Anritsu envision : ensure

Network Master Pro MT1000A

10G Multirate Module MU100010A

100G Multirate Module MU100011A

High Performance GPS Disciplined Oscillator MU100090A

Scenario Environment Editing Kit (SEEK) MX100003A

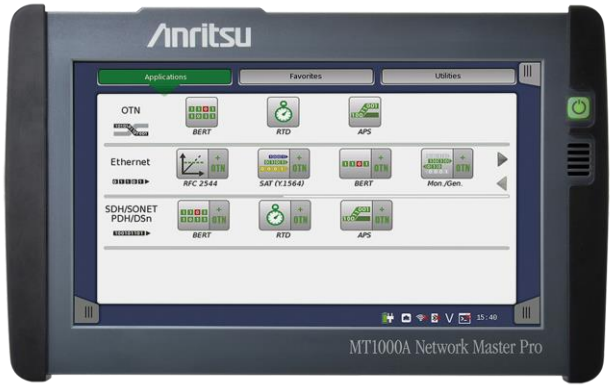
Contents

- Network Master Pro MT1000A
  - Redefining Transport Testing
- Instrument Views
- Product Structure
- Carrier Class Ethernet Installation and Troubleshooting
- TCP Throughput Option (RFC 6349)
- Ethernet OAM Functionality
- Mobile Backhaul Installation and Verification
  - Synchronous Ethernet Test
  - Phase/Time Synchronization Test
- Mobile Fronthaul Installation and Verification
  - CPRI/OBSAI Test
  - eCPRI/IEEE1914.3 Test
- Powerful Storage Area Networking (SAN) Testing
  - Fibre Channel Functionality
- OTN Metro and Core Network Installation and Maintenance
- Quick and Easy Tests of SDH/SONET/PDH/DSn Networks
- VIP : Video Inspection Probe
- Operation and Presentation
- Report Generation
- Remote Operation
  - Remote Control - Scripting
  - Remote GUI & Scripting
- Automation Testing (MX100003A)

Network Master Pro MT1000A

Back to Index page

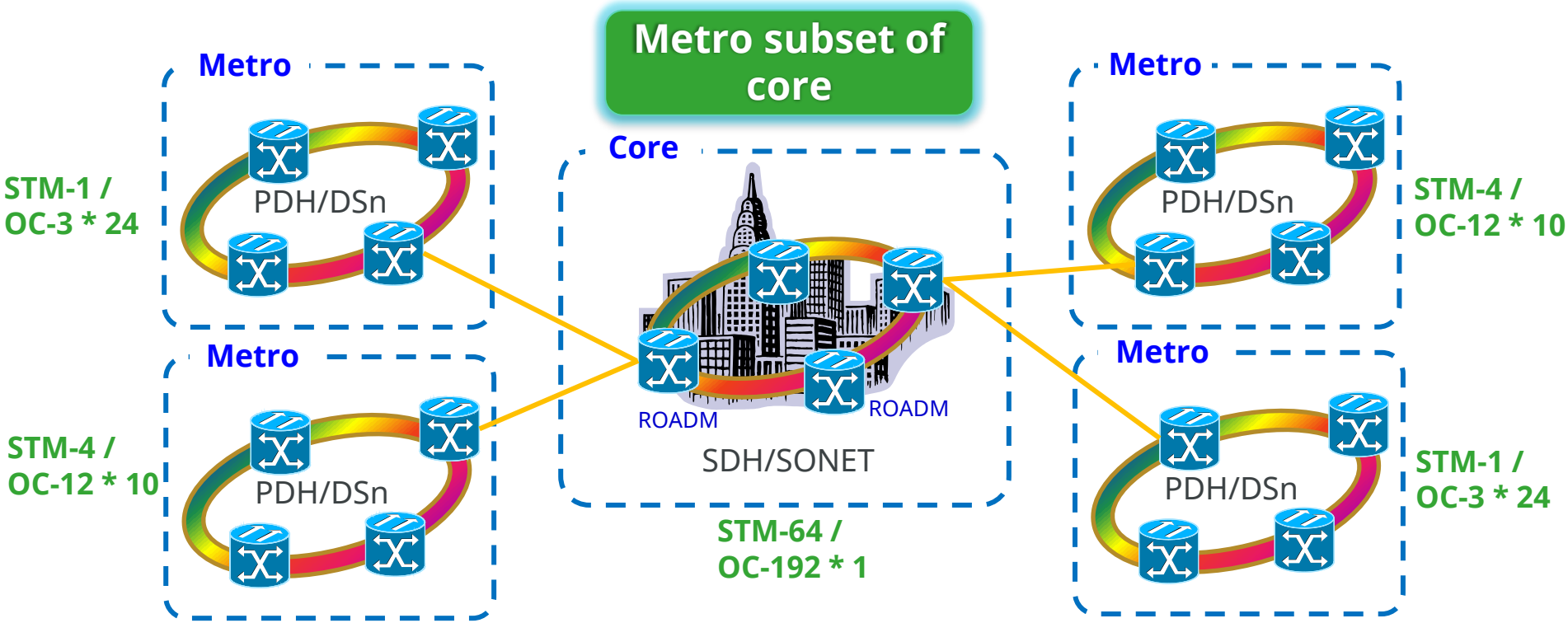
- Redefining Transport Testing



Market Situation—Historical

Back to Index page

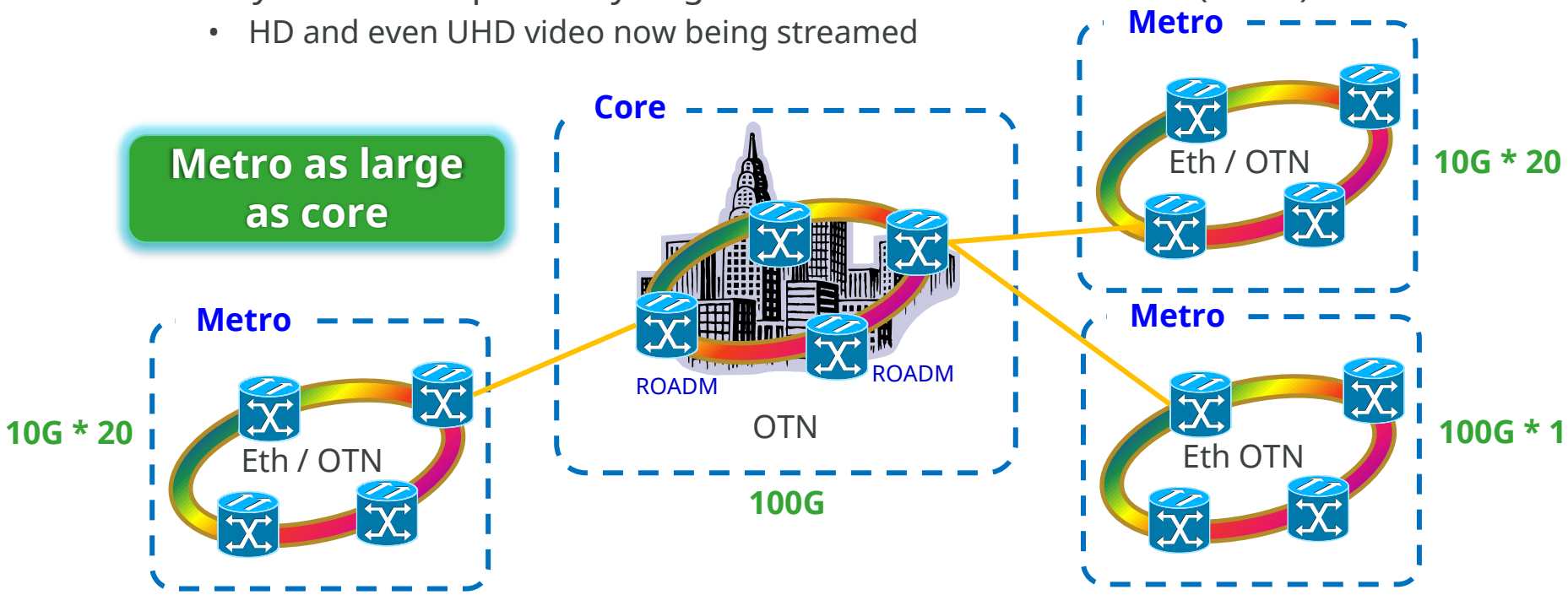
- Core network had multiple metro/access network subsets
  - Much of the network coming to the access network was muxed up to a larger metro network which was muxed up to the core network.
    - Not all traffic was transferred to the core, but a large percentage was.
    - To a large extent, the core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



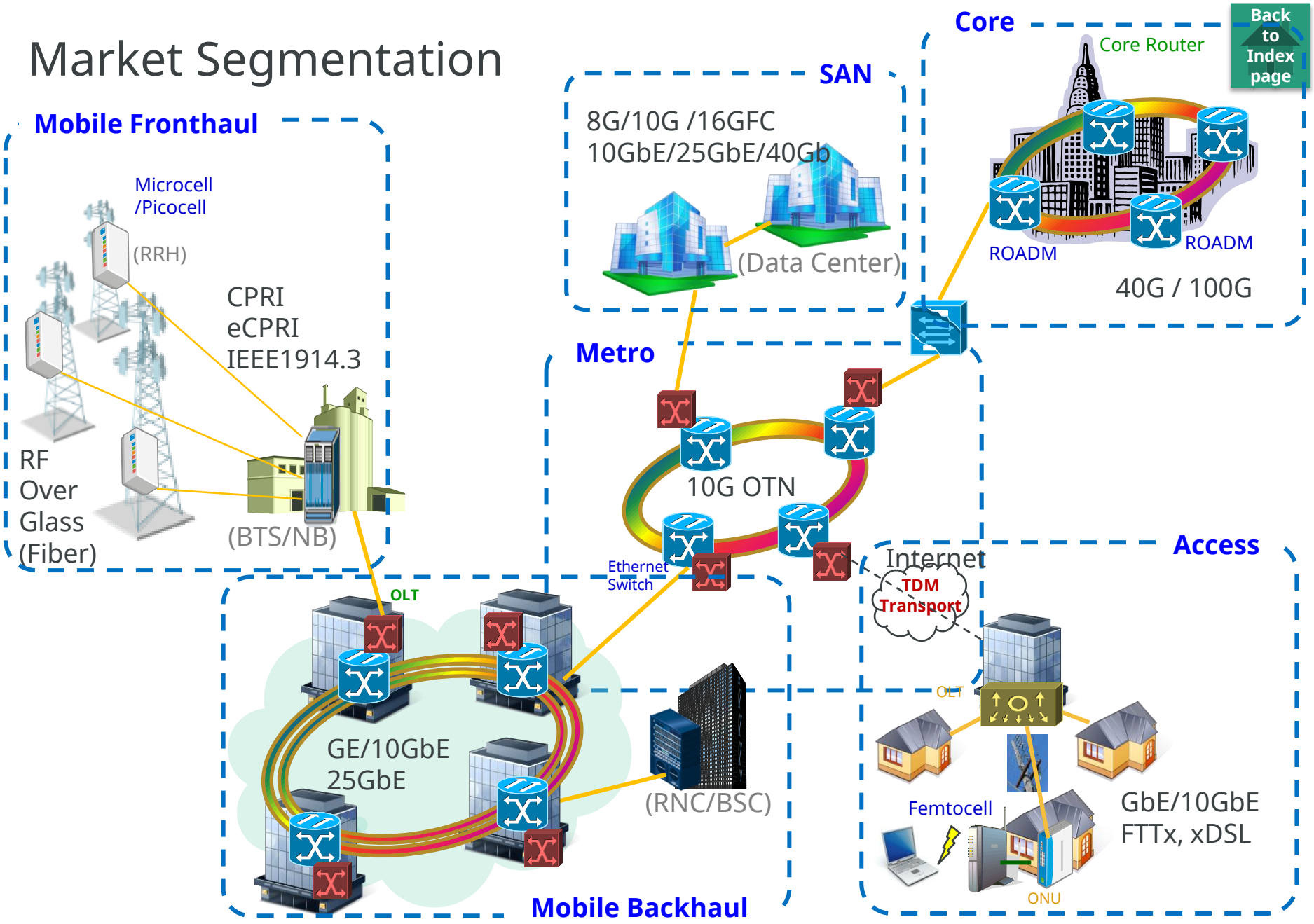
Market Situation—Current and Future

Back to Index page

- Metro networks becoming same or larger size than core
  - Many services now require “near” real-time response (simultaneous multiple access to data)
    - 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)
    - HD and even UHD video now being streamed

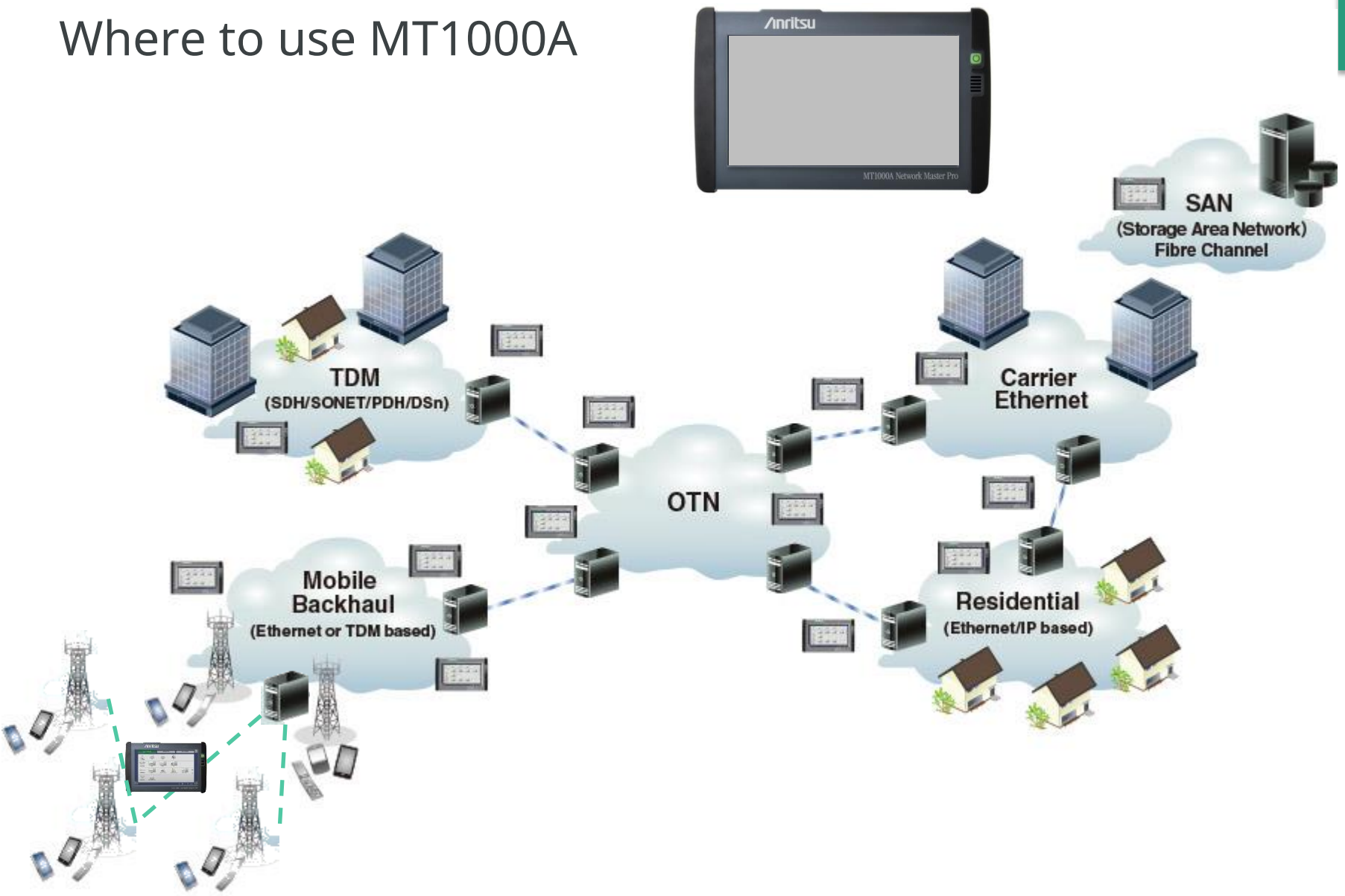


Market Segmentation



Where to use MT1000A

Back to Index page

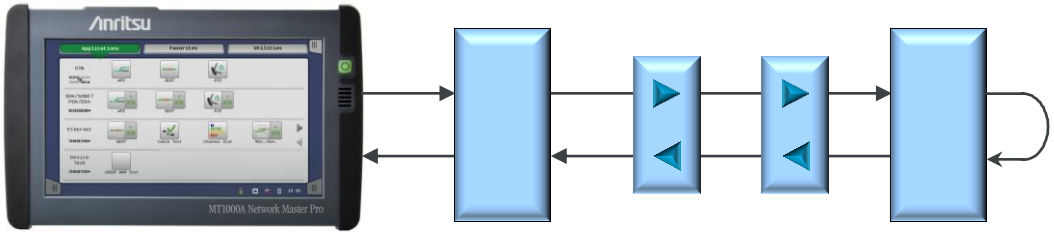


Mobile Fronthaul (CPRI/OBSAI)

Out-of-Service Installation Testing

Back to Index page

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

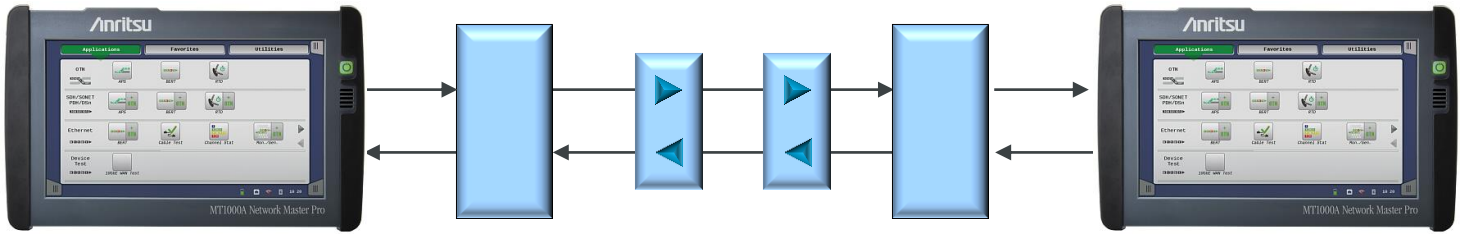


MT1000A

Out-of-Service Installation Testing

Back to Index page

- One-way testing using two instruments
  - Separate results for each line direction
  - Performed between MT1000A and MT1000A

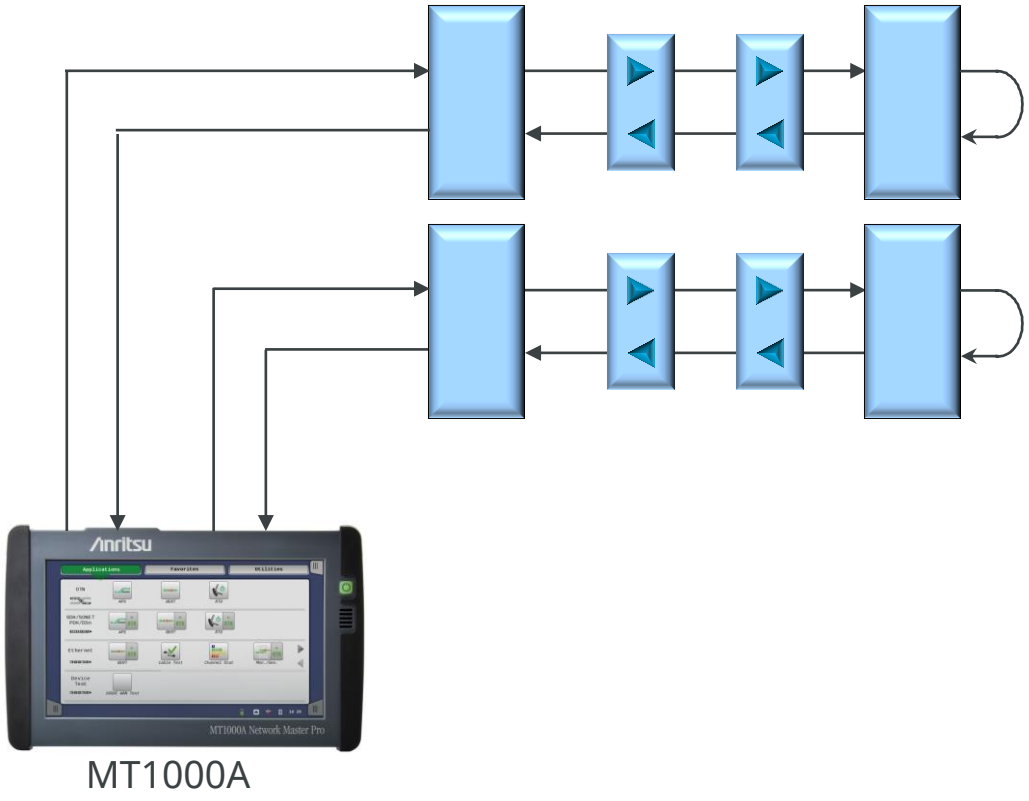


MT1000A MT1000A

Out-of-Service Installation Testing

Back to Index page

- Efficient simultaneous out-of-service testing of up to two lines
  - Supports up to two fully independent ports at all rates

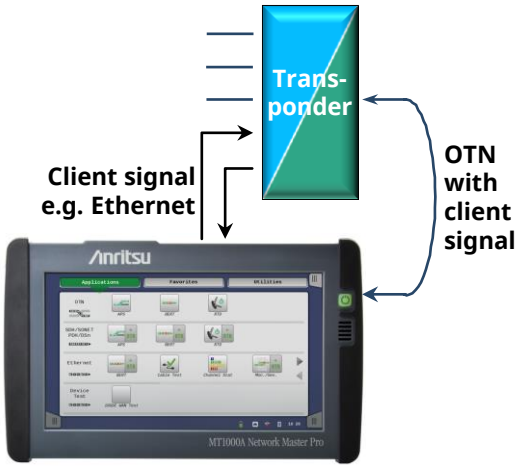


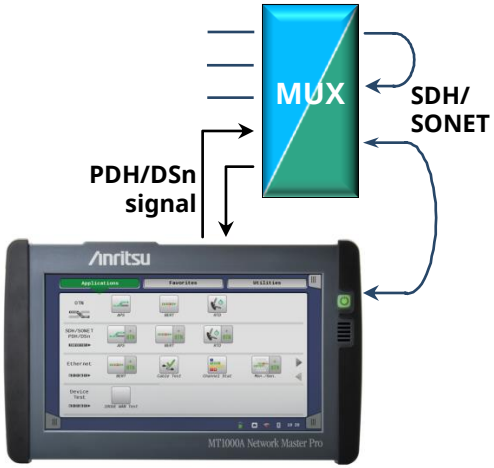
MT1000A

Out-of-Service Testing

Back to Index page

- Network element installation/commissioning
- Error-performance measurements
- Propagation-time measurements
- Alarm, error, slip and frequency-deviation measurements
- System stressing through generation of alarms, errors, slip and frequency offset

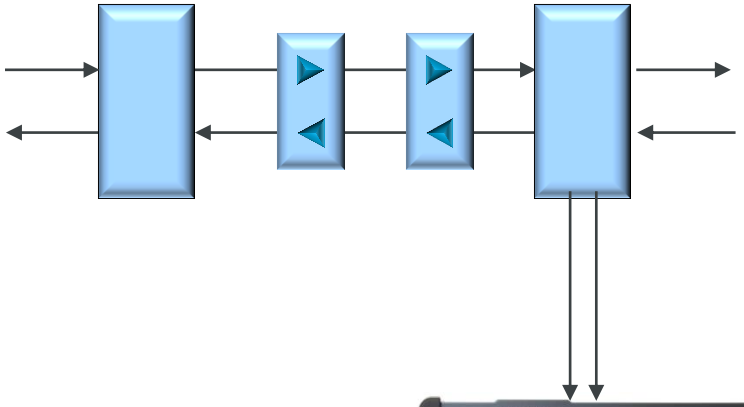




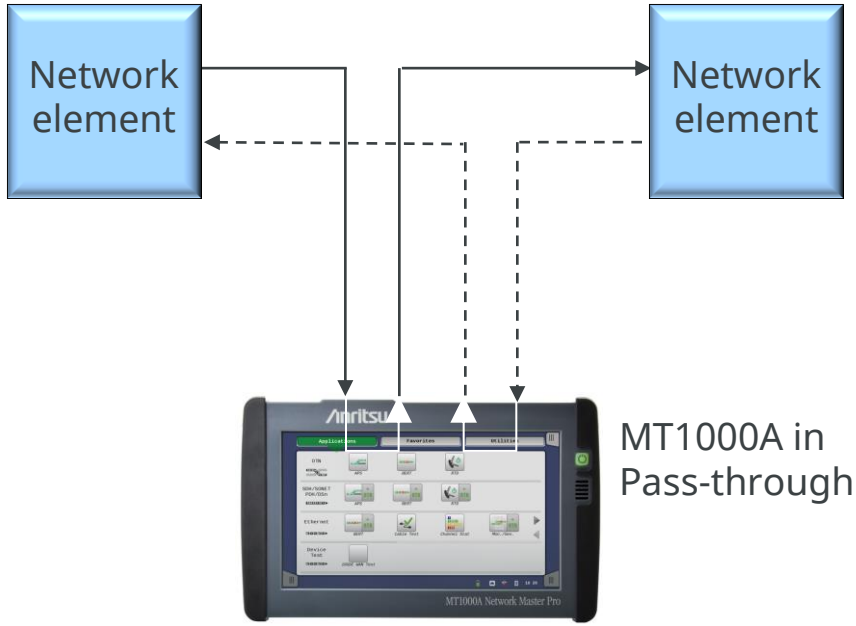
In-Service Troubleshooting and Analysis

Back to Index page

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

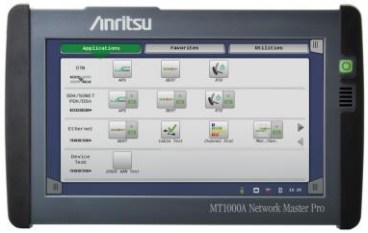


MT1000A connected to monitoring point



MT1000A in Pass-through mode

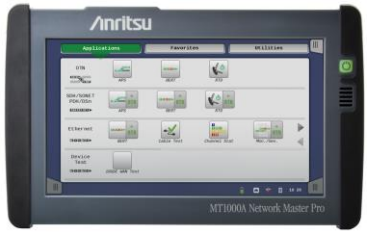
MT1000A Key Applications



Back to Index page

- Carrier Class Ethernet I&M and troubleshooting
  - Ethernet testing up to 100 GigE
  - Include RFC 2544, and Y.1564
  - Include RFC 6349 (Up to 10Gbps)
  - Ethernet OAM
  - MPLS-TP and PBB
  - IP Channel statistics
  - Frame capture for advanced troubleshooting
- Core and Metro networks I&M
  - OTN up to OTU4
  - Mapping of Ethernet/CPRI/SDH/SONET/Fibre Channel client signals, multistage mapping
  - FEC (Forward Error Correction) and O.182 Poisson error insertion
- 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
  - eCPRI/IEEE 1914.3 up to 100 Gbps

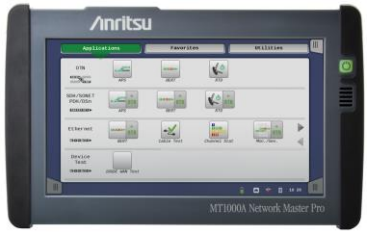
MT1000A Key Applications



Back to Index page

- Powerful Storage Area Networking (SAN) testing
  - Fibre Channel up to 16 Gbps
  - Supports throughput, latency, and buffer credit performance verification
- Quick and easy testing of SDH/SONET, PDH/DSn Networks
  - SDH/SONET up to STM-64/OC-192
  - PDH/DSn (E1, E3, E4, DS1, DS3)
- Fiber endface inspection using VIP (Video Inspection Probe)
- Dual port at 10Gbps rates
  - Reduced testing time by simultaneous testing of two lines with one unit
  - In-service bi-directional monitoring

MT1000A Key Benefits and Features



Back to Index page

- Easy intuitive GUI
  - Large 9-inch touch screen
  - Eight languages (English, Chinese, Japanese, , Korean, German, French, Russian and Spanish)
- 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
- Hand-held product
  - Compact and lightweight design for maximum portability in field
  - Clam shell (single module installation)
  - Modular platform ensures maximum return on investment
- Battery-operated
- High performance in small form factor

*1 Available for certified countries, including USA, Canada, Japan, all EU countries

Network Master Family

Network Master

Back to Index page

- Transport

Network Master GigE MT9090A	Network Master Pro MT1000A	Network Master Flex MT1100A
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, eCPRI/IEEE 1914.3/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, eCPRI/IEEE 1914.3/CPRI/OBSAI, Fibre Channel, SDH/SONET and PDH/DSn

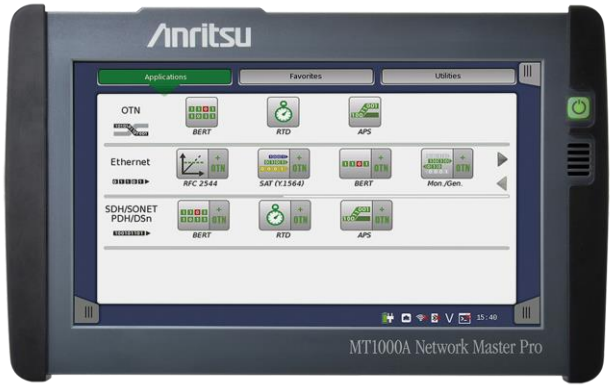
- Optical

Optical Channel Analyzer MT9090A	µOTDR MT9090A
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 Pro MT1000A

Back to Index page

- Instrument Views



MT1000A Instrument Views

Back to Index page

	Kg	lb
Weight	2,7	6,0
	mm	inch
Width	257	10,1
Height	164	6,5
Depth	77	3,0

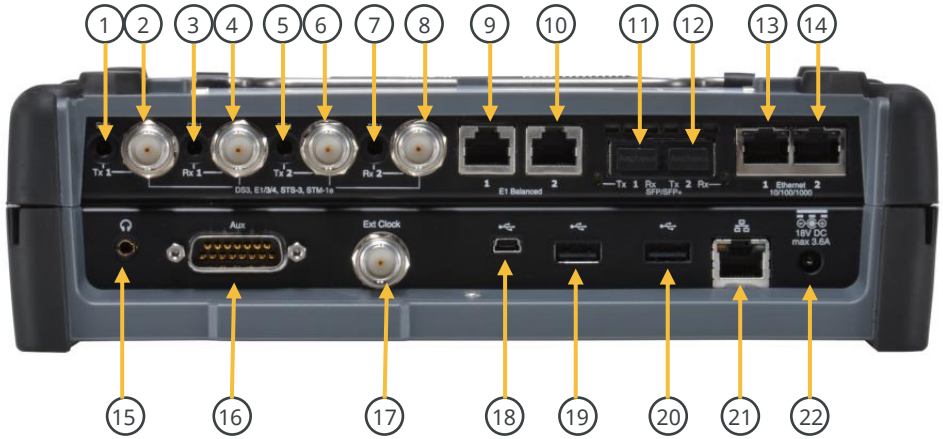
- Front View

- Other Views:

Instrument Views 1/3

Back to Index page

- Top (connector panel) View
  - MT1000A + MU100010A

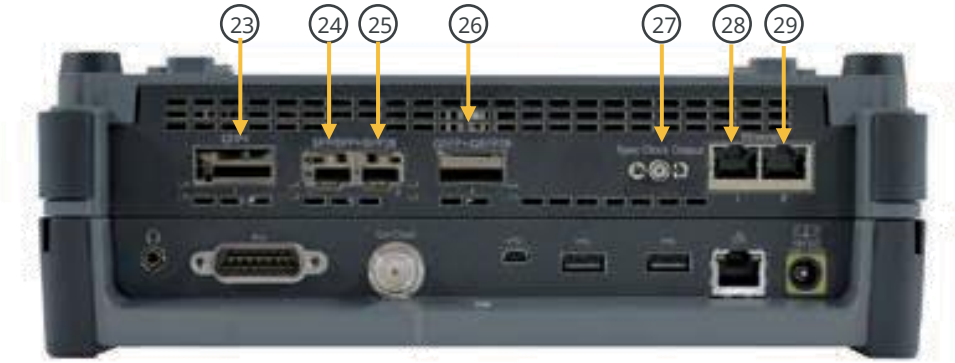


1. Port 1, Tx Bantam (DS1)
2. Port 1, Tx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
3. Port 1, Rx Bantam (DS1)
4. Port 1, Rx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
5. Port 2, Tx Bantam (DS1)
6. Port 2, Tx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
7. Port 2, Rx Bantam (DS1)
8. Port 2, Rx BNC (E1, E3, E4, DS3, STM-1-e, STS-3e
9. Port 1, Tx/Rx RJ48 (E1 balanced)
10. Port 2, Tx/Rx RJ48 (E1 balanced)
11. Port 1, Tx/Rx SFP/SFP+ (optical OTN/Ethernet/CPRI/OBSAI/Fibre Channel/SDH/SONET)
12. Port 2, Tx/Rx SFP/SFP+ (optical OTN/Ethernet/CPRI/OBSAI/Fibre Channel/SDH/SONET)
13. Port 1, Tx/Rx RJ45 (Ethernet electrical)
14. Port 2, Tx/Rx RJ45 (Ethernet electrical)
15. Audio
16. AUX
17. Clock input
18. USB Mini-B
19. USB A
20. USB A
21. Ethernet service interface
22. DC input (18 VDC)

Instrument Views 2/3

Back to Index page

- Top (connector panel) View
  - MT1000A + MU100011A



23. Port 1, Tx/Rx CFP4 (optical OTN/Ethernet)
24. Port 1, Tx/Rx SFP/SFP+/SFP28 (optical OTN/Ethernet/eCPRI/RoE/CPRI/OBSAI/Fibre Channel/SDH/SONET)
25. Port 2, Tx/Rx SFP/SFP+/SFP28 (optical OTN/Ethernet/eCPRI/RoE/CPRI/OBSAI/Fibre Channel/SDH/SONET)
26. Port 1, Tx/Rx QSFP28 (optical 25G Ethernet)
27. Port 1, Sync Clock Out (CAUI4, 25GAUI, OTL 4.4)
28. Port 1, Tx/Rx RJ45 (Ethernet electrical)
29. Port 2, Tx/Rx RJ45 (Ethernet electrical)

Instrument Views 3/3

Back to Index page

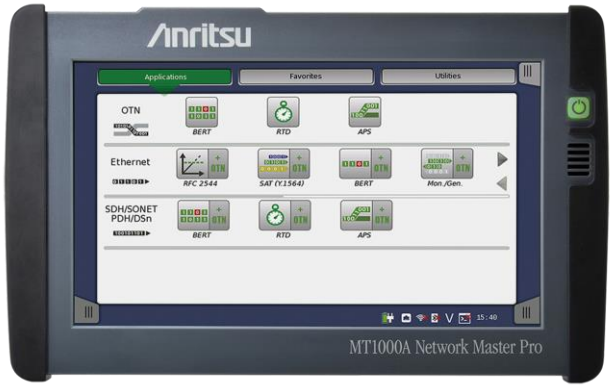
- Top (connector panel) View
  - MT1000A + MU100010A

30. AUX D-SUB 9 pin
31. 1 pps Output
32. 10 MHz Output
33. OCS LED
34. GPS received LED
35. 1 pps Sync In
36. GPS Antenna Input

Network Master Pro MT1000A

Back to Index page

- Product Structure



MT1000A Product Structure

Back to Index page

- Mainframe and Accessories

Model/Order No.	Name	
MT1000A	Network Master Pro	
Standard Accessories		
MT1000A-006*1	High Power Supply:	Installed
	Line Cord*2:	1 pc
B0690A	Softbag:	1 pc
B0728A*3	Rear Panel kit:	1 pc
G0385A*4	High Power AC Adaptor:	1 pc
G0310A	Li-ion Battery:	1 pc
Z1746A	Stylus:	1 pc
Z1747A*5	Carrying Strap:	1 pc
Z1748A*6	Handle:	1 pc
Z1817A*7	Utilities ROM:	1 pc
Options		
MT1000A-003*8	Connectivity for WLAN/Bluetooth	
MT1000A-005*9	AUX I/O	

Model/Order No.	Name
Optional Accessories	
B0691B*10	Hard Case
B0720A	Rear Panel
B0729A*11	Screw 1U
B0730A*11	Screw 2U
B0731A*11	Screw 3U
B0732A*12	Screw Kit
G0382A*13	Autofocus Video Inspection Probe
G0306B*13	Video Inspection Probe
G0309A*4	AC Adapter
G0324A	Battery Charger
G0325A	GPS Receiver
J1569B	Car 12 Vdc Adapter
J1667A*14	GPIB-USB Converter
Z1821A*15	Utilities in USB Stick

Soft Bag B0690A (Standard Accessory)

This bag with shoulder strap can hold the MT1000A with up to three installed modules.

