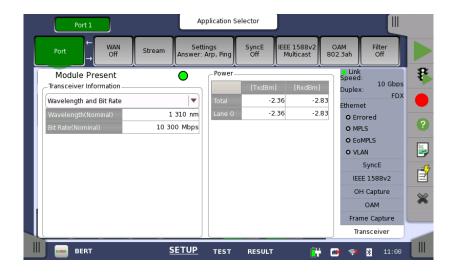
- Some problems on electrical Ethernet are basic:
 - Short in wire pair
 - Break in wire pair
- Cable test easily identifies such basic problems
- Cable test displays distance from instrument to fault



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MT1100A Signal Level Display for Optical Ethernet

- Some problems on optical Ethernet connection are basic:
 - Bent cables
 - Breaks in cable
 - Dirty connectors
- Optical signal level display easily identifies such problems



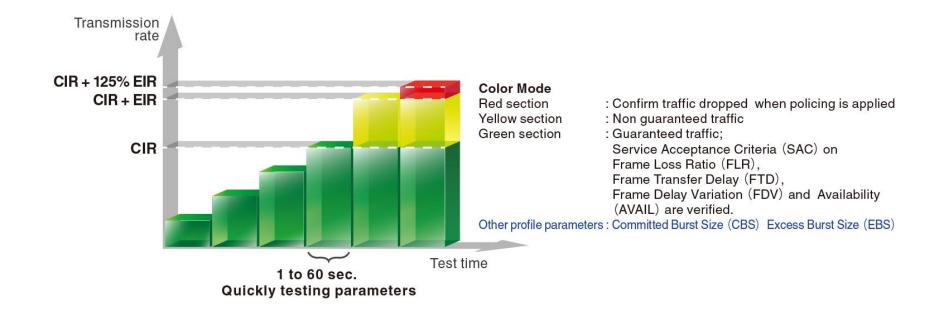
- What is ITU-T Y.1564?
 - Anritsu actively involved in creating Y.1564 standard
 - Defines new method for testing multiple Ethernet services on network simultaneously
 - Designed to allow service providers to assess customer end-to-end network performance including:
 - End user traffic profiles with multiple frame sizes
 - Services with different traffic priorities on network
 - Verifies following for each surface:
 - Frame Loss, transfer time and jitter across network
 - Policing
 - Network ability to manage short-duration traffic bursts





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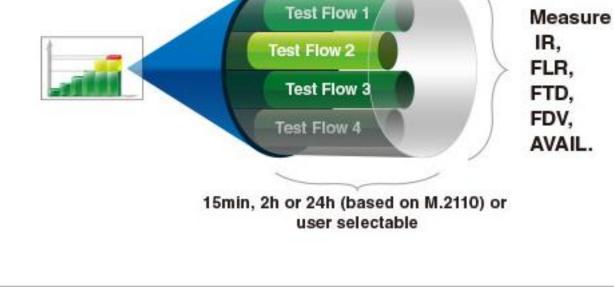
- What is ITU-T Y.1564?
 - ITU-T Y.1564 completes testing in two phases:
 - Phase 1: Service Configuration Test—confirms each service configured correctly throughout network at Committed Information Rate (CIR), and others rates as required
 - Tests one service at a time





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- What is ITU-T Y.1564?
 - ITU-T Y.1564 completes testing in two phases:
 - Phase 2: Service Performance Test—Transmits one or many services simultaneously at CIR confirming all traffic can transverse network under full service load
 - Default test time: 15 minutes, 2 hours, or 24 hours



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- What is ITU-T Y.1564?
 - Test configurations:
 - One-way test, using two testers
 - Provides individual results for each direction
 - "Preferred configuration" in Y.1564
 - How to synchronize two instruments to test one-way FTD (Frame Transfer Delay) is an issue.



• Round-trip test

envision: ensure

/Inritsu

- FDV (Frame Delay Variation) may be irrelevant



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- What is ITU-T Y.1564?
 - RFC 2544 often used for Service Activation Test
 - Not intended use for RFC 2544:
 - "Benchmarking Methodology for Network Interconnect Devices"
 - Defines number of tests used for describing performance characteristics of network devices
 - Y.1564 intended for Service Activation Test

Item	ITU-T Y.1564	RFC 2544				
Designed for	Service activation	Device performance				
Concurrent services	Multiple services simultaneously	One service at a time				
Simulates	Realistic network	One service on network				
Testing time	Short due to simultaneous testing	Long due to sequential test of				
	of services	parameters and services				
Test result	Directly related to SLA	Link performance limit				
	requirements					



- Supports tests specified in Y.1564
- Features:
 - Two-step test based on:
 - Bandwidth profile parameters: CIR, EIR, CBS, EBS

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- Performance parameters: FTD, FDV, FLR, AVAIL
- Includes support for CM ("Color Aware") and EMIX
- Local–Remote operation
 - One-way test results using two MT1100A units
 - GPS add-on option for one-way FTD measurements
- Round-trip measurements

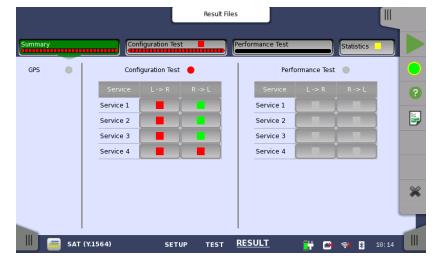
- Results
 - On instrument display
 - Easy-to-understand GO/NO GO display
 - Full result details also available
 - As pdf reports

Result Files						Resu	Result Files				
Summary	Configuration Test	Performance Test	Statistics		Summary	Configuratio	on Test	Performance	Test	Statistics	
Configuration Tes	st 😐	Performance	e Test 😑		Service	IR (Mbps)	FL	FTD (ms)	FDV (ms)	Avail (%)	
Service	Status	Service	Status	?	Service 1	100.00	0	0.000	N/A	100	?
Service 1		Service 1			Service 2	100.00	0	0.000	N/A	100	
Service 2		Service 2		E	Service 3	125.00	0	0.000	N/A	100	E
Service 3		Service 3			Service 4	150.00	0	0.000	N/A	100	
Service 4		Service 4		*	Click on each cell to see	the details					*
					Min 0.000	Max 0.001		ean 000	Threshold 0.500		
SAT (Y.1564)	SETUP TES	T <u>RESULT</u>	💾 📑 🤿 🎉 10	:36	SAT (Y.1564	4)	SETUP TES	т <u>RESULT</u>	: : ••	🔿 ∦ 10 3	7
	Result S	ummary					Result	Details			

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- Setup of overall test conditions
 - Display results from local and remote instruments on local instrument when one-way test (using two instruments) selected





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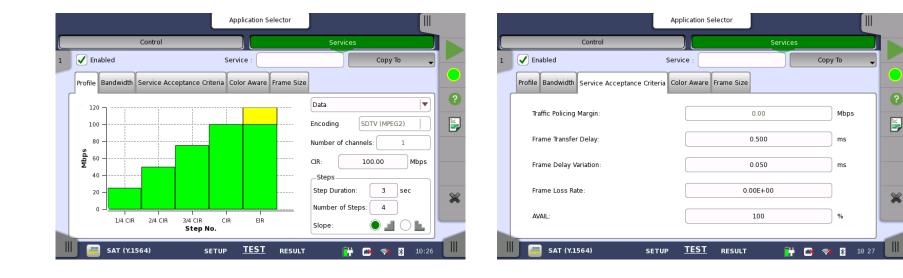
Result Summary on Local Instrument after Test

- Setup of each service
 - Graphical presentation of traffic profile for easy overview

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– Full flexibility in programming parameters

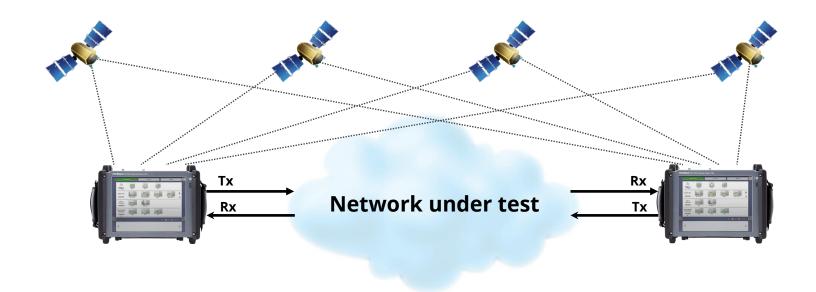


- GPS synchronization
 - Accurate information on one-way FTD with GPS synchronization option
 - Once synchronized, MT1100A holds synchronization for period of time

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- Relevant when difficult to get GPS signals at test site



MT1100A RFC 2544 Analysis

- ETF RFC 2544 "Benchmarking Methodology for Network
 Interconnect Devices"
 - Defines number of tests used to describe performance characteristics of network devices
 - Throughput for selected layer
 - Frame Loss
 - Latency
 - Packet jitter
 - Burstability
- Easy-to-interpret graphs
- Full-detail tables



Graphs are bar graphs with legends (where applicable), giving users a better overview of results



RFC 2544 tables fit the screen width – no need for horizontal scrolling

MT1100A RFC 2544 Reporting

- Report tables are organized like the GUI with Tx row followed by Rx row, making it easy to find faulty test areas with Frame loss.
 - New tables display per-port test results before actual results tables.
 Users can quickly identify combinations

of Frame sizes and utilizations with problems.



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RFC 2544 graphs same as GUI



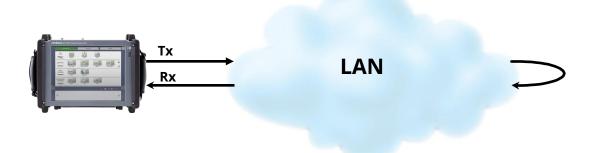
PDF reports are displayed with the built-in PDF viewer

RFC2544 Summary section with new table showing which tests completed

Benefit of RFC 2544 End-to-End Test

• Typical test set-up with one instrument and reflector or loop-back OK for symmetrical links:

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- For Ethernet links carried over asymmetrical connections (xDSL, WIMAX) throughput tests only reflect performance of link direction with lowest capacity
- Symmetrical typical test set-up does not identify transmission performance differences between two link directions

MT1100A RFC 2544 End-to-End Test

- RFC 2544 end-to-end test with Local–Remote relationship
 - Needed for test of Ethernet links over asymmetrical connections
 - Identifies transmission performance differences between two directions in link
 - User sets test at local master instrument which exchanges set-up and results with remote slave instrument

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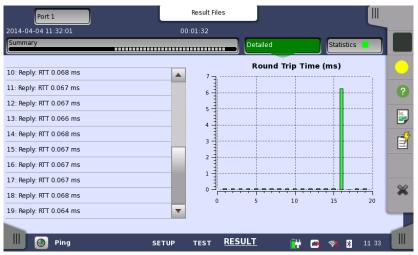
- Tests Throughput, Frame Loss and Burstability
- Tests two lines simultaneously



MT1100A Ethernet Ping Test

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





MT1100A Ethernet Traceroute Test

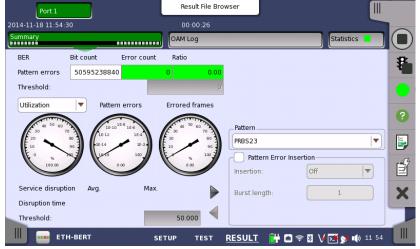
- Traces IP route over IP network
- Ping timing data per hop



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MT1100A Ethernet BER Tests

- Traditional test of physical connection
- Generates and detects test patterns
- Counts errors in received test pattern
- Color-coded errors and alarms for easy overview
- Pattern generation:
 - Unframed
 - Layer 2 (Mac address)
 - Layer 3 (with IP header)
 - Layer 4 (with UDP/TCP header)
- Detects sequence errors and loss of sequence synchronization
- Frame loss count and frame loss seconds



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MT1100A BER Tests

• Layered Throughput analysis

Frame representation	Throughput Calculation
IFG Pre-	Data
amble MAC MPLS EoMPLS VLAN LLC SNAP IP UDP PAYLOAD CRC	layer
IFG Pre-	Network
amble MAC MPLS EoMPLS VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) (opt) (opt) head TCP PAYLOAD CRC	layer
IFG Pre-	Link
amble MAC MPLS EoMPLS VLAN LLC SNAP IP UDP PAYLOAD CRC	layer
IFG Pre- amble MAC MPLS EOMPLS VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) (opt) (opt) head TCP PAYLOAD CRC	Physical layer no preamble
IFG Pre-	Physical
amble MAC MPLS EOMPLS VLAN LLC SNAP IP UDP PAYLOAD CRC amble header (opt) (opt) (opt) (opt) (opt) head TCP PAYLOAD CRC	layer
min. Pre-	Utilization
IFG MAC MPLS EOMPLS VLAN LLC SNAP IP UDP PAYLOAD CRC IFG amble header (opt) (opt) (opt) (opt) (opt) head TCP PAYLOAD CRC	layer
CMA 3000 frame size (does not include Preamble) Area included in throughput calculation IFG Area included in utilization calculation	Frame information



Why Service Disruption on Ethernet Links?

- Many Ethernet links carried over OTN/SDH/SONET via backbone network
 - OTN/SDH/SONET networks sometimes have Automatic Protection Switching (APS)
 - If OTN/SDH/SONET network line fails, APS switches traffic to working line

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– Switch and service disruption should be completed in less than 50 ms

MT1100A Service Disruption Measurement

- Service disruption can be measured as part of BER test
 - Using far-end loopback or two MT1100A testers
 - Max. acceptable service disruption time can be set
 - Color-coded results when max. time exceeded



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MT1100A Ethernet Signal Analysis

- Frame performance
- Frame type statistics
- Frame size distribution statistics
- Burst statistics
- Transmit statistics
- Full-detail tables
- User-defined thresholds to highlight problems

		F	Result Files						
2014-04-04 12:08:	04	00:0	0:30						
Summary	mmary								
III Total	Ethernet - Size Di	stribution		SI prefix	T	iraph 🥐			
12:08:04 Back		Ро	rt 1						
2014-04-04 12:08:09	Total Frames	Frames	Ratio						
2014-04-04	Total	21.3477 M	100			?			
12:08:14	Good	21.3477 M	100						
2014-04-04 12:08:19						5			
2014-04-04 12:08:24	Size Dist.	Frames	Ratio			(
2014-04-04	64-127	513.74 k	2.40654						
12:08:29	128-255	1.02807 M	4.81584			*			
Current	256-511	5.81694 M	27.2486						
2014-04-04 12:08:33	512-1023	6.62752 M	31.0456			-			
Ш 📰 Мо	n./Gen.	SETUP	test <u>RESUL</u>	<u>.</u> 🔐 C	* 🛪 *	12:08			

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MT1100A Latency and Packet Jitter Measurements

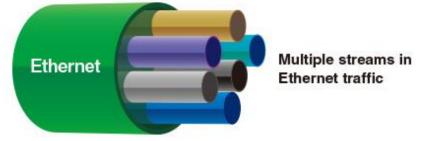
- Latency and packet jitter can cause problems for real-time services like VoIP
 - Part of statistical measurements
 - User selects included information

	Result Files		Port 1	Application Selector
2014-04-04 12:05:06	00:00:29		Control Generator	Streams Thresholds
Summary		Statistics	3 Stream 3 profile	
Total Ethernet - Multi Stre	eam Latency	▼ SI prefix ▼		/oiceStream 3 measurement
12.05.06	Port 1		Encoding: SDTV (MPEG2)	Rame loss
Back 2014-04-04 Latency(us) M	Min. Max. Avg.		Number of channels:	Threshold
12:05:11 Stream 1	4 5 4	?	Line load	Count Ratio 0
12:05:16 2014-04-04 Stream 2	4 5 4		Constant Ramp 17.0000	¶%
12:05:21 Stream 3	4 5 4		Total: 73.0000	% Threshold 0.0 us
2014-04-04 Stream 4 12:05:26	4 5 4	É	Frame size	Latency 2
Stream 5	N/A N/A N/A		Random	Beguiros far and is lean bask device
12:05:31 Stream 6	N/A N/A N/A	× 1		Threshold 0.0 us
Current Stream 7	N/A N/A N/A		Start: 64 End:	
2014-04-04 12:05:33 Stream 8	N/A N/A N/A		Step: 64 Duration:	1 s
Mon./Gen.	SETUP TEST <u>RESULT</u>	🔐 🗃 🧇 🕅 12 05	Mon./Gen. SETU	P TEST RESULT 🔐 🗃 🖘 🛿 12:10

Benefit of Ethernet Multistream Test

• By sending several traffic streams with different priority settings, the user can verify that high-priority traffic is transported better (i.e. has lower frame loss) through a congested network than low-priority traffic.

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- VoIP traffic is often given high priority to ensure service quality
 - Sometimes DSCP/TOS byte used to give high priority
 - Other times high priority given to selected TCP/UDP ports
- Some operators allocate certain traffic capacity to each traffic type on link with limited capacity
- User can verify that each traffic types gets allocated capacity by sending several traffic streams with different type indications
 - Traffic type indicated by VLAN tags

MT1100A Ethernet Multistream Test

- Using MT1100A, user can generate up to 16 streams per port on Ethernet link
 - Individual settings for traffic load and header information for streams, including DSCP/TOS byte and TCP/UDP port numbers for each stream

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	Port 1	A	pplication Selecto	·				
	Control	Generator	St	reams		Thresholds	5	
IP				Percent	•	3		
-		Dst IP: 0.0.0.0		<u>_</u>				8
2:		Src IP: 2.0.0.0 Dst IP: 2.0.0.0		15.0000				<u>۲</u>
3:		Src IP: 3.0.0.0 Dst IP: 3.0.0.0		17.0000				
4:		Src IP: 4.0.0.0 Dst IP: 4.0.0.0		21.0000		0		?
5:		Src IP: 0.0.0.0 Dst IP: 0.0.0.0		Off				
6:		Src IP: 0.0.0.0 Dst IP: 0.0.0.0		Off		0.0	us	E,
7:		Src IP: 0.0.0.0 Dst IP: 0.0.0.0		Off				1
8:		Src IP: 0.0.0.0 Dst IP: 0.0.0.0		Off		ck device		×
9:		Src IP: 0.0.0.0 Dst IP: 0.0.0.0		Off	-	0.0	us	~
			To	tal: 73.0000				
				_	_	J		
	Mon./Gen.	SETUP	TEST RES	SULT		🔉 🚿 🕷	12 13	

Stream Selector and Overview

MT1100A Ethernet Multistream Test

• Multistream function displays frame loss for up to 16 streams per port, making it easy to spot whether high-priority traffic has lower frame loss than low-priority traffic

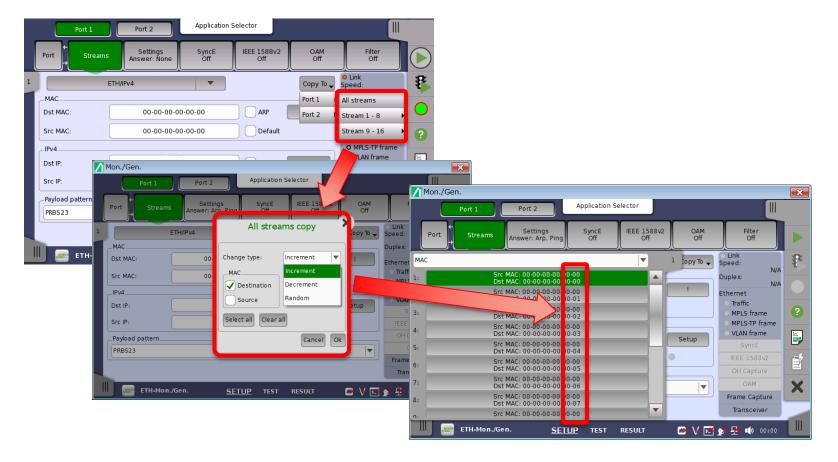


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Simple Stream Address Creation

• When generating Ethernet and IPv4/v6 test Frames, a function supports creation of [Increment], [Decrement], and [Random] streams for the address specified location, resulting in shorter test setting times.

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VLAN Background

- Virtual Local Area Networks (VLANs) IEEE 802.1Q
 - Segment LAN on organizational basis, by functions, project teams or applications
 - Each VLAN has ID and priority
 - 802.1p priority bits (3) segment traffic into eight Classes of Service (CoS), enabling traffic differentiation

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- 12-bit ID supports 4096 VLANs
- Stacked VLAN ("Q-in-Q") IEEE 802.1ad
 - VLAN carried on VLAN
 - Method to provide more VLAN IDs
 - Allows service provider to carry customer VLAN traffic transparently service provider VLAN
 - Sometimes service provider and/or customer use more than one VLAN tag

MT1100A Ethernet Stacked VLAN Function

• Insert up to eight layers of VLAN tags into Ethernet frame

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- Can be combined with Multistream function
- Special layer naming when two layers selected
 - S-VLAN Service provider VLAN
 - C-VLAN Customer VLAN

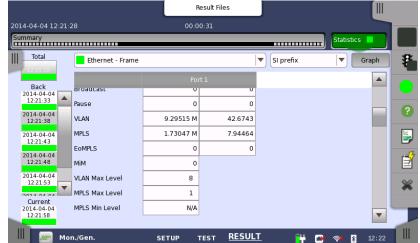
Layer 4	_Frame Content	Application Selector Stream Setup	? ×	Layer 4	_Frame Content	Application Selector Stream Setup	? ×
None	ETH	VLAN IPv	4 Payload Variable	None 💌	ETH	VLAN IPv4	Payload Variable
1 IPv4	Level count: 8			1 IPv4	Level count: 2		
Layer 2SNAP	#1: ID: 0 #2: ID: 0		D Ethertype: 0x8100	Layer 2	S-VLAN ID: 0		Ethertype: 0x8100 Ethertype: 0x0800 (IPv4)
ша	#3: ID: 0	DEI Priority:	D Ethertype: 0x8100	шсі) ··· (IPV4)
VLAN	#4: ID: 0	DEI Priority:	D Ethertype: 0x8100 ▼	VLAN PBB			
MPLS-TP	#5: ID: 0 #6: ID: 0		D Ethertype: 0x8100	MPLS-TP			
MPLS	#8: ID: 0		D Ethertype: 0x8100 ▼ D Ethertype: 0x8100 ▼	MPLS			
	#8: ID: 0	DEI Priority:	D Ethertype 0x0800 (IPv4)				
Stream 1 2	3 4 5 6	7 8 9 10 11	12 13 14 15 16 Close	Stream 1 2	3 4 5 6	7 8 9 10 11 11	2 13 14 15 16 Close

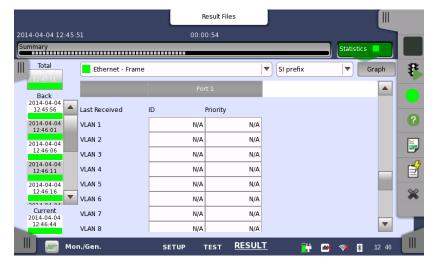
CFI bit renamed to DEI (Drop Eligible Indicator)

MT1100A Ethernet Stacked VLAN Function

- VLAN information:
 - Indicates detected VLAN tagged frames in Status pane
 - Counts detected VLAN tagged frames and max. VLAN tag level in statistical measurements
 - Displays information on last received VLAN frame

		Port 1	Applic	ation Selector				
	Port	← WAN → Off	Streams Settings Answer: A		IEEE 1588v2 Multicast	OAM 802.3ah	Filter Off	
3		ETH/VLAN/IPv4	•		Сору То	- Spe	ink eed: blex: FDX	
	Dst MAC:		00-00-00-00-00				ernet	
	Src MAC:		00-00-00-00-00		Default		Errored MPLS	?
	_IPv4					•	EoMPLS	
	Dst IP:		3.0.0.0		NS Setu	•	VLAN	5
	Src IP:		3.0.0.0		HCP		SyncE IEEE 1588v2	ľ
	VLAN			Payload p	attern		OH Capture	~~~
	#1	ID:	0				OAM	*
				PRBS23		▼]	Frame Capture	
	#2	ID:	0				Transceiver	
		Mon./Gen.	SETUP 1	TEST RESULT	r 📑	i 🔿 🖞	२ 1 2:19	





MPLS Background

- Multi-Protocol Label Switching (MPLS)
 - Carries data; considered to be between Layer 2 (Data Link Layer) and Layer 3 (Network Layer); often called "Layer 2.5".
 - Simplifies point-to-point routing
 - MPLS header has one or more 'labels' (label stack) and each label has four fields:

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- 20-bit label value
- 3-bit field for QoS priority
- 1-bit bottom of stack flag
- 8-bit TTL (time to live) field
- EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo Wire Emulation Edge-to-Edge)
 - Defines method to transport Layer 2 protocol across MPLS network

MT1100A MPLS/MPLS-TP Function

- Stacked MPLS generation
 - Inserts up to 8 layers of MPLS labels into Ethernet frame
 - Can be combined with Multistream facility
 - EoMPLS Control word can be added with MPLS-TP

None	E		MPLS	MPLS-TP	IPv	4 Payload	d Variable	
			MIFLS	MILDEN	11.0	4 Tayload		
Layer 3	Level co	unt: 8	•					
Layer 2	#1:	Label:	100	EXP:	0	Stack 0	TTL:	32
SNAP	#2:	Label:	200	EXP:	1	Stack 0	TTL:	32
шсі	#3:	Label:	300	EXP:	2	Stack 0	TTL: :	32
VLAN	#4:	Label:	400	EXP:	3	Stack 0	ΠL: :	32
PBB	#5:	Label:	500	EXP:	4	Stack 0	ΠL: []	32
MPLS-TP	#6:	Label:	600	EXP:	5	Stack 0	TTL:	32
MPLS	#7:	Label:	700	EXP:	6	Stack 0	TTL:	32
	#8:	Label:	800	EXP:	7	Stack 1	TTL:	32



MT1100A MPLS/MPLS-TP Function

- MPLS information:
 - Indicates detection of MPLS and EoMPLS frames in Status pane
 - Counts detected MPLS and MPLS-TP (EoMPLS) frames and max. MPLS layer

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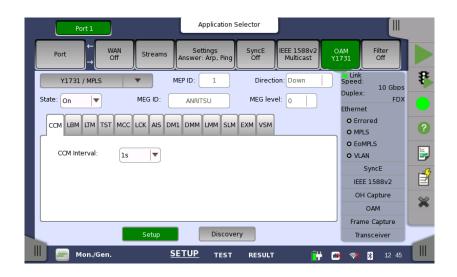
page

Displays information on latest received MPLS frames

		Result	File Browser						Re	sult File Brov	wser			
2014-07-03 10:	37:58	00:00):16			20	014-07-03 10:37:58		00	0:00:36				
Summary					Statistics		ummary			_og			Statistics	
<u>Total</u> 2014-07-03	Ethernet - Frame			SI prefix				Ethernet - Frame				SI prefix	•	8
10:37:59		Port	· 1				10:37:59			Port 1				<u>`</u>
Back 2014-07-03 10:38:04	Pause frame	0	0.00 %				Back 2014-07-03 10:38:04		Label Prio					
2014-07-03	VLAN frame	0	0.00 %				2014-07-03	MPLS 1	100	0	32			?
10:38:09	MPLS frame	173.611 M	100.00 %					MPLS 2	200	1	32			
2014-07-03 10:38:14	MPLS-TP frame	173.611 M	100.00 %				2014-07-03 10:38:14	MPLS 3	300	2	32			ĕ
	PBB frame	0	0.00 %					MPLS 4	400	3	32			
	VLAN max level	N/A			l é	7		MPLS 5	500	4	32			Í
	VLAN min level	N/A					2014-07-03 10:38:24	MPLS 6	600	5	32			-
Current	MPLS max level	8			×		Current	MPLS 7	700	6	32			X
2014-07-03 10:38:14	MPLS min level	8			• 5			MPLS 8	800	7	32		•	
	Mon./Gen.	SETUP T	est <u>RESUL</u> 1	- 📄 📑 🕅	* V/ 💽 1 0:38		📗 虅 Mon.	/Gen.	SETUP	TEST	<u>RESULT</u>	📔 📑 🔿	≫ V ⊡ 10 38	

MT1100A MPLS-TP Function

- MPLS-TP information:
 - Activation of MLPS-TP OAM function



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MT1100A PBB Function

- PBB(Mac-in-Mac) information:
 - Counts PBB frames at result page
 - Can be combined with Multistream facility



MT1100A TCP Function

- Set TCP connections before sending traffic with TCP headers
 - Allows traffic to pass firewalls using "state-full inspection"
 - Limited implementation:
 For example:
 - No retransmissions
 - No flow control

		Stream S			? X
Layer 4	Frame Content				
ТСР 💌	2777	IPv4	TCP	Payload	Variable
Layer 3	Auto connec	:t	Lister	mode	
IPv4	Storent	0	Dst Port:		0
Layer 2	Seq number:	0	Auto i	ncrement	
	Ack number:	0			
шсі	Data offset:	5			
VLAN	Reserved:	00h			-
РВВ	Flags		E URG	🖌 АСК	1
MPLS-TP		PSH RS	T SYN	FIN	i i
MPLS	Window:	0	Urgent po	inter:	0
	Checksum	#HB33E			
Stream 1 2	3 4	5 6 7 8	9 10 2	11 12 13	14 15 16 Close

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MT1100A Ethernet Traffic Generator

• Ramp Traffic: Increases traffic automatically until maximum capacity exceeded

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- Program control for each stream
- Burst Traffic: Continuous sending at specified conditions
- Generate Tx rates above 100%
- Data type profiles (data, video, audio)