Hard Case B0691B

This strong plastic case can hold the MT1000A with up to two installed modules.
462 (W) × 372 (H) × 207 (D) mm

*1: The presence of the MT1000A-006 option can be recognized at the top right of the front panel. To retrofit to the already shipped item, please contact us.

Without MT1000A-006

With in MT1000A-006

*2: One line cord is attached to the area to shipment.
*3: Composed of B0720A, B0729A, B0730A and B0731A. Refer to Module Composition for the module combination.
*4: The MT1000A with MT1000A-006 can be used. Use the AC adapter when using the MT1000A without MT1000A-006 installed.
*5: Shoulder strap for MT1000A.
*6: Hand strap for MT1000A.
*7: This DVD includes PDF files and formatting tools of each product's instruction manual (such as W3933AE, W3810AE, W3736AE, W3946AE).
*8: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.
*9: MT1000A-005 is required for MU100090A. To retrofit to the already shipped item, please contact us.
*10: Can use module 1 to 2 in combination
*11: Includes 4 bolts of same length
*12: Includes B0729A, B0730A and B0731A

*13: This fiberscope uses the VIP function in the MT1000A Utility menu. Different tip types are used by the G0382A and G0306B.

G0382A

G0306B

*14: J1667A is required for SCPI remote control via GPIB
*15: Include MT1000A Operation Manual and the Remote Script Manual.

MT1000A Product Structure

Back to Index page

Model	Name	
MU100010A	10G Multirate Module	
Standard Accessories		
W3935AE	MT1000A Transport Quick Reference Guide:	1 pc
B0692A*	ESD Box (for optical modules):	1 pc

*: Up to four SFP+/SFPs can be stored.

- 10G Multirate Module MU100010A

MU100010A	Bit Rate	Less than 5G	From 6G to 10G	
Transport Technology	No. of Measurement Ports*1	2 (Dual Channel)	1 (Single Channel)	2 (Dual Channel)
Ethernet				
IPv4/IPv6, Y.1564, IEEE 1588 v2, RFC 2544, BER, Multistream, OAM, SyncE, MPLS, MPLS-TP, Multistage VLAN, PBB, Ping/Traceroute, Cable Tests, In-band Control, Auto discovery, Path-through		MU100010A-001 Up to 2.7G Dual Channel	MU100010A-011 Ethernet 10G Single Channel	MU100010A-012 Ethernet 10G Dual Channel
TCP Throughput Test (RFC 6349, iPerf)		MU100010A-020 TCP Throughput		
OTN*2, *3				
Errors/Alarms, Error Performance/Delay/APS Test, FEC Test, O.182 Test, Overhead Editing/Capture, TCM Monitoring/Generation, Tributary Scan		MU100010A-001 Up to 2.7G Dual Channel	MU100010A-051 OTN 10G Single Channel	MU100010A-052 OTN 10G Dual Channel
ODU Multiplexing Addition*4		MU100010A-061 ODU Multiplexing		
ODU Flex Addition*5		—	MU100010A-062 ODU Flex	
CPRI/OBSAI				
CPRI/OBSAI L1: Level/Bit Rate/Frequency deviation Measurement, Alarms/Errors Detection, Unframed BER CPRI L2: Link Status Monitoring, Alarms/Errors Detection, Framed BER Measurement, RTD Measurement, Monitoring using Passthrough		MU100010A-071 CPRI/OBSAI Up to 5G Dual Channel	MU100010A-072 CPRI/OBSAI 6G to 10G Single Channel	MU100010A-073 CPRI/OBSAI 6G to 10G Dual Channel
Fibre Channel				
Performance Test, Signal Generation/Monitoring, Latency, BER, Line Alarm/Error Monitoring		MU100010A-002 FC 1G 2G 4G Dual Channel	MU100010A-091 FC 8G 10G Single Channel	MU100010A-092 FC 8G 10G Dual Channel
SDH/SONET, PDH/DSn				
PDH/DSn Test, Tw-Way Monitoring/Mapping, Errors/Alarms, Error Performance/Delay/APS Test, Header Monitoring/Generation, Pointer Event Generation, Tributary Scan		MU100010A-001 Up to 2.7G Dual Channel	MU100010A-081 STM-64 OC-192 Single Channel	MU100010A-082 STM-64 OC-192 Dual Channel

Notes:
*1: The channel is not related to the physical port position. The user can freely choose either of the two physical ports assigned to the option via software. For a dual channel setup, the two different ports of one protocol can operate simultaneously, or two different single channel options can operate simultaneously.
*2: Please see the datasheet for supported OTN mapping.
*3: When using the OTN function, the channel can be used as client signal mapped to OTN. For example, when mapping STM-64/OC-192 to OTU2, both the MU100010A-051/052 (for physical port) and the MU100010A-081/082 (for client signal) are required.
*4: When the ODU Multimapping option is installed, OTN multistage mapping measurements are supported. This one option supports both single channel and dual channel.
*5: When the ODU Flex option is installed, since transport is over OTN networks, mappings based on used ODU Flex standard can be measured. This one option supports both single channel and dual channel.

MT1000A Product Structure

Back to Index page

Model	Name
MU100011A*	100G Multirate Module
Standard Accessories	
W3935AE	MT1000A Transport Quick Reference Guide: 1 pc

*: MT1000A-006 is required for MU100011A.

- 100G Multirate Module MU100011A

MU100011A	Bit Rate	Less than 10G		Up to 10G
Transport Technology	No. of Measurement Ports*1	1 (Single Channel)	2 (Dual Channel)	1 (Single Channel)
Ethernet				
IPv4/IPv6, Y.1564, IEEE 1588 v2, RFC 2544, BER, Multistream, OAM, SyncE, MPLS, MPLS-TP, Multistage VLAN, PBB, Ping/Traceroute, Cable Tests, In-band Control, Auto discovery, Path-through		MU100011A-001 Up to 10G Single Channel	MU100011A-003 Up to 10G Dual Channel	MU100011A-017 Ethernet 25G Single Channel MU100011A-013 Ethernet 40G Single Channel MU100011A-015 Ethernet 100G Single Channel
TCP Throughput Test (RFC 6349, iPerf)		MU100011A-020 TCP Throughput		—
RS-FEC for 100GBASE-SR4		—	—	MU100011A-023 RS-FEC for 100GBASE-SR4 MU100011A-015 Ethernet 100G Single Channel
OTN*2, *3				
Errors/Alarms, Error Performance/Delay/APS Test, FEC Test, O.182 Test, Overhead Editing/Capture, TCM Monitoring/Generation, Tributary Scan		MU100011A-001 Up to 10G Single Channel	MU100011A-003 Up to 10G Dual Channel	MU100011A-053 OTN 40G Single Channel MU100011A-055 OTN 100G Single Channel
ODU Multiplexing Addition*2, *4		MU100011A-063 ODU Multiplexing/Multi Stage		
ODU Flex Addition*2, *5		MU100011A-062 ODU Flex		
CPRI/OBSAI				
CPRI/OBSAI L1: Level/Bit Rate/Frequency deviation Measurement, Alarms/Errors Detection, Unframed BER CPRI L2: Link Status Monitoring, Alarms/Errors Detection, Framed BER Measurement, RTD Measurement, Monitoring using Passthrough		MU100011A-071 CPRI/OBSAI Up to 10G Single Channel	MU100011A-072 CPRI/OBSAI Up to 10G Dual Channel	—
Fibre Channel				
Performance Test, Signal Generation/Monitoring, Latency, BER, Line Alarm/Error Monitoring		MU100011A-004 Up to 10G FC Single Channel	MU100011A-005 Up to 10G FC Dual Channel	MU100011A-091 FC 16G Single Channel
SDH/SONET				
PDH/DSn Test, Tw-Way Monitoring/Mapping, Errors/Alarms, Error Performance/Delay/APS Test, Header Monitoring/Generation, Pointer Event Generation, Tributary Scan		MU100011A-001 Up to 10G Single Channel	MU100011A-003 Up to 10G Dual Channel	MU100011A-083*6 STM-256/OC-768 Client Signal

Notes:
*1: The channel is not related to the physical port position. The user can freely choose either of the two physical ports assigned to the option via software. For a dual channel setup, the two different ports of one protocol can operate simultaneously, or two different single channel options can operate simultaneously.
*2: Please see the datasheet for supported OTN mapping.
*3: When using the OTN function, the channel can be used as client signal mapped to OTN. For example, when mapping 100G Ethernet to OTU4, both the MU100011A-055 (for physical port) and the MU100011A-015 (for client signal) are required.
*4: When the ODU Multiplexing/Multistage option is installed, OTN multistage mapping measurements are supported. This one option supports both single channel and dual channel.
*5: This mapping function is based on the ODUFlex standard for transmissions over OTN networks and supports client signals of any speed.
*6: The MU100011A has no STM-256/OC-768 PHY interface; it can be used for OTN client signals.

MT1000A Product Structure

Back to Index page

- Optical Transceiver for Transport Module

MU110010A	MU110011A	Model/ Order No.	Name	Form Factor	100 Meg Ethernet	156 Meg STM-1	614 Meg CPRI	622 Meg STM-4	768 Meg OBSAI	1GFC	1.23 Gig CPRI	1.25 Gig Ethernet	1.54 Gig OBSAI	2GFC	2.46 Gig CPRI	2.488 Gig STM-16	2.67 Gig OTU1	3.07 Gig CPRI OBSAI	4GFC	4.92 Gig CPRI	6.14 Gig CPRI OBSAI	8GFC	9.83 Gig CPRI	9.95 Gig STM-64	10.1 Gig CPRI	10.3 Gig Ethernet	10GFC	10.7 Gig OTU2	11.05 Gig OTU1e	11.09 Gig OTU2e	11.27 Gig OTU1f	11.3 Gig OTU2f	16GFC	25G Ethernet	40G Ethernet	40G OTN	100G Ethernet	100G OTN
✓	✓	G0332A	100M FX 1310 nm MM SFP	SFP	1310 nm, MM, 2 km																																
✓	✓	G0319A	Up to 2.7G 1310 nm 15 km SFP	SFP		1310 nm, SM, 15 km																																
✓	✓	G0320A	Up to 2.7G 1310 nm 40 km SFP	SFP		1310 nm, SM, 40 km																																
✓	✓	G0321A	Up to 2.7G 1550 nm 80 km SFP	SFP		1550 nm, SM, 80 km																																
✓	✓	G0328A	1G/2G/4G FC 850 nm SFP	SFP						850 nm, MM, 0.5 km																													
✓	✓	G0322A	1G/2G/4G FC 1310 nm SFP	SFP						1310 nm, SM, 10 km																													
✓	✓	G0323A	1G/2G/4G FC 1550 nm SFP	SFP						1550 nm, SM, 40 km																													
✓	✓	G0315A	10G LR/LW 1310 nm SFP+	SFP+																		1310 nm, SM, 10 km																
✓	✓	G0316A	10G ER/EW 1550 nm 40 km SFP+	SFP+																		1550 nm, SM, 40 km																
✓	✓	G0318A	10G ZR/ZW 1550 nm 80 km SFP+	SFP+																		1550 nm, SM, 80 km																
✓	✓	G0329A	10G LR 1310 nm SFP+	SFP+								1310 nm, SM, 10 km																												
✓	✓	G0356A	8G FC/10G SR 850 nm SFP+	SFP+																		850 nm, MM, 0.3 km																
	✓	G0396A	16GFC SR 850 nm SFP+	SFP+																													850 nm, MM, 0.5 km					
	✓	G0397A	16GFC LR 1310 nm SFP+	SFP+																													1310 nm, SM, 10 km					
	✓	G0398A	25G SR 850 nm SFP28	SFP28																														850 nm, MM, 0.5 km				
	✓	G0399A	25G LR 1310 nm SFP28	SFP28																														1310 nm, SM, 10 km				
	✓	G0296A	40G SR4 850 nm QSFP+	QSFP+																															850 nm, MM, 0.1 km			
	✓	G0334A	40G LR4 1310 nm QSFP+	QSFP+																															1310 nm, SM, 10 km			
	✓	G0366A	100G SR4 850 nm QSFP28	QSFP28																																850 nm, MM, 0.1 km		
	✓	G0364A	100G LR4 1310 nm QSFP28	QSFP28																																1310 nm, SM, 10 km		
	✓	G0365A	100G LR4 Dual Rate 1310 nm QSFP28	QSFP28																																1310 nm, SM, 10 km		
	✓	G0369A	100G LR4 Dual Rate 1310 nm CFP4	CFP4																																1310 nm, SM, 10 km		

MT1000A Product Structure

Back to Index page

- High Performance GPS Disciplined Oscillator MU100090A

Model/Order No.	Name
MU100090A*1	High Performance GPS Disciplined Oscillator
Standard Accessories	
J1705A	AUX Conversion Adaptor
J1706A	GPS Antenna
J1710A	BNC Cable(20 cm) × 2
Mandatory Main Frame Option	
MT1000A-005*2	AUX I/O

*1: Excellent Eco Product non-compliant.
*2: MT1000A-005 is required for MU100090A.

- Transport Test Accessories

Model	Name	Notes
G0325A	GPS Receiver	It is required when measuring one-way latency at Ethernet tests. However, it is unnecessary when purchasing MU100090A.
W3933AE	MT1000A Transport Module Operation Manual	Printed manual
W3736AE	MT1000A/MT1100A Remote Scripting Operation Manual	Printed manual
Z1821A	Utilities in USB Stick	USB memory with operation manual, remote scripts instruction manual, etc.
J1583A	Optical Attenuator 10 dB LC/PC to LC/PC	
J1584A	RJ45 Cable 3 m	
J1585A	RJ48 to Crocodile Clips Cable 3 m	E1 interface cable.
J1586A	RJ48 to Crocodile Clips Cable 20 dB ATT 3 m	E1 interface cable.
J1588A	BNC Cable 2.5 m	E1, E3, E4, DS3, STM-1e, STS-3 interface cable. Impedance: 75Ω
J1589A	BNC to 1.6/5.6 Cable 2.5 m	E1, E3, E4, DS3, STM-1e, STS-3 interface cable. Impedance: 75Ω
J1591A	RJ48 to Two 3-pin Banana Plug Cable 2.5 m	E1 interface cable.
J1597A	RJ48 Balanced PDH Cable Crossed 3 m	E1 interface cable.
J1598A	Bantam Cable 3 m	DS1 interface cable.
J1710A	BNC Cable 0.2 m	BNC cable for MU100090A and main-frame external clock input connector. Impedance: 50Ω
J0127B	COAXIAL CORD, 2.0 M	BNC cable for MU100090A and main-frame external clock input connector. Impedance: 50Ω

MT1000A Product Structure

Back to Index page

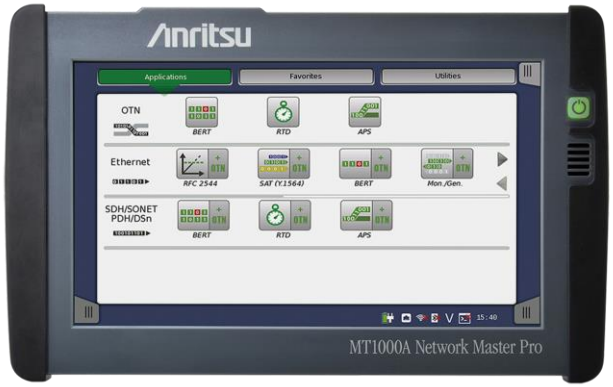
- Warranty Products

Model	Name
MT1000A	
MT1000A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MT1000A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MT1000A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)
MU100010A	
MU100010A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MU100010A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MU100010A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)
MU100011A	
MU100011A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MU100011A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MU100011A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)
MU100090A	
MU100090A-ES210	2 Years Extended Warranty Service (standard 1 year + 1 year)
MU100090A-ES310	3 Years Extended Warranty Service (standard 1 year + 2 years)
MU100090A-ES510	5 Years Extended Warranty Service (standard 1 year + 4 years)

Network Master Pro MT1000A

Back to Index page

- Carrier Class Ethernet Installation and Troubleshooting



MT1000A Product Highlights

Back to Index page

- Easy Ethernet test solution
  - Ethernet testing
    - at 100Gbps, 40Gbps, 25Gbps, 10Gbps, 1Gbps, 100Mbps and 10Mbps
  - Traffic generation up to full line rate
  - 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

MT1000A Product Highlights

Back to Index page

- Easy Ethernet test solution—continued
  - Comprehensive statistics including:
    - Performance (utilization, Throughput, frame rate)
    - 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 line directions
  - IP Channel Statistics to identify error streams, top talkers, network attacks for up to 230 multiflow counters
  - Ethernet OAM: IEEE 802.3 (IEEE 802.3ah), IEEE 802.1ag, ITU-T Y.1731

MT1000A Product Highlights

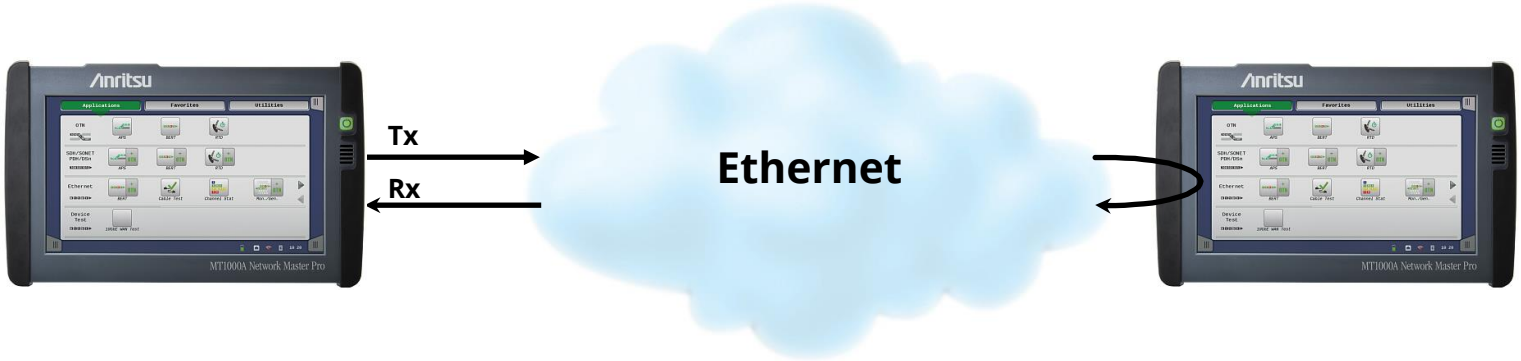
Back to Index page

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

MT1000A Applications – Out-of-Service Testing

Back to Index page

- 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 MT1000A Ethernet test signal using cable or reflector at far end

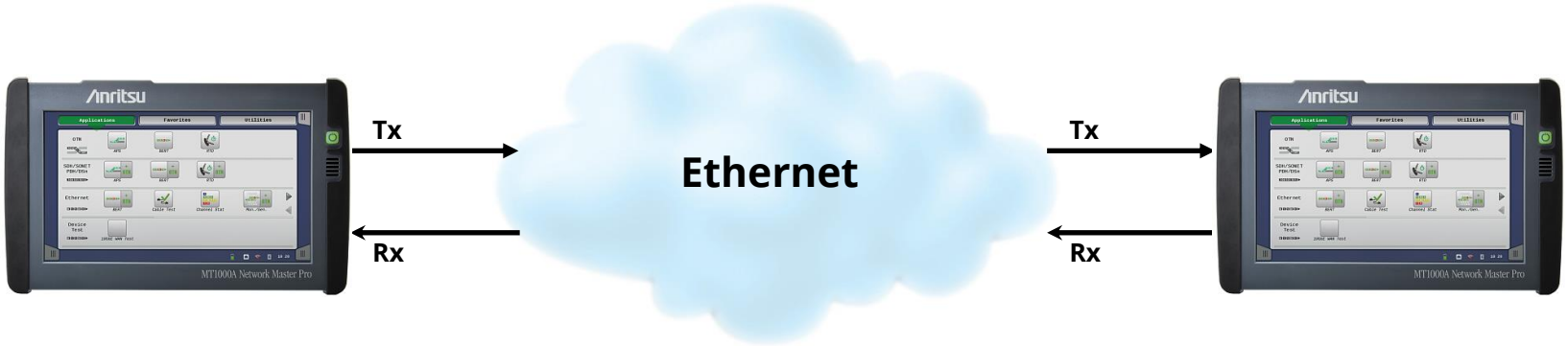


Ethernet testing with far-end reflector

MT1000A Applications – Out-of-Service Testing

Back to Index page

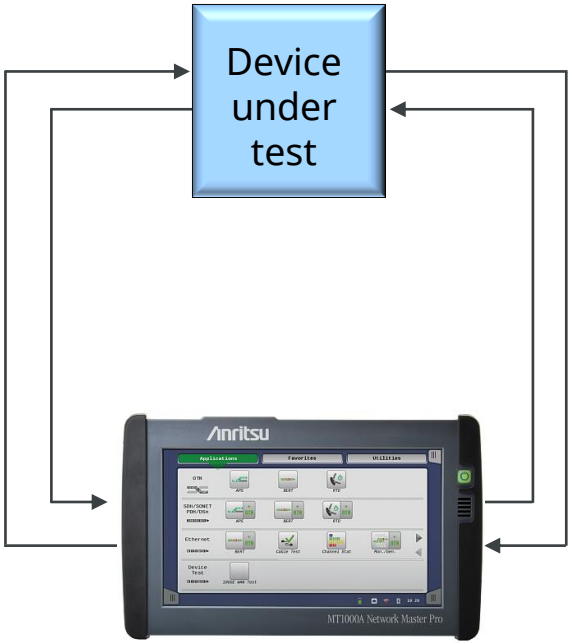
- Ethernet end-to-end testing
  - Due to nature of IP/Ethernet networks key parameters like Throughput, Frame Loss and Packet Jitter may differ in two directions of connection
    - Two instruments needed to capture data for each direction



MT1000A Applications – Out-of-Service Testing

Back to Index page

- Typical applications[1]:
  - Dual-port testing of networks or network elements
  - One-way latency measurements
  - Router testing
  - QoS verification

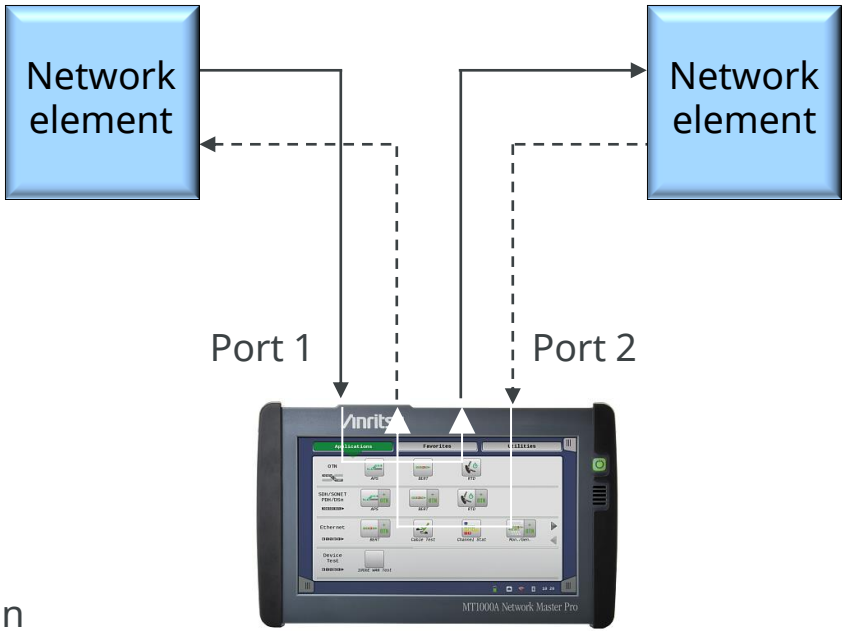


[1] Requires 10 Gbps dual-port option

MT1000A Applications – In-Service Monitoring

Back to Index page

- Typical applications[1]:
  - Rapid in-service diagnostics
  - In-service troubleshooting
  - Live traffic analysis and statistics



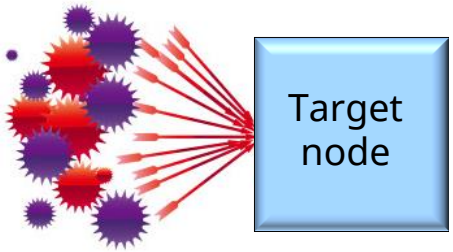
MT1000A in Pass-through mode

[1] Requires 10 Gbps dual-port option

MT1000A IP Channel Statistics (Up to 10Gbp)

Back to Index page

- 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



MT1000A IP Channel Statistics (Up to 10Gbp)

Back to Index page

- 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)

MT1000A IP Channel Statistics (Up to 10Gbp)

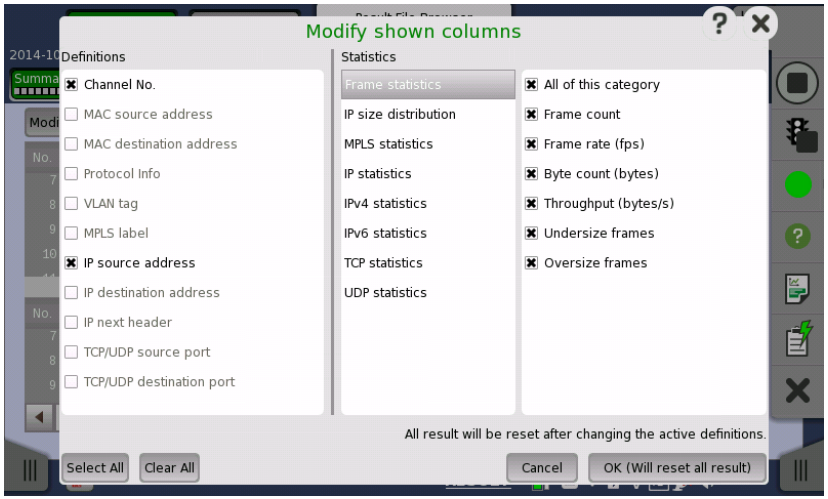
Back to Index page

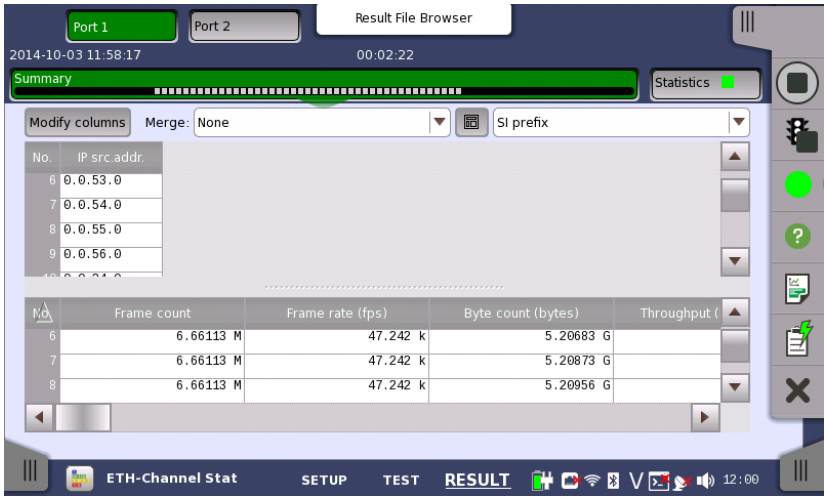
- IP Channel Statistics
  - Combination of filters
    - IPv4, IPv6 or MAC address, VLAN ID or MPLS label, IP next header (protocol), TCP/UDP ports
  - Monitoring values
    - Frame counts/rate, Throughput, Error frames, Size distribution, IPv4/IPv6 statistics, TCP/UDP statistics, etc.
  - Added value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

MT1000A IP Channel Statistics (Up to 10Gbp)

Back to Index page

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

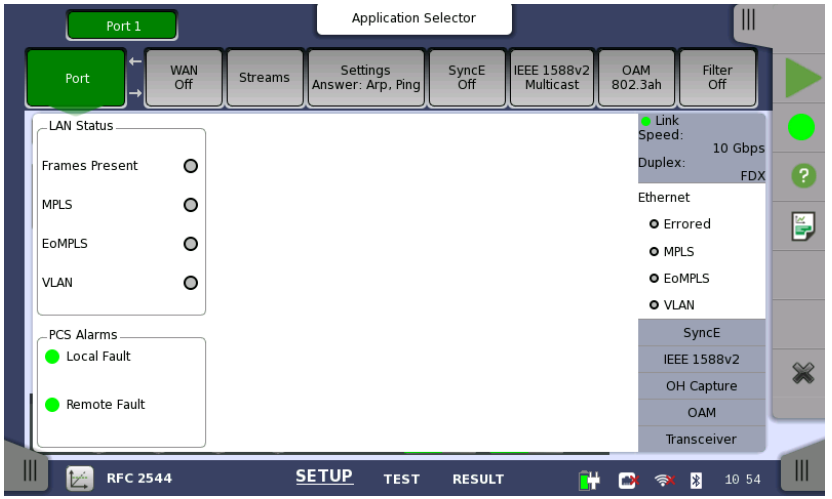


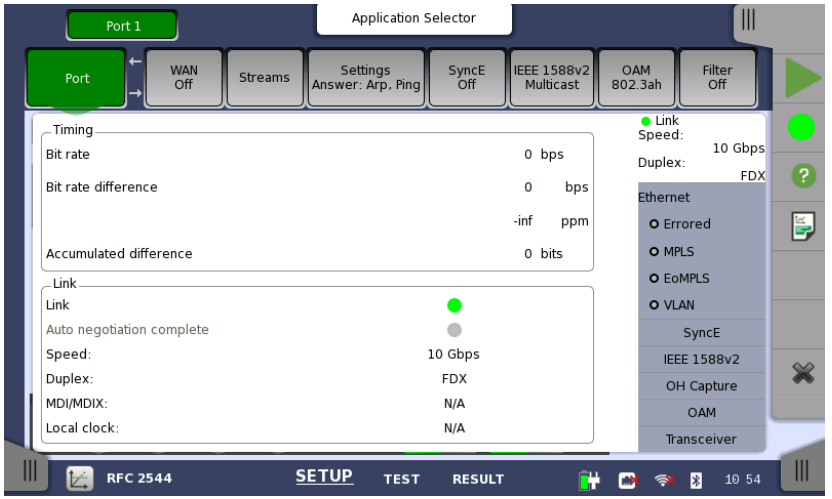


MT1000A Ethernet Line Status

Back to Index page

- Line alarms as LED indicators
- Displays current line status

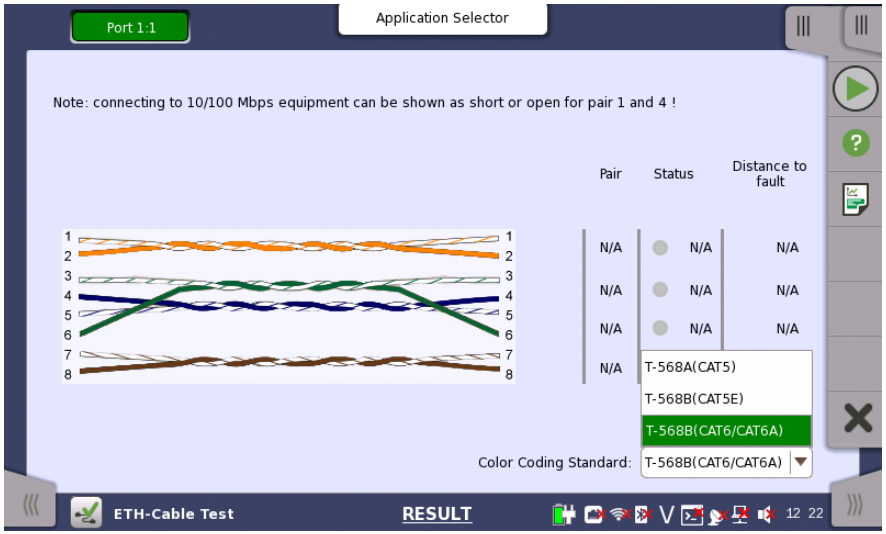




MT1000A Cable Test for Electrical Ethernet

Back to Index page

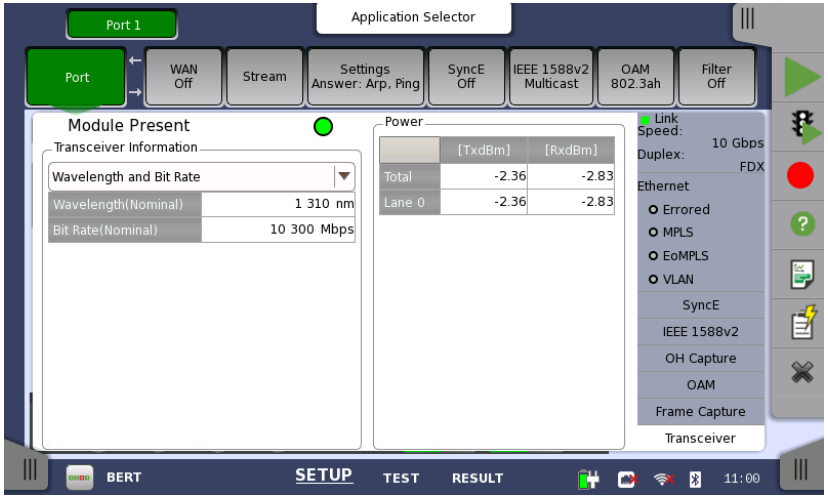
- Some problems on electrical Ethernet are basic:
  - Short in wire pair
  - Break in wire pair
- Cable test easily identifies such basic problems
- Cable test displays distance from instrument to fault



MT1000A Signal Level Display for Optical Ethernet

Back to Index page

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



MT1000A Service Activation Test

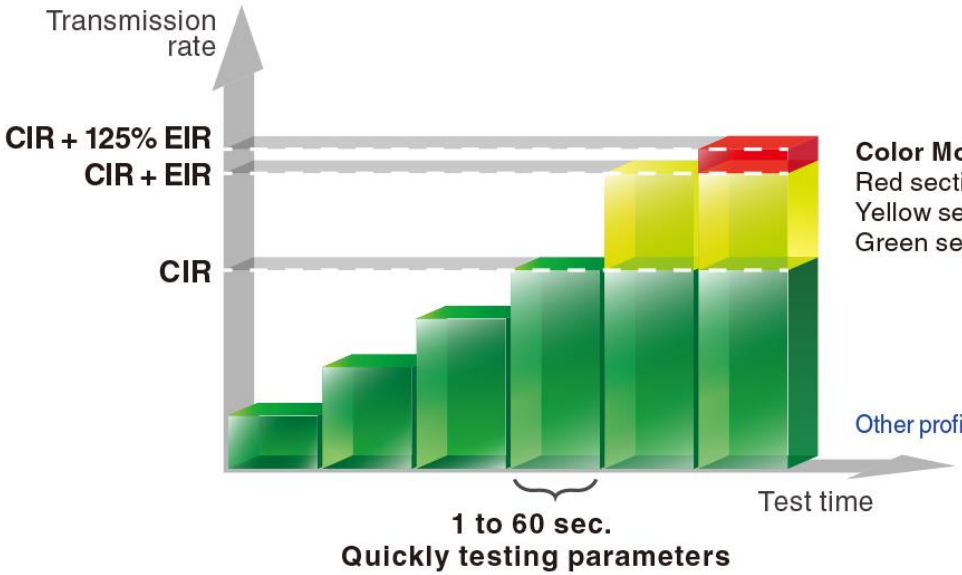
Back to Index page

- 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

MT1000A Service Activation Test

Back to Index page

- 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



Color Mode

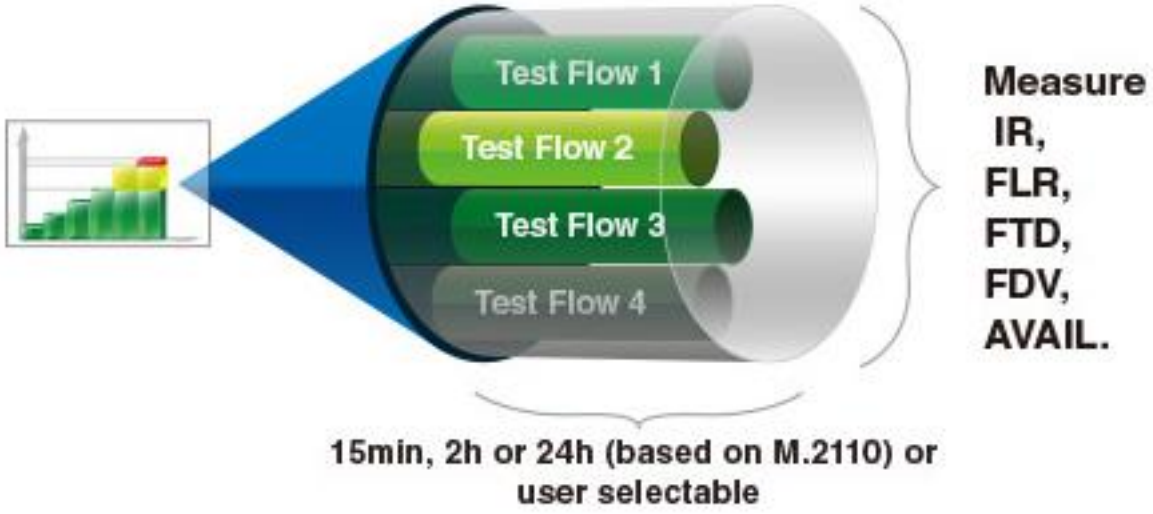
Red section	: Confirm traffic dropped when policing is applied
Yellow section	: Non guaranteed traffic
Green section	: Guaranteed traffic; Service Acceptance Criteria (SAC) on Frame Loss Ratio (FLR), Frame Transfer Delay (FTD), Frame Delay Variation (FDV) and Availability (AVAIL) are verified.

Other profile parameters : Committed Burst Size (CBS) Excess Burst Size (EBS)

MT1000A Service Activation Test

Back to Index page

- 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

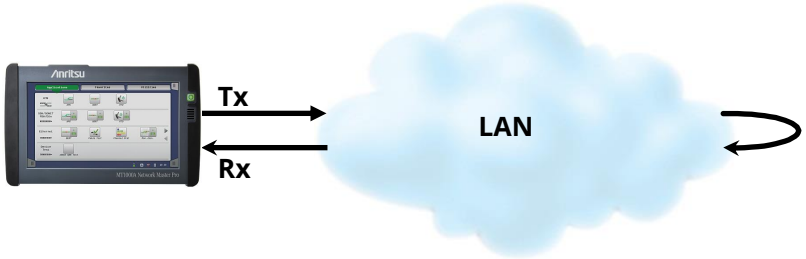


MT1000A Service Activation Test

Back to Index page

- 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
      - FDV (Frame Delay Variation) may be irrelevant



MT1000A Service Activation Test

Back to Index page

- 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 of services	Long due to sequential test of parameters and services
Test result	Directly related to SLA requirements	Link performance limit

MT1000A Service Activation Test

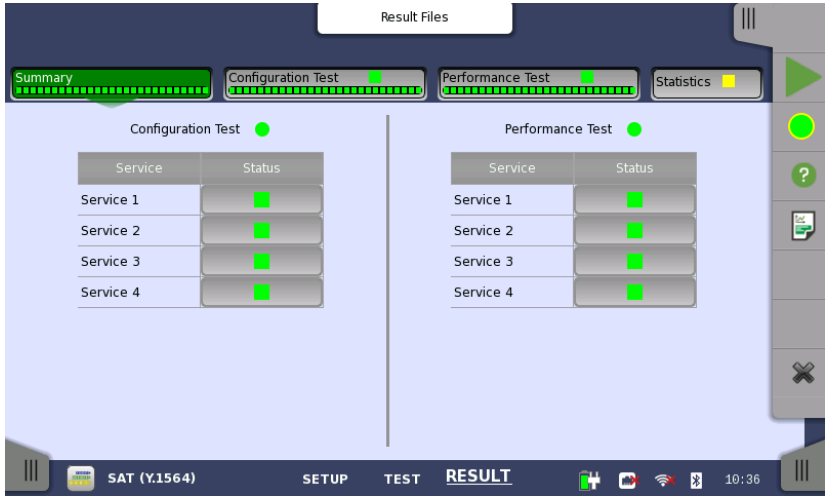
Back to Index page

- Supports tests specified in Y.1564
- Features:
  - Two-step test based on:
    - Bandwidth profile parameters: CIR, EIR, CBS, EBS
    - Performance parameters: FTD, FDV, FLR, AVAIL
  - Includes support for CM (”Color Aware”) and EMIX
  - Local–Remote operation
    - One-way test results using two MT1000A units
    - GPS add-on option for one-way FTD measurements
  - Round-trip measurements

MT1000A Service Activation Test

Back to Index page

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



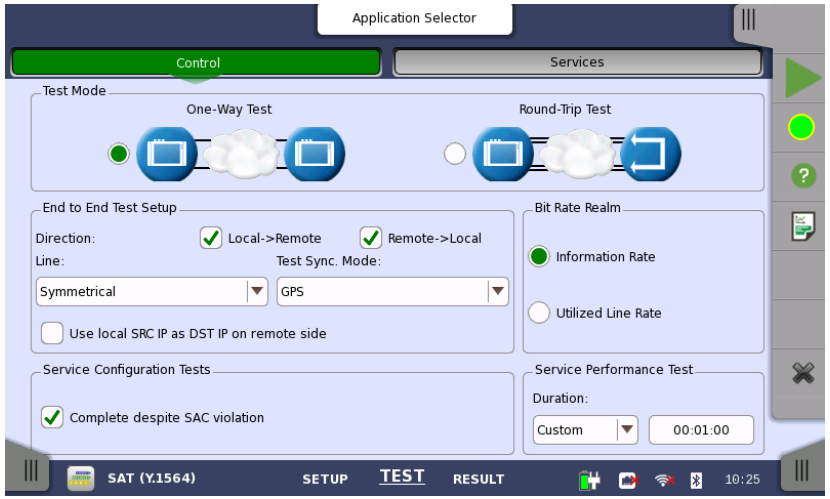
Result Summary

Result Details

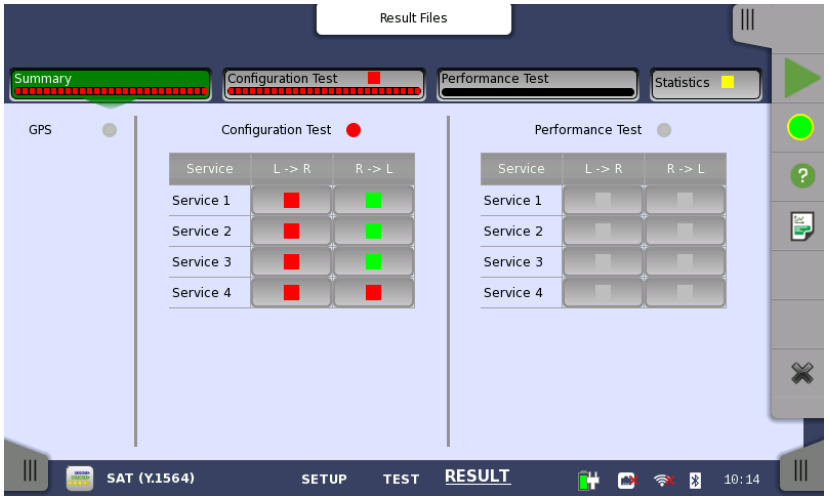
MT1000A Service Activation Test

Back to Index page

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



Test Setup

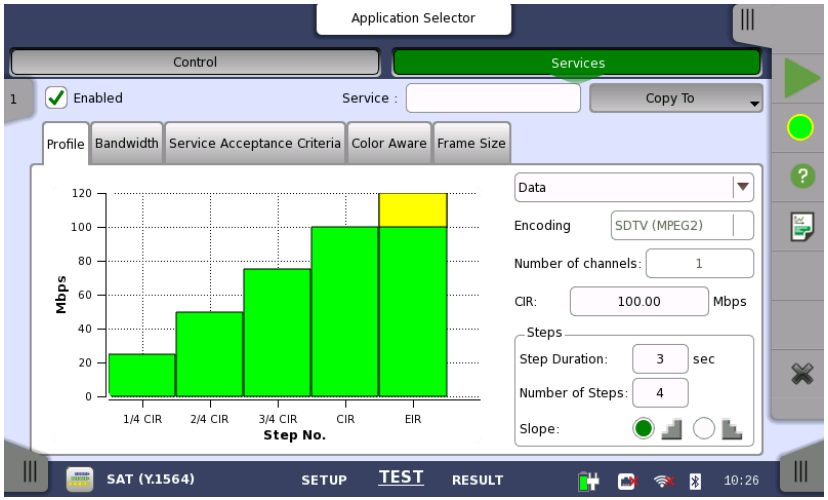


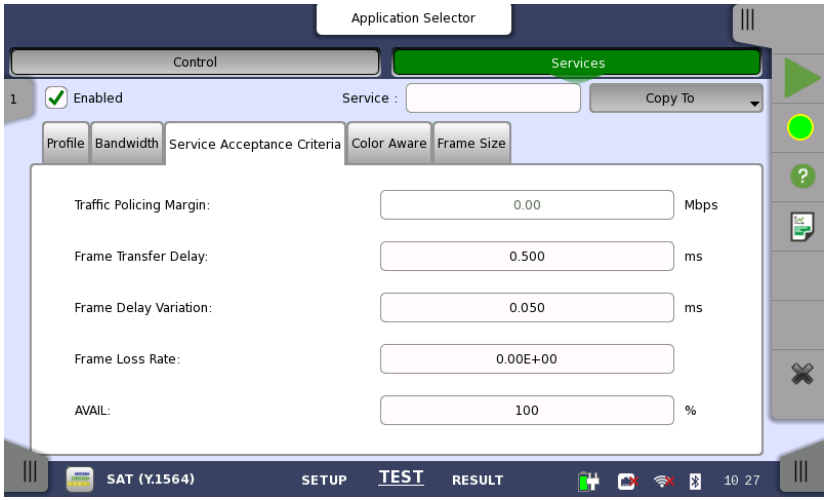
Result Summary on Local Instrument after Test

MT1000A Service Activation Test

Back to Index page

- Setup of each service
  - Graphical presentation of traffic profile for easy overview
  - Full flexibility in programming parameters

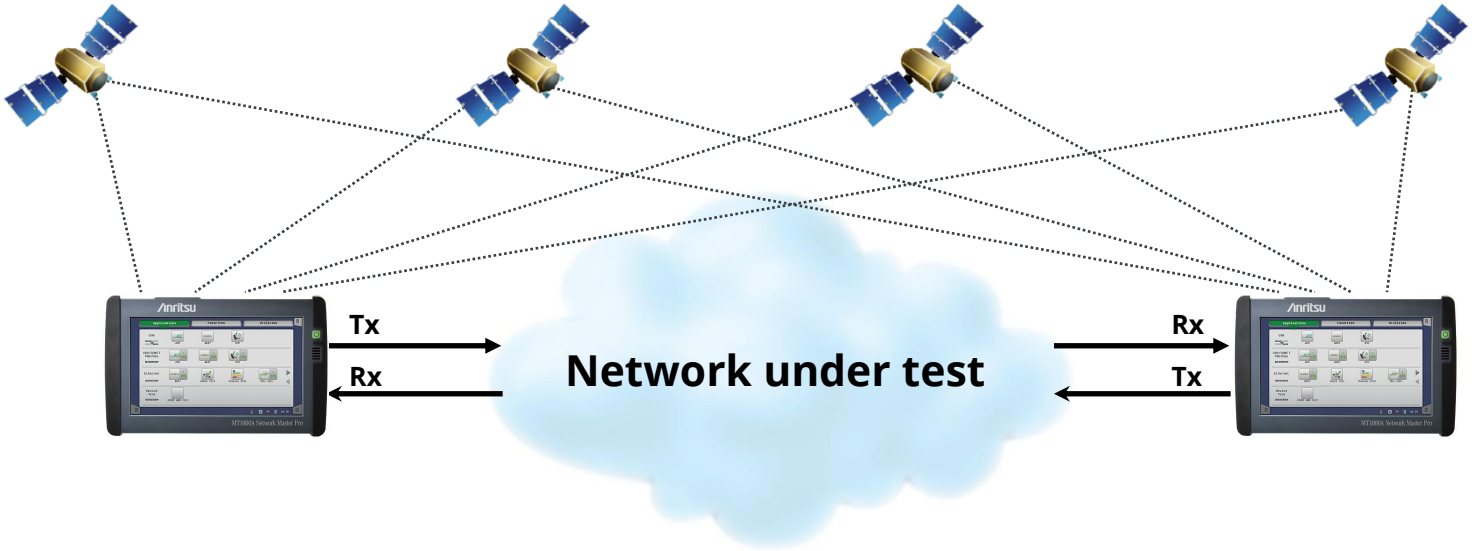




MT1000A Service Activation Test

Back to Index page

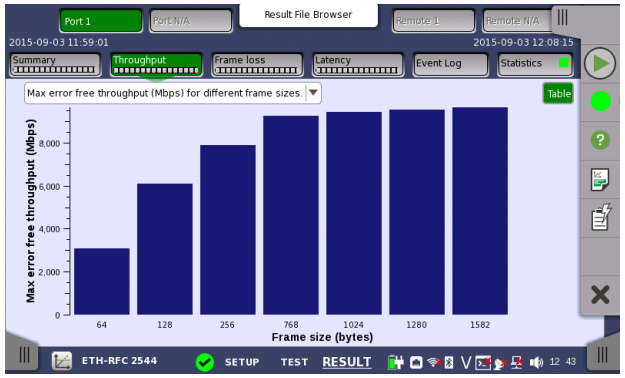
- GPS synchronization
  - Accurate information on one-way FTD with GPS synchronization option
    - Once synchronized, MT1000A holds synchronization for period of time
      - Relevant when difficult to get GPS signals at test site



MT1000A RFC 2544 Analysis

Back to Index page

- 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



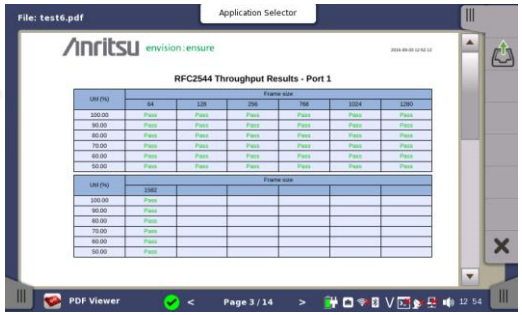
Graphs are bar graphs with legends (where applicable), giving users a better overview of results

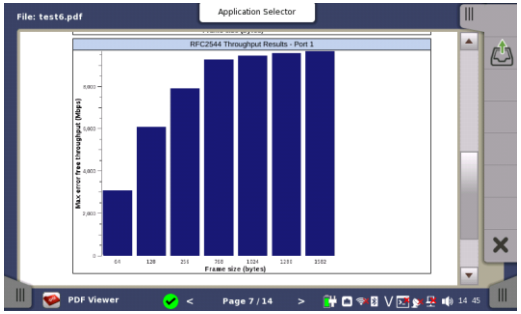
RFC 2544 tables fit the screen width - no need for horizontal scrolling

MT1000A RFC 2544 Reporting

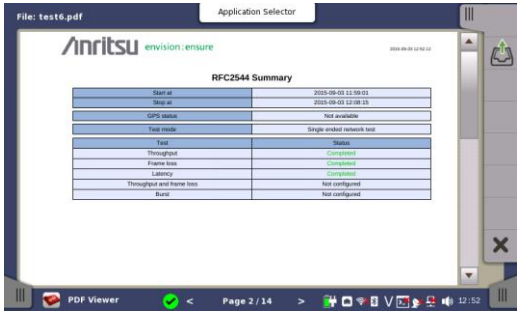
Back to Index page

- 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.





RFC 2544 graphs same as GUI



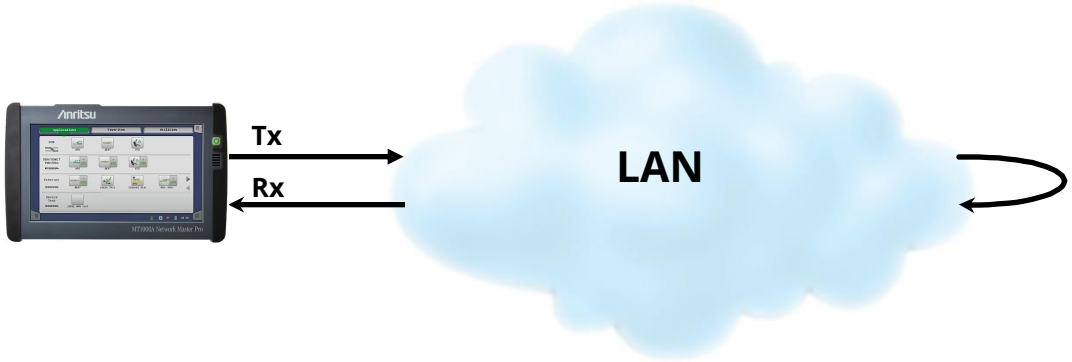
PDF reports are displayed with the built-in PDF viewer

RFC 2544 Summary section with new table showing which tests completed

Benefit of RFC 2544 End-to-End Test

Back to Index page

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



- 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

MT1000A RFC 2544 End-to-End Test

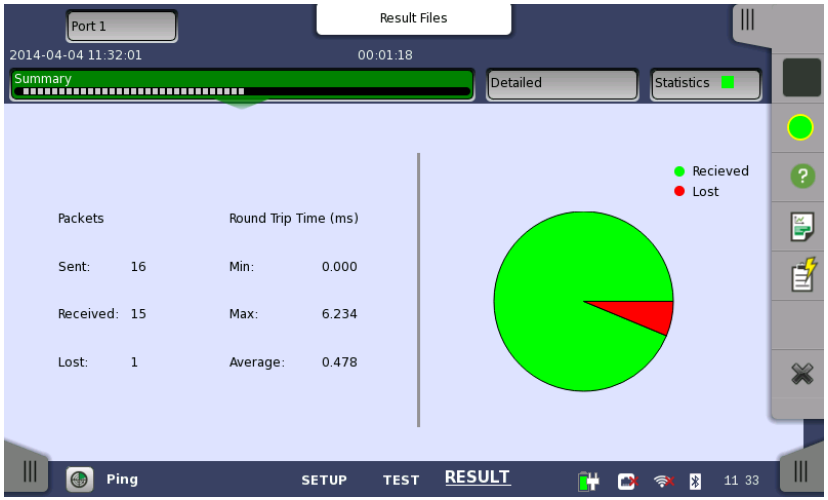
Back to Index page

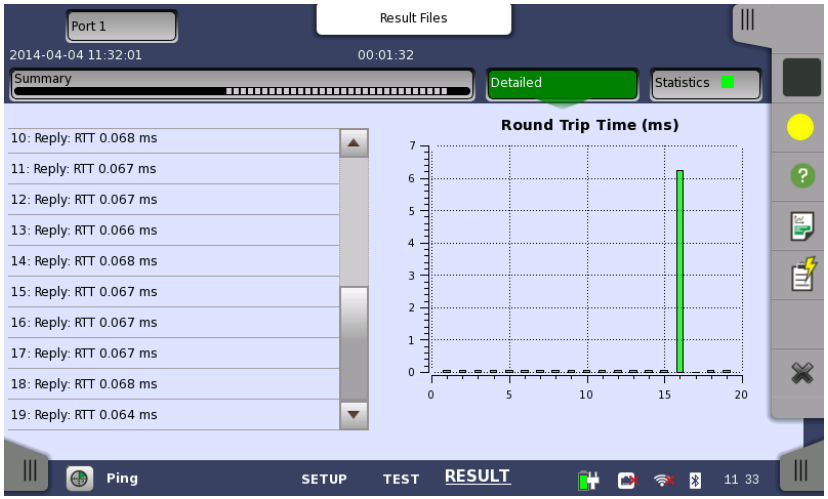
- RFC 2544 end-to-end test with Local–Remote relationship
  - Needed for test of Ethernet links over asymmetrical connections
  - Identifies transmission performance differences between two directions in link
  - User sets test at local master instrument which exchanges set-up and results with remote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

MT1000A Ethernet Ping Test

Back to Index page

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

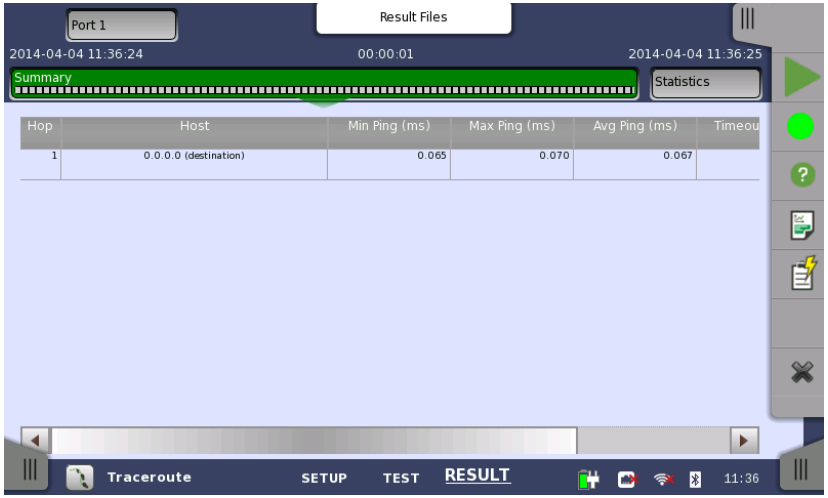


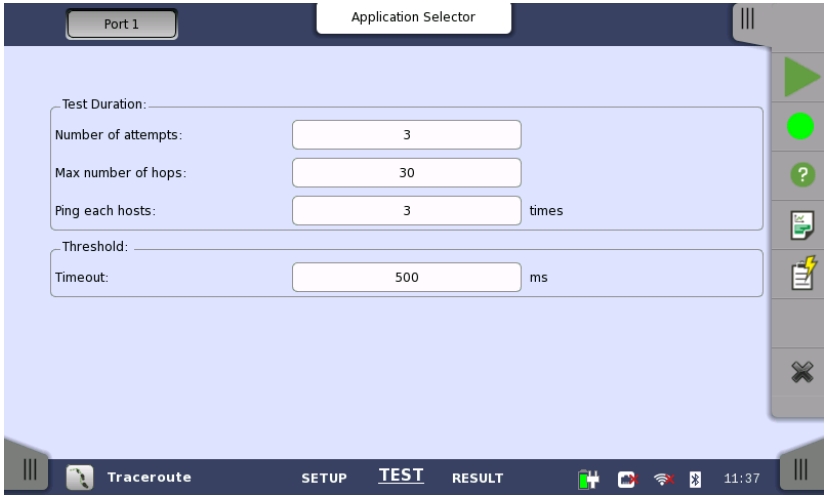


MT1000A Ethernet Traceroute Test

Back to Index page

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

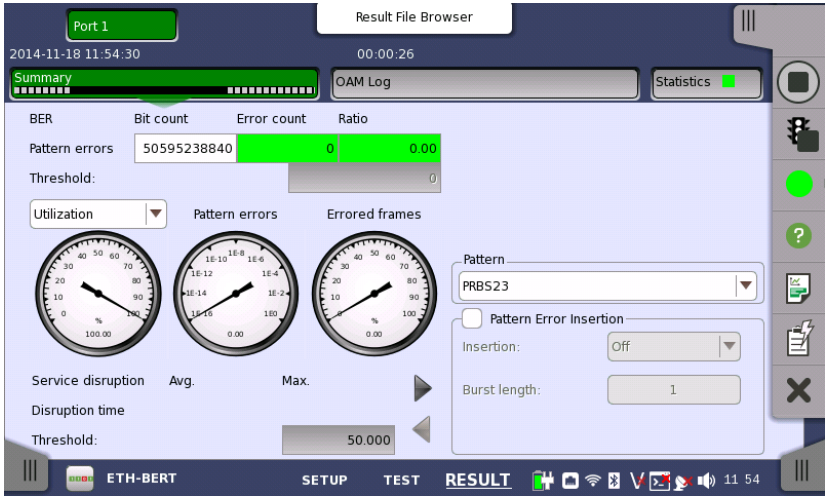


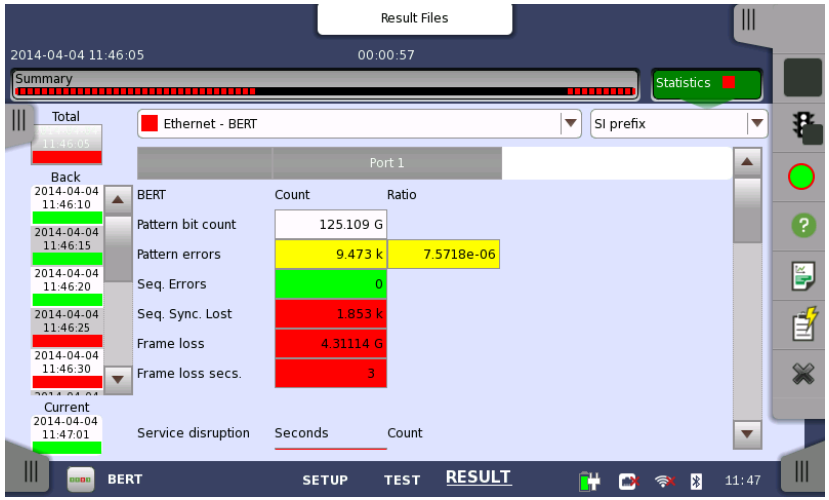


MT1000A Ethernet BER Tests

Back to Index page

- 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



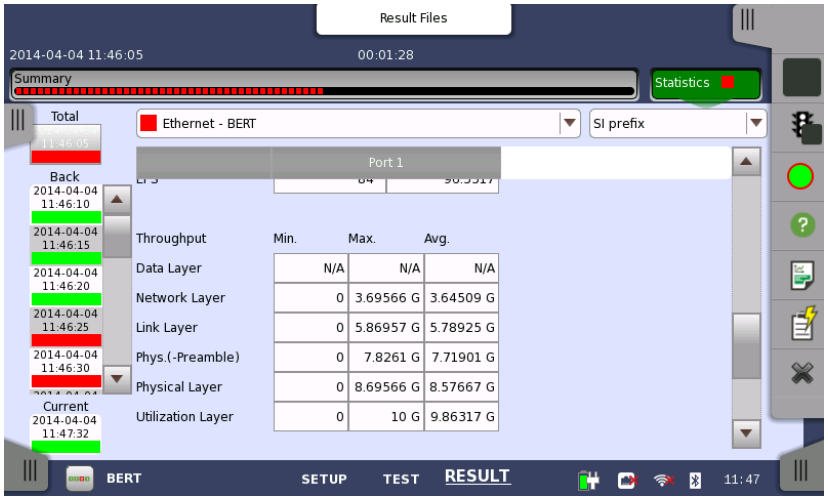


MT1000A BER Tests

Back to Index page

- Layered Throughput analysis

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



Why Service Disruption on Ethernet Links?

Back to Index page

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

MT1000A Service Disruption Measurement

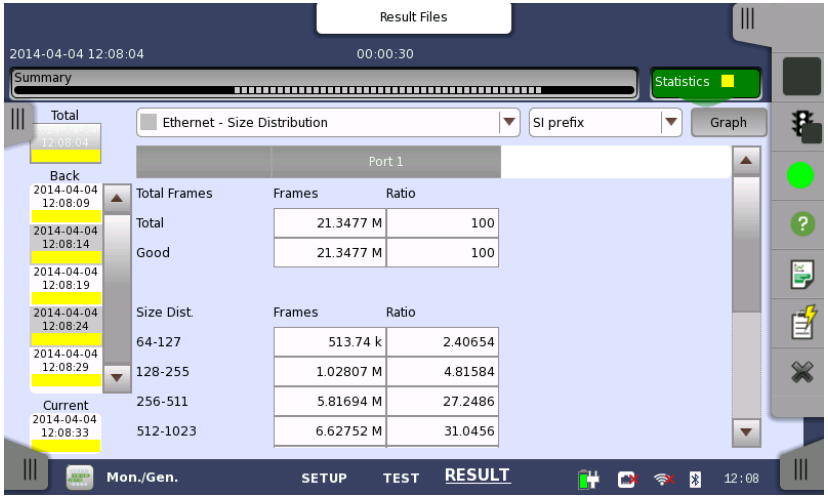
Back to Index page

- Service disruption can be measured as part of BER test
  - Using far-end loopback or two MT1000A testers
  - Max. acceptable service disruption time can be set
    - Color-coded results when max. time exceeded

MT1000A Ethernet Signal Analysis

Back to Index page

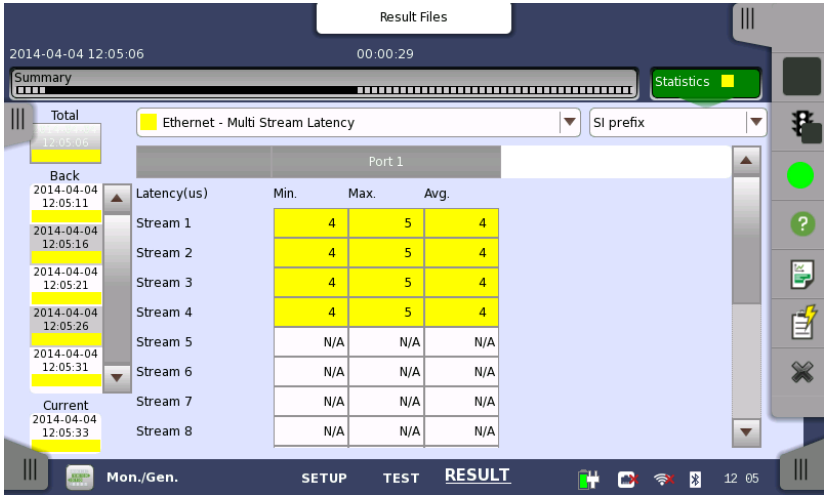
- Frame performance
- Frame type statistics
- Frame size distribution statistics
- Burst statistics
- Transmit statistics
- Full-detail tables
- User-defined thresholds to highlight problems

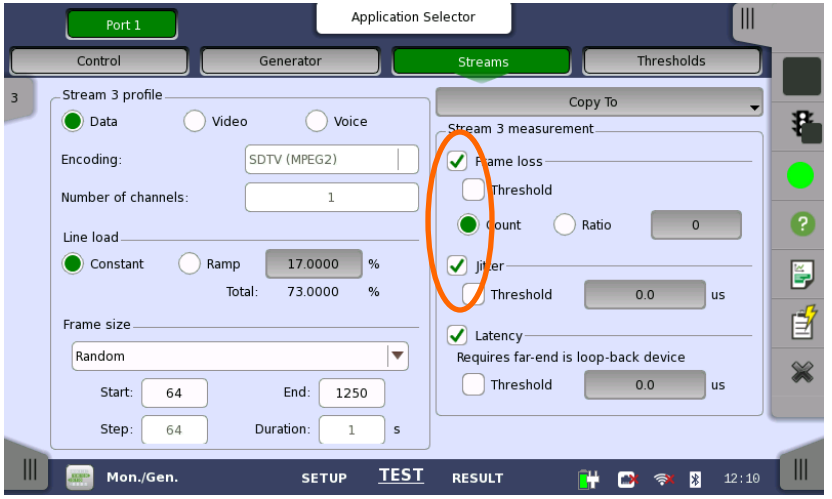


MT1000A Latency and Packet Jitter Measurements

Back to Index page

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

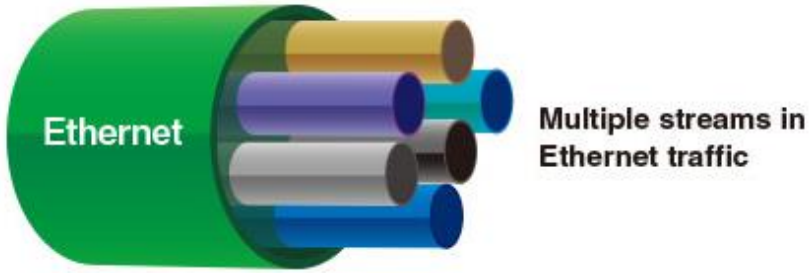




Benefit of Ethernet Multistream Test

Back to Index page

- 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.