_	Port 1		plication Selector	×			Port 1	Application 5	Selector		
	Control			Thresholds		_	Control	Generator	Streams	Thresholds	
1	Stream 1 profile	bps	\wedge		8	1	Stream 1 profile	o Ovoice	Stream 1 measurem	Copy To .	*
	Encoding: Number of channels:			»[s]			Encoding: Number of channels:	SDTV (MPEG2)	Frame loss		
	Line load		Percent Mbps	0	?		Line load		Count	Ratio 0	?
	Constant 🔵	Line load start: Line load end:	0.0008 %	0,0 us			Constant Ramp	0.0008 % al: 100.0000 %	Jitter Threshold	0.0 us	5
	Frame size	Step size:	Keep end Repeat ramp		Ľ		Frame size		✓ Latency		2
	Start: 72	Step duration: Ramp mode:	Invert ramp	ack device 0.0 us	*		Start: 72	End: 100	Requires far-end is	0.0 us	*
	Step: 64	Off		Close			Step: 64	Duration: 1 s			
	Mon./Gen.	SETUP	TEST RESULT	🔐 🕬 🛪 🖁 12:38			im Mon./Gen.	SETUP <u>TEST</u>	RESULT	🔐 🔿 🛪 🖁 12 3	8

Custom Editing of Ethernet Header

- Free editing of the Ethernet Header in the Frame stream settings to support special protocols for R&D.
 - This function can be used with the following applications:
 - Ethernet BERT Application

7 DEDT		ream Setup	_	? X	
Layer 4	Frame Content	Decidere d	1 fe wi		
Layer 3 None V Layer 2 SNAP LLC1 VLAN PBB	CUSTOM Custom pattern: File Import File Export	Payload Length 40 00 XX XX XX 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00		able	
Select La or Layer			00 00 00 00	00 00 00 00 00 00 00 00	Variable
		<u> <u>36101</u></u>	TEOT REDUE	.	Close

 Edit Custom header with text editor for Save and Load

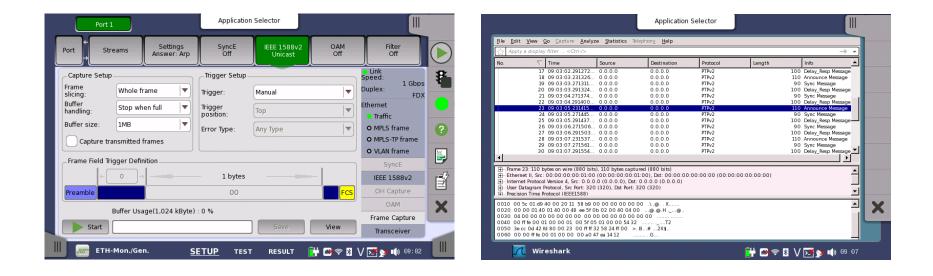
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- ✓ Supports Header lengths up to 256 bytes
- The following restrictions apply:
 - "Ethernet over OTN" not supported
 - Rx filters other than Layer 2 not supported when using Layer 3 Custom headers
 - No Rx filters supported when using Layer 2 Custom headers
 - Arp/Ping functions not supported when using Layer 2/3 Custom headers

MT1100A Ethernet Frame Capture Function

- Protocol analysis
 - For advanced Ethernet troubleshooting
 - Captures frames in live traffic of monitored line
 - Analyzes captured frames using Wireshark[®] protocol analysis software

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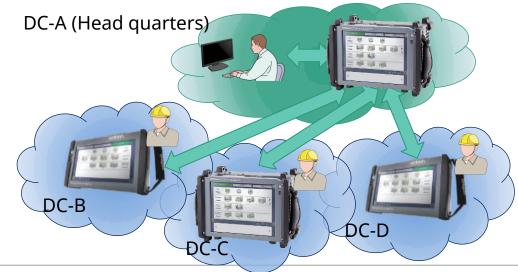


Network Discovery and In-band Control

- No Need for Two Engineers for End-to-end Test
 - One engineer controls both local and remote testers without dedicated LAN for remote access

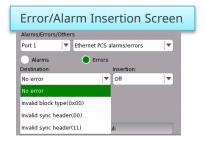
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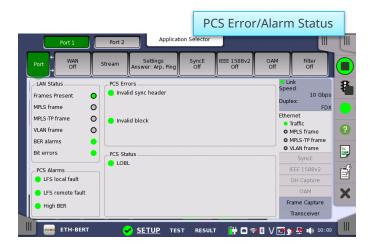
- Testing from one end cuts OPEX
- Process
 - Discover other "Network Master(s)" on network
 - Remote-control far-end tests, such as RFC2544, Y.1564, Reflector (L2/L3/L4 loopback) etc.
 - Generate report at local controller with results summarized at both local and remote testers

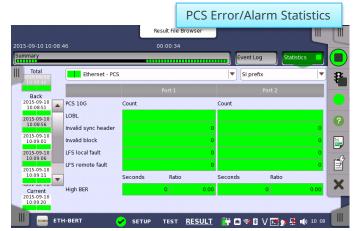


Validating PCS

- Validating PCS operation at the 10 GbE interface to support fast troubleshooting in the PCS layer:
 - Error/Alarm Insertion
 - Error/Alarm Display/Count
 - 10G/40G/1000G LAN PHY is supported





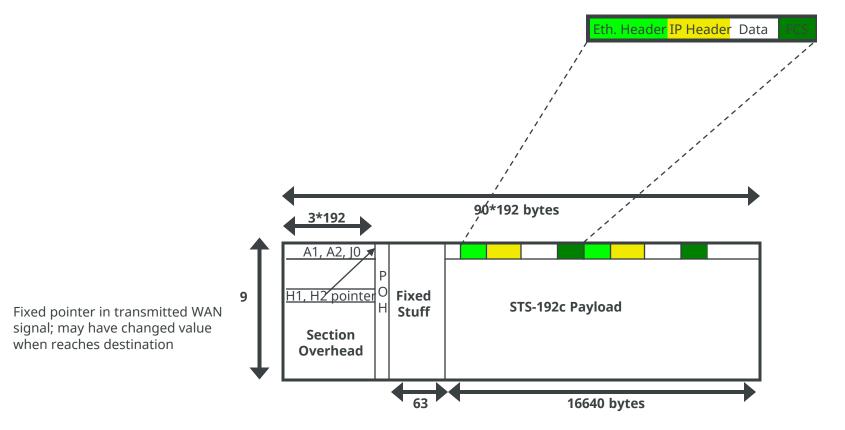


• Does not support Stimuli function Invalid alignment marker/BIP error

10G WAN PHY Background

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- 10G WAN PHY
 - Mapping Ethernet frames to SONET/SDH



MT1100A 10G WAN PHY Function

- WAN results
 - Bi-directional overhead byte capture (requires dual-port version)
 - Error and alarm statistics on WAN part of signal with Ethernet BERT application

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MT1100A 10G WAN PHY Function

- WAN overhead byte generation
 - User programming of transmitted OH bytes
 - SDH or SONET terminology



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Network Master Flex MT1100A

• TCP Throughput Option (RFC 6349)



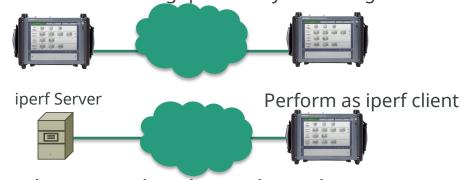
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- Optimized performance essential in modern communication
 networks
- IP network operators can test networks based on IETF RFC 2544 and ITU-T Y.1564
 - Even when network seems fine at these tests, customers may complain that achieved throughput below agreement with operator
 - Can be caused by non-optimal configuration of Transmission Control Protocol (TCP) providing higher-layer connections through network, or badly configured network element burst size settings
- TCP adds reliability to communication over IP network because data receiver acknowledges packets received correctly
 - To support this, network elements have buffering
 - Data throughput reduced if buffering dimensions incorrect
- Operators use RFC 6349 test methodology to optimize TCP throughput

Benefit of TCP Throughput Test (up to 10 Gbps)

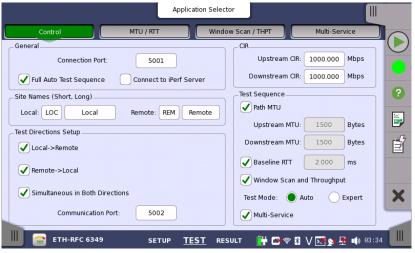
• Eliminate end-user factors from test by emulating TCP host Bi-directional TCP throughput test by emulating end user hosts



- MT1100A TCP throughput test hardware based
 - Always validate maximum TCP throughput potential possible on customer's network.
 - Repeatable tests with consistent results
- MT1100A can perform bi-directional TCP throughput testing
 - More realistic test result can be got.
- MT1100A can test up to four ports simultaneously
 - Can shorten multiple network commissioning test time.

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- TCP performance verification using RFC 6349 test methodology
- Client and server modes
- Connect to iperf server as client
- Automated or manual testing
 - New installation mode
 - Troubleshooting mode
- Simultaneous bi-directional testing with independent settings
- Configuration of TCP Throughput (RFC 6349) test





- Measurements include:
 - MTU (Maximum Transmission Unit) based on RFC 4821
 - RTT (Round-Trip Time)
 - Window scan
 - Throughput
 - Multi-service (if selected)

Measurement res	sults include:
-----------------	----------------

- Transmitted and Retransmitted
 Bytes
- TCP Transfer Time Ratio
- TCP Efficiency
- Retransmitted Percentage
- Buffer Delay Percentage

		Local->Remote				Local->Remote		Graph	
Window Size	Connections	Threshold	Avg Throughput	Avg RTT	Avg Throughput	949.284 Mbps	Window Size/Conn	2920 Bytes / 1	
2920 Bytes	1	95.00 % of Idea	il 949.284 Mbps	0.022 ms	Ideal Throughput	949.285 Mbps	Transmitted Bytes	1.11 GB	
					Actual Transfer Time	10.00 s	Retransmitted Bytes	0 Bytes	
Network Parameters	Source	Value	RFC6349 Metrics	Result	Ideal Transfer Time	10.00 s	Retransmitted %	0.00 %	
MTU / MSS	Measured	1500 / 1460 Bytes	Transfer Time Ratio	1.00	Transfer Time Ratio	1.00	TCP Efficiency	100.00 %	
RTT	Measured	0.022 ms	TCP Efficiency	100.00 %					
CIR	User Input	1000.000 Mbps	Buffer Delay	0.00 %	Baseline RTT	Min RTT Av	g RTT Max RTT	Buffer Delay	
					0.022 ms	0.015 ms 0.02	22 ms 0.023 ms	0.00 %	

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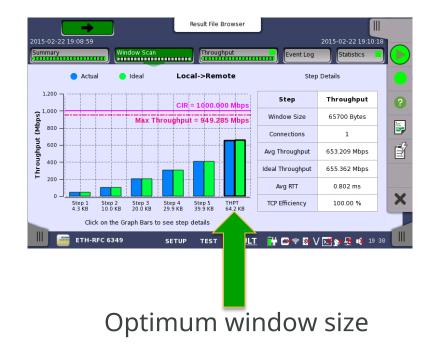
- Multi-service results (when selected) ullet
 - Test up to 16 connections

Result File Browser										
nmary	imary Window Scan Throughput I Multi-Service Event Log Statistics									
ndow Size/Conn:	2920 Bytes / 16	Local->Remote		Graph						
Connection	Min RTT	Avg RTT	Max RTT	TX THPT	TCP Efficiency					
11	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %					
12	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %					
13	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %					
14	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %					
15	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %					
16	0.027 ms	0.027 ms	0.027 ms	59.330 Mbps	100.00 %	-				
	0.015 ms	0.027 ms	0.027 ms	949.284 Mbps	100.00 %					

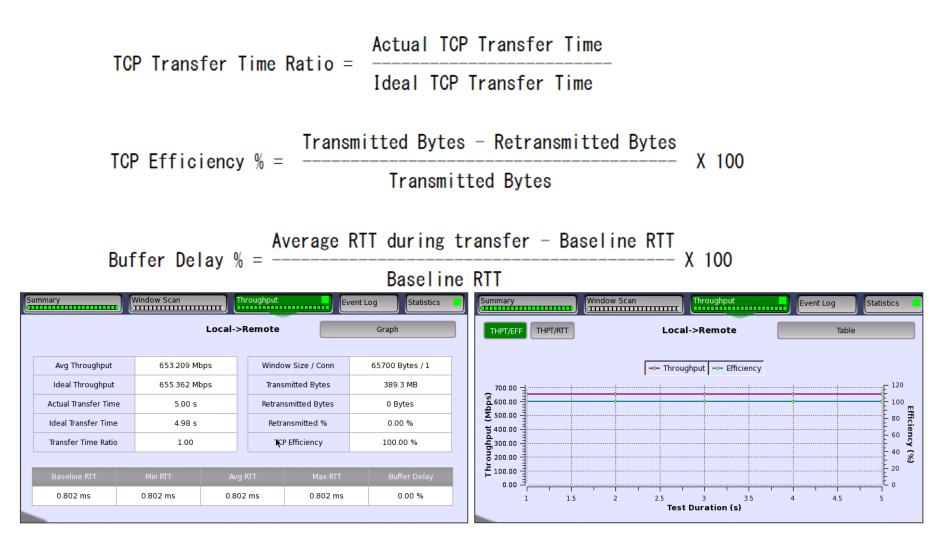
Window Scan Result

• MT1100A runs "Window Scan" test measuring TCP Throughput at each window size

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TCP Throughput Metrics



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Network Master Flex MT1100A

• Ethernet OAM Functionality



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Ethernet OAM Background

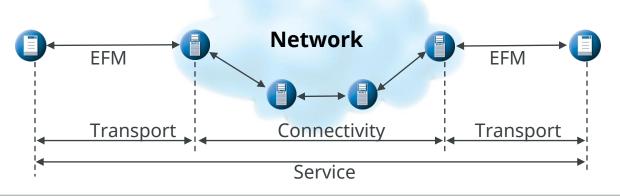
• Ethernet moved from LAN technology to Carrier Class technology

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- Ethernet Operations, Administration and Maintenance (OAM) developed to:
 - Ease operations, administration, and maintenance of complex Ethernet networks
 - Reduce operational expenses
- Ethernet OAM covers:
 - Link fault management
 - Connectivity fault management
 - Performance monitoring

Ethernet OAM Layers

OAM layers	Functions	Standards
Transport layer	Ensures bi-directional communication between two directly connected devices Focuses on Ethernet First Mile (EFM) Link fault management	IEEE 802.3 (now includes IEEE 802.3ah)
Connectivity layer	Monitors path between two devices not directly connected Connectivity fault management incl. Link trace, continuity check and loopback protocols	IEEE 802.1ag ITU-T Y.1731
Service layer	Monitors status of services as seen by customer Performance monitoring including Frame Loss, Frame Delay and Throughput measurements	ITU-T Y.1731



Ethernet OAM Y.1731 and IEEE 802.1ag

- Y.1731 and IEEE 802.1ag similar
 - Supported by both Y.1731 and IEEE 802.1ag:
 - Connectivity fault management
 - Supported by Y.1731 only:
 - Performance monitoring
 - Same frame format for OAM PDUs (Protocol Data Units)