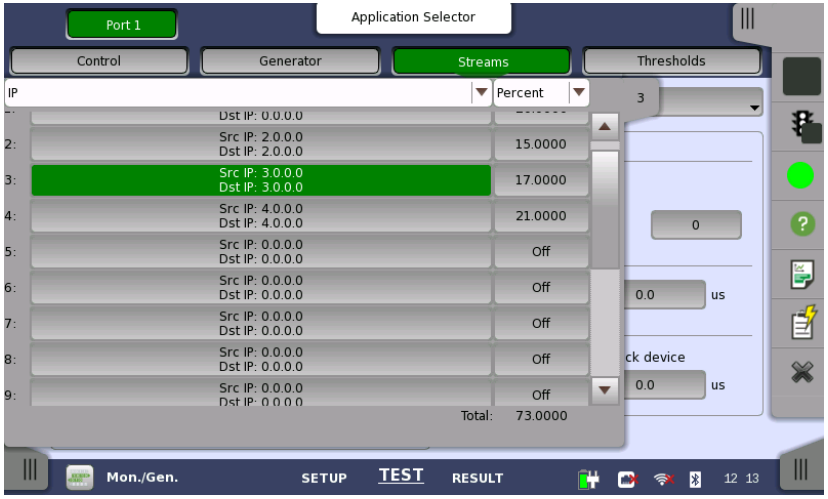


- VoIP traffic is often given high priority to ensure service quality
  - Sometimes DSCP/TOS byte used to give high priority
  - Other times high priority given to selected TCP/UDP ports
- Some operators allocate certain traffic capacity to each traffic type on link with limited capacity
- User can verify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

MT1000A Ethernet Multistream Test

Back to Index page

- Using MT1000A, 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

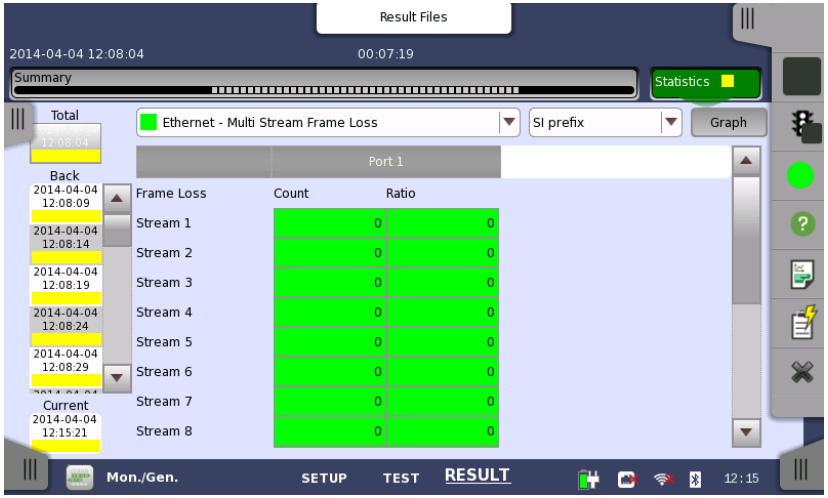


Stream Selector and Overview

MT1000A Ethernet Multistream Test

Back to Index page

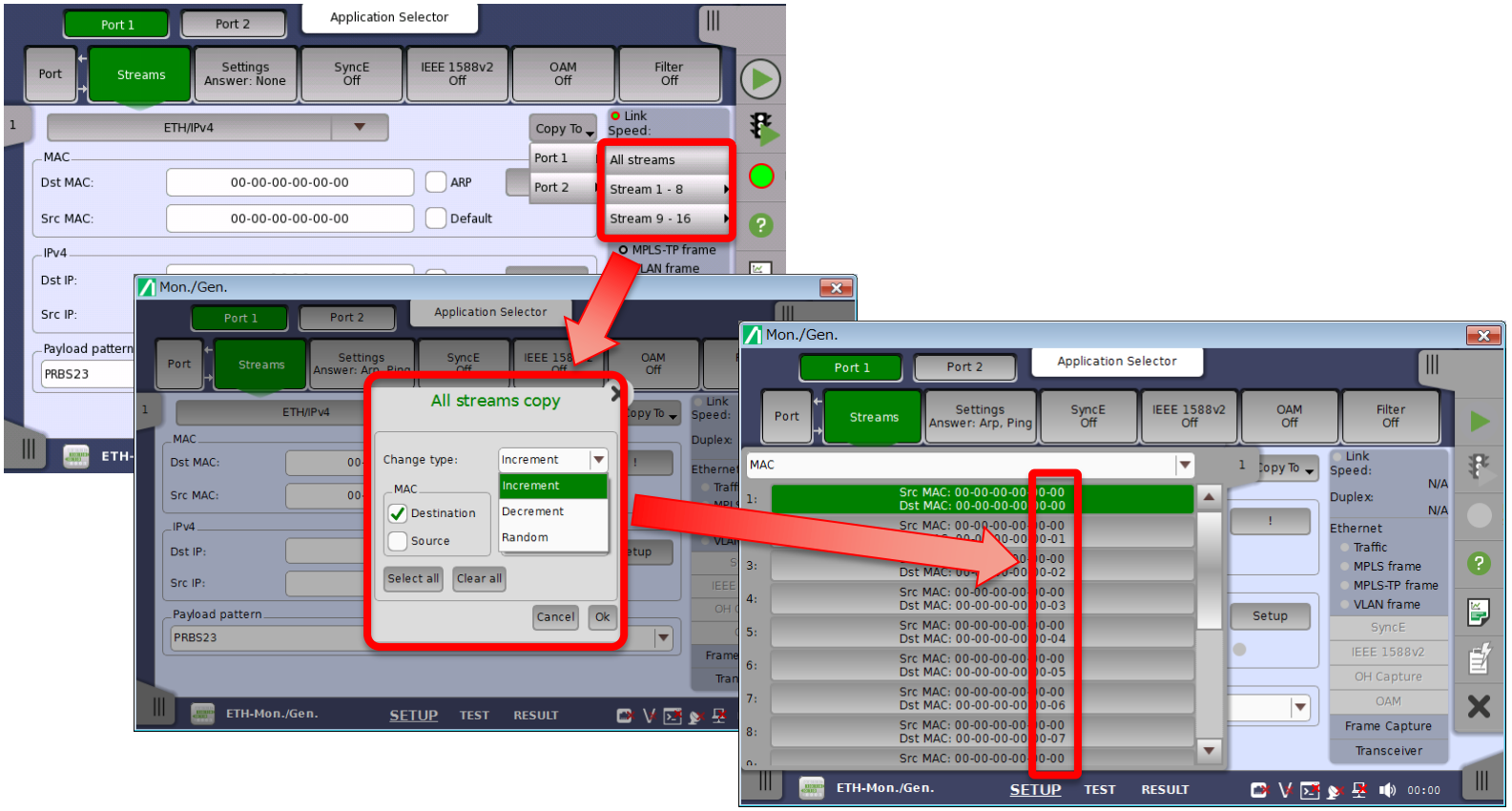
- Multistream function displays frame loss for up to 16 streams per port, making it easy to spot whether high-priority traffic has lower frame loss than low-priority traffic



Simple Stream Address Creation

Back to Index page

- 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.



VLAN Background

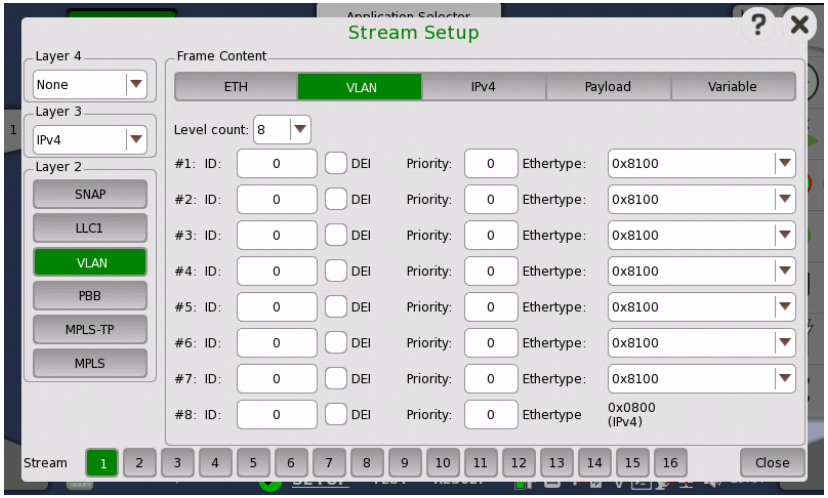
Back to Index page

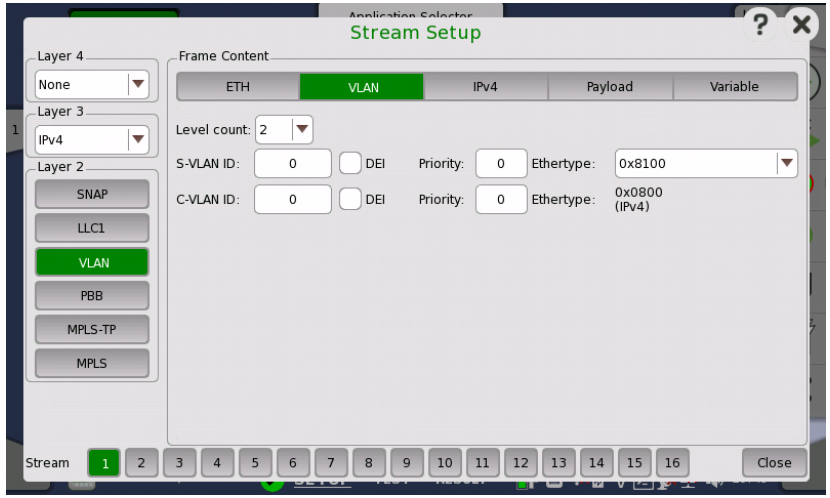
- Virtual Local Area Networks (VLANs) - IEEE 802.1Q
  - Segment LAN on organizational basis, by functions, project teams or applications
    - Each VLAN has ID and priority
      - 802.1p priority bits (3) segment traffic into eight Classes of Service (CoS), enabling traffic differentiation
      - 12-bit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

MT1000A Ethernet Stacked VLAN Function

Back to Index page

- Insert up to eight layers of VLAN tags into Ethernet frame
  - Can be combined with Multistream function
  - Special layer naming when two layers selected
    - S-VLAN – Service provider VLAN
    - C-VLAN – Customer VLAN



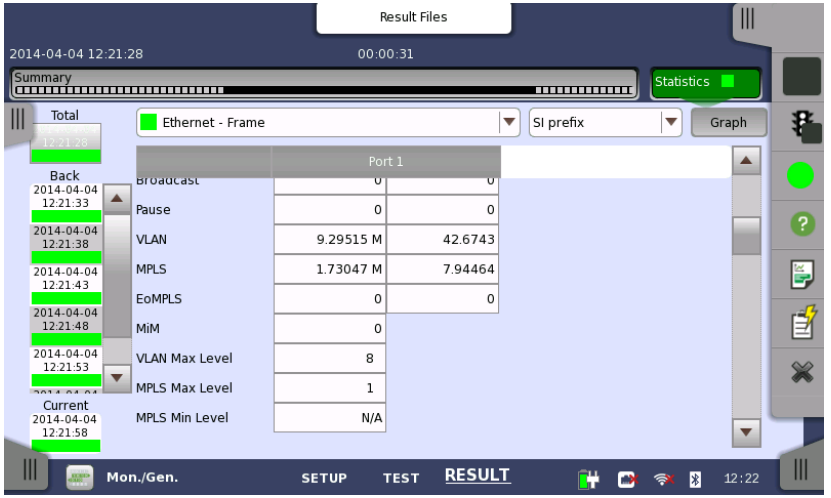


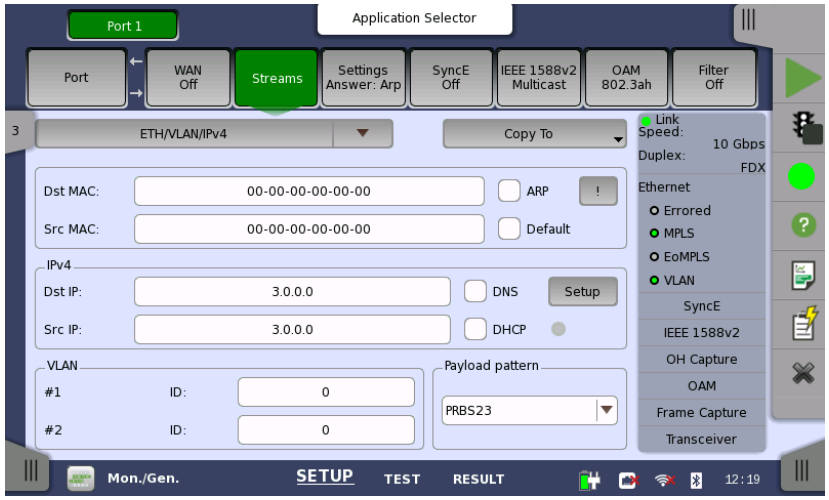
CFI bit renamed to DEI (Drop Eligible Indicator)

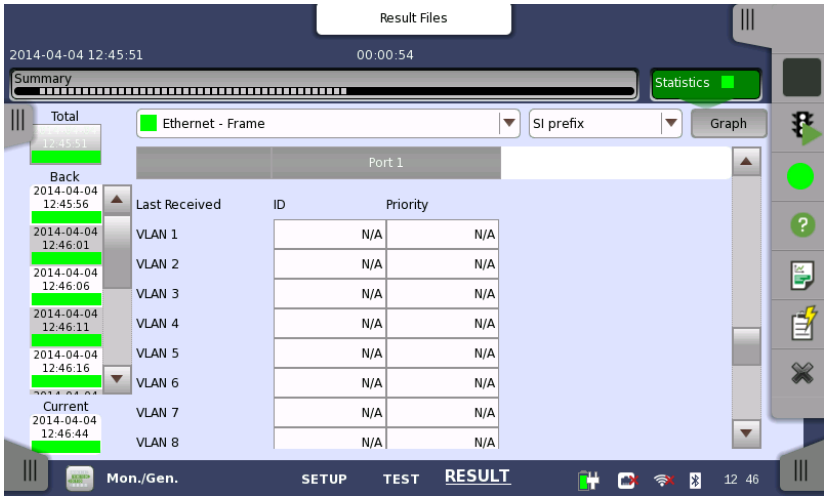
MT1000A Ethernet Stacked VLAN Function

Back to Index page

- 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







MPLS Background

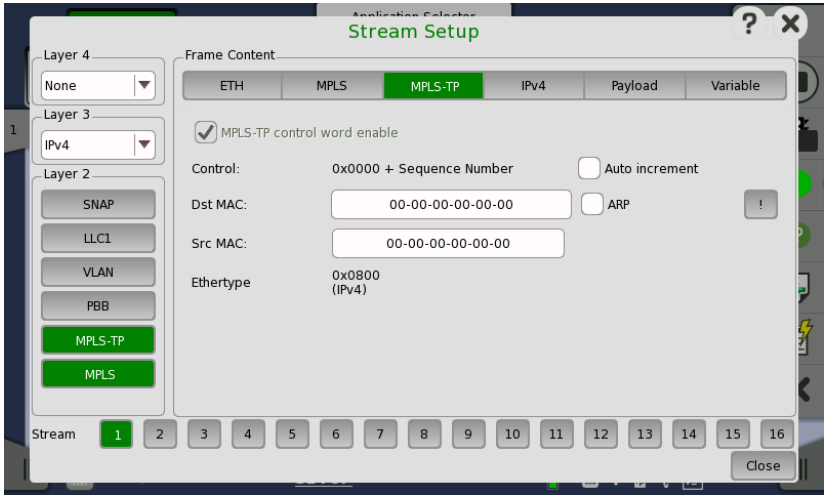
Back to Index page

- 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:
      - 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

MT1000A MPLS/MPLS-TP Function

Back to Index page

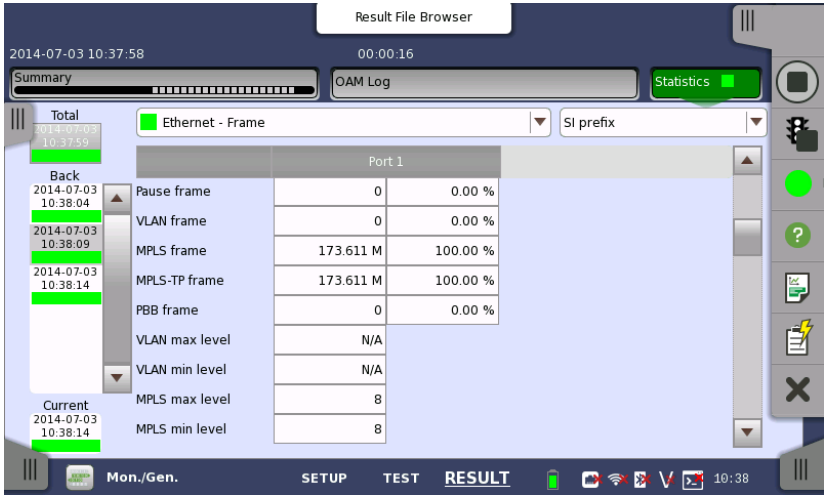
- Stacked MPLS generation
  - Inserts up to 8 layers of MPLS labels into Ethernet frame
  - Can be combined with Multistream facility
  - EoMPLS Control word can be added with MPLS-TP

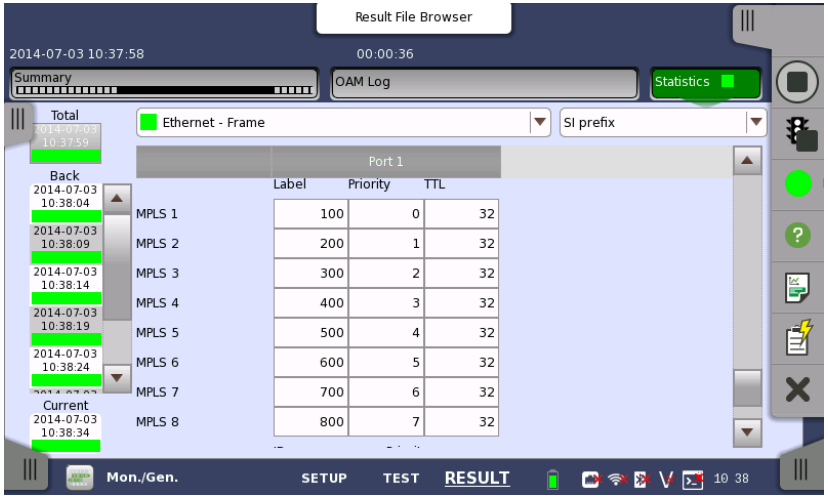


MT1000A MPLS/MPLS-TP Function

Back to Index page

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

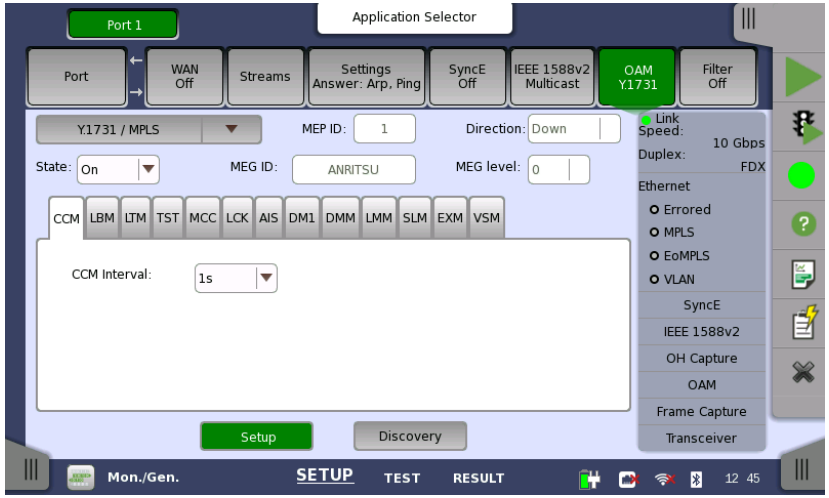




MT1000A MPLS-TP Function

Back to Index page

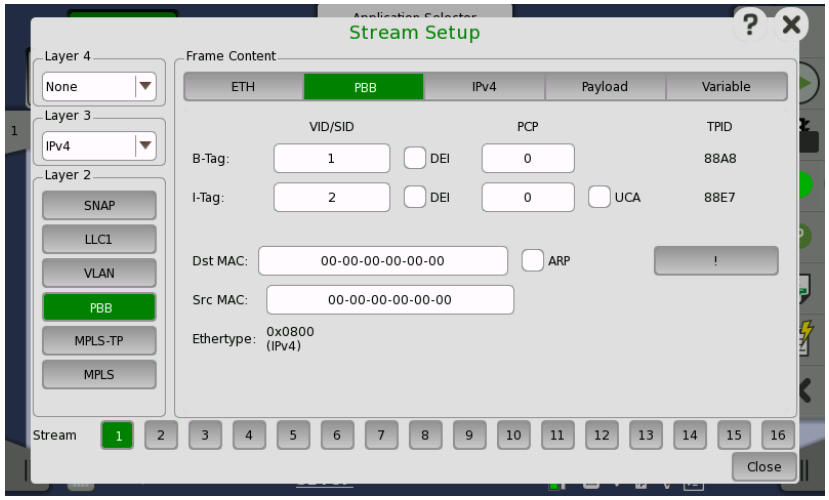
- MPLS-TP information:
  - Activation of MLPS-TP OAM function

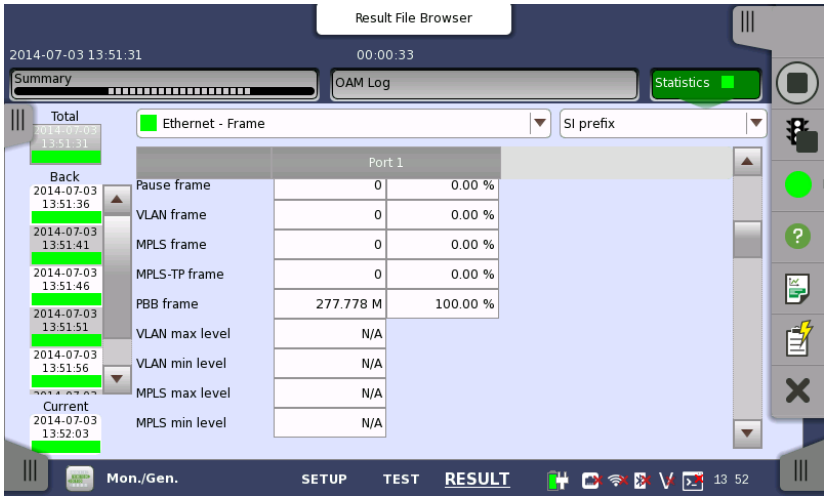


MT1000A PBB Function

Back to Index page

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



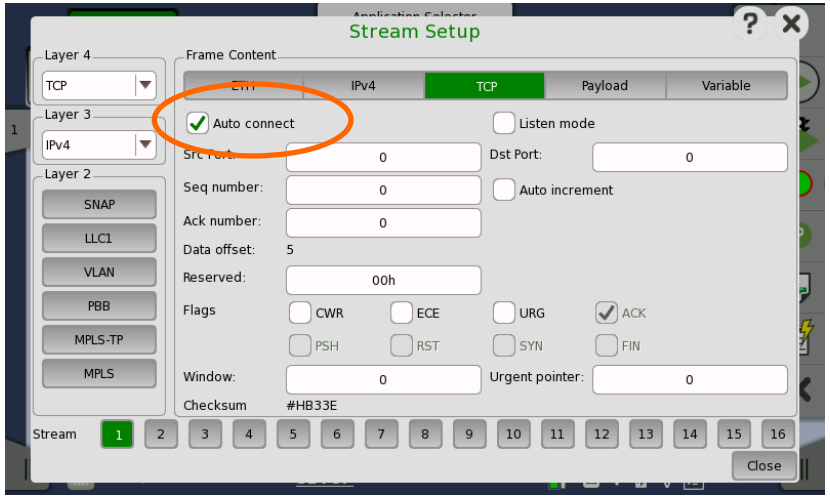


MT1000A TCP Function

Back to Index page

- Set TCP connections before sending traffic with TCP headers
  - Allows traffic to pass firewalls using “state-full inspection”
  - Limited implementation:
    For example:

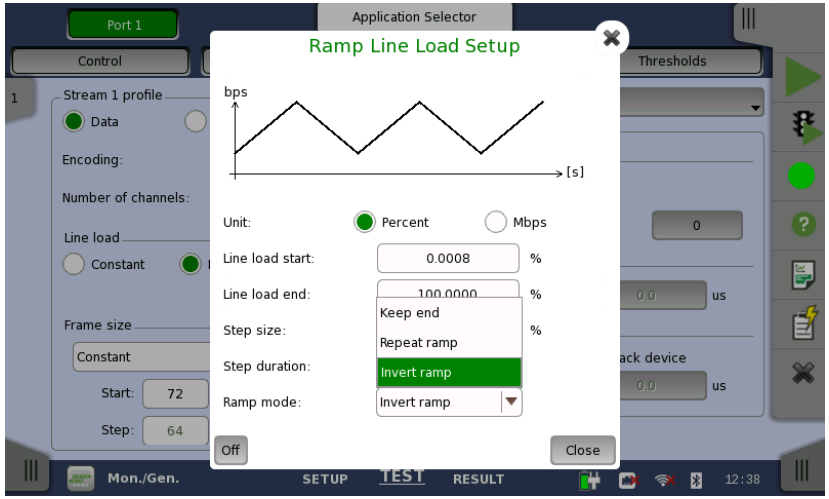
    No retransmissions
    No flow control

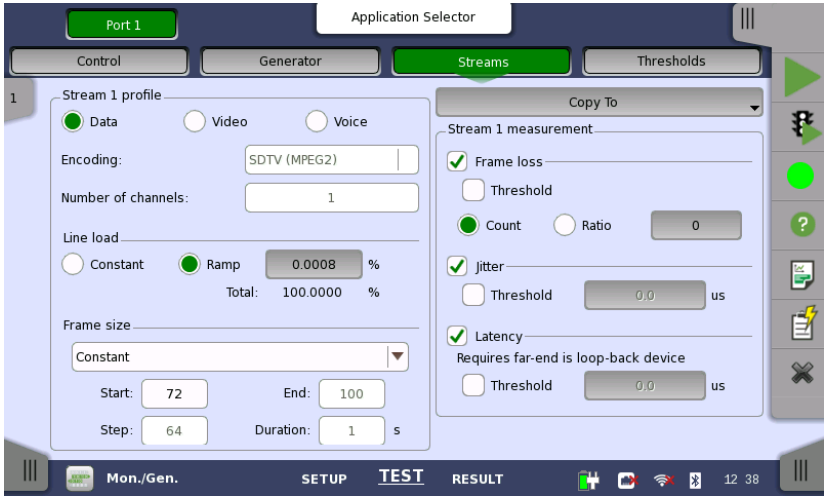


MT1000A Ethernet Traffic Generator

Back to Index page

- Ramp traffic: Increases traffic automatically until max. capacity exceeded
  - Programmable per stream
- Burst Traffic: Continuous sending at specified conditions
- Generate Tx rates above 100%
- Data type profiles (data, video, voice)

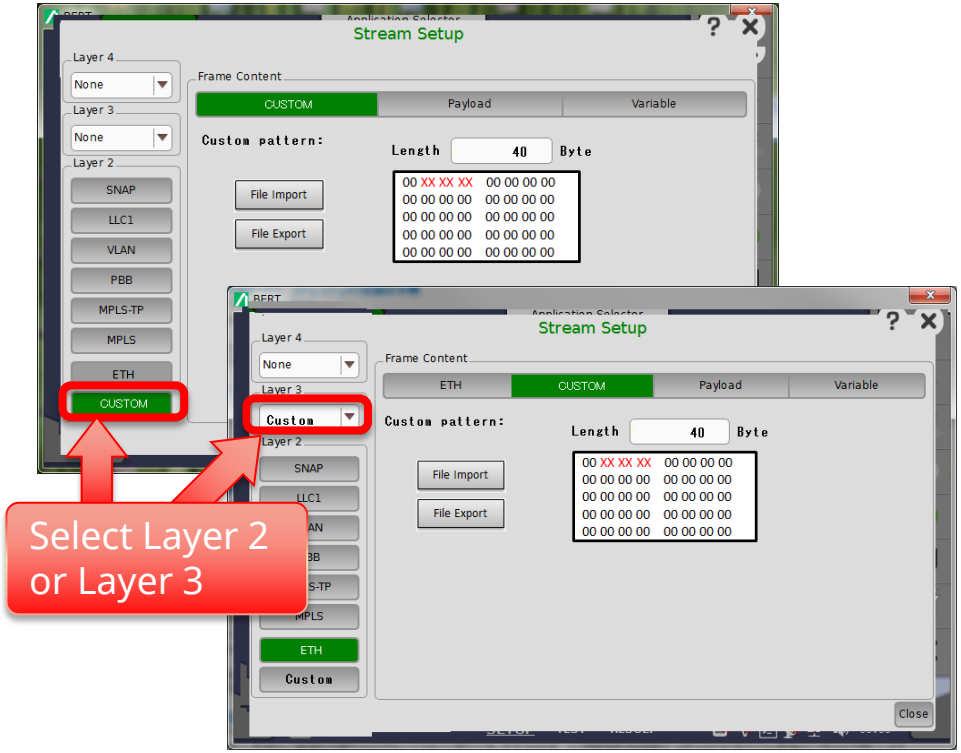




Custom Editing of Ethernet Header

Back to Index page

- 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



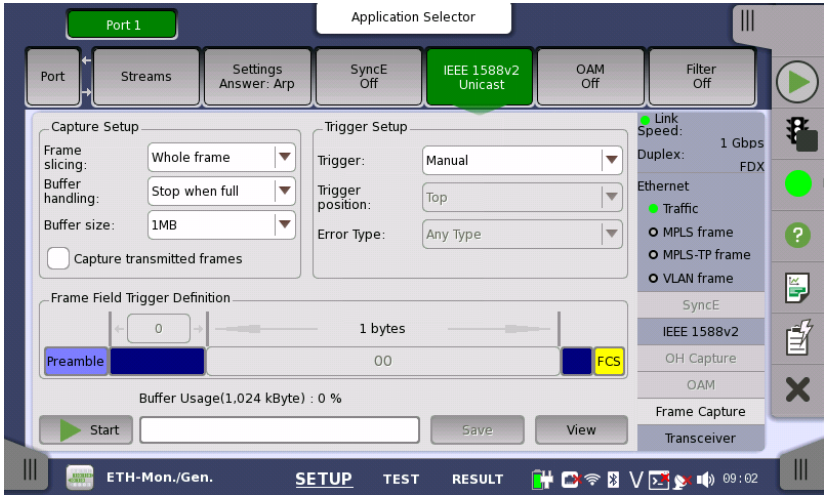
- ✓ Edit Custom header with text editor for Save and Load
- ✓ Supports Header lengths up to 256 bytes

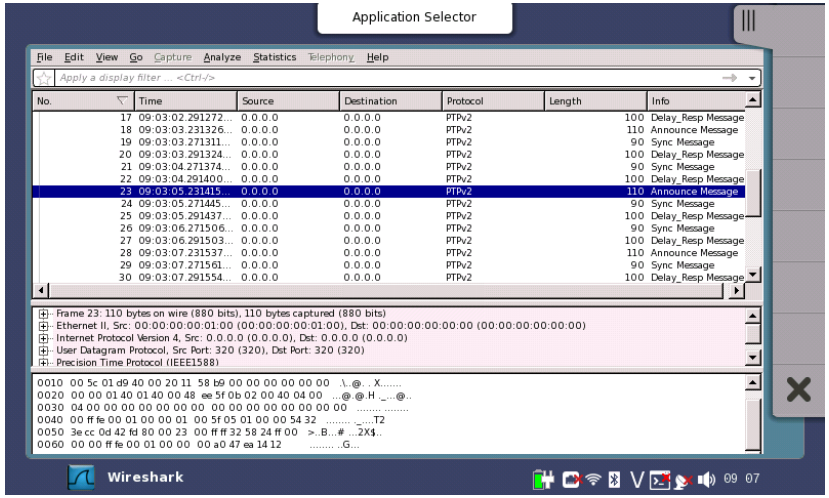
- ◆ The following restrictions apply:
  - "Ethernet over OTN" not supported
  - Rx filters other than Layer 2 not supported when using Layer 3 Custom headers
  - No Rx filters supported when using Layer 2 Custom headers
  - Arp/Ping functions not supported when using Layer 2/3 Custom headers

MT1000A Ethernet Frame Capture Function

Back to Index page

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

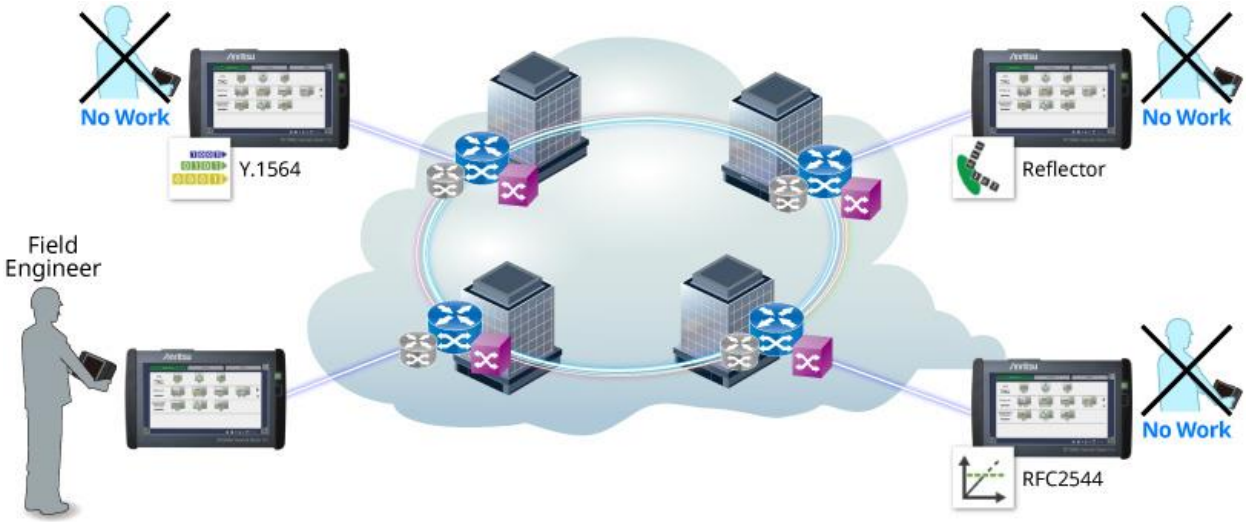




Network Discovery and In-band Control

Back to Index page

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

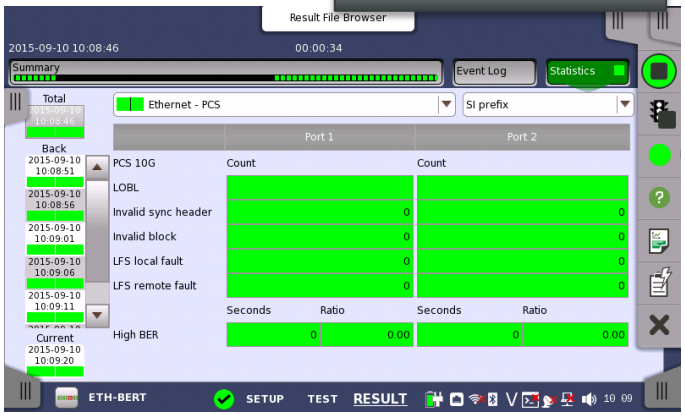


Validating PCS at 10 GbE

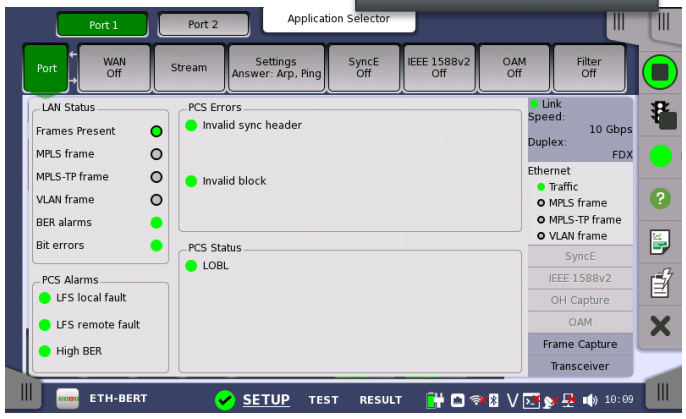
Back to Index page

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

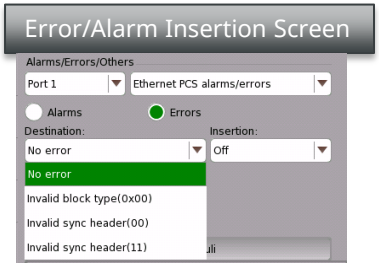
PCS Error/Alarm Statistics



PCS Error/Alarm Status



Error/Alarm Insertion Screen

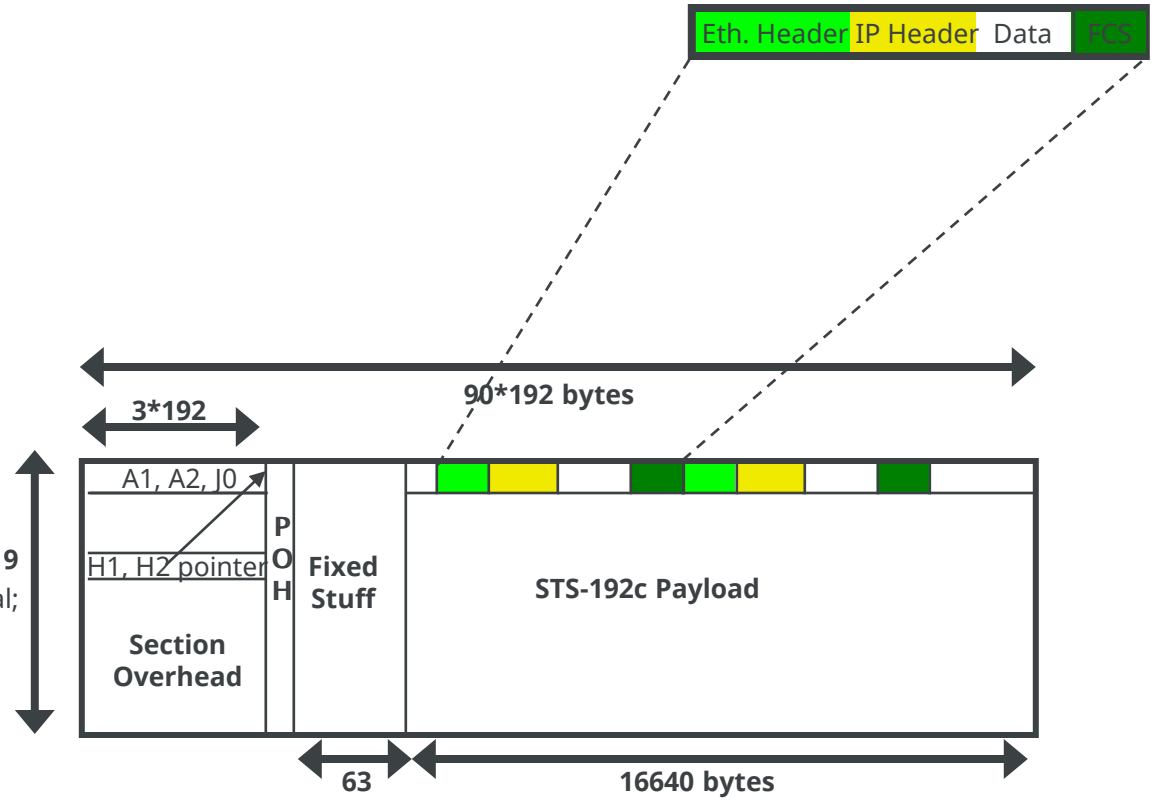


- Does not support Stimuli function Invalid alignment marker/BIP error

10G WAN PHY Background

Back to Index page

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

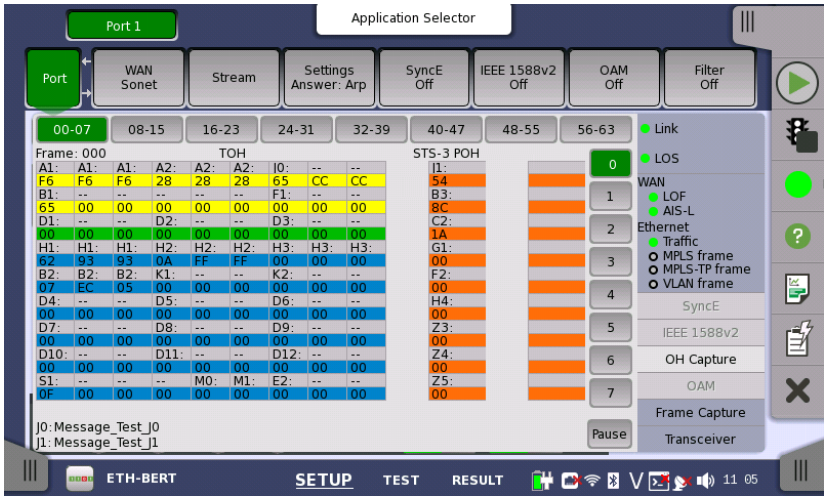


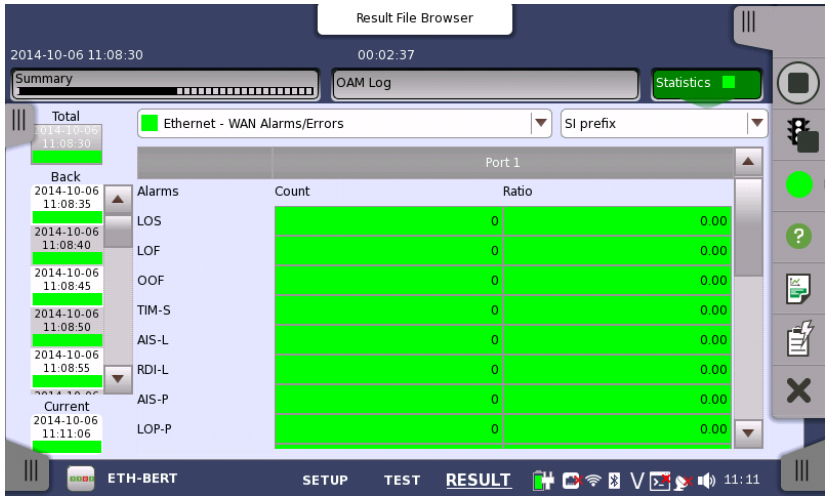
Fixed pointer in transmitted WAN signal; may have changed value when reaches destination

MT1000A 10G WAN PHY Function

Back to Index page

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

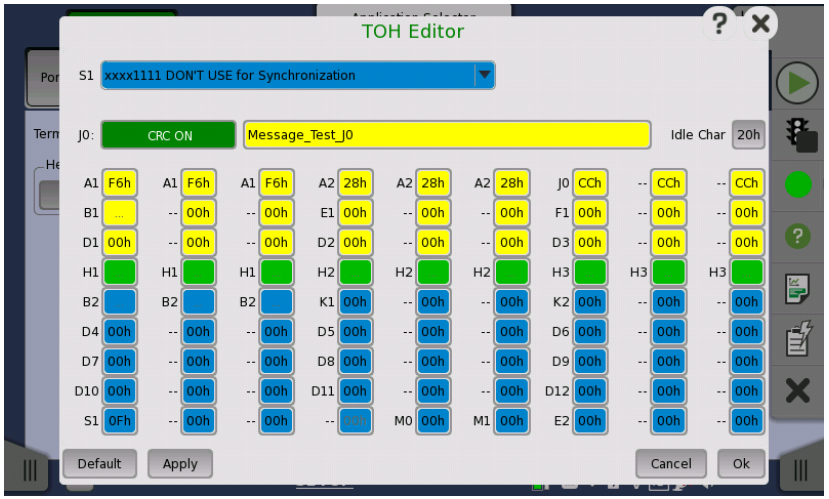


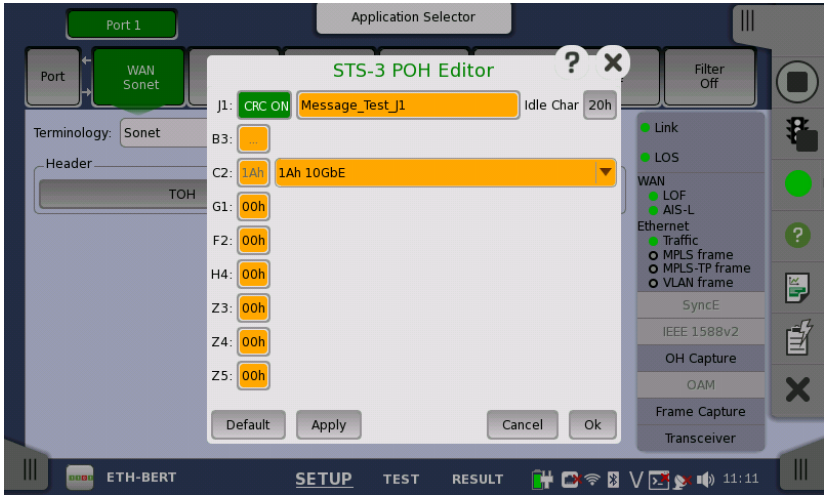


MT1000A 10G WAN PHY Function

Back to Index page

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

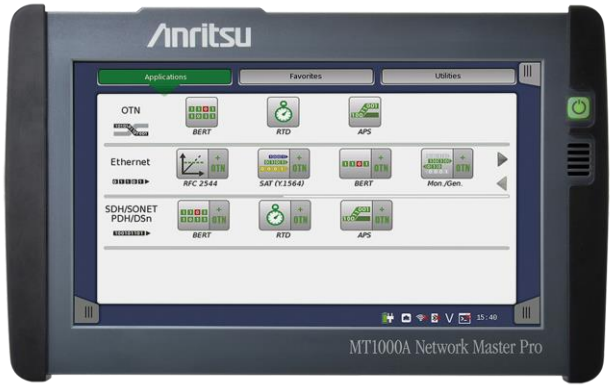




Network Master Pro MT1000A

Back to Index page

- TCP Throughput Option (RFC 6349) (Up to 10Gbps)



RFC 6349 Testing – TCP Throughput Option (Up to 10Gbps)

Back to Index page

- 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 sizes incorrect
- Operators use RFC 6349 test methodology to optimize TCP throughput

RFC 6349 Testing – Benefit of TCP Throughput Test

Back to Index page

- Eliminate end-user factors from test by emulating TCP host

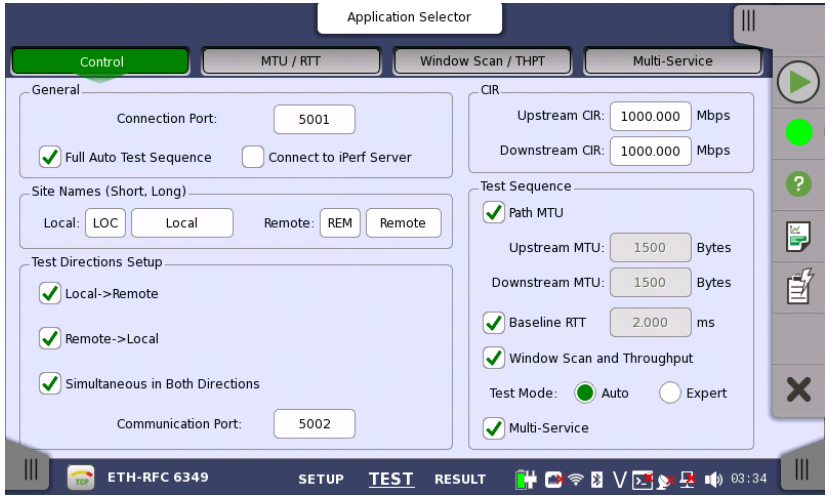
Bi-directional TCP throughput test by emulating end user hosts

- MT1000A TCP throughput test hardware based
  - Always validate maximum TCP throughput potential possible on customer's network
  - Repeatable tests with consistent results
- MT1000A can perform bi-directional TCP throughput testing
  - More realistic test result
  - MT1000A can test up to four ports simultaneously
  - Can shorten multiple network commissioning test time

RFC 6349 Testing – TCP Throughput Option (Up to 10Gbps)

Back to Index page

- 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

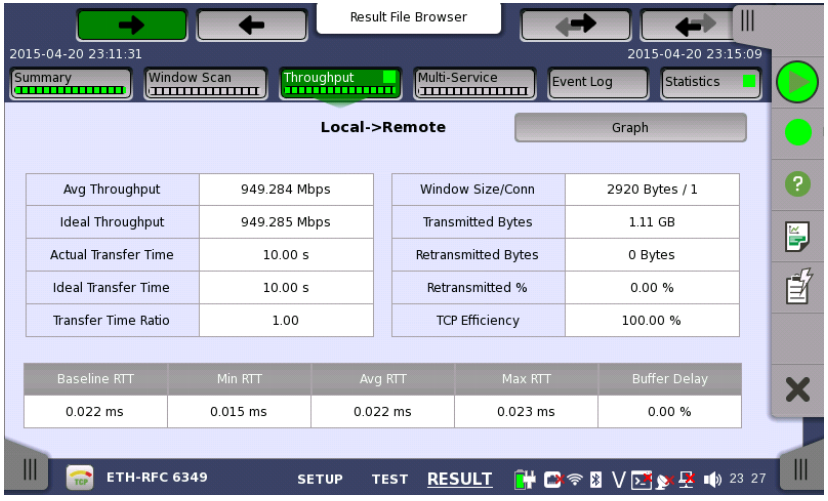


RFC 6349 Testing – TCP Throughput Option (Up to 10Gbps)

Back to Index page

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

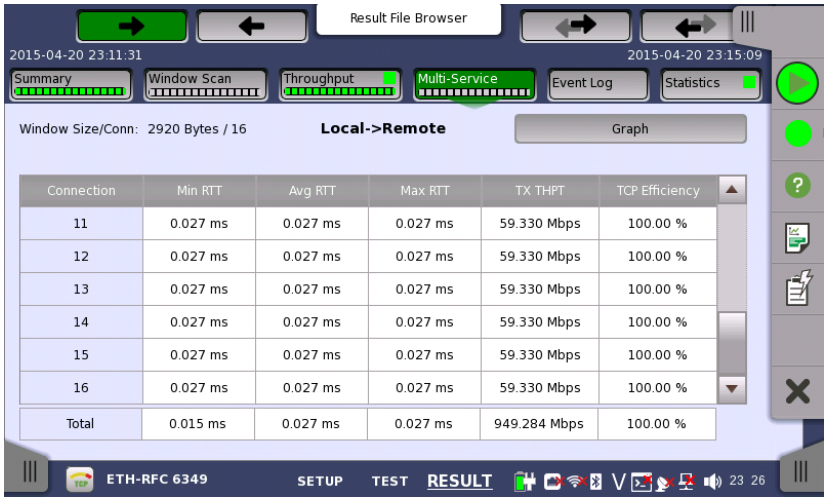
- Measurement results include:
  - Transmitted and Retransmitted Bytes
  - TCP Transfer Time Ratio
  - TCP Efficiency
  - Retransmitted Percentage
  - Buffer Delay Percentage



RFC 6349 Testing – TCP Throughput Option (Up to 10Gbps)

Back to Index page

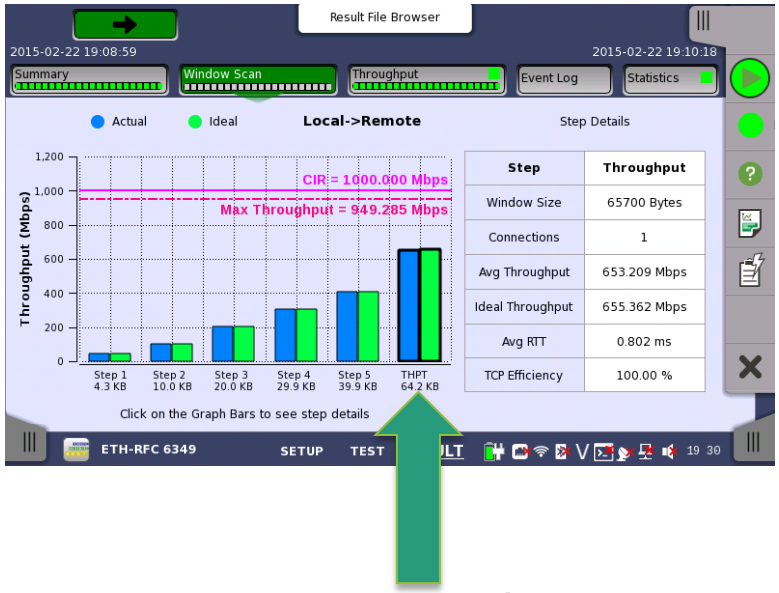
- Multi-service results (when selected)
  - Test up to 16 connections



RFC 6349 Testing – TCP Throughput Option (Up to 10Gbps)

Back to Index page

- Window Scan Result
  - MT1000A runs “Window Scan” test measuring TCP Throughput at each window size



Optimum window size

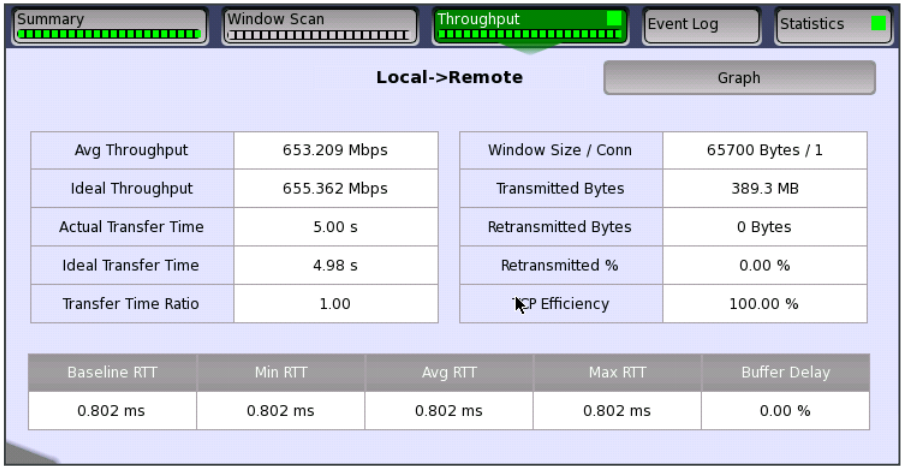
RFC 6349 Testing – TCP Throughput Metrics (Up to 10Gbps)

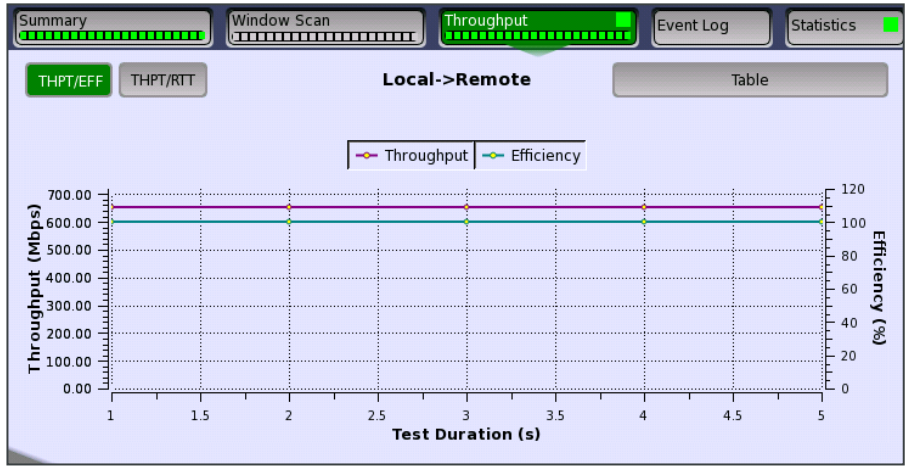
Back to Index page

$$\text{TCP Transfer Time Ratio} = \frac{\text{Actual TCP Transfer Time}}{\text{Ideal TCP Transfer Time}}$$

$$\text{TCP Efficiency \%} = \frac{\text{Transmitted Bytes} - \text{Retransmitted Bytes}}{\text{Transmitted Bytes}} \times 100$$

$$\text{Buffer Delay \%} = \frac{\text{Average RTT during transfer} - \text{Baseline RTT}}{\text{Baseline RTT}} \times 100$$

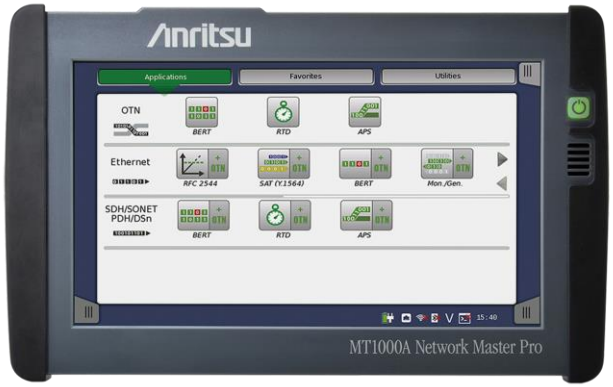




Network Master Pro MT1000A

Back to Index page

- Ethernet OAM Functionality



Ethernet OAM background

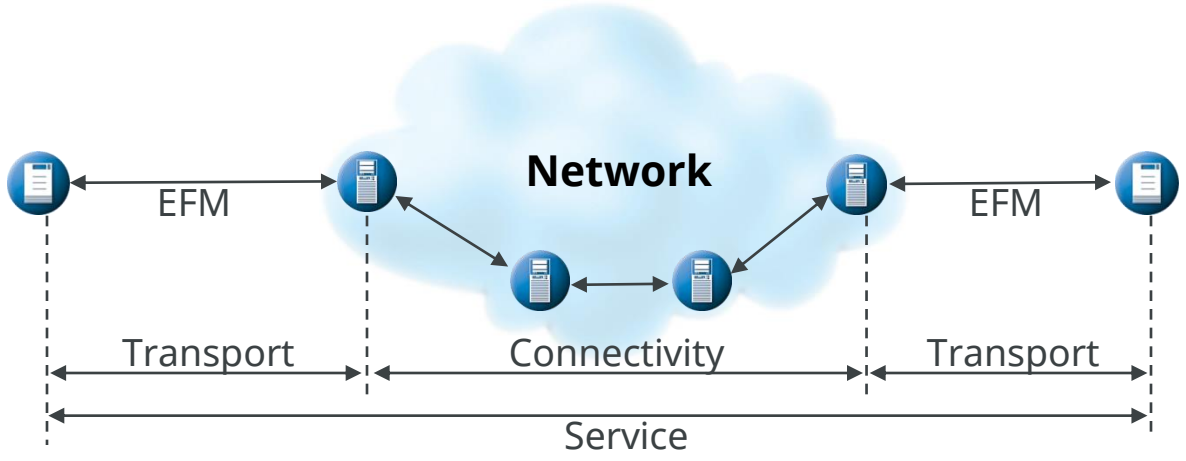
Back to Index page

- Ethernet moved from LAN technology to Carrier Class technology
- 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

Back to Index page

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

Back to Index page

- 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)

Ethernet OAM IEEE 802.3ah

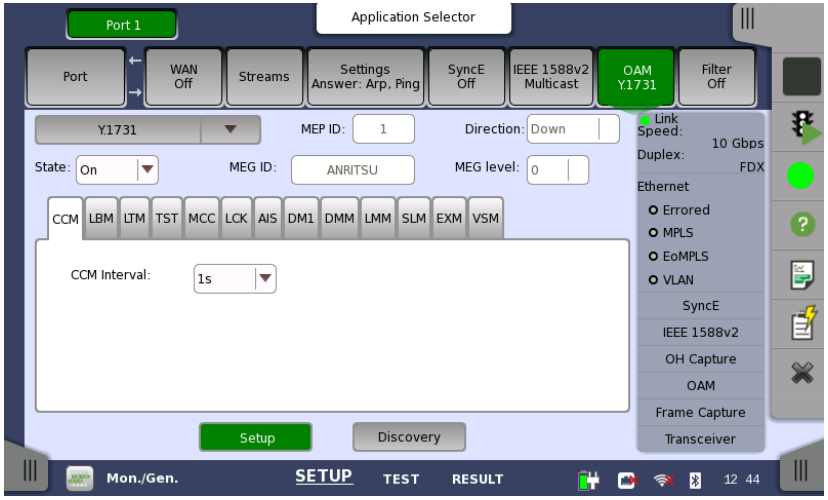
Back to Index page

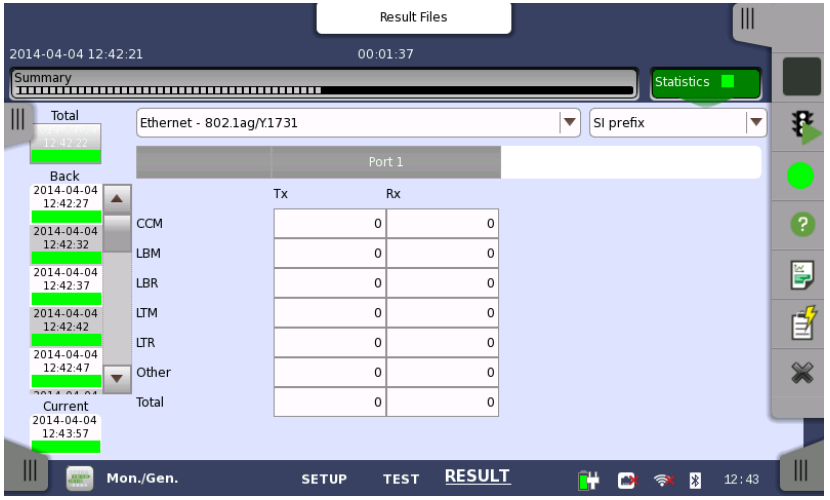
- Ethernet OAM IEEE 802.3ah functions:
  - Remote failure indication during fault
  - Remote loopback mode (“Real” loopback)
  - Fault isolation
  - Link performance and status monitoring
  - OAM discovery mechanism
    - Determines whether remote device has OAM enabled and configured parameters and supported functions compatible with requesting device
  - Optional activation of OAM
    - OAM can be enabled on ports subset or all ports
  - Extension mechanism
    - Available for higher-level management applications

Ethernet OAM

Back to Index page

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

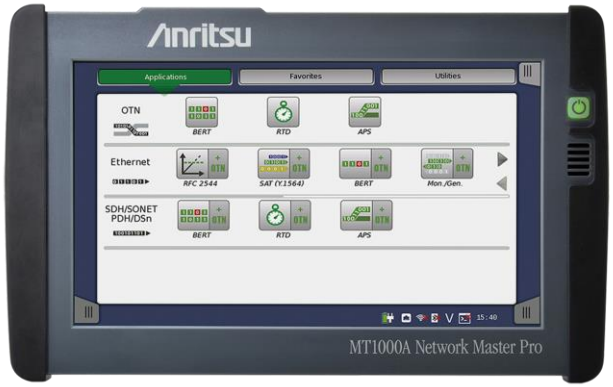




Network Master Pro MT1000A

Back to Index page

- Mobile Backhaul Installation and Verification
  - Synchronous Ethernet Test
  - Phase/Time Synchronization Test



Synchronous Ethernet Test

Back to Index page

- 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 end-to- end communications
- Synchronous networks (PDH, SDH/SONET) migrating to Ethernet-based packet-switched network (PSN) are used for Mobile Backhaul network(MBH).
- Asynchronous nature of Ethernet causes challenges:
  - Mobile networks have strong requirement for frequency synchronization across entire network
  - TDD and LTE-Advanced technology pushes requirement for phase/time synchronization to the Ethernet-based MBH.

Synchronous Ethernet Test

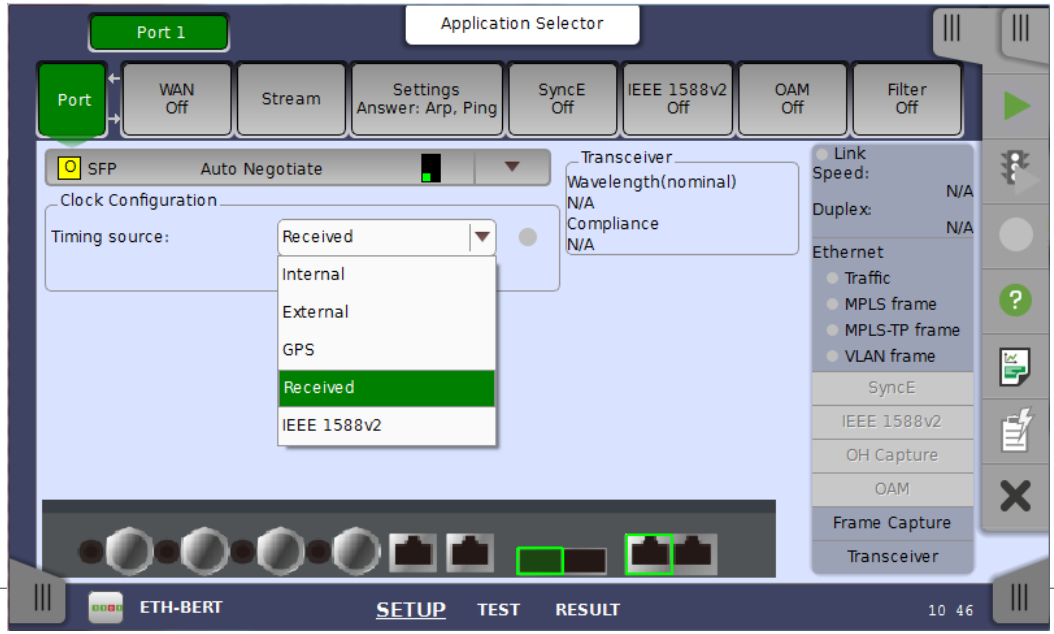
Back to Index page

- 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)
  - 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

MT1000A Synchronous Ethernet Test

Back to Index page

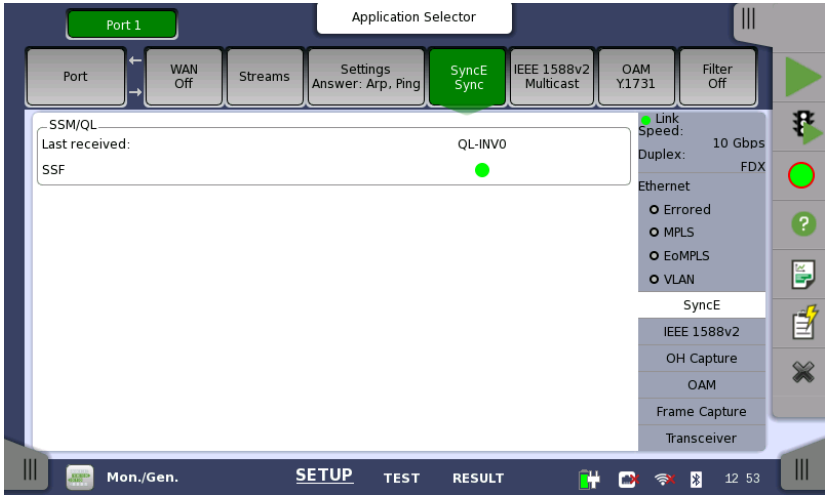
- SyncE (ITU-T G.826x) functions:
  - Detect ESMC messages and real time display of received SSM/QL byte
  - Record ESMC message log
  - Generate alarm when SSM/QL not received within 5 seconds
    - Clear alarm on SSM/QL reception
  - Transmit ESMC/SSM messages with user-defined QL
    - Four user-selectable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

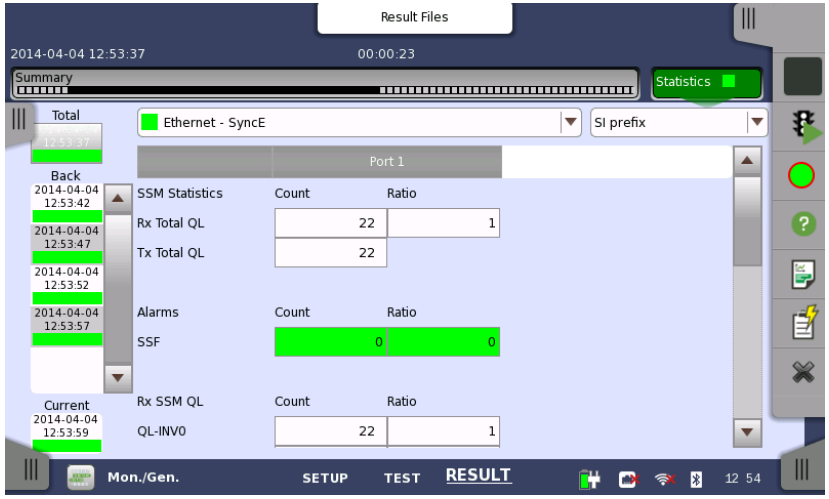


MT1000A Synchronous Ethernet Test

Back to Index page

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





MT1000A Synchronous Ethernet Test

Back to Index page

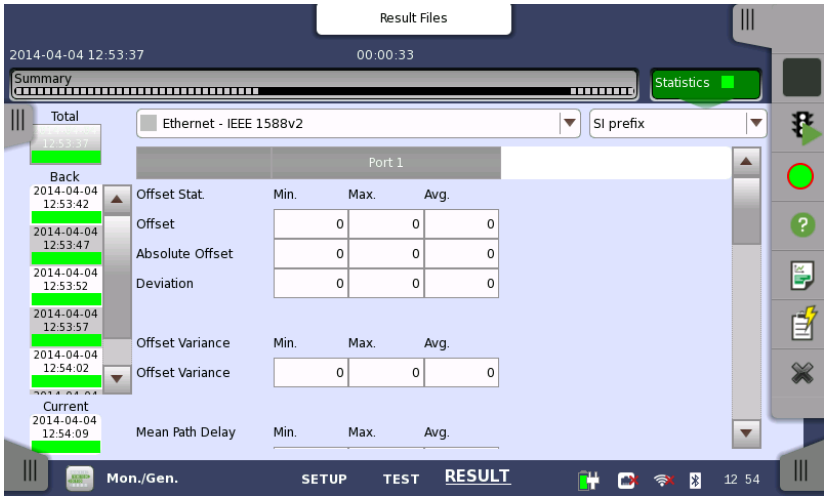
- IEEE 1588 v2 (PTP) functions:
  - Support G.8265.1, G.8275.1 profile and ‘User defined’ one.
  - Emulating a master clock.
    - Selectable UTC source from internal instrument clock or GPS.
    - Configurable parameters of Announce message, etc.
  - Emulating slave clock
    - Configurable parameters 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.