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Ethernet OAM IEEE 802.3ah

- Ethernet OAM IEEE 802.3ah functions:
 - Remote failure indication during fault
 - Remote loopback mode ("Real" loopback)
 - Fault isolation
 - Link performance and status monitoring
 - OAM discovery mechanism
 - Determines whether remote device has OAM enabled and configured parameters and supported functions compatible with requesting device

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- Optional activation of OAM
 - OAM can be enabled on ports subset or all ports
- Extension mechanism
 - Available for higher-level management applications

Ethernet OAM

• Ethernet OAM Y.1731 set-up and results:



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Network Master Flex MT1100A

- Mobile Backhaul Test
 - Synchronous Ethernet Test



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Ancitsu envision : ensure

- Recently Ethernet become dominant technology for data transmission, due to simplicity and low cost
 - Started as LAN (Local Area Network) technology but now used for endto- end communications
- Synchronous networks (PDH, SDH/SONET) migrating to Ethernetbased packet-switched network (PSN)
- Asynchronous nature of Ethernet causes transmission challenges:
 - Many existing networks have strong requirement for frequency synchronization across entire network
 - PDH, SDH/SONET technologies have "built-in" physical layer ability to carry reference Clock

- Synchronization can be applied to Ethernet-based packet networks using Synchronous Ethernet
- Techniques under consideration for Ethernet synchronization are:
 - Physical synchronization signal forwarding as defined in ITU-T recommendations G.8261, G.8262 and G.8264 (in many cases now called SyncE)



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- Packet-based synchronization as defined in IEEE1588 v2 Precision Time Protocol (PTP)
 - ITU-T G.8265.1 telecom profile for frequency synchronization
 - ITU-T G.8275.1 telecom profile for phase/time synchronization



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MT1100A Synchronous Ethernet Test (up to 10 Gbps)

- SyncE (ITU-T G.826x) functions:
 - Detect ESMC messages and real time display of received SSM/QL byte
 - Record ESMC message log
 - Generate alarm when SSM/QL not received within 5 seconds
 - Clear alarm on SSM/QL reception
 - Transmit ESMC/SSM messages with user-defined QL
 - Four user-selectable QL interpretations
 - SyncE recovered frequency monitor and synchronized packet generation.

Port 1	Applicatio	on Selector		
Port WAN Off	Settings Answer: Arp, Ping	SyncE IEEE 1588v2 Off Off	OAM Filter Off Off	
Clock Configuration	Received	Transceiver Wavelength(nominal) N/A Compliance N/A	Link Speed: N/A Duplex: N/A Ethernet Traffic MPLS frame MPLS-TP frame VLAN frame SyncE IEEE 1588v2 OH Capture OAM	* • •
			Frame Capture Transceiver	
ETH-BERT	<u>SETUP</u> TEST	RESULT	10 46	

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- SyncE (ITU-T G.826x) results (per port):
 - Status information:
 - Rx SSM QL (current value)
 - Statistics on SSM QL messages and values



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- IEEE 1588 v2 (PTP) functions:
 - Support G.8265.1, G.8275.1 profile and 'User defined' one.
 - Emulating a master clock.
 - Selectable UTC source from internal instrument clock or GPS.
 - Configurable parameters of Announce message, etc.
 - Emulating slave clock
 - Configurable parameters of message interval, etc.
 - Best master clock algorithm (BMC)
 - Supported encapsulations: PTP-UDP-IP(IPv4 and IPv6) and PTP-MAC
 - Support stacked VLAN and MPLS
 - Real time PTP signaling sequence in ladder chart, off-line analysis by PCAP file capture, message statistics, message rate measurement.

For quick analysis and troubleshooting of IEEE 1588 v2 (PTP) signaling

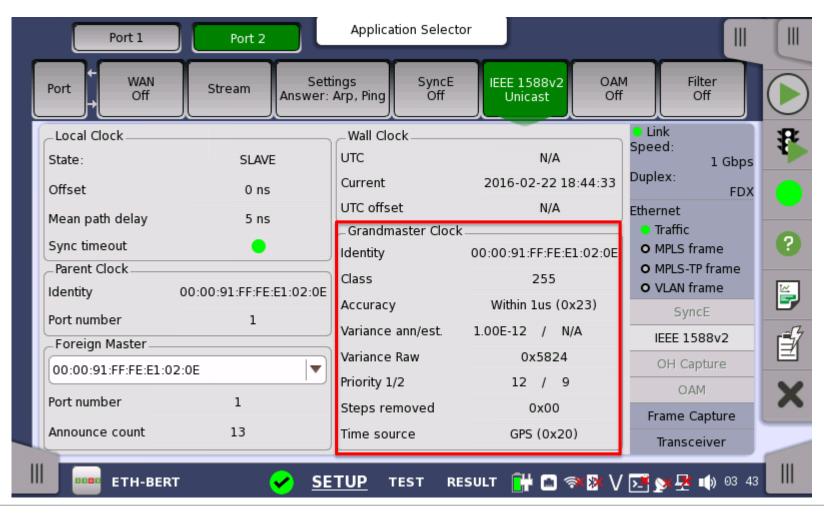
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- IEEE 1588 v2 (PTP) results statistics on:
 - Offset and offset variance
 - Path Delay Variation (PDV)
 - Messages
 - Clock state transitions

	Result Files			Result Files	
2014-04-04 12:53:37	00:00:33		2014-04-04 12:53:37	00:01:00	
Summary		Statistics	Summary		Statistics
III Ethernet - IEEE 1588v	3v2	SI prefix	Total Ethernet - IEEE 15	588v2	SI prefix
Back	Port 1		12:53:37 Back	Port 1	
2014-04-04 12:53:42 Offset Stat. Min	in. Max. Avg.		2014-04-04 12:53:42 Mean Path Delay	Min. Max. Avg.	
2014-04-04 12:53:47	0 0 0		2014-04-04 Req./Resp. 12:53:47	0 0 0	
2014-04-04 12:53:52 Deviation	0 0 0 0 0 0		2014-04-04 12:53:52	0 0 0	
2014-04-04 12:53:57 Offset Variance Min	in. Max. Avg.	É	2014-04-04 12:53:57 Path Delay	Min. Max. Avg.	1
2014-04-04 12:54:02 Offset Variance	0 0 0	*	2014-04-04 12:54:02		*
Current 2014-04-04 12:54:09 Mean Path Delay Min	in. Max. Avg.		Current Message Stat. 2014-04-04 12:54:36 Announce count	Tx Rx 58 0	
Mon./Gen.	SETUP TEST <u>RESULT</u>	🔐 🔿 🛪 🕅 12 54	Mon./Gen.	SETUP TEST <u>RESULT</u>	🔐 🗃 🛪 🎖 12:54

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• IEEE 1588 v2 (PTP) clock status real time information



Network Master Flex MT1100A

- Mobile Fronthaul Installation and Verification
 - CPRI/OBSAI Test



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CPRI Background

- Operators supporting explosive spread of smartphones and tablets by increasing bandwidth of mobile communications networks
- Driving complete change in mobile communications systems
 - Adoption of Centralized-Radio Access Network (C-RAN).
 - Using C-RAN, the mobile fronthaul is configured from centralized Base Band Units (BBU) and multiple Remote Radio Head (RRH) units connected via general-purpose interfaces, such as the Common Public Radio Interface (CPRI) or Open Base Station Architecture Initiative (OBSAI).

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CPRI Bit Rates

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- CPRI bit rates are referred to as "option #"
- There are now eight options (CPRI Specification V6.0)
- MT1100A supports Option 8, 10.1376 Gbps, reflecting marketing requirement of supporting exploring mobile network bandwidth.
- MT1100A can perform simultaneous testing up to 4 ports to reduce commissioning testing time.

Option	Bit Rate (Gbps)	Line Code
1	0.6144	8B/10B
2	1.2288	8B/10B
3	2.4576	8B/10B
4	3.0720	8B/10B
5	4.9152	8B/10B
6	6.1440	8B/10B
7	9.8304	8B/10B
8	10.1376	64B/66B

OBSAI Bit Rates

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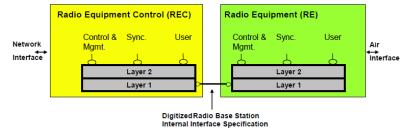
- Four OBSAI bit rates are defined.
- MT1100A supports 6.144 Gbps, reflecting marketing requirement of supporting exploring mobile network bandwidth.
- MT1100A can perform simultaneous testing up to 4 ports to reduce commissioning testing time.

Bit Rate (Gbps)	Line Code
0.768	8B/10B
1.536	8B/10B
3.072	8B/10B
6.144	8B/10B

C-RAN Market

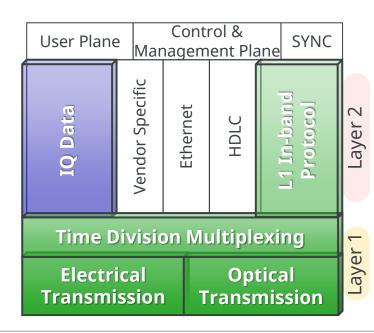
- Market requirements
 - Minimizing number of BBU's per antenna cuts operator costs (rent, power, HW, etc.)
 Locating BBU 15 km or more from multiple RRH requires reliable connection i.e. C-RAN
 - CPRI runs over C-RAN with two main layers:
 - Layer 1: Physical transport
 - Layer 2: Several areas

C-RAN main interest is L1 in-band protocol; understanding this area allows operator to troubleshoot alarms and errors



In CPRI, BBU is called REC, and RRH is called RE (Fig. 1 from CPRI Specification V6.0)

envision: ensure





Test case 1



- Test case 1
 - Test the line <u>between</u> REC(s) and RE(s)
 - System testing
 - Installation testing
 - The line can be
 - Optical
 - Carried over radio link or microwave link
 - CPRI over OTN
 - Instrument is connected via optical interface to the link
 - Terminate both sides of the transmission line
 - BER test (Framed or unframed)
 - One side could be loop back
 - Delay measurement
 - With one side in loop back

- Test case 2
 - CPRI Specification V6.0 defines
 - When both the devices are in the Operation state or in the Passive link state, the link is in normal operation
 - Operators have experienced that up to 80% of CPRI turn up issues happen in the lowest layers
 - Essential during installation to confirm the RRH/RE is able to communicate to the ground even without a BBU/REC
 No C&M (L2+) setup
 Passive link (L2+) setup
 Protocol setup
 - Confirming the RRH/RE is able to connect to the Passive Link state
 - Confirming HDLC layer (Layer 2) network is connecting
 - With the above completed it minimizes any chance of issues during the BBU/REC installation phase

Extract from Figure 30 in CPRI Specification V6.0: Start-up states and transitions

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Operation

Interface and

vendor specific negotiation

L1

synchronization

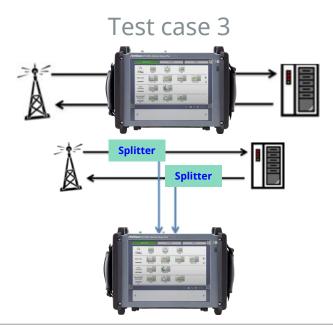
Standby

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- Test case 2
 - Connect to the actual equipment (REC or RE) to verify that it is alive
 - Signal level and frequency measurement
 - Optical cable ends may be checked with Video Inspection Probe (VIP)
 - Monitor control word K30.7 indicates error in the 8B/10B line code (CPRI option 1-7 only) and 8B/10B code violations
 - Check equipment behaviour
 - Check that the equipment can reach the "Passive Link" state
 - Confirming HDLC layer (Layer 2) network is connecting
 - Check the equipment's behaviour when alarms are generated



- Test case 3
 - Monitoring of the actual line between REC (Radio Equipment Control) -(master) and RE (Radio Equipment) - (slave)
 - Utilizing dual port in through mode or monitor
 - Monitor interactive behaviour of equipment
 - For maintenance or in-service troubleshooting



• Supports CPRI interface rate option 1 (614.4 Mbit/s) to option 8 (10.1376 Gbit/s)

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page

– Ensures testing of current and future CPRI interfaces

Port 1	Application Select	or		
Port +	Unframed - PRBS15	Inverted		
Port mode:	Off	_Transceiver		
Line rate:	614.4 Mbps (CPRI)	Wavelength(nominal) N/A	 Signal loss 	?
Clock Configuratio	614.4 Mbps (CPRI)	Compliance N/A		0
Timing source:	768 Mbps (OBSAI)		CPRI	Ĕ.
	1228.8 Mbps (CPRI)			-
	1536 Mbps (OBSAI)		 LOS 	Ĩ
	2457.6 Mbps (CPRI)		• LOF	
	3072.0 Mbps (CPRI/OBSAI)		LSS	
	4915.2 Mbps (CPRI)			Y
	6144.0 Mbps (CPRI/OBSAI)		Pattern error	~
	9830.4 Mbps (CPRI)		Transceiver	
CPRI-BEF	10137.6 Mbps (CPRI)	ULT 🔐 🍽 🛜 🛚 V	<mark>∑≣ §§ 🛃 ∎</mark>) 01 46	

- Testing at any rate
- Ability to exercise BBU or RRH up to Passive link status (as per latest CPRI standard)

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- Support of pass-through mode
 - Complete solution for detailed I&M testing

Port 1	Application Selector	
Port +	CPRI Link - PRBS15 Inverted	
Content: CPRI Link CPRI Link		• Signal loss
Start up:	Disabled 💌	3
Role:	Master	CPRI 😜
Protocol:	Protocol version 2	• LOS
HDLC	Pointer: 20	• LOF
Rate: NO HDLC	Pointer: 20	• LSS
Pattern		• Pattern error
Type: PRBS15 V Inversion:	Inverted Viser pattern: 32/32 Bits	Transceiver
CPRI-BERT SET	<u>'UP</u> test result 📑 🗃 🛜 🎖 V	💽 🔊 🛃 動 01:48

• Displayed signal level and bit rate gives first verification of received- signal condition

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ort +	CPRI Link - PRBS15 Inverted	
Rx		
Signal level 😑	-4.78 dBm	Signal loss
Bit rate	10 137 599 936 bps	
Deviation	0 ppm	
	-64 bps	CPRI
Pattern bit rate	9 216 000 128 bps	= LOS
Тх		
Signal level	-2.49 dBm	• LOF
Bit rate	10 137 599 936 bps	• LSS
Deviation	0 ppm	0.000
	-64 bps	Pattern error
Pattern bit rate	9 216 000 000 bps	Transceiver

• Using Video Inspection Probe (VIP) to check fiber end face confirms quality practices and removes key cause of turn-up failure.