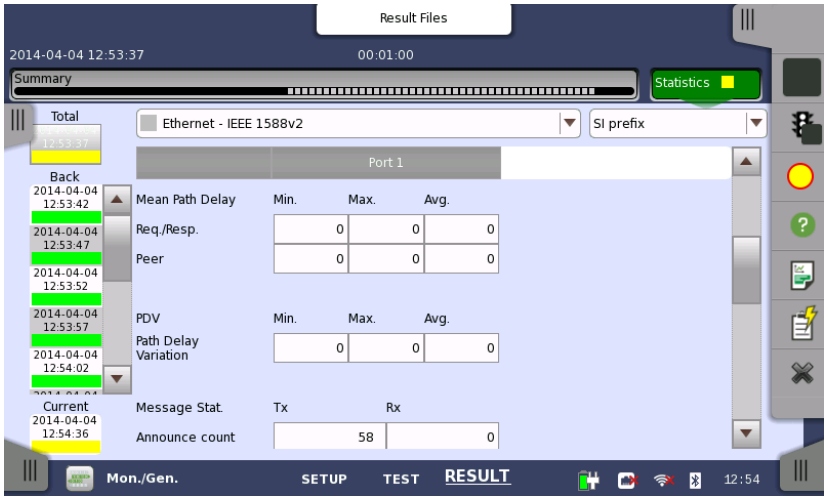
For quick analysis and troubleshooting of IEEE 1588 v2 (PTP) signaling

MT1000A Synchronous Ethernet Test

Back to Index page

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

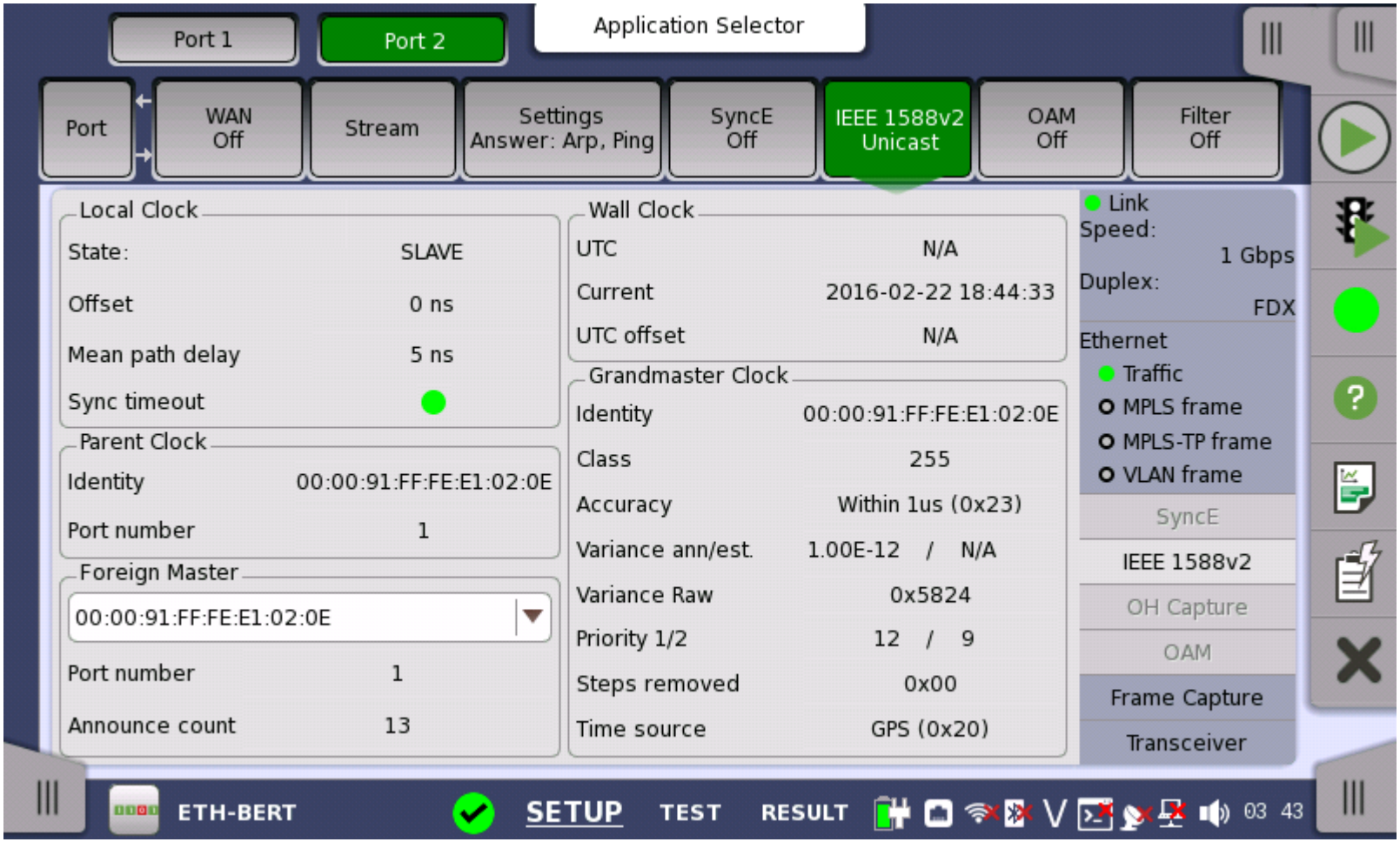




MT1000A Synchronous Ethernet Test

Back to Index page

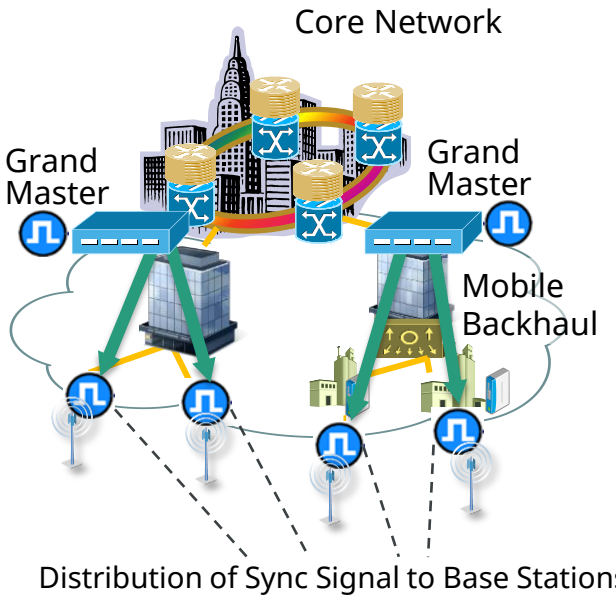
- IEEE 1588 v2 (PTP) clock status real time information



Phase/Time Synchronization Test

Back to Index page

- CDMA2000 and W-CDMA(TDD) require not only frequency synchronization but also phase/time synchronization among base stations. GPS has been used for that purpose.
- Expanding small cell deployment and technologies of LTE-TDD and LTE-Advanced cause increasing demands for packet-based phase/time synchronization by IEEE1588v2.
- New testing demands for mobile network installation and maintenance using IEEE1588v2 are rapidly increasing.



Distribution of Sync Signal to Base Stations

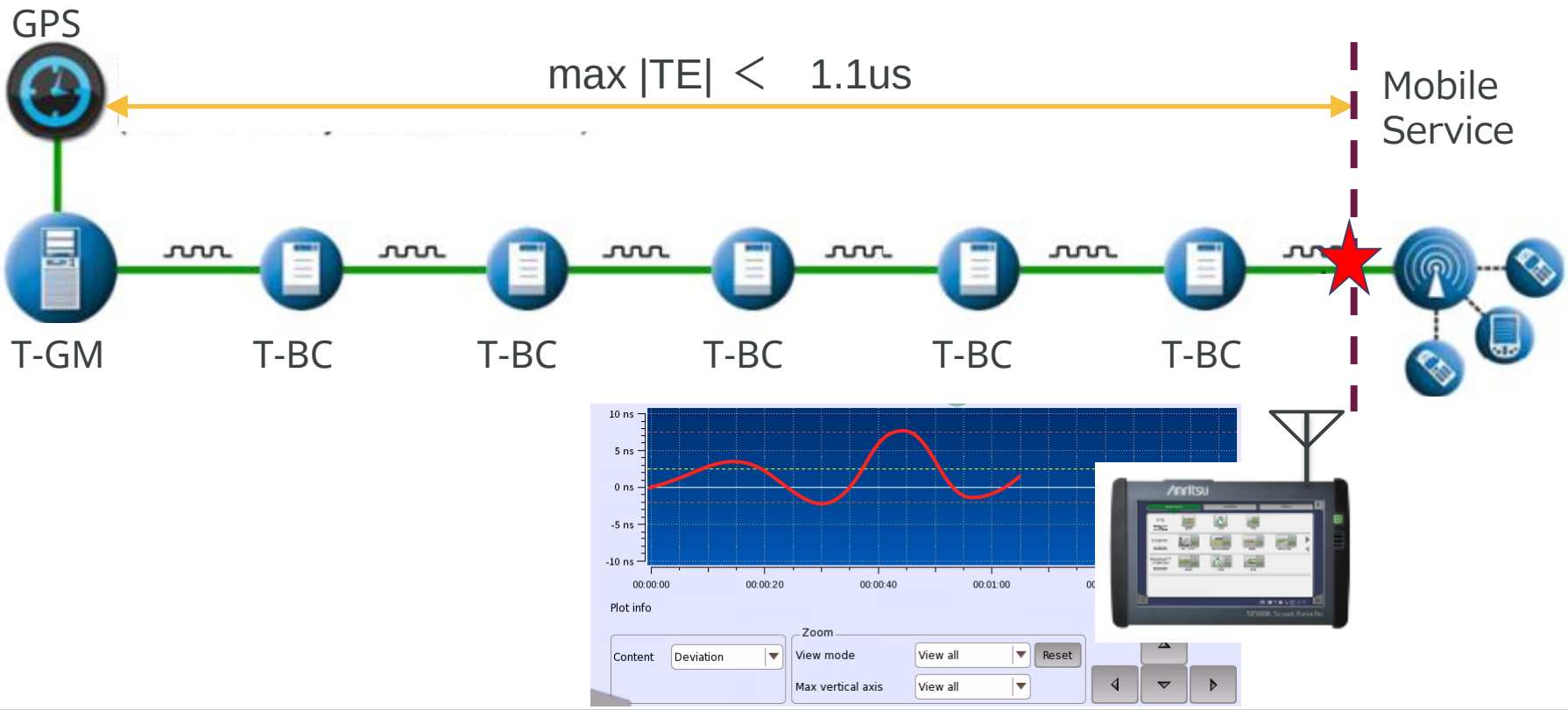
Application	Mobile Backhaul		Air Interface	
	Frequency	Phase	Frequency	Phase
LTE FDD	±16ppb	N/A	±50ppb	N/A
LTE TDD (large cell)		±1.1μs		±5μs
LTE TDD (small cell)		±1.1μs		±1.5μs
LTE-A MBSFN		±1.1μs		±1 to 5μs
LTE-A CoMP		±500ns to 1.1μs		±500ns to 5μs
LTE-A eICIC		±1.1μs		±1 to 5μs

Synchronization requirement to MBH

Phase/Time Synchronization Test

Back to Index page

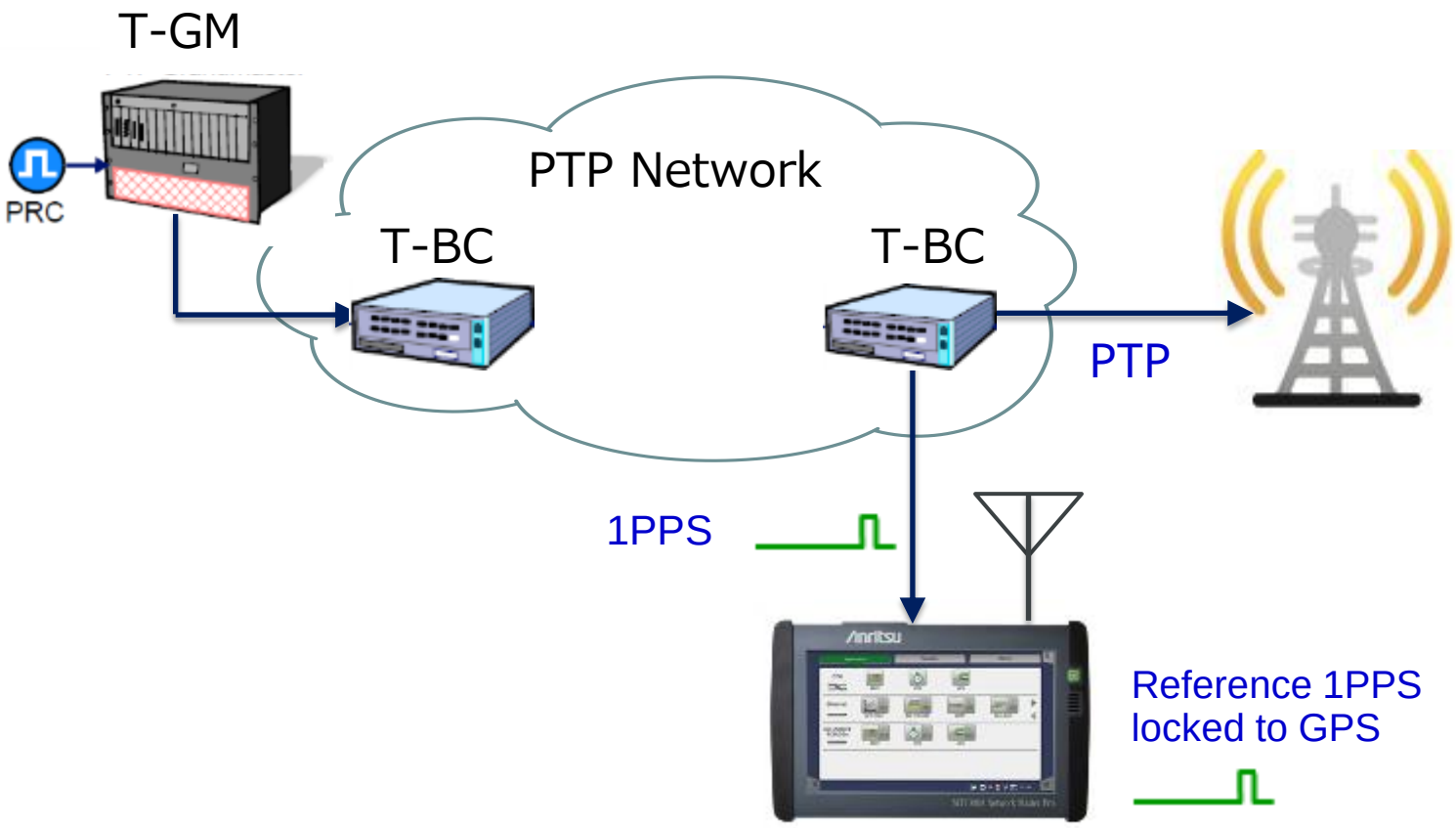
- MT1000A is located at the service demarcation point between mobile backhaul and mobile service. It evaluates SLA of the backhaul.
- MT1000A measures max|TE|, cTE(Constant Time Error) and dTE(Dynamic Time Error) as metrics of phase/time synchronization.
- Supports GbE, 10GbE optical interfaces.



Phase/Time Synchronization Test

Back to Index page

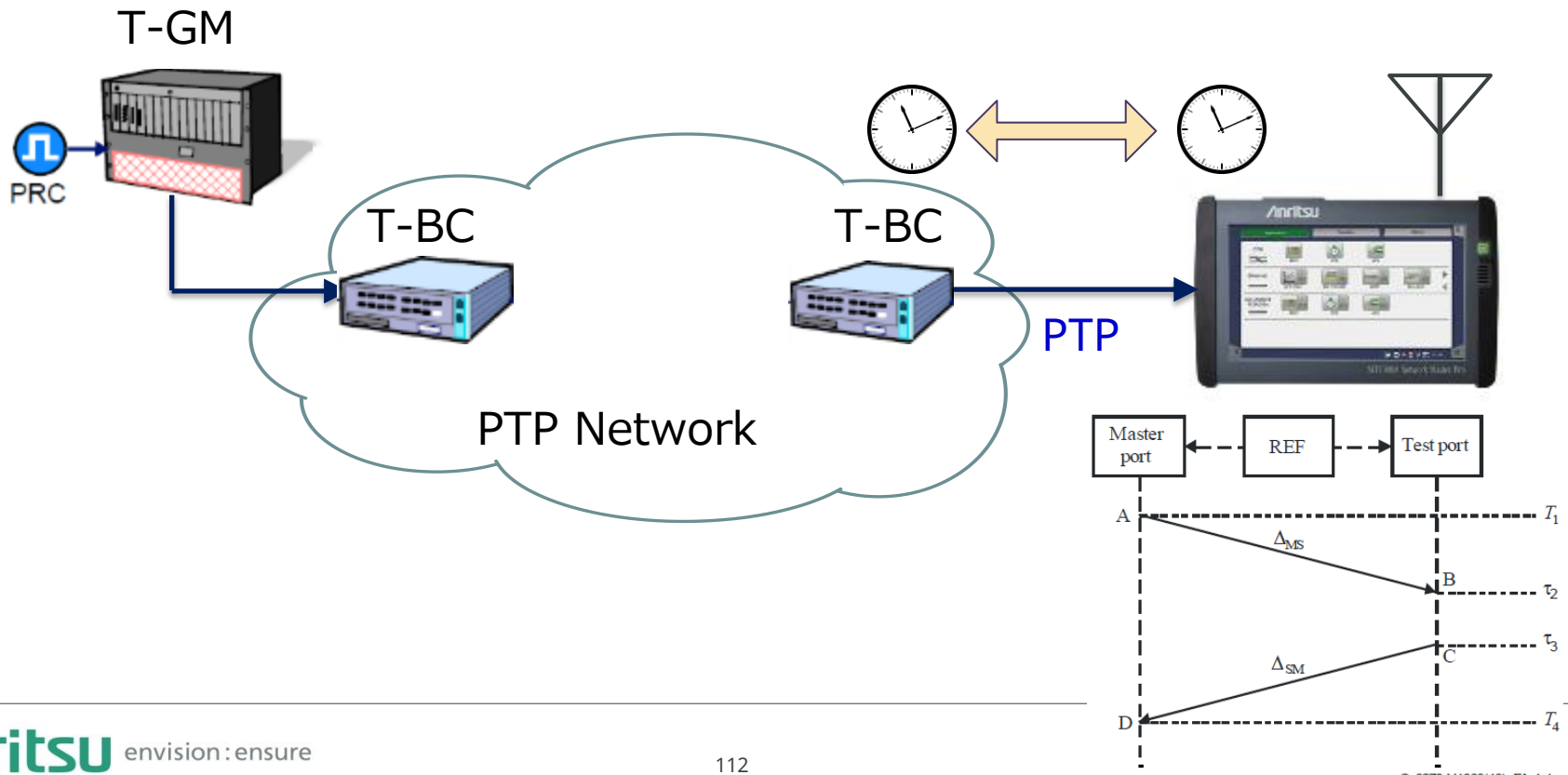
- Time Error method No.1: 1PPS Signal phase measurement
  Measuring the phase difference between the reference in the tester and 1PPS signal from the network under test.



Phase/Time Synchronization Test

Back to Index page

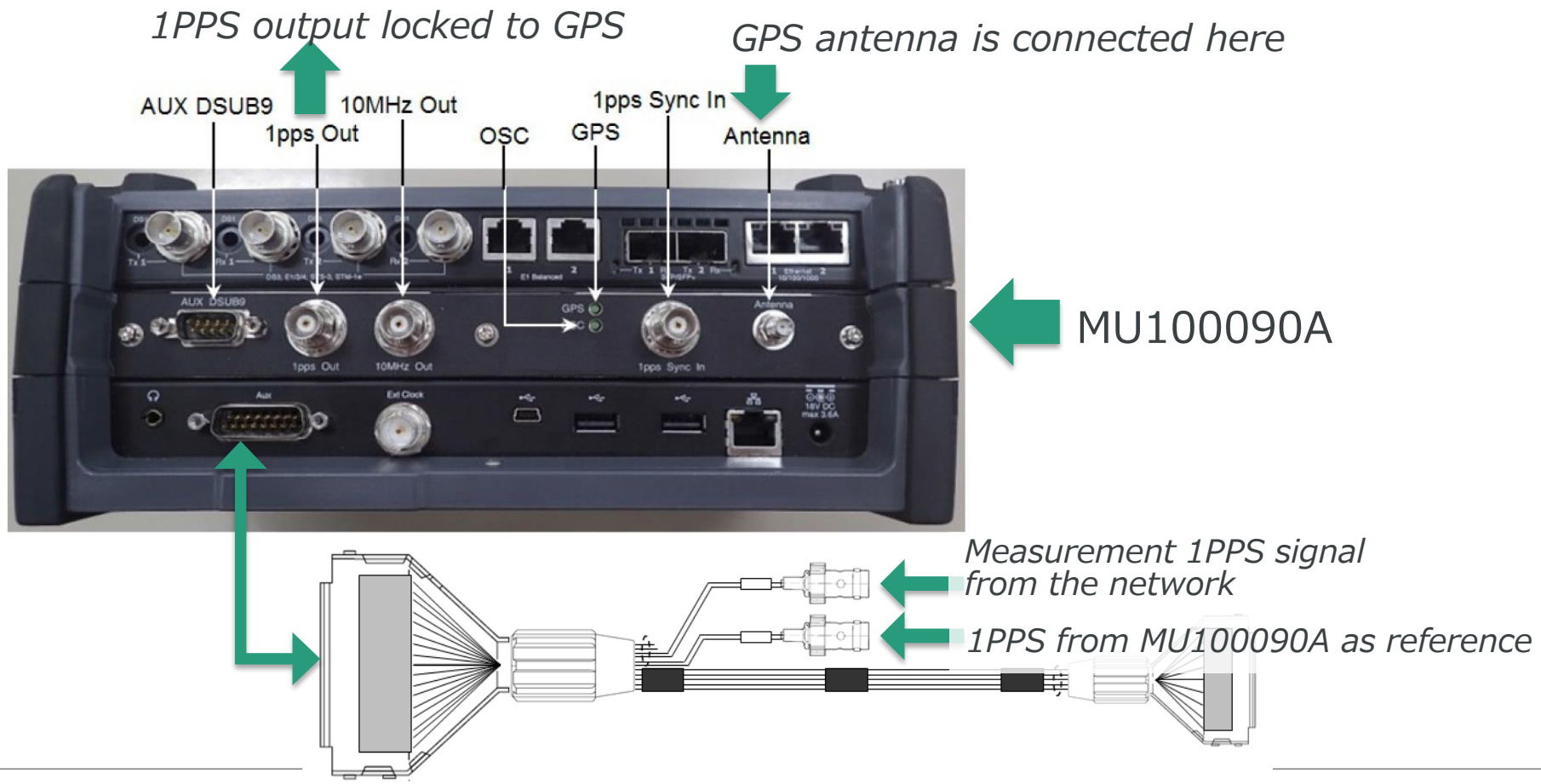
- Time Error method No.2: By PTP timestamp (defined in ITU-T G.8273)
  - The tester emulates slave clock and has reference UTC from GPS.
  - The tester measures the difference between the timing of PTP message reception and the time stamp inside the message (T1 and T4). This is observed as OWD(One-Way-Delay) .
  - Because cable length is known the tester estimates the time error by deducting the cable delay from the OWD.



Phase/Time Synchronization Test

Back to Index page

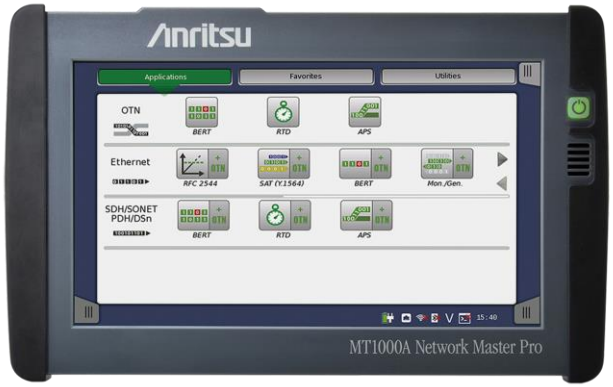
- MU100090A High Performance GPS Disciplined Oscillator is required for phase/time synchronization test.



Network Master Pro MT1000A

Back to Index page

- Mobile Fronthaul Installation and Verification
  - CPRI/OBSAI Test
  - eCPRI/IEEE 1914.3



CPRI Background

Back to Index page

- 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 Networks (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).

CPRI Bit Rates

Back to Index page

- CPRI bit rates are referred to as “option #”
- There are now eight options (CPRI Specification V6.0)
- MT1000A supports Option 8, 10.1376 Gbps, reflecting marketing requirement of supporting exploring mobile network bandwidth.
- MT1000A can perform simultaneous testing up to 2 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

Back to Index page

- Four OBSAI bit rates are defined.
- MT1000A supports 6.144 Gbps, reflecting marketing requirement of supporting exploring mobile network bandwidth. *1
- MT1000A can perform simultaneous testing up to 2 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

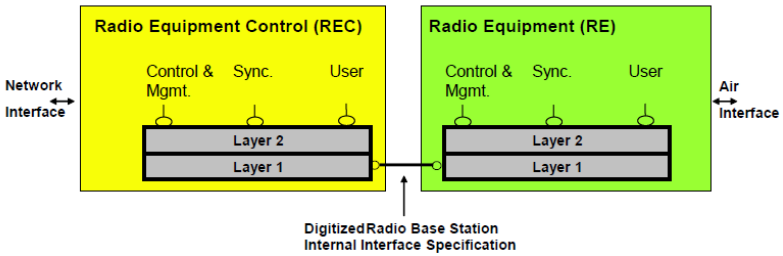
*1: Only Un Frame

C-RAN Market

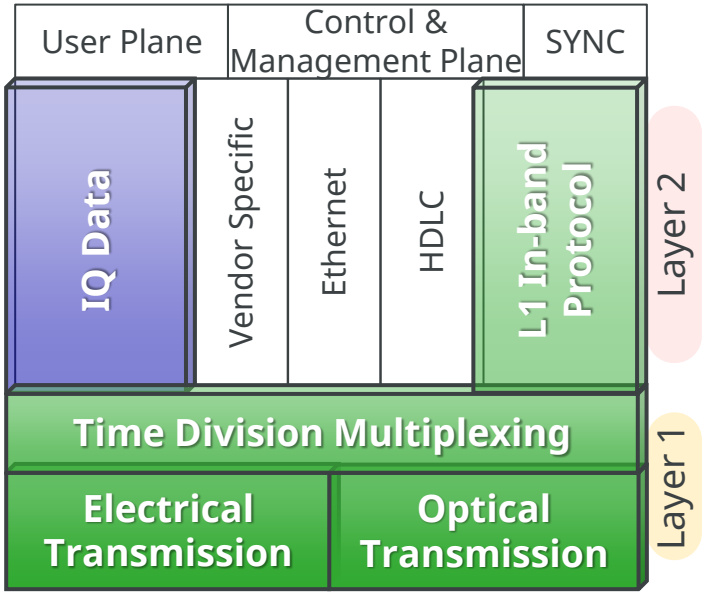
Back to Index page

- Market requirements
  - Minimizing number of BBUs 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)



CPRI/OBSAI - Test cases

Back to Index page

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

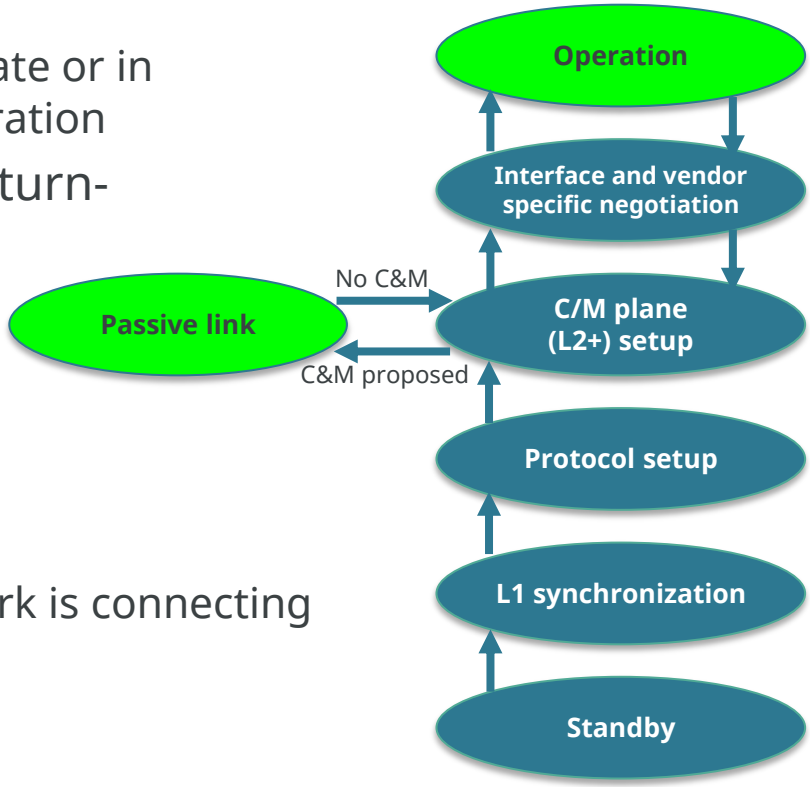
Test case 1

*1: OBSAI supports UnFrame only

CPRI/OBSAI - Test cases

Back to Index page

- Test case 2
  - CPRI Specification V6.0 defines
    - When both devices are in Operation state or in Passive link state, link is in normal operation
  - Operators find that up to 80% of CPRI turn-up issues occur in lowest layers
  - Essential during installation to: confirm RRH/RE can communicate to ground even without BBU/REC
    - Confirming RRH/RE can connect to Passive link state
    - Confirming HDLC layer (Layer 2) network is connecting
  - Completing above minimizes chance of issues during BBU/REC installation

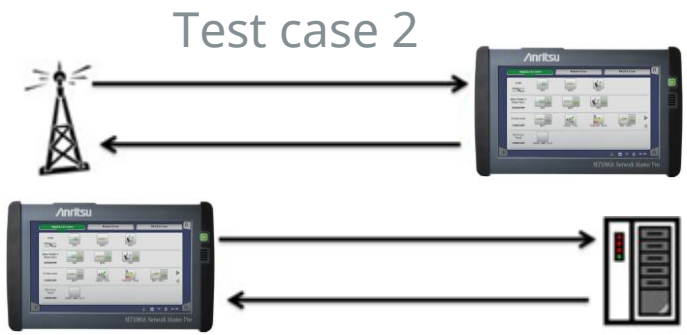


Extract from Figure 30 in CPRI Specification V6.0: Start-up states and transitions

CPRI/OBSAI - Test cases

Back to Index page

- Test case 2
  - Connect to actual equipment (REC or RE) to verify alive
    - Signal level and frequency measurement
      - Optical cable ends can be checked with Video Inspection Probe (VIP)
    - Monitor control word K30.7 – indicates error in 8B/10B line code (CPRI option 1-7 only) – and 8B/10B code violations
    - Check equipment behavior
      - Check that equipment can reach Passive link state
      - Confirm HDLC layer (Layer 2) network connecting
      - Check equipment behaviour at alarms

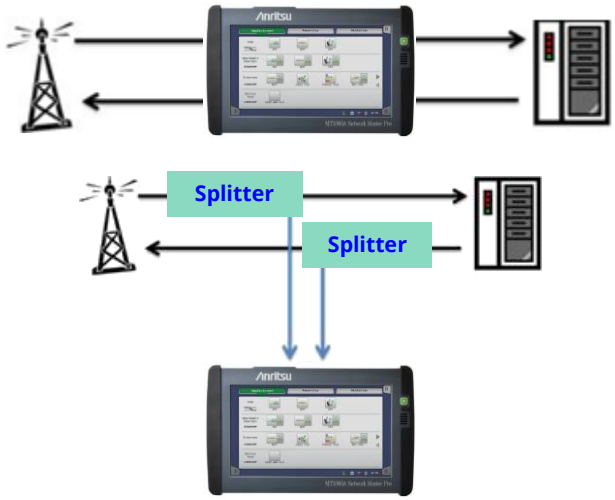


CPRI/OBSAI - Test cases

Back to Index page

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

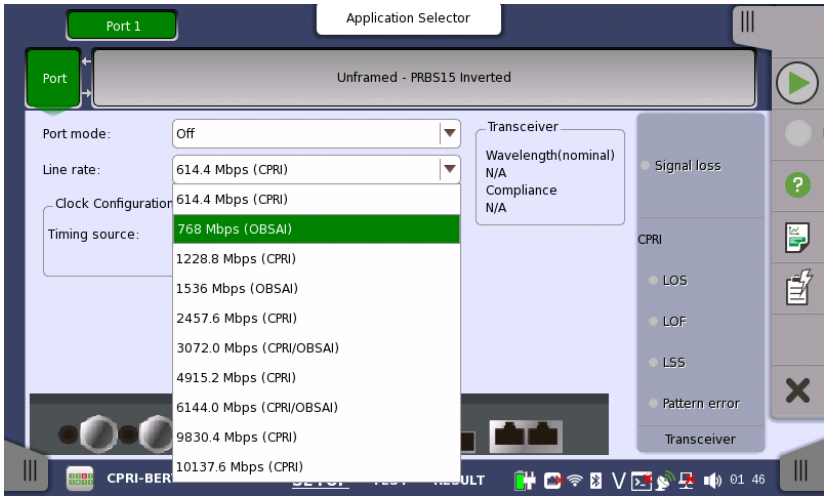
Test case 3



MT1000A CPRI Wire Line Testing

Back to Index page

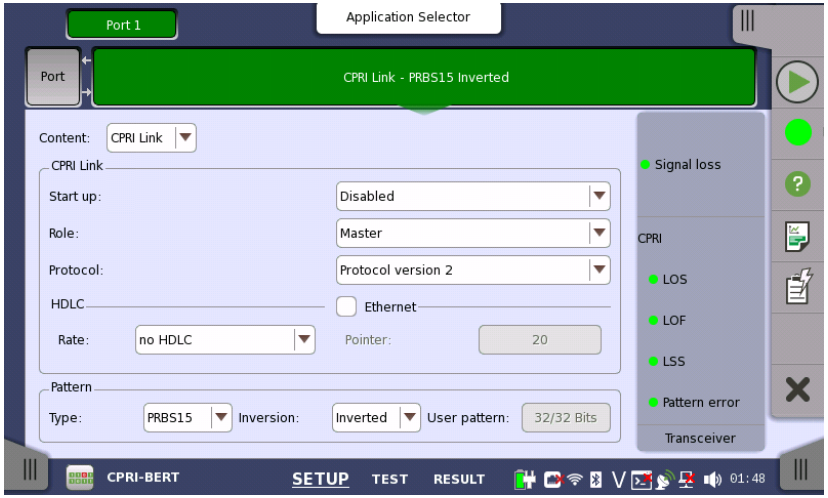
- Supports CPRI interface rate option 1 (614.4 Mbit/s) to option 8 (10.1376 Gbit/s)
  - Ensures testing of current and future CPRI interfaces



MT1000A CPRI Wire Line Testing

Back to Index page

- Testing at any rate
- Ability to exercise BBU or RRH up to Passive link status (as per latest CPRI standard)
- Support for Pass-through mode
  - Complete solution for detailed I&M testing



MT1000A CPRI Wire Line Testing

Back to Index page

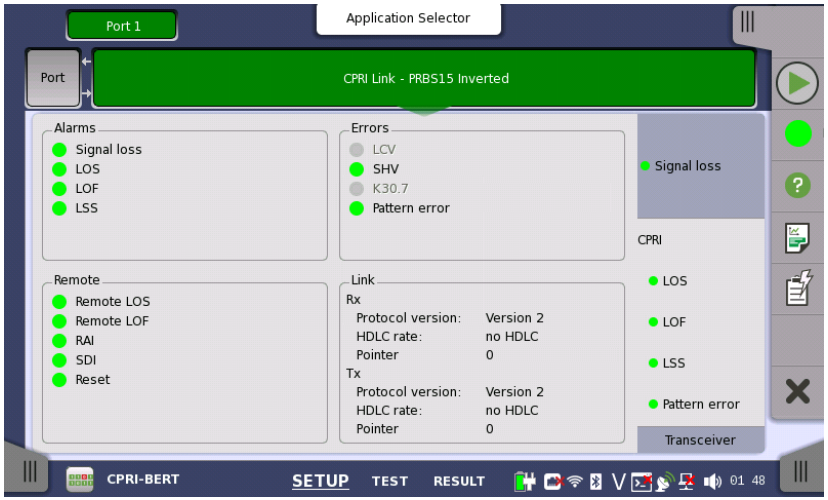
- Displayed signal level and bit rate gives first verification of received- signal condition

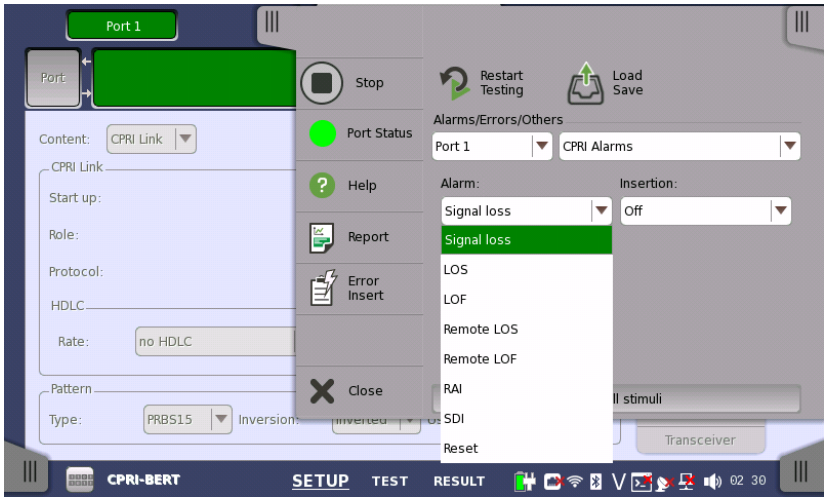
- Using Video Inspection Probe (VIP) to check fiber endface confirms quality practices and removes key cause of turn-up failure.