 Checking for and inserting Layer-2 alarms and errors from BBU to RRH

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Ensures engineer can complete advanced fault finding and evaluate issue root cause



- Test results:
 - Summary screen with pattern error information and survey of result pages

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- Alarms/Errors screen with details of detected CPRI alarms and errors
- Color coding highlights detected alarms and errors

Port 1 Result File B	Browser			Result File Browser	
2015-04-20 01:49:26 00:00:22			2015-04-20 01:49:26	00:01:21	
Summary	Event Log Sta	itistics	Summary		Event Log
BER Error count Rate			CPRI - Alarms/Err	rors	SI prefix
Pattern error	_		01:49:26	Port 1	
Threshold:	0	•	Back 2015-04-20 01:49:31 Alarms	Count Ratio	•
			2015-04-20 Signal loss 01:49:36	0	0.00
Statistics Category Status	Pattern		2015-04-20	0	0.00
CPRI - Alarms/Errors	PRBS15		01:49:41 LOF	0	0.00
CPRI - Frames	Pattern Error Insertion		2015-04-20 Remote LOS 01:49:46	0	0.00
CPRI - Round Trip Delay	Insertion: Off		2015-04-20 01:49:51	0	0.00
		×		0	0.00
	Burst length:		Current SDI 2015-04-20 01:50:46 Reset	0	0.00
CPRI-BERT SETUP TEST	<u>RESULT</u> 🔐 🖙 🛛 V 🖂 🔊 🗄	P 🕩 01:49	CPRI-BERT	SETUP TEST <u>RESULT</u>	S ◆ 8 V 💽 🌶 🗜 🕪 01:50

- Test results:
 - CPRI Frames screen with counts of received and sent frames and code words

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– Delay screen showing measured Round Trip Delay



- Added APS measurement function to CPRI BERT application
 - Sets any APS measurement start/stop trigger using checkbox, with APS measurement started/stopped at selected trigger OR condition
 - Choice of triggers for network configuration and hypothetical faults for analyzing how equipment and network perform at APS operation

Port 1	Result	File Browser	2016-02-16 04:18:22		
Summary	APS	Eve	ent Log Statistics 📕		
1: Swithing time 0.002 ms 2: Swithing time 0.002 ms 3: Swithing time 0.001 ms 4: Swithing time > 1 s 5: Swithing time > 1 s	0.002	Automatic Switc	ning Time (ms)	· · · · · · · · · · · · · · · · · · ·	
Minimum switching time Average switching time Maximum switching time Threshold Measurement count	0.001 ms 0.002 ms > 1000.000 ms 50.000 ms 3 Port 1 Control	5 10 App Delay	15 20 lication Selector	Thresholds	
	APS Reference events Alarms Signal loss LOS V LOF	Errors LCV SHV Pattern error	Remote alarms Remote LOS Remote LOF Ral SDI	Reset	• • •
	Select all Error free period: Threshold:	Default 100ms 50	.000 ms		×
	CPRI-BERT	! SETUP	TEST RESULT 🔐 🗅	≈ 🛛 🗸 💽 💓 🗜 🕪 04 3	31



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Graph and Event log screens for easy viewing and analysis

CPRI over OTN

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- Market requirements
 - Several vendors working on CPRI over OTN solutions
 - CPRI over OTN:
 - Transport raw radio (CPRI) data from RE over optical fiber to central location for baseband processing
 - Single location serving multiple REs
 - Consolidation has huge power and cost savings over distributed approach without impacting network scalability
 - OTN supports transport of several protocols over same fiber
 - Same management system across network

Support for CPRI over OTN enables tests of latest CPRI implementations

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Network Master Flex MT1100A

- Powerful Storage Area Networking (SAN) Testing
 - Fibre Channel Functionality



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MT1100A Product Highlights

- Powerful tests of Fibre Channel links
 - Test of 1 GFC, 2 GFC, 4 GFC, 8 GFC and 10 GFC
 - Optional mapping to OTN
 - Latency measurement
 - BER testing including service disruption measurement

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- Line alarm and error monitoring
- Normal or Reflector mode

MT1100A Product Highlights

- Color-coded displays give easy overview of GO/NO-GO results on Fibre Channel links
- Powerful Fibre Channel statistics include Latency, Packet Jitter and service disruption information

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Optional threshold settings for easy understanding of results

Port 1	-		Result File Browser		
2014-10-02 14:18:22 00:00:12		2014-10-03 07:45:36	00:00:49		
Summary		Summary			Statistics 📕 🔳
BER Bit count Error count Rate	*	III Total Fibre Channel - B	IERT	SI prefix	
Pattern errors 88962404480 1 112E-11		07:45:37	Port	1	
Threshold: 2		Back 2014-10-03 07:45:42	Min. Max.	Avg.	
Utilization Pattern errors Errored frames	?	2014-10-03 Latency(us)	0.0 us	0.0 us	0.0 us
		07:45:47			
Pattern FOX		07:45:52	Min. Max.	Avg.	
100 00 Pattern Error Insertion		2014-10-03 07:45:57	0.0 us	0.1 us	0.0 us
Insertion: Manual		2014-10-03 07:46:02	Seconds C	ount	
Service disruption Avg. Max. Disruption time N/A 0.0 us Burst length: 1	×	Current Max. disruption	0.0 us	ount	×
Threshold: 50,000		2014-10-03 07:46:25 Avg. disruption	N/A		0
FC-BERT SETUP TEST RESULT 💾 🕅 🕿 🕅 🗸 🚾 🗤 14:18		FC-BERT		🛗 🗖 🕿 🛛 🗸	N 07 46
🛄 🔤 FC-BERT SETUP TEST <u>RESULT</u> 🔐 🗃 🖓 🕅 💓 🚺 14:18		FC-BERT	SETUP TEST <u>RESULT</u>	. 🔐 🕬 🗟 V	ጅ y 🗱 07 46 🛛 🛄

MT1100A Product Highlights

- Point-to-point and Fabric topology
- Latency, Packet Jitter and service disruption measurements

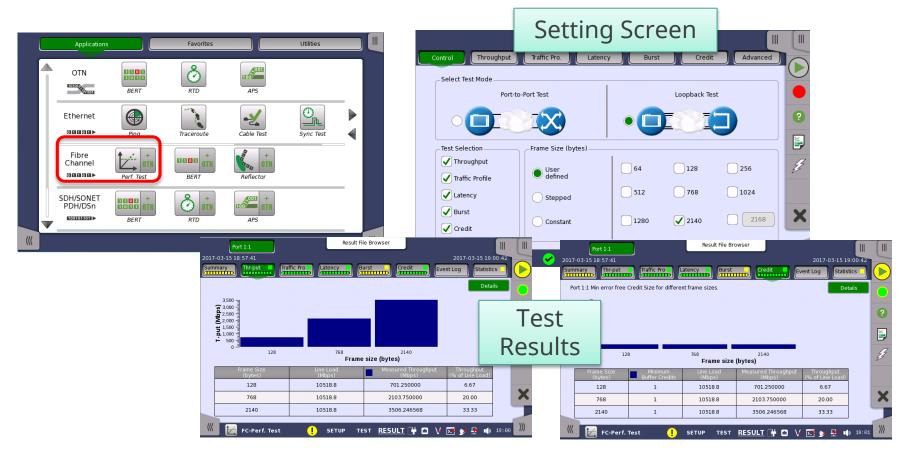
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MT1000A Product Highlights

- Performance test application to Fibre channel interface
 - Supports throughput, latency, and buffer credit performance verification for Fibre channel networks and Fibre channel equipment

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Network Master Flex MT1100A

 Quick and Easy Tests of SDH/SONET/PDH/DSn Networks



MT1100A Product Highlights

- Quick and easy tests of SDH/SONET/PDH/DSn
 - Testing SDH/SONET systems at STM-256/STM-64/STM-16/STM-4/STM-1/OC-768/OC-192/OC-48/OC-12/ OC-3/STS-3 and embedded PDH (E1/E3/E4) and DSn (DS1/DS3) systems

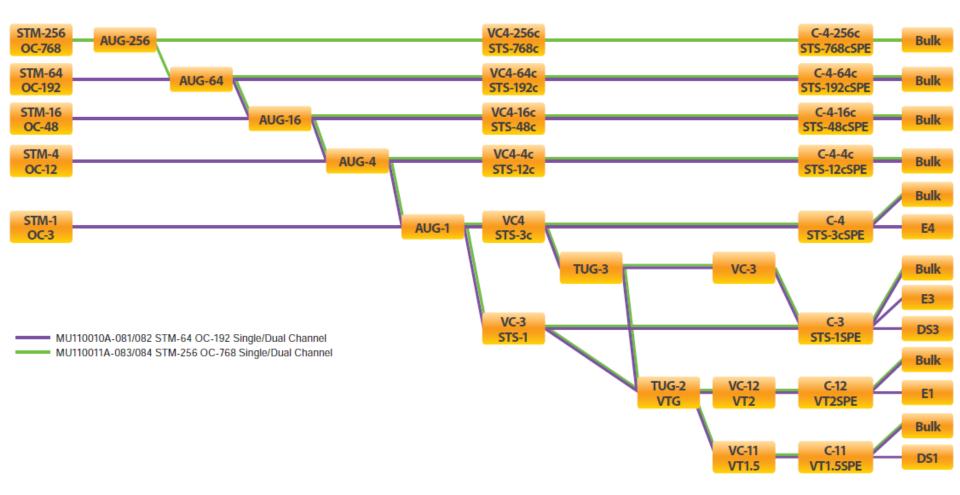
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- Powerful PDH (E1/E3/E4) and DSn (DS1/DS3) testing
- Simultaneous bi-directional monitoring of SDH/SONET/PDH/DSn lines
- SDH/SONET mapping and de-mapping
- Comprehensive error and alarm statistics
 - G.826/G.828/G.829/M.2100 error-performance measurements on SDH/SONET traffic
 - G.826/M.2100 error-performance measurements on PDH/DSn traffic
- SDH/SONET OH byte testing and monitoring
- SDH/SONET trouble scan
- SDH/SONET pointer event generation and monitoring
- SDH/SONET/PDH/DSn delay measurements

MT1100A Product Highlights

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• SDH/SONET mappings

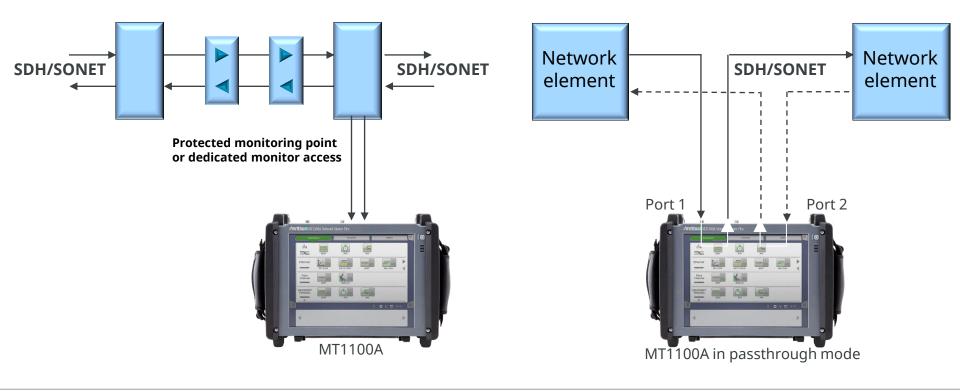


MT1100A SDH/SONET In-Service Measurements

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- Alarm and error monitoring for both sides of SDH/SONET line
- Frequency-deviation measurements

 G.826/G.828/G.829/M.2100 error-performance measurements on live traffic



MT1100A SDH/SONET Out-of-Service Testing

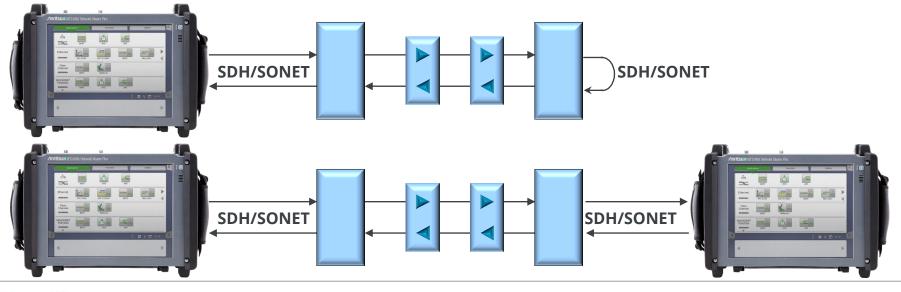
- Installing, commissioning and troubleshooting SDH/SONET lines
- Stressing system by generating alarms, errors, pointer operations, slip and frequency offset
- Testing synchronization circuits

- Generating embedded PDH/DSn signals
- G.826/G.828/G.829/M.2100 error performance

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page

- Propagation time
- Alarm, error, slip and frequencydeviation measurements



Anritsu envision : ensure

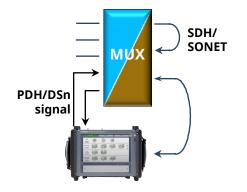
MT1100A SDH /SONET Out-of-Service Testing

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- Installing/commissioning
- G.826/G.828/G.829/M.2100 error-performance measurements
- System stressing by generating alarms, errors, slip and frequency offset

- Testing synchronization circuits
- Alarm, error, drift and frequency-deviation measurements
- Propagation time measurements





MT1100A SDH/SONET Line Status

• Physical line information

• Current alarms and errors

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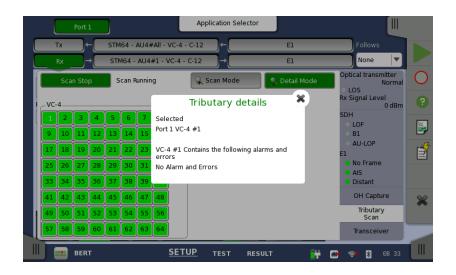
page

Tx ←	STM64 - AU4#All - VC-4 - C-12 ←	E1 Follows	Tx ← STM64 - AU4#	All - VC-4 - C-12 ← E1	Follows
Rx→	STM64 - AU4#1 - VC-4 - C-12 →	E1 None 🔻	Rx → STM64 - AU4#	#1 - VC-4 - C-12 → E1	None 🔻
SDH Rx Signal Level Deviation Bit Rate Pattern Bit Rate Tx Signal Level	 -3 dBm 0 ppm 0 bps 9 953 280 000 bps 64 000 bps -2 dBm 	SDH LOF B1	Alarms LOS TU-LOM LOF LP-TIM OOF LP-UNEQ MS-AIS LP-RDI AU-AIS LSS AU-LOP HP-TIM TC-UNEQ HP-PLM TC-TIC HP-PLM TC-TIM HP-RDI TC-AIS	Errors A1A2 B1 TU-NDF B2 Switch MS-REI B3 TC-IEC HP-REI U-REI LP-REI TC-OEI PRBS Errors	Optical transmitter Normal Rx Signal Level - 3 dBm SDH - LOF B1 - AU-LOP E1 - No Frame - AIS - Distant
TA SIGNALEVEL	-2 dun	OH Capture Tributary Scan Transceiver	TU-AIS TC-RDI TU-LOP TC-ODI	Pointer information AU-Positive TU-Positive AU-Negative TU-Negative	OH Capture Tributary Scan Transceiver