MT1000A CPRI Wire Line Testing

Back to Index page

- Checking for and inserting Layer-2 alarms and errors from BBU to RRH
  - Ensures engineer can complete advanced fault finding and evaluate issue root cause

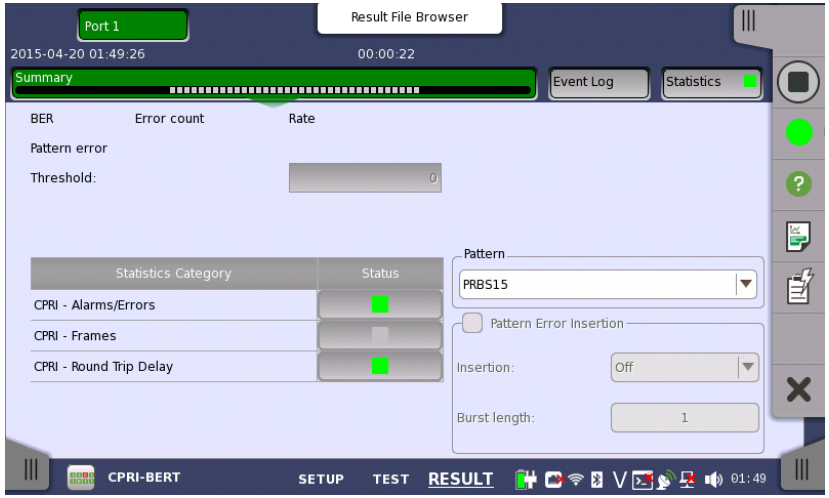


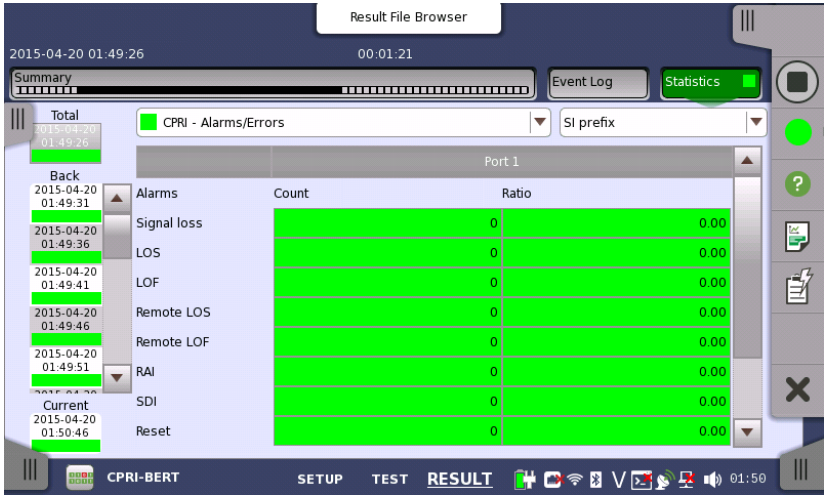


MT1000A CPRI Wire Line Testing

Back to Index page

- Test results:
  - Summary screen with pattern error information and survey of result pages
  - Alarms/Errors screen with details of detected CPRI alarms and errors
  - Color coding highlights detected alarms and errors

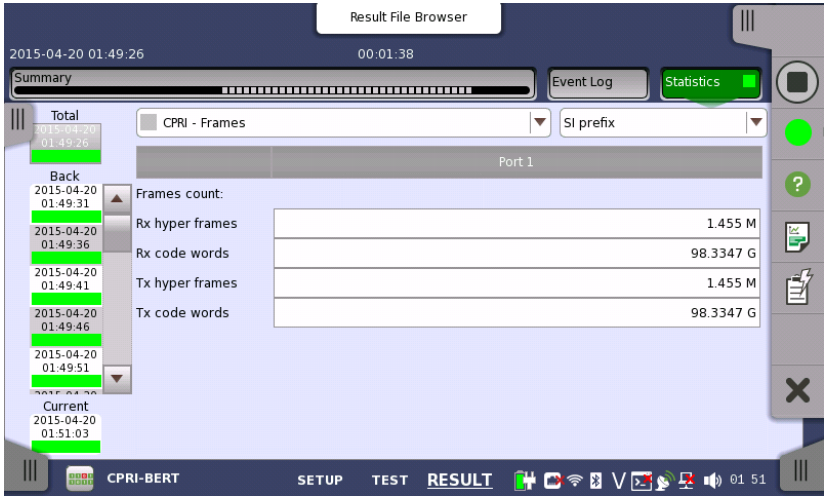


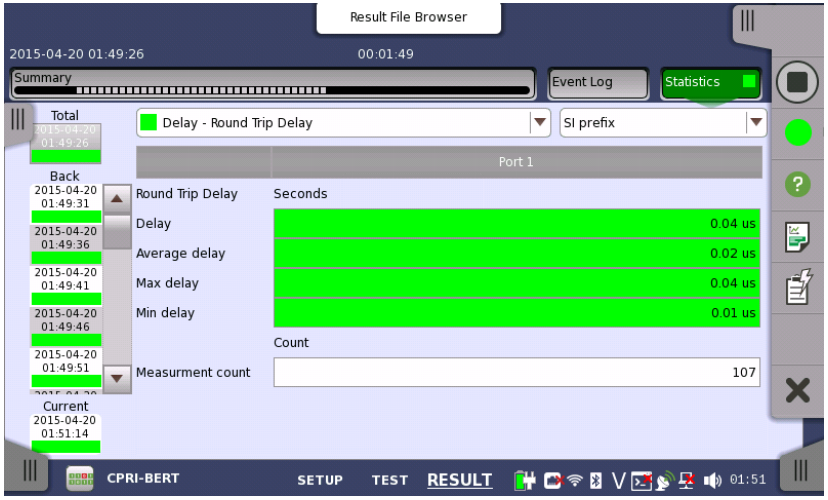


MT1000A CPRI Wire Line Testing

Back to Index page

- Test results:
  - CPRI Frames screen with counts of received and sent frames and code words
  - Delay screen showing measured Round Trip Delay

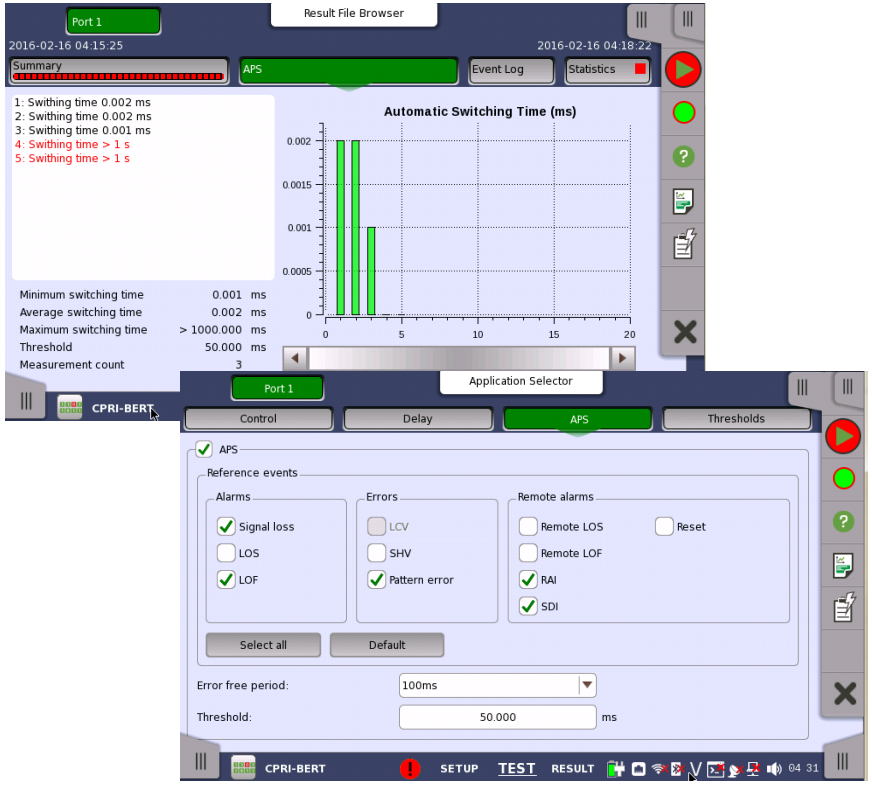




MT1000A CPRI Wire Line Testing

Back to Index page

- 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



Graph and Event log screens for easy viewing and analysis

CPRI over OTN

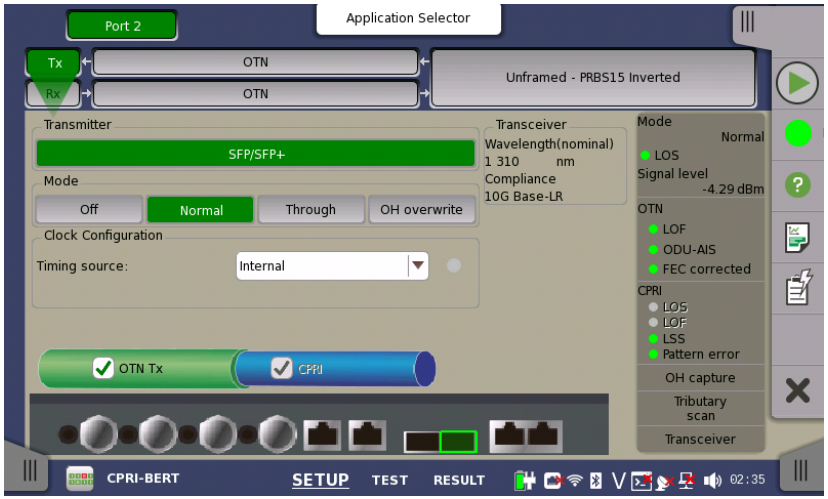
Back to Index page

- Market requirements
  - 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

MT1000A CPRI Wire Line Testing

Back to Index page

- Support for CPRI over OTN enables tests of latest CPRI implementations

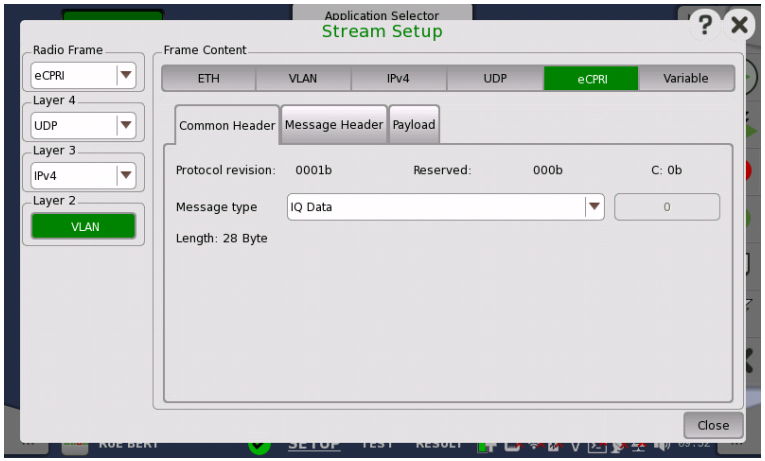


eCPRI/IEEE1914.3

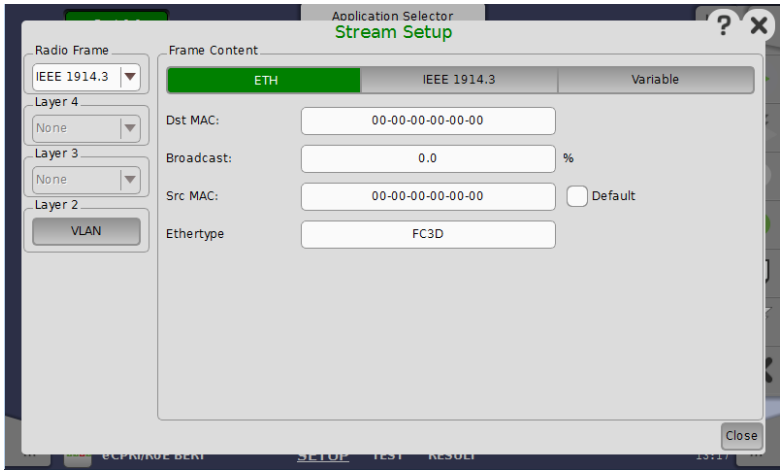
Back to Index page

- Market
  - Most MFH networks are based on CPRI and will have to move to these new frame formats for 5G or before allowing the operator to manage the massive increase in data throughput requirements.
  - IEEE 1914.3 frames will likely also to be utilized back into the MBH as the architecture as the connection from Core / Metro to the MFH will evolve.

MT1000A support BER test of eCPRI/IEEE 1914.3



eCPRI Frame Setting

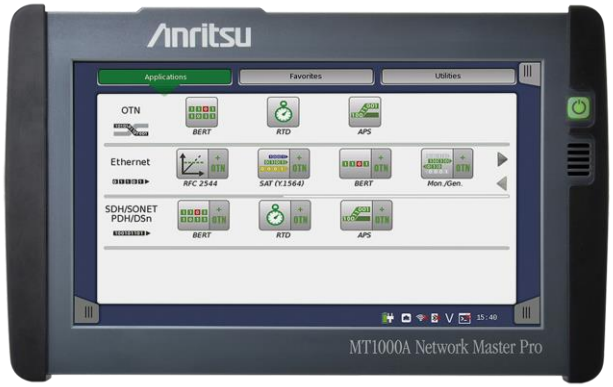


IEEE1914.3 Frame Setting

Network Master Pro MT1000A

Back to Index page

- Powerful Storage Area Networking (SAN) Tests
  - Fibre Channel Functions



MT1000A Product Highlights

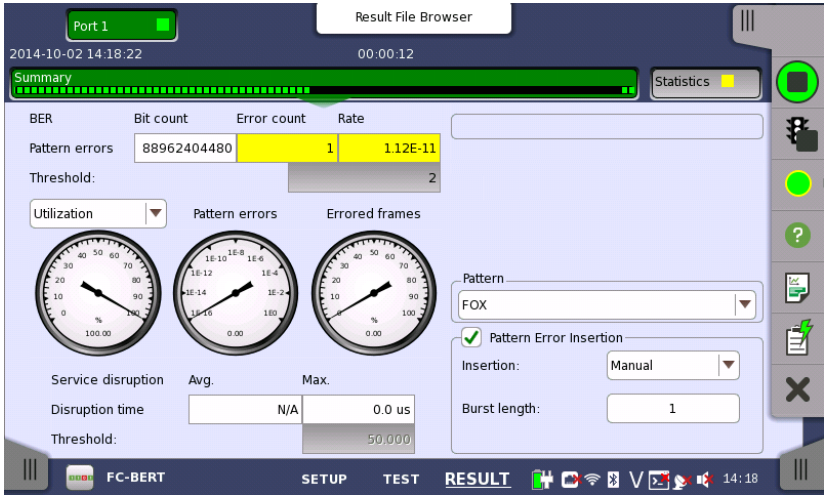
Back to Index page

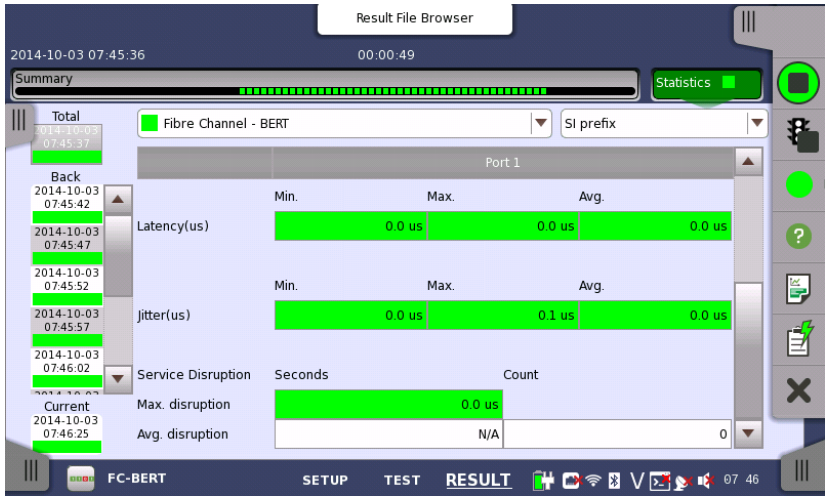
- Powerful tests of Fibre Channel links
  - Test of 1 GFC, 2 GFC, 4 GFC, 8 GFC, 10 GFC and 16GFC
    - Optional mapping to OTN
  - Performance Test
  - Latency measurement
  - BER testing including service disruption measurement
  - Line alarm and error monitoring
  - Normal or Reflector mode

MT1000A Product Highlights

Back to Index page

- 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
  - Optional threshold settings for easy understanding of results

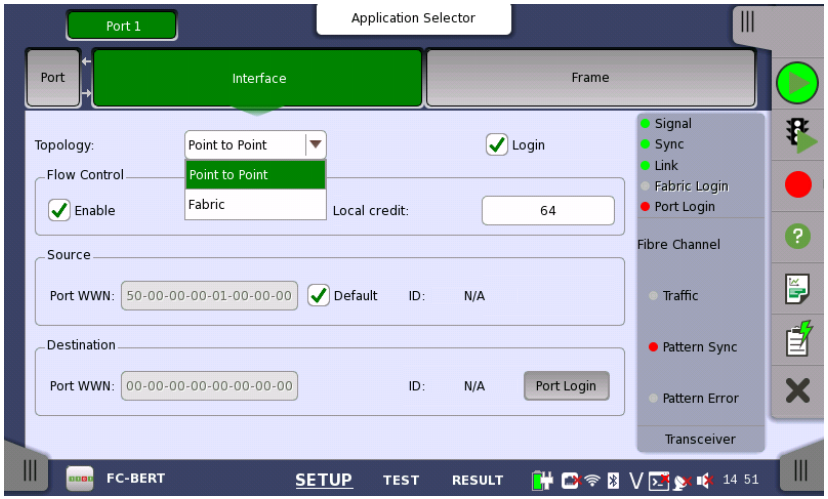


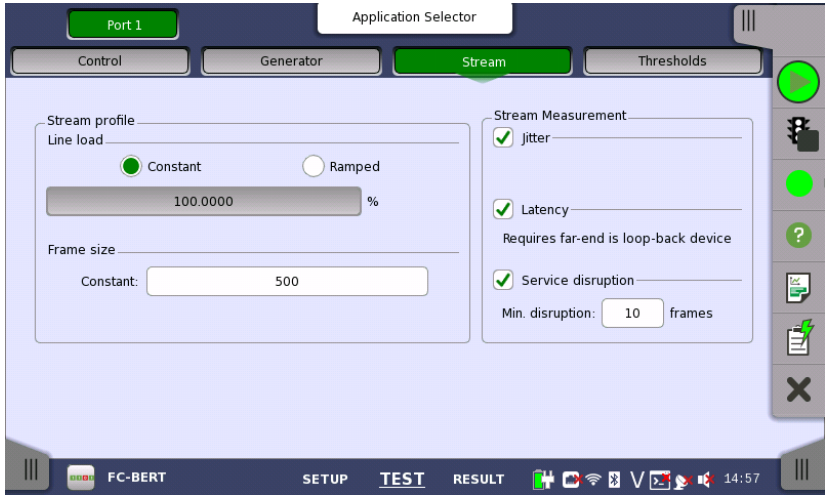


MT1000A Product Highlights

Back to Index page

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

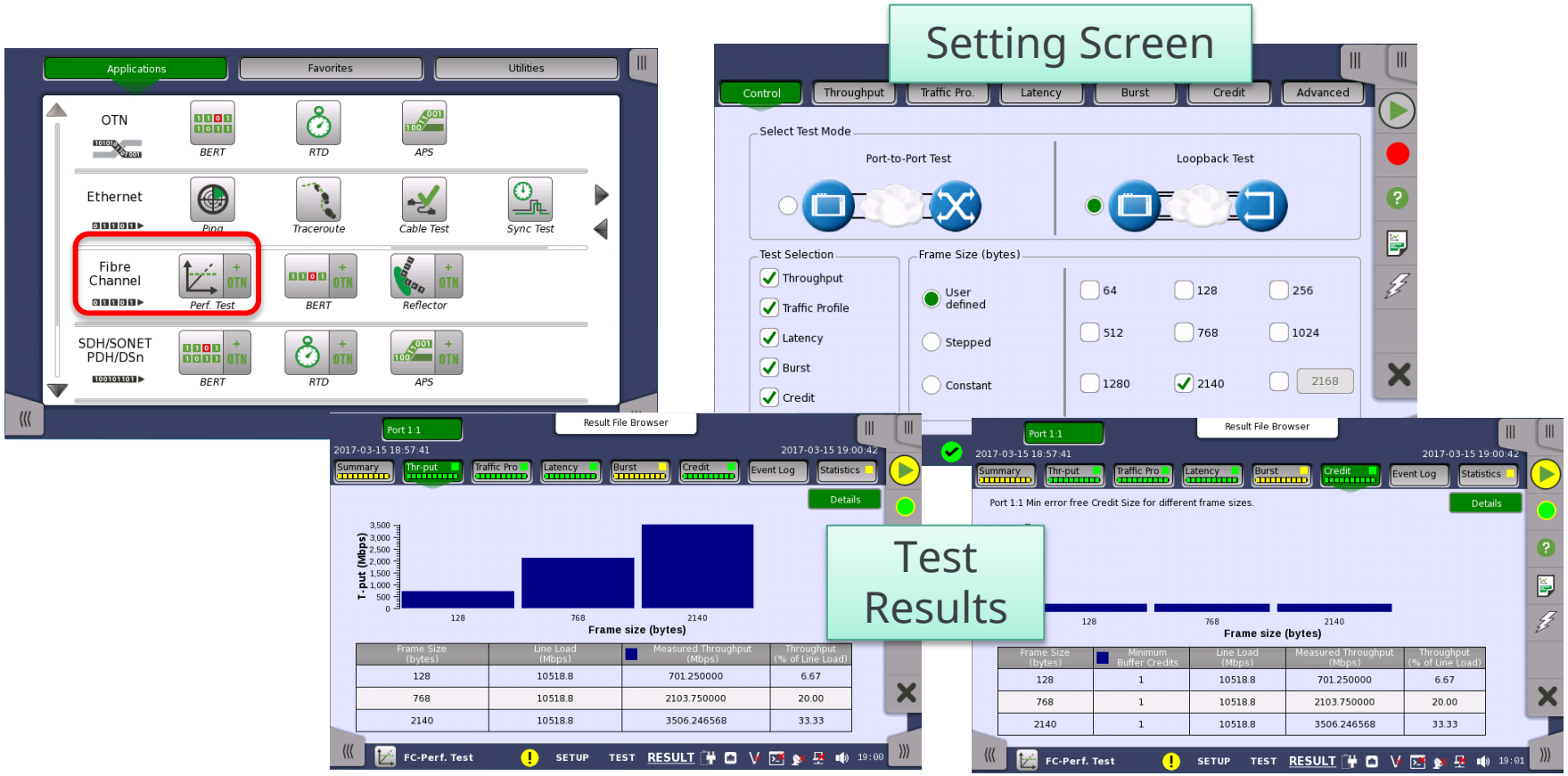




MT1000A Product Highlights

Back to Index page

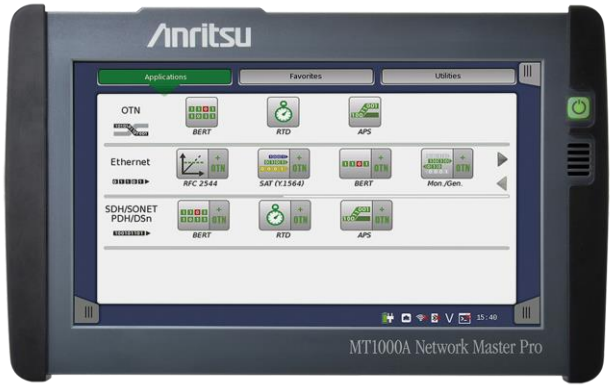
- Performance test application to Fibre channel interface
  - Supports throughput, latency, and buffer credit performance verification for Fibre channel networks and Fibre channel equipment



Network Master Pro MT1000A

Back to Index page

- OTN Metro and Core Network Installation and Maintenance



OTN Background

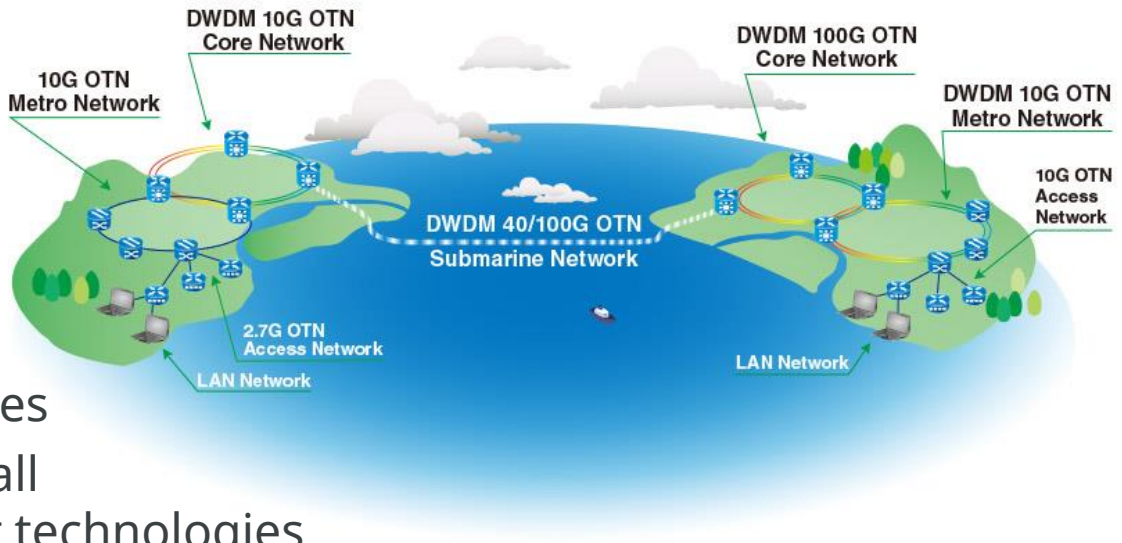
Back to Index page

- 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.
  - 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

Back to Index page

- OTN networks first designed for submarine sections
  - Quickly moved to Core → Metro → Access
    - Operators can implement more services, control and management
- Simplifying network management is key for operators
  - Control customer traffic from access point and across network (single system, single management)
  - Greater insight about faults, quick repair and fewer maintenance issues
  - Single management of all legacy and replacement technologies



MT1000A OTN Test Function

Back to Index page

- Comprehensive OTN testing for metro and core network I&M
  - OTU1, OTU2, OTU3, OTU4, OTU1e, OTU2e, OTU1f, OTU2f, OTU3e1, OTU3e2 tests
  - ODU0, ODUflex*1, ODU1, ODU2, ODU3, ODU4.
    ODU0 to ODU4 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 O.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

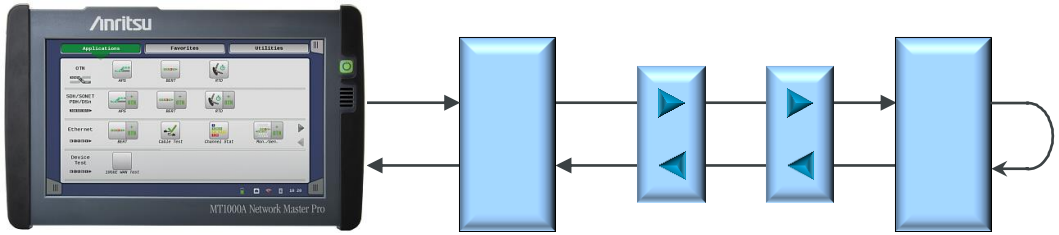
*1 Up to OTU2

MT1000A OTN Test configuration (1/3)

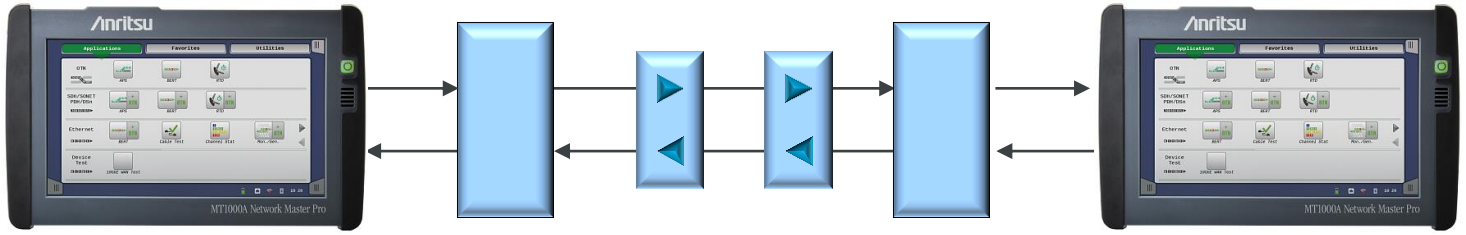
Back to Index page

- OTN out-of-service testing
  - For installation and commissioning
  - For troubleshooting

  - OTN testing with far-end loopback



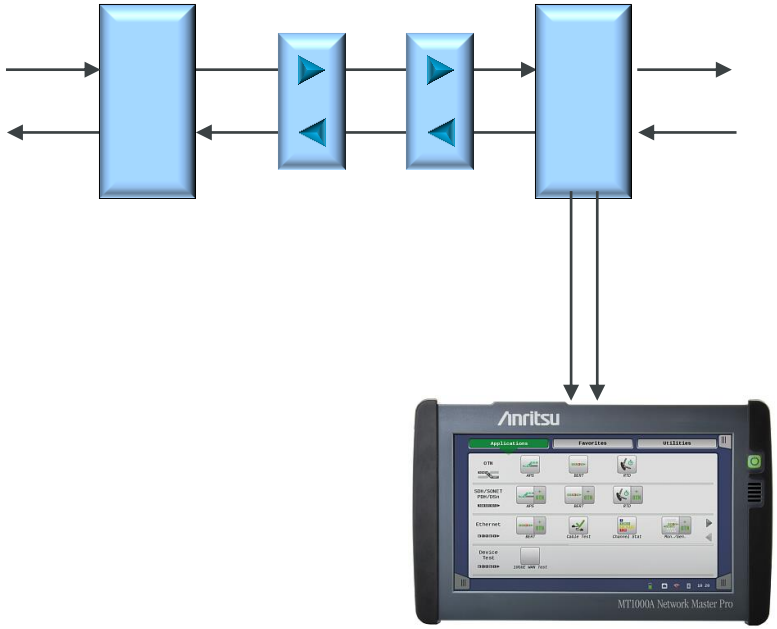
  - OTN testing with two instruments
    - Separate results for each side of line



MT1000A OTN Test configuration (2/3)