Anritsu envision : ensure

MT1100A SDH/SONET Tributary Scan

- Quick overview of problems in monitored SDH/SONET signals
- Detailed problem description when required
 - Click tributary for more details



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MT1100A SDH/SONET Performance Measurements

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- Bi-directional performance measurement
 - Easy information switching between two ports
- BER measurements of embedded PDH/DSn signal



MT1100A SDH/SONET Overhead Byte Analysis

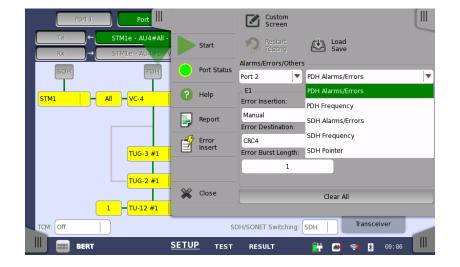
- Bi-directional OH byte capture
- User-programmable transmitted OH bytes



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MT1100A SDH/SONET Event Insertion

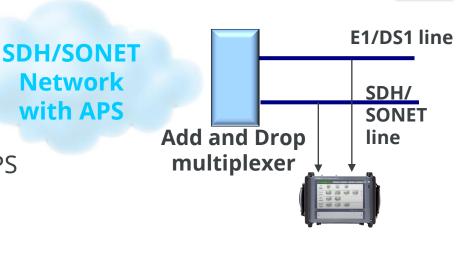
- Stress-test network elements by inserting events in test signal
- Inserted Events:
 - Alarms
 - Errors
 - Frequency deviations
 - Pointer operations



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MT1100A SDH/SONET APS Test Application

- Max switchover time measurement
 - User-defined max. time
 - User-defined switching criteria: APS measurement triggered by SDH/SONET or E1/DS1 events
 - Average time display
- APS protocol events can be generated and detected
 - No. of switchovers based on APS protocol events count
- Measurement at two receivers for simultaneous APS protocol event monitoring and switch time measurement

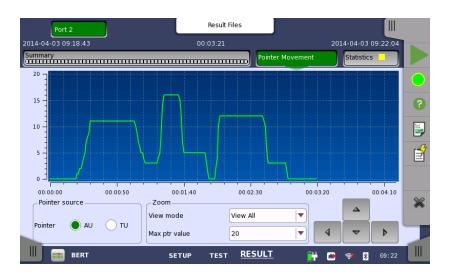




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MT1100A SDH/SONET Pointer Movement Graph

- Graph of pointer movements
 - Good overview of pointer operations
- Information on AU and TU pointer
- Magnify graph points of interest
- Results stored in MT1100A memory



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MT1100A SDH/SONET TCM Functions

- Analyze TCM (Tandem Connection Monitoring) function in SDH/SONET systems
 - Simultaneous bi-directional monitoring of TCM information on SDH/SONET lines
 - Comprehensive TCM error and alarm statistics
 - Inject TCM events to stress-test network elements

			Result Files					
2014-04-03 09:27	:36	00:	00:23					
Summary				Pointer Movem	ent	Statistics		
Total	SDH - TCM			•	SI prefix			
09.27.36 Back		P	ort 2					?
2014-04-03	Alarms	Count	Ratio					
2014-04-03	TC-UNEQ		o	0				Ĕ.
09:27:46	тс-шс		D	0				- 24
2014-04-03 09:27:51	TC-TIM		D	0				
2014-04-03	TC-AIS		D	0				
09:27:56	TC-RDI		D	0				
•	TC-ODI		D	0				×
Current 2014-04-03 09:27:58	Errors	Count	Ratio				-	
BEI	RT	SETUP	TEST RE	<u>SULT</u>	🔐 💌	🦈 ∦	09:27	

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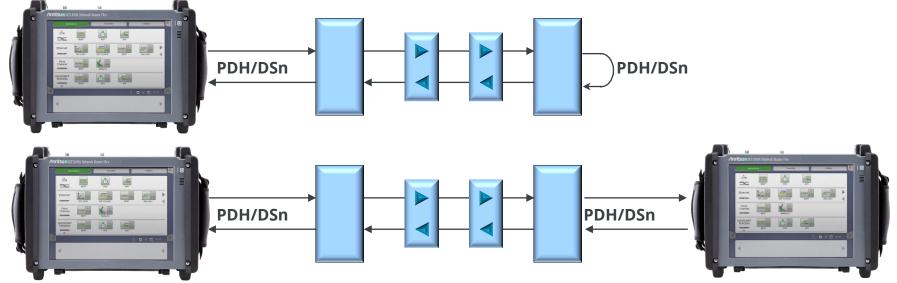
MT1100A PDH/DSn Out-of-Service Testing

- Installing, commissioning and troubleshooting PDH/DSn lines
- Stress system by generating alarms, errors, slip and frequency offset
- Testing synchronization circuits

• G.821(E1/DS1)/G.826/M.2100 error performance

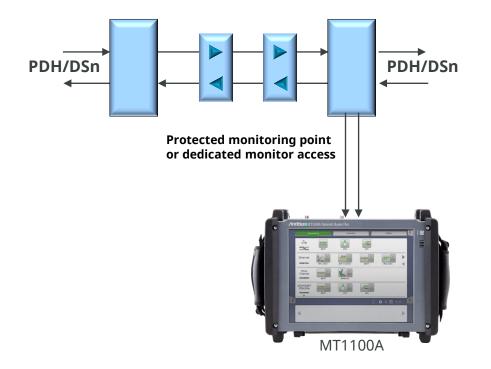
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- Alarm, error, slip and frequency-deviation measurements
- Propagation time with farend loopback



MT1100A PDH/DSn In-Service Measurements

- Alarm and error monitoring at both sides of PDH/DSn line
- Frequency-deviation measurements
- G.821(E1/DS1)/G.826/M.2100 error-performance measurements on live traffic

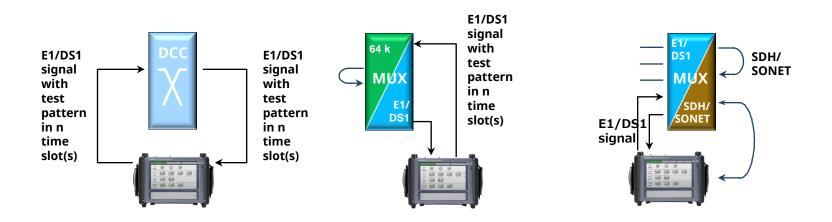


MT1100A E1/DS1 Network-Element Testing

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- Installing/commissioning
- G.821, G.826 or M.2100 errorperformance measurements
- System stressing by generating alarms, errors, slip and frequency offset

- Testing synchronization circuits
- Alarm, error, slip and frequency-deviation measurements
- Propagation time measurements



MT1100A E1/DS1 Drop-and-Insert Testing

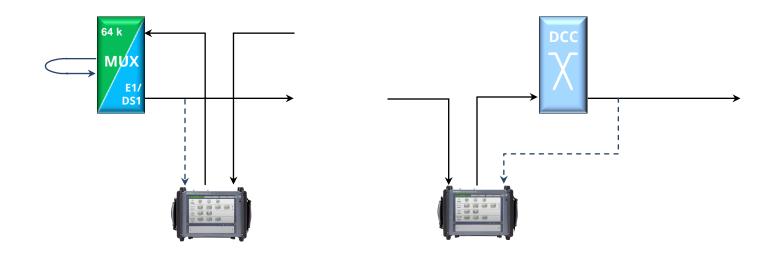
- Pseudo in-service testing on live PCM systems
- Add and drop N*64 kbps signals
- Alarm, error and slip generation and measurement

- Inject errors in live traffic channel
- G.821, G.826 or M.2100 errorperformance

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page

• Frequency deviation



MT1100A PDH/DSn Line Status

- Physical line information display of current:
 - Input frequency and deviation
 - Input-level indication
 - Pattern bit rate
- Current alarms and errors

Port 2	Application Selector	
Tx →	El	Follows
Rx →	El	Tx 🔻
Alarms LOS AIS No Frame Distant No CRC4 MF Distant No Sync No CAS MF Distant MF	Errors FAS Pattern CRC4 CRC4 MFAS E-Bit Code Pattern Slip Frame Slip	Fransmission On LOS Deviation Oppm E1 No Frame AIS Distant
		Alignment CAS Audio
BERT	SETUP TEST RESULT	Traffic □ → ⊗ ⊗ 09 30 □

Port 2		Application Selector			
Tx →		E1		Follows	
Rx →		El		Tx 🔻	
_E1				Transmission On	
Signal Level	• 1	dB		 LOS Deviation 0 ppm 	?
Deviation	0	ppm		E1	_
	0	bps			5
Propagation Delay	0	ms		No Frame	Í
Pattern Bit Rate	64 000	bps		AIS	
Bit Rate	2 048 000	bps		 Distant 	
APS	N/A			Alignment	
				CAS	~
				Audio	
				Traffic	
BERT	SETUP	TEST RESULT	r 🔐 📾	🗧 🛪 🧏 09:30	

MT1100A PDH/DSn Alarm and Error Statistics

- Alarm-second counts and ratios
- Error counts and ratios
- M.2100, G.826 or G.821 parameters
- Histograms show measurement overview
 - Click parameter to activate histogram

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MT1100A E1 Alignment and CAS Displays

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 Information on FAS words and Sa bits

- Information on CAS bits
 - User-selectable bit pattern for red and yellow colors



MT1100A DS1 Alignment and CAS Displays

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- Information on F-bits and S-bits
- Information on CAS bits
 - User-selectable bit pattern for red and yellow colors



MT1100A E1/DS1 Channel Status Display

• Fast overview of E1/DS1 line status



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MT1100A E1/DS1 Audio Display

- Details on contents of one selected traffic channel
 - Displays information from two ports for bidirectional monitoring

TX /t		E1	
Rx →		El	
Audio Channel			Transmission
	Port 1	Port 2	 LOS Deviation
Content	10011100	01010101	0 ppm
Content(inv.)	11001001	0000000	E1
Peak(pos. and neg.)	+81 -88	+0 -0	
Level	-9	-66	AIS
Tone frequency	495	427	No frame
Coder offset	-7	2	Notraine
			No Sync
			Alignment
ort 1 Audio level	-30 -25 -20		CAS
	-30 -25 -20	-15 -10 -5 0	Audio
ort 2 Audio level	-30 -25 -20	-15 -10 -5 0	5 Traffic

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Network Master Flex MT1100A

Optical Transceiver Analysis



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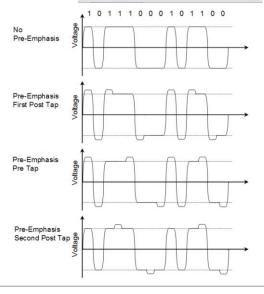
Optical Transceiver analysis

- MDIO analysis
 - Transceiver information display
 - Alarm, Wavelength, Bit rate, Compliance, Vendor information
 - Output control
 - Power monitor
 - For CFP, CFP2
 - NVR1, NVR2, Module FAWS, NW Lane FAWS, CTRL
 - MDIO Read/Write
- PCS electrical interface control
 - CFP: VOD, Pre-Emphasis, RX Equalizer
 - CFP2: Attenuation, Pre-Emphasis, RX Equalizer

		Transceiv	/er		3 X		Transcei	ver		?
	Tracking	Lane 0	Lane 1	Lane 2	Lane 3					
						Tracking	Lane O	Lane 1	Lane 2	Lane
	Off	50	50	50	50		_			
						Off	0	0	0	0
	Off	0	0	0	0	Off	0	0	0	0
	off	0	0	0	0	Off	8	8	8	8
	Off	0	0	0	0			A		
	Off	0	0	0	0	r				
	Off	1	1	1	1	Execute Auto Tune		Re	store Defaults	
Default Apply				Can	cel Ok	Apply			Car	ncel
		CF	D				CFF	12		

Port:	WAN Off	Stream	Settings Answer: Arp.	Ping	off IEEE	1588v2 Off	OA Of	4 Filter Off
Module	Present		0	Power m	ionitor		- 5	• Link Speed:
Transce	ever Informatio	in			Tx[diim]	Re[dBm]		N/A Duplex:
Alarm				Total	6.13	5.08		N/A
Loss of	signal		•	Lane 0	0.23	-1.09		Ethernet Traffic
Global a		-		Lane 1	0.03	-0.89		MPLS frame
and the second sec				Lane 2	0.07	-1.00		MPLS-TP frame
Distant Advent		-		Lane 3	0.12	-0.76		VLAN frame
								IEEE 1588v2
								OH Capture
							•	MAC
-	and the second se					600		Frame Capture
MDIO an	alysis					Set	tings	Transceiver





Optical Transceiver analysis

 Added functions for manual control of optical module hard pins and for dumping internal register data to MDIO Analysis function for displaying CFP/CFP2/CFP4 optical module data and confirming faults



WR1 NVR2	Module FAW	S NW Lan	e FAWS CT	RL MDIO Re	ad/Write				
ingle Read /	Write								
Address	Value								
0000h	0000	۰) 🕅	Read	Write					
Burst Read									
Address	Length								
8000h	256		Read					Expo	rt
	+ 0	+1	+ 2	+ 3	+ 4	+ 5	+ 6	+ 7	
8000h	0011	00E4	0007	0001	0000	0000	0000	0008	
	0018	0044	0011	008C	008C	A000	0000	0000	
	0001	0004	00CA	0045	0000	00B7	0000	0064	
	0021	0044	0040	004E	001C	003C	0064	0046	
	00FB	0046	0055	004A	0049	0054	0053	0055	
	0020	0020	0020	0020	0020	0020	0020	0020	
	0020	0000	0000	000E	0046	0049	004D	0033	-
									-

- Applications
 - Forced reset and initialization tolerance test
 - Confirmation of hardware pin status operation
 User can analyze whether start sequence completed or faulty, and sequence transitions

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- Fault troubleshooting using CFP initialization and internal FIFO reset
- Extended Functions
 - Initialization of CFP/CFP2/CFP4 module (restart start sequence)
 - Control of hardware pins
 - Reset internal FIFO
- Applications
 - Test CFP/CFP2/CFP4 internal register access
 - Compare internal register status and basic settings User can find unintended settings, status, and operations
- Extended Functions
 - Displays burst register read/write and results
 - Reads up to 1024 registers
 - (about same size as one internal register group, such as NVR1, defined by MSA)
 - Sets read start address
 - Outputs read results in csv file format

Network Master Flex MT1100A

• PCS Lane Testing



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PCS Lane Testing with CAUI/XLAUI Interface

- 10-lane extender MZ1223C
 - Attachment for MU110011A CFP connector
 - Captures CFP electrical input/output signals using MT1100A's optional accessory cables
 - No software version dependency



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- Application
 - Evaluating devices such as optical transceivers, framer ICs, network equipment CAUI/XLAUI electrical interface

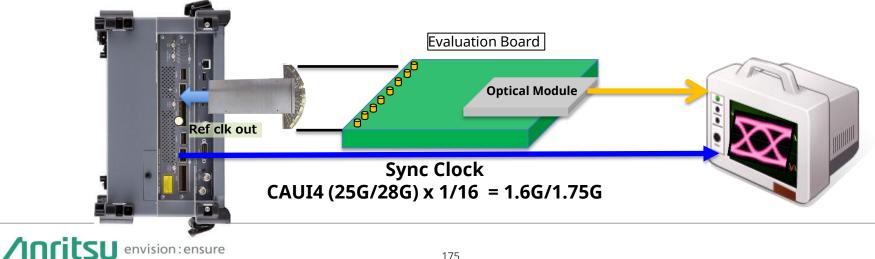


Test PCS Lanes using CAUI4 Interface

- 4-Lane Extender for CFP2 J1666A ۲
 - Mounted on MU110013A CFP2 connector
 - Uses MT1100A application part to extend CFP2 CAUI4 electrical I/O signals externally



- Application
 - For evaluating optical transceivers, Frame ICs, transmission equipment using CAUI4 interface



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Network Master Flex MT1100A

• VIP: Video Inspection Probe



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VIP: Video Inspection Probe

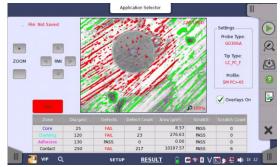
- VIP Video Inspection Probe
 - Judge quality of optical fiber and module endface
 - Find trouble in optical fiber and module endface Reduce degraded signal transmission and effect on measurement results
 - Prevent connected optical fiber and module endface damage
- Dirty connector endface...

envision: ensure

- Dirty connector endface causes more reflection
- Cleaning connector endfaces maintains good connection
- Damaged connector endface...
 - Damaged connector endface has greater reflection and larger ORL (Optical Return Loss)
- MT1100A supports G0382A/G0306B VIP option
 - From the Table View, you can identify "defects" or "scratches"
 - The automatic pass/fail determination is made in accordance with the IEC61300-3-35 standard on the end of the fiber.











VIP – Order items 1/2 –

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page

Model No.							
G0382A		Autofocus Video Inspection	Probe				
- Standard accessories*1 -		Soft Bag Seven Connector Tips -1.25mm PC Male, -2.5mm PC Male, -2.5mm APC Male, -1.25mm PC Female(LC), -2.5mm PC Female(FC), -2.5mm PC Female(SC), -2.5mm APC Female(SC) Quick Reference Guide					
		Applicat	tion Parts				
Model No.			Model No.				
H0382A	2.5PC-M (2	.5mm PC Male)	H0395A	FC-APC-F (FC APC Female)			
H0383A	1.25PC-M (1.25mm PC Male)	H0385A	LC-PC-F (LC PC Female)			
H0387A	2.5APC-M (2.5mm APC Male)	H0393A	LC-PC-F-L (LC PC Long Female)			
H0388A	1.25APC-M	(1.25mm APC Male)	H0394A	LC-APC-F-L (LC APC Long Female)			
H0384A	SC-PC-F(SC	PC Female)	H0396A	ST-PC-F (ST PC Female)			
H0398A	SC-APC-F (S	5C APC Female)	H0397A	MU-PC-F (MU PC Female)			
H0386A	FC-PC-F (SC	IPC Female)	H0390A	E2000-PC-F (E2000 PC Female)			
			H0392A*2	MPO-PC/APC-F (MPO PC/APC Female)			

*1: Operation manual and MX900031A Autofocus VIP Software (For PC) can be downloaded from Anritsu public Web site.

*2: H0392A MPO tip does not have Autofocus and Pass/Fail functions.



VIP – Order items 2/2 –

Model No.							
G0306B	400x Video II	/ideo Inspection Probe					
- Standard accessories -	Soft Bug Seven Conne - 1.25mm PC - 1.25mm PC	Operation manual (Printed) Soft Bug Seven Connector Tips - 1.25mm PC Male, - 2.5mm PC Male, - 2.5mm APC Male - 1.25mm PC Female(LC), - 2.5mm PC Female(FC) - 2.5mm PC Female(SC), - 2.5mm APC Female(SC)					
Application Parts							
Model No.		Model No.					
H0360A	2.5PC-M	H0366A	SC-APC-F				
H0361A	1.25PC-M	H0372A	E2000-PC-F				
H0362A	2.5APC-M	H0373A	FC-APC-F				
H0363A	LC-PC-F	H0374A	MU-PC-F				
H0364A	FC-PC-F	H0375A	ST-PC-F				
H0365A	SC-PC-F	H0376A	1.25APC-M				
		H0380A	LC65-PC-F				



Network Master Flex MT1100A

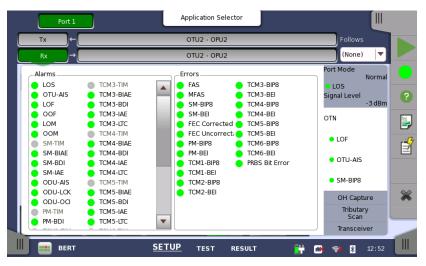
• Operation and Presentation



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MT1100A Operation and Presentation

- Easy operation
 - Simple, intuitive GUI
 - Loading and transferring configurations
 - Go/No Go testing
- Touch-screen based operation
- Remote operation
 - Via Ethernet interface
- Setup transfer/data transfer/firmware upgrade
 - Via USB interface



• Five main groups

Application Selector Results Files thernet SDH/SONET RTD Set Results Folder OTN 001 ALL DE LE DE BERT 2014-03-24@09-00-3 Select All Files Unselect All Files Create Report 5AT (Y.1564) BERT 2014-03-25@10-29-54 Ethernet Mon./Gen. BERT 2014-03-25@10-30-41 01101 \delta otw **...................................** oto SDH/SONET PDH/DSn BERT 2014-03-24@09-00-3 Folder: /property/mnt/internal BERT 2014-03-25@10-29-54 Total Space: 0.562572 GB BERT 2014-03-25@10-30-41 Free Space: 0.558651 GB 🙀 🗃 🤜 🖁



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- Application selector
 - Intuitive launch of new test
 - "Double" keys for starting tests of client signals in OTN
 - Right side of key starts test of client signals in OTN
 - Left side of key starts test of client signals directly



- Select Port display
 - Displayed after selecting application
 - Select one port or two if available and press Accept

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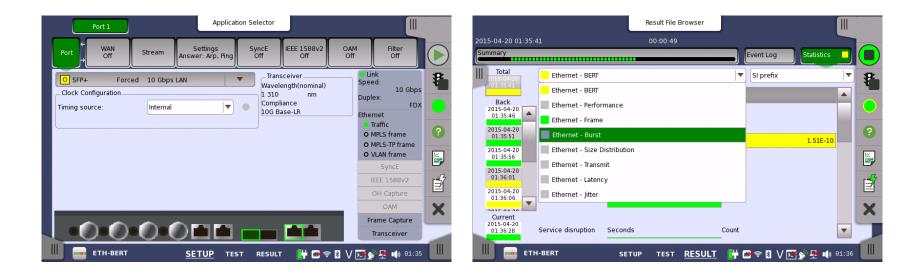


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- Result pages:
 - Summary page
 - Event log
 - Statistics page(s)
 - Color-coded GO/NO GO indications



- Several pages in each main group
 - Selected with tabs
 - Selected from drop-down menu



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MT1100A Histograms for General Statistics

• User sees distribution over time for selected parameter easily

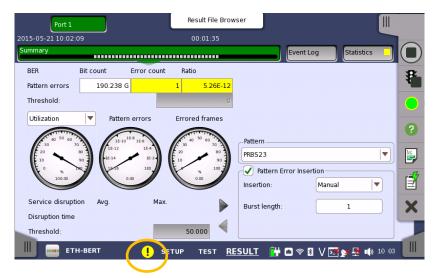
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- Click parameter and select histogram
- Click Zoom: Large numeric makes distance reading easy



Test Applications Summary

- Summarizes measurement results for all current Test Applications (applications using port resources) belonging to one user – using the Remote GUI software up to four users can use the MT1100A
- Test Application Summary and Overall Test Status only updates during <u>testing</u>:
 - Green: No trouble
 - Yellow: Errors (and no alarms) are pending or occurred in the past.
 - **Red**: Threshold violation or Alarms are pending or occurred in the past.



<u>Shows worst Status of all test</u> <u>applications</u>.



All applications are OK



One or more applications have Yellow Test Status (and no Red)



One or more applications have Red Test Status

• Clicking the Test Applications Summary icon opens the Overall Test Status screen

Overall Test Status

• For viewing test status for all current Test Applications from a distance

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- Test Application Summary and Overall Test Status has no current/history distinction basically they show history.
- To "clear" Test Status: Restart the test.
- User configurable to show the Test Application Summary indicator and to get access to the Overall Test Status screen



- Overall Test Status only updates during <u>testing</u>:
 - Green: No trouble
 - Yellow: Errors (and no alarms) are pending or occurred in the past.
 - Red: Threshold violation or Alarms are pending or occurred in the past.

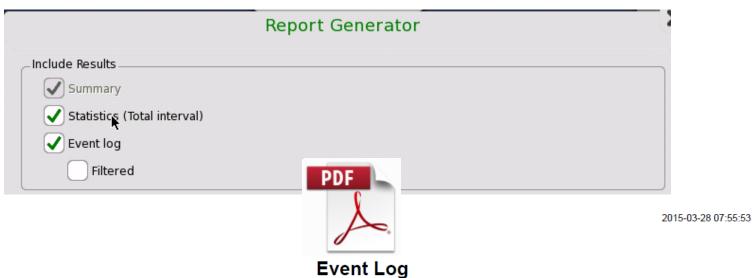
- Back to Index page
- Event Log gives users powerful means to analyze problems of long -term testing
- Records what/when problem happened and how long/often been happening

					Result File Browser		
2015-03	-28 07:34:03				00:05:48		
Summai	ry				Event Log	Statistics 📕	
	Filter				View: All ports	CSV export	*
No.	Time	Port	Туре	Src.	Description	Dur./Count	
32	2015-03-28 07:37:06	1		ETH	Link	00:00:09	\bigcirc
33	2015-03-28 07:37:06	1	•	ETH	Invalid blocks	14	?
34	2015-03-28 07:37:07	1		ETH	Frame Loss Secs.	00:00:09	•
35	2015-03-28 07:37:15	1		ETH	Seq. Sync. Lost	00:00:01	E.
36	2015-03-28 07:37:15	1	•	ETH	Pattern Errors	311	
37	2015-03-28 07:37:15	1	•	ETH	Invalid blocks	2.451 k	Ĩ
38	2015-03-28 07:37:15	1	•	ETH	Preamble violations	260	V
39	2015-03-28 07:37:15	1	•	ETH	Rx FCS Errored Frame	634 📐	^
40	2015-03-28 07:37:15	1	•	ETH	Fragmented	82 🔻	
	ETH-BERT			SETU	ρ τεςτ <u>RESULT</u> 📑 🖬 🖘 🕅 ∨	/ 💽 🔉 🕂 🌒 07:39	

• GUI filter function and CSV export

Summary		Event Log	Statistics	
✔ Filter Clear filter		Time format: Absolute	CSV export	
V Event	🗸 Number	r range	Dur./Count 🔺	
Exclude specific event(s)	From:	1		
Specify	To:	100		a,
ETH 10G LFS Remote Fault ETH Fragmented	🗸 Date/Tir	me range		EventLog.csv
ETH Frame Loss	From:	2001-01-01 00:00:00		EventLog.csv
	To:	2001-02-01 00:00:00		
			•	

• Logged events included in report

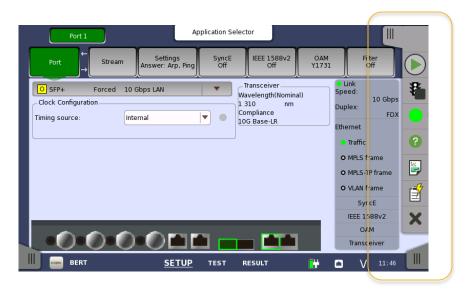


No.	Time	Port	Туре	Src.	Description	Dur./Count
1	2015-03-28 07:41:40		Test	Test	Started	
2	2015-03-28 07:41:49	1	Alarm	ETH	10G LFS Remote Fault	00:00:03
3	2015-03-28 07:41:49	1	Error	ETH	Invalid blocks	73.566 k
4	2015-03-28 07:41:50	1	Alarm	ETH	Frame Loss Secs.	00:00:03
5	2015-03-28 07:41:51	1	Error	ETH	Invalid blocks	22
6	2015-03-28 07:41:52	1	Alarm	ETH	Seq. Sync. Lost	00:00:01

• Time stamp shows relation between event and statistics

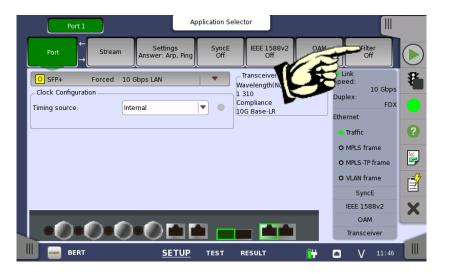
	No.	Time	Port	Туре	Src.	Descriptio	n	Dur./Count	
	1 2015-0	03-28 07:41:40			Test	Started			
	2 2015-0	03-28 07:41:49	1		ETH	10G LFS Remote Fault		00:00:03	
	3 2015-0	03-28 07:41:49	1	•	ETH	Invalid blocks		73.566 k	
	4 2015-0	03-28 07:41:50	1		ETH	Frame Loss Secs.		00:00:03	
2015-03-28 07:41:51	2015-0	03-28 07:41:51	1	•	ETH	Invalid blocks		22	
	6 2015-0	03-28 07:41:52	1		ETH	Seq. Sync. Lost		00:00:01	
	7 2015-0	03-28 07:41:52	1	•	ETH	Pattern Errors		72	
	8 2015-0	03-28 07:41:52	1	•	ETH	Invalid blocks		5.763 k	
	9 2015-0	03-28 07:41:52	1	•	ETH	Preamble violations		5	•
	2015-03-28 0	07:41:40				00:01:57			
· · · · · · · · · · · · · · · · · · ·	Summary			10			Event Log	Statistics	
	Summary Total 2015-03-28 07:41:40	3 Ethern	net - Tra				SI prefix	Statistics	
2015-03-28	Total 2015-03-28 07:41:40 Back	B Ethern		ansmit		Port 1	SI prefix	Statistics	
	Total 2015-03-28 07:41:40	B Traffic			x	Port 1 Rx	SI prefix		1.
2015-03-28 07:41:51	Total 2015-03-28 07:41:40 Back 2015-03-28 07:41:49 2015-03-28	B Traffic Frames		ansmit	x	Port 1 Rx 14.4442 M	SI prefix	0	1.
	Total 2015-03-28 07:41:40 Back 2015-03-28 07:41:49	3 Traffic Frames Bytes		ansmit	x	Port 1 Rx 14.4442 M 924.427 M	SI prefix	0 0	1.
	Total 2015-03-28 07:41:40 Back 2015-03-28 07:41:49 2015-03-28 07:41:49 2015-03-28 07:41:50 2015-03-28 07:41:50 2015-03-28	B Traffic Frames Bytes Unicast		ansmit	x	Port 1 Rx 14.4442 M 924.427 M 14.4442 M	SI prefix	0 0 0	1.
	Total 2015-03-28 07:41:40 Back 2015-03-28 07:41:49 2015-03-28	3 Traffic 7 Traffic 8 Bytes Unicast Multicast	net - Tra	ansmit	x	Port 1 Rx 14.4442 M 924.427 M 14.4442 M 0	SI prefix	0 0 0 0	1.
	Total 2015-03-28 07:41:40 Back 2015-03-28 07:41:49 2015-03-28 07:41:49 2015-03-28 07:41:50 0015-03-28 07:41:51 2015-03-28 07:41:52 2015-03-28	B Traffic Frames Bytes Unicast Multicast Broadcast	net - Tra	ansmit	x	Port 1 Rx 14.4442 M 924.427 M 14.4442 M 0 0	SI prefix	0 0 0	1.
	Total 2015-03-28 07:41:40 8ack 2015-03-28 07:41:49 2015-03-28 07:41:50 1015-03-28 07:41:50 1015-03-28 07:41:52 2015-03-28 07:41:53	Bytes Unicast Multicast Errored	net - Tra	ansmit	x	Port 1 Rx 14.4442 M 924.427 M 14.4442 M 0 0 0 0 0	SI prefix	0 0 0 0	1.
	Total 2015-03-28 07:41:40 Back 2015-03-28 07:41:49 2015-03-28 07:41:50 2015-03-28 07:41:51 2015-03-28 07:41:52 2015-03-28 07:41:53	B Traffic Frames Bytes Unicast Multicast Broadcast FCS errored	net - Tra	ansmit	x	Port 1 Rx 14.4442 M 924.427 M 14.4442 M 0 0	SI prefix	0 0 0 0	

- Control panes
 - Control applications in work space



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- Control panes
 - Control applications in work space
 - Click to expand



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Control panes

Control applications in work space – expanded

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- Control panes
 - Control instrument in application work space expanded
 - Click to expand instrument control



Control panes

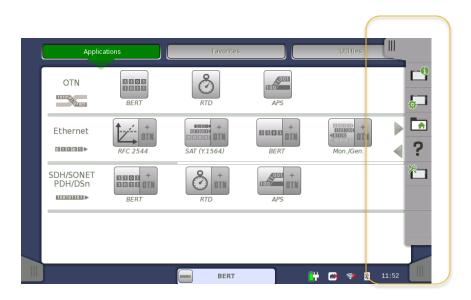
- Control instrument in application work space



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- Control panes
 - Control instrument in Application selector and test Result pages

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MT1100A GUI

- Power button menu
 - Pressing Power button while instrument on displays menu to:
 - Switch applications (when two applications running)
 - Take screen shot
 - Activate screen lock can be password protected
 - Power-down
 - Switch applications by clicking running applications at screen bottom
 - Running applications window always accessible





MT1100A Instrument Setup

- Password protection
 - Prevent unintended changes to parameters and measurement start/stop
 - Enabled/disabled by user



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Network Master Flex MT1100A

• Report Generation



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Report Generator

- Generates reports:
 - Summary page only
 - Summary and Statistics pages
 - Port setup and Application setup included as option
 - User-customized report including:
 - Logo in .png format
 - Customer ID, Operator ID, notes, and similar information in measurement .pdf reports
 - Output report in .pdf, .CSV or .XML format to USB port

Report Generator

Anritsu envision : ensure

2015-05-26 14:08:55

Document Information

Report Name	BERT
Customer	Customer 001
Project	Testing of line 1
Operator	Operator 001
Notes	This is a sample report

Module Type	Serial no	Software Version
MT1000A	6D60000101	3.01
MU100010A	6D6000087	

Report Layout

Report Generator

Report has been successfully generated.

View PDF

ОК

• Look of pages like Ethernet stats, event log and port settings



• Look of reports from other applications.

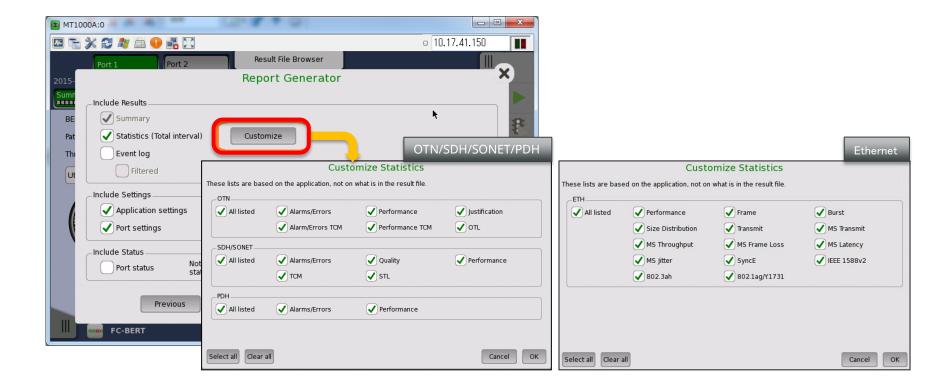
	2010 A 40 40 40 40 40 40 40	- c		ensure	2016-09-04 10:37:54		/II	nritsu	envision : ensur	e			2014-09-02 12 12 12
,	est Summary			OTN: Alarms/Errors(Port 1)					RFC254-	Throughput F	Results - Port	1	
Start et	2015-09-04 09:50:21		OTU alarms	Count	Ratio					In	atte size		
Skop at	2025-09-04 09:58:20		Signal	0102				UH (N)	64 128	256	765	1004	1280
GPS status	Not available		LOS	0	0.00			100.00	Pass Pass	Pass	Pass	Pass	Pass
Overall Test Result	PASS		OTU-A/S	0	0.00				Pass Pass		Pass	Pass	Pass
			OTU LOF	0	0.00				Pare Pares	Para	Pass.	Pats	Pasa
	Sequence Summary		OTU OOF	0	0.00				Pars Pars	Pass	Pass	Pass	Pass
Netlastrik Parameter Strurce	2000 - Fernam Remon + 2008		OTU LOM	0	0.00				Pass Pass		Pass	Pase	Pala
CIR User Input Baseline RTT Measured	1000.000 Mbps 2000.000 Mbps 0.025 ms		OTU DOM	0	0.00			50.00	Pass Pass	Para	Pass	Pess	Pass
BOP Calculated	3125 Bytes 3125 Bytes		SM-BIAE SM-BDI	0	0.00			UNH (%)		Po.	while sume		
	1500 / 1460 Bytes 1500 / 1460 Bytes		SM-BDI	0	0.00				1582			1	
				0	0.00				Parts				
			OTU evers	Count	Ratio				Pass		-		
			Signal	0102					Pársa			-	
			OTU FAS	0	0.00				Pare				
		X	MEAS SM-BIP8	0	0.00	×			Pass				
			SM-BP/S SM-BEI	0	0.00			50.00	Partit	1	1	1	
			FEC covected	0	0.00								
			FEC uncorrectable	0	0.00								

- Reports can be viewed in the built-in PDF viewer immediately after they are generated
 - This makes it simple and easy for the user to inspect the report

Filtering Results Display at Report Output

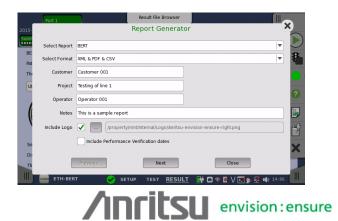
• The user can select the information to output when reporting statistical test results. As a result, file save times are shortened and files sizes are smaller.

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Report Generator

- <u>Optionally include Performance Verification information in reports</u>
 - Performance verification period is user programmable





2015-05-26 14:11:03

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Document Information

Report Name	BERT				
Customer	Customer 001				
Project	Testing of line 1				
Operator	Operator 001				
Notes	This is a sample report				

Module Type	Serial no	Performance Verification Date	Performance Verification Due Date	Software Version
MT1000A	6D60000101	2014-05-06	2016-05-06	3.01
MU100010A	6D6000087	2014-05-06	2016-05-06	

Network Master Flex MT1100A

• Remote Operation



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Three Remote Control Types

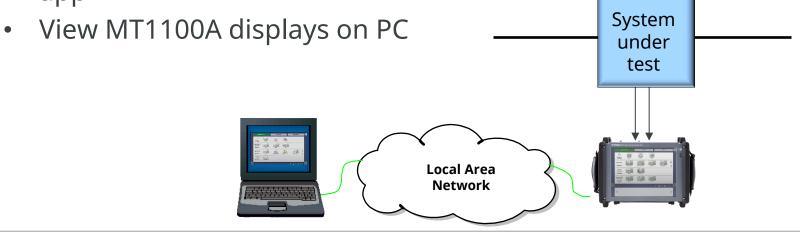
	Function	Multi- user	File Sharing
VNC	Control from remote site	No	No
Remote GUI	Control from remote site Port sharing File sharing	ОК	ОК
SCPI	Automation Control from remote site	ОК	OK
One Button	Automatic test at the scenario mode of the MT1100A	No	No

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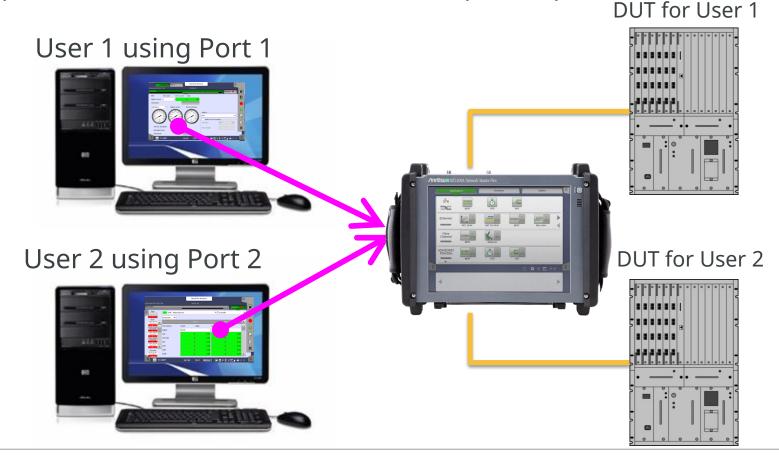
MT1100A Remote Operation – Applications

- Remote access
- Troubleshooting spurious errors
- Long-term surveillance and stability tests
- Multi-site surveillance
- Multi-user access
- Display screens via projector
- Documentation and training
- Operate MT1100A from PC with VNC client or new Remote GUI
 app

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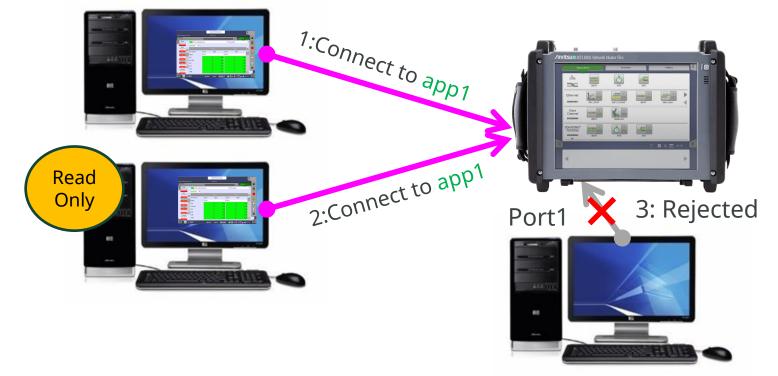


- Remote GUI application runs on Windows 7/8/8.1
- Port-oriented connection not unit-oriented
- Multiple users share same unit and use separate ports



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• Connect one application to up to two GUIs



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- Only one GUI can change settings and start test (Read/Write)
- Next user just observes (Read only)
- Any user can take right to change settings with exchangeable rights

- Remote GUI can run as <u>'Standalone' viewer</u>
- Users can:

- Generate report(s)
- Analyze results offline
- Create setup file(s) for deployment
- Remote GUI supports
 - Firmware update via LAN
 - Remote unit reset

envision: ensure

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- Share file system—user can access file system from Windows Explorer
- Access PC file system—user can save/load file to/from Windows memory

			 1	
General	File Sharing	Network		
Ethernet	Share File System	Bluetooth		
	IP Address 172.29.2.45		and the summary states in the summary states in the summary states in the summary states in the summary states	
Remote Control	Domain	File Sharing		
	User			
	Password	で		
	Folder Name			
	Mount Status NOT CONNECTED			
	Defaults Cancel OK Apply		JT	
	Îť	🖿 🛜 🛛 🗸 💽 🔊 🛃 🏟 03:11		

- Remote GUI supports:
 - Firmware update via LAN.
 - Remote unit reset

Result files Setting files Report files Capture files Back to Index

Network Master Flex MT1100A

• Remote Control – Scripting



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Remote Control Scripting Option

- Automated testing for developing applications
- Remote control commands/replies as ASCII format strings lacksquare
 - SCPI 1999.0 compliant with IEEE 488.2 mandatory common commands
- Fast command response ullet
 - Execute up to 8 commands per second
 - Reduces test time at mass production
- Communication between controller (PC) and MT1100A:
 - Via MT1100A Ethernet Service Interface
 - TCP/IP connection
 - Test facility can be isolated LAN
 - Via WLAN
 - Via GPIB
- Includes documentation and scripting example
- LabVIEW driver sample

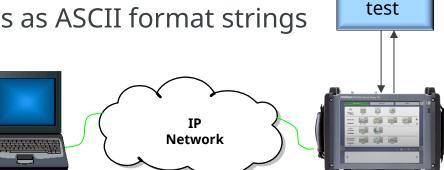
envision: ensure

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automated environments based on

GPIB.





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Device

under

Network Master Flex MT1100A

• Remote Control – GUI & Scripting



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Remote Control GUI & Scripting Option

- Execution became possible simultaneously about remote GUI (MX100001A) control and SCPI control for each ports.
 - Customer can use one facility more effectively by being able to use two kinds of control commands at the same time.

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Network Master Flex MT1100A

One Button Test



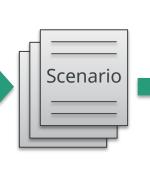
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One Button Test Function

- Execute Specified Tests with One Button
 - Manual testing requires setting of many parameters. To simplify set-up, the MT1100A can test the DUT repeatedly by executing a scenario file containing a predetermined set of tests.

MX100003A Scenario Edit Environment Kit (SEEK)





- Create scenarios using drag and drop dedicated GUI
- ✓ At-a-glance results evaluation with OK/NG indications
- ✓ Support for complex tests under branching conditions incorporating SCPI commands



 One-button testing after loading scenario into MT1100A

100GigE FEG

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page

E

 ✓ Remote output of test results saved in MT1100A for analysis

ritsum MT1100A Network Ma





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