Back to Index page

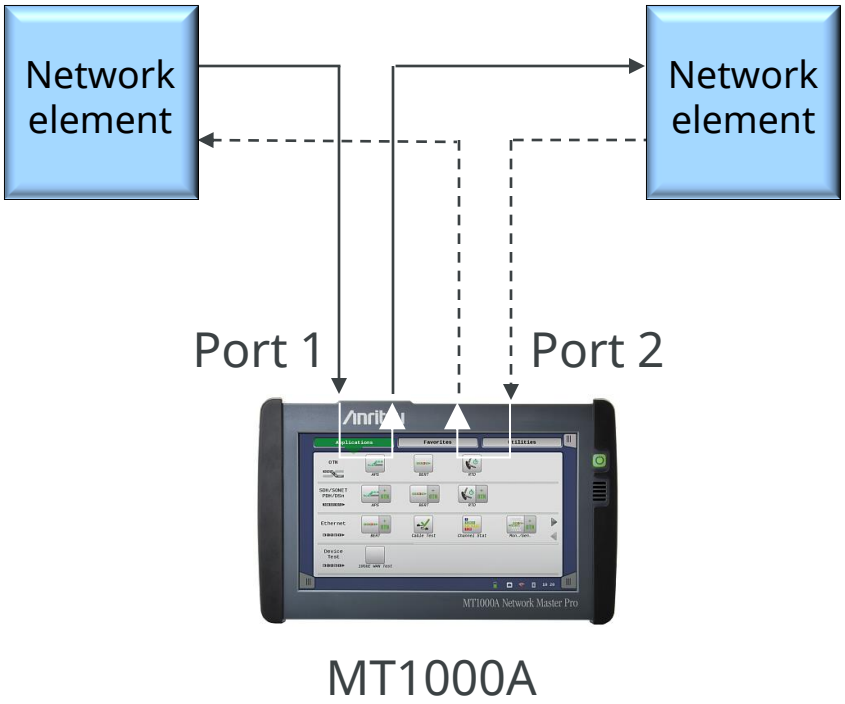
- OTN in-service testing
  - Troubleshooting live traffic
  - Connected at monitoring point



MT1000A OTN Test configuration (3/3)

Back to Index page

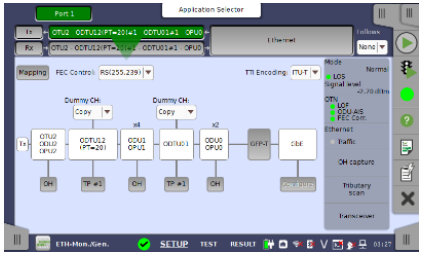
- OTN in-service pass-through testing
  - Troubleshooting live traffic when no monitoring point

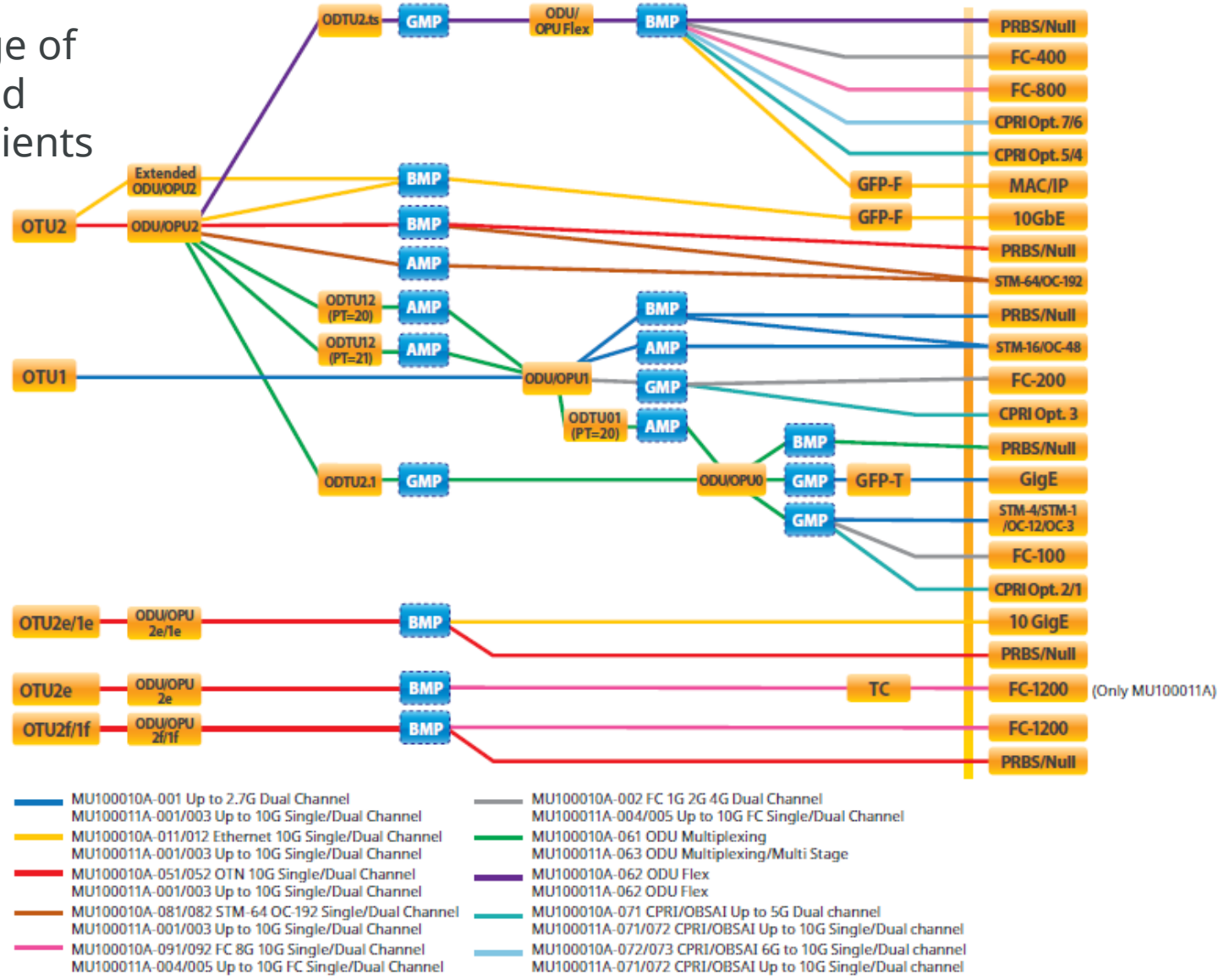


MT1000A OTN Mapping OTU1/OTU2

Back to Index page

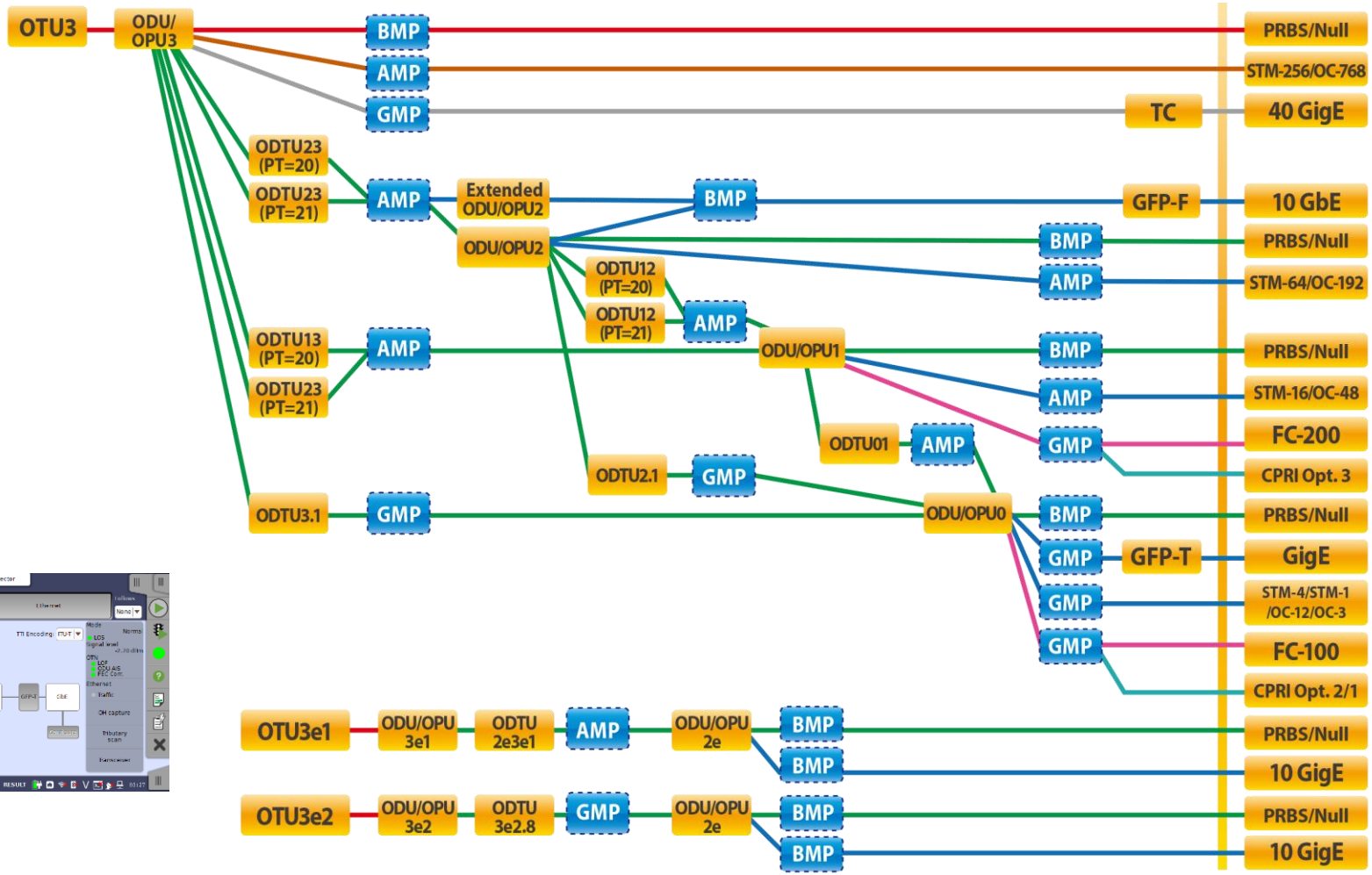
- Largest Range of Mappings and Supported Clients

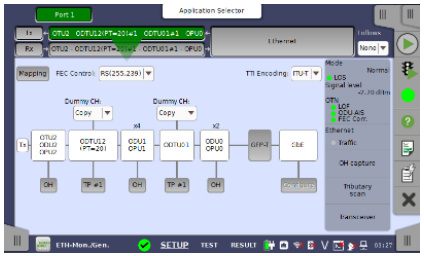




MT1000A OTN Mapping OTU3

Back to Index page

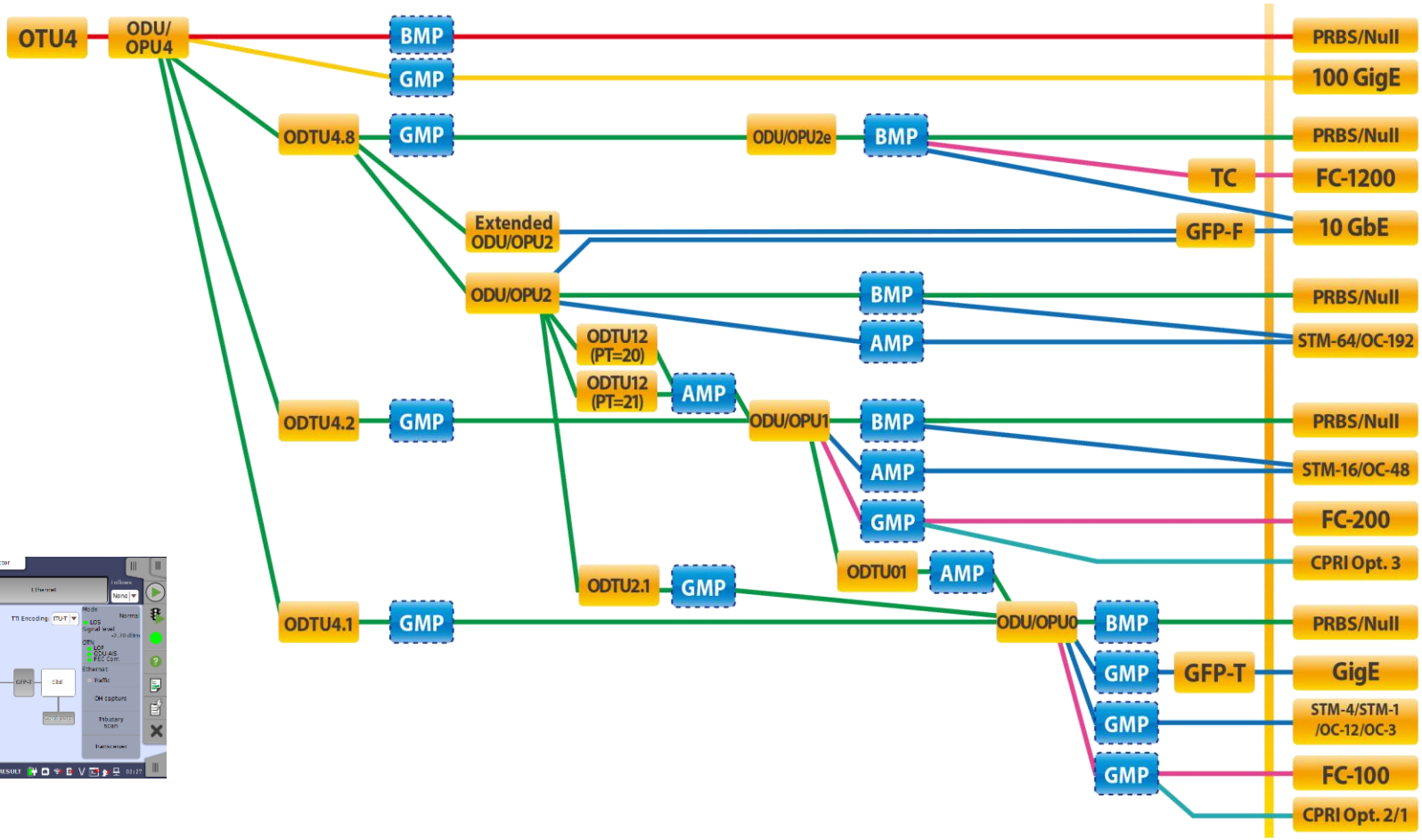


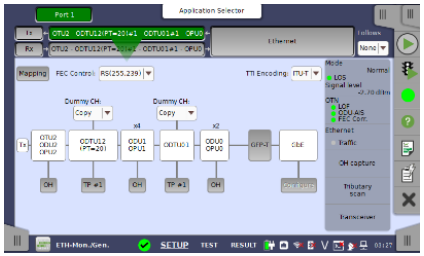


MU100011A-053 OTN 40 Gig Single Channel
MU100011A-063 40/100G ODU Multistage
MU100011A-001/003 Up to 10G Single/Dual Channel
MU100011A-004/005 Up to 10G FC Single/Dual channel
MU100011A-071/072 CPRI/OBSAI Up to 10G Single/Dual Channel
MU100011A-013 Ethernet 40G Single Channel
MU100011A-083 STM-256 OC-768 Single Channel

MT1000A OTN Mapping OTU4

Back to Index page



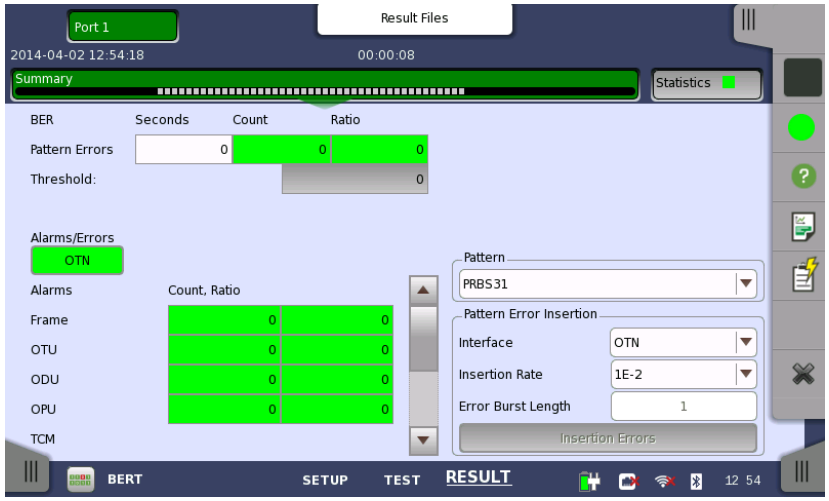


MU100011A-055 OTN 100G Single Channel
MU100011A-063 40/100G ODU Multistage
MU100011A-001/003 Up to 10G Single/Dual Channel
MU100011A-004/005 Up to 10G FC Single/Dual Channel
MU100011A-071/072 CPRI/OBSAI Up to 10G Single/Dual Channel
MU100011A-015 Ethernet 100G Single Channel

MT1000A Product Highlights

Back to Index page

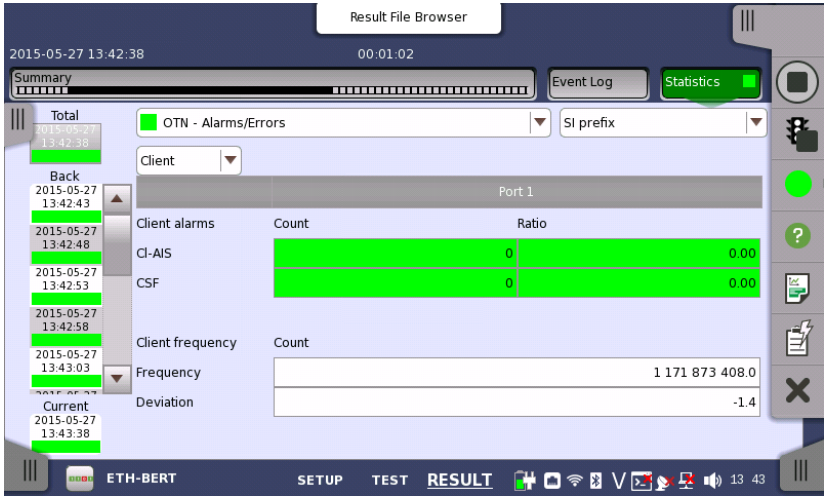
- OTN statistics
  - Summary page with main results
  - Additional pages with detailed statistics
  - GO/NO GO color coding gives easy overview of results

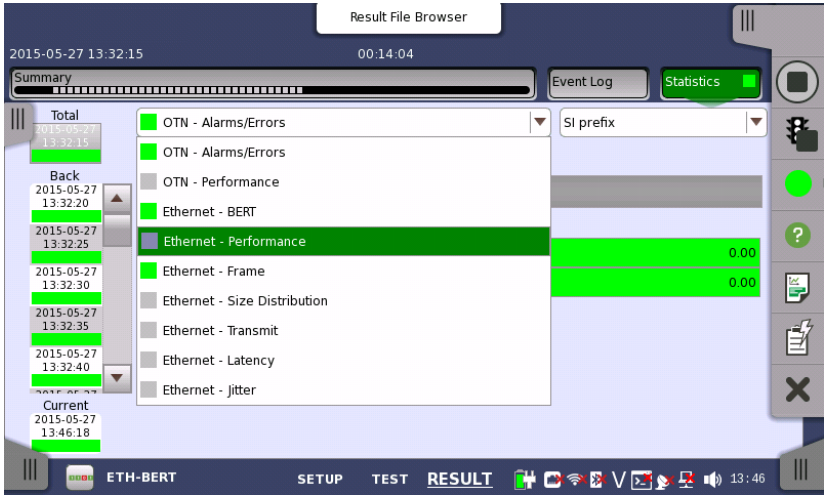


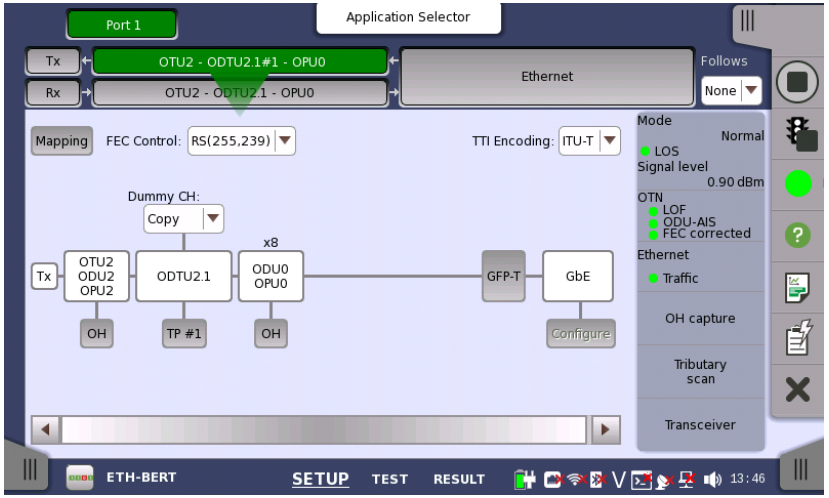
MT1000A Product Highlights

Back to Index page

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



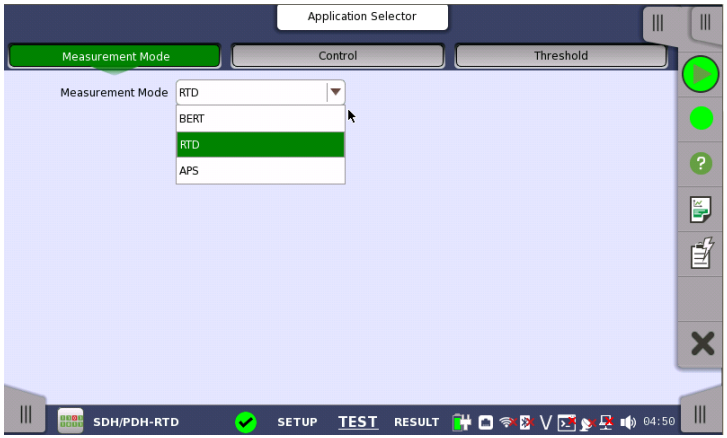


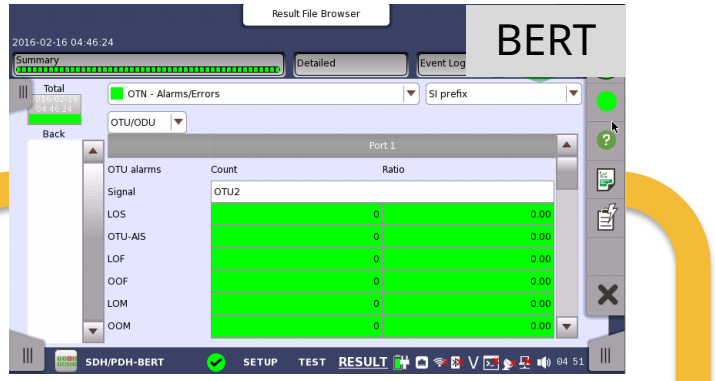


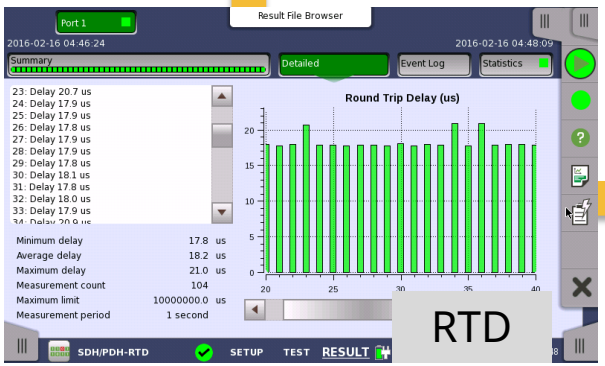
MT1000A Product Highlights

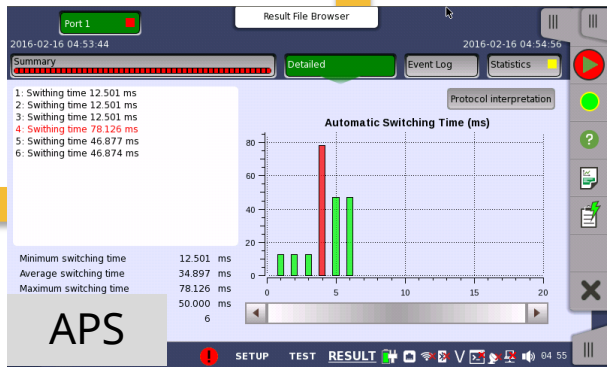
Back to Index page

- SDH/SONET/DSn/PDH in OTN
  - BERT applications and upgraded to switch without closing BERT, APS and RTD applications to improve operation efficiency





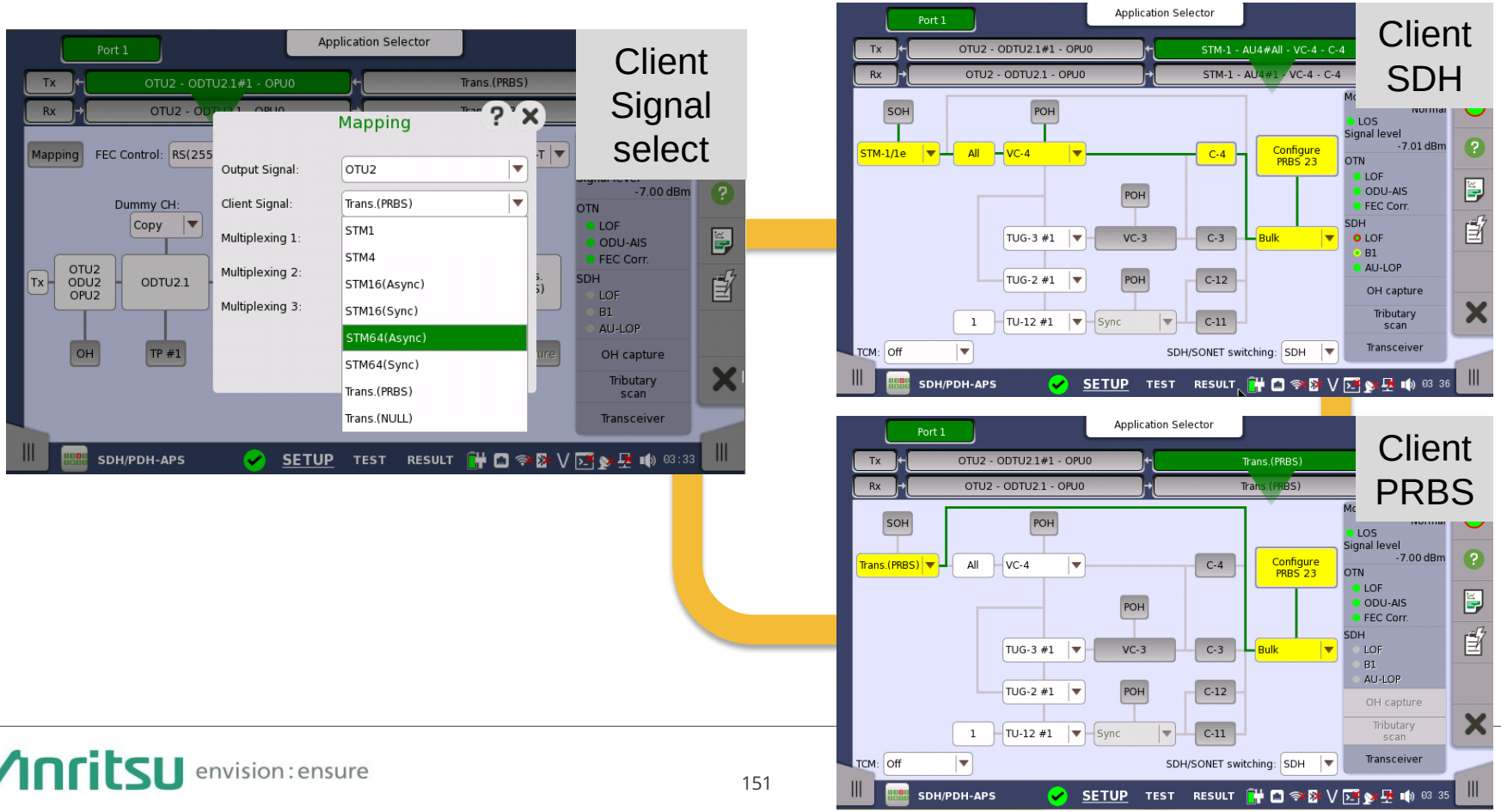




MT1000A Product Highlights

Back to Index page

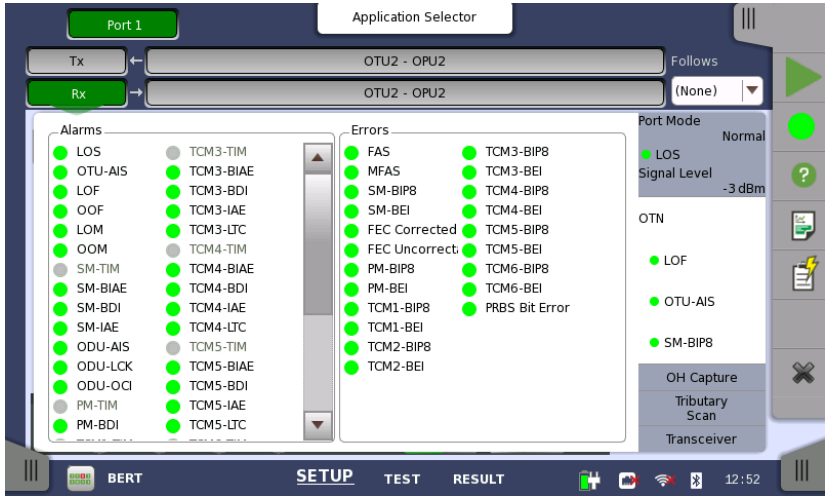
- SDH/SONET in OTN
  - Upgraded Client signal selection method used for ATN mappings at SDH-OTN-BERT application, and enabled Client SDH and Client PRBS signal switching without closing applications to improve operation efficiency

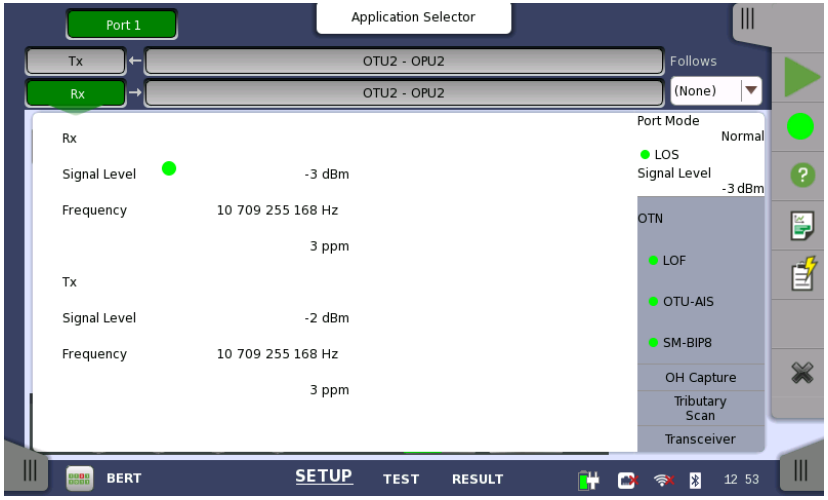


MT1000A Product Highlights

Back to Index page

- 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

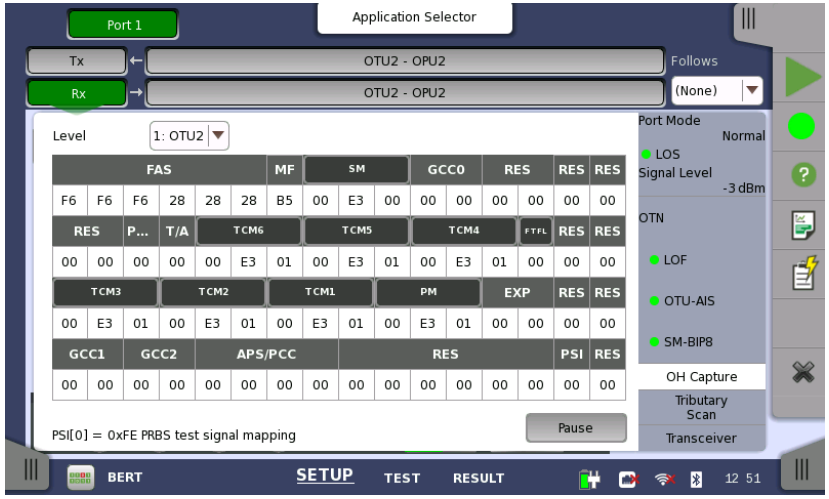




MT1000A Product Highlights

Back to Index page

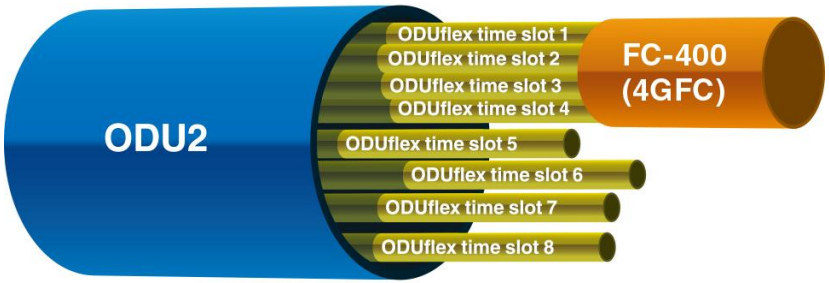
- OTN Over Head (OH) Byte capture
  - Inspect OH bytes for detailed troubleshooting
    - Updates about every 1 second



MT1000A Product Highlights

Back to Index page

- 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

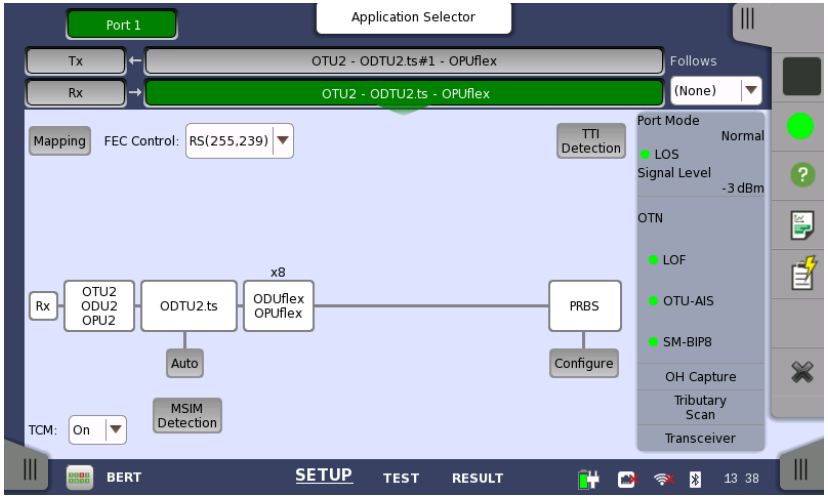


    - In above example, FC-400 (4GFC) Fibre Channel signal occupies four ODUflex time slots, freeing other four ODUflex time slots in ODU2 for other payloads
    - MT1000A supports ODUflex testing, allowing operators deploying new technology to verify working correctly throughout network

MT1000A Product Highlights

Back to Index page

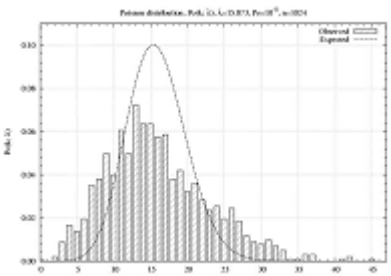
- ODUflex
  - Configuration and results



MT1000A OTN FEC Test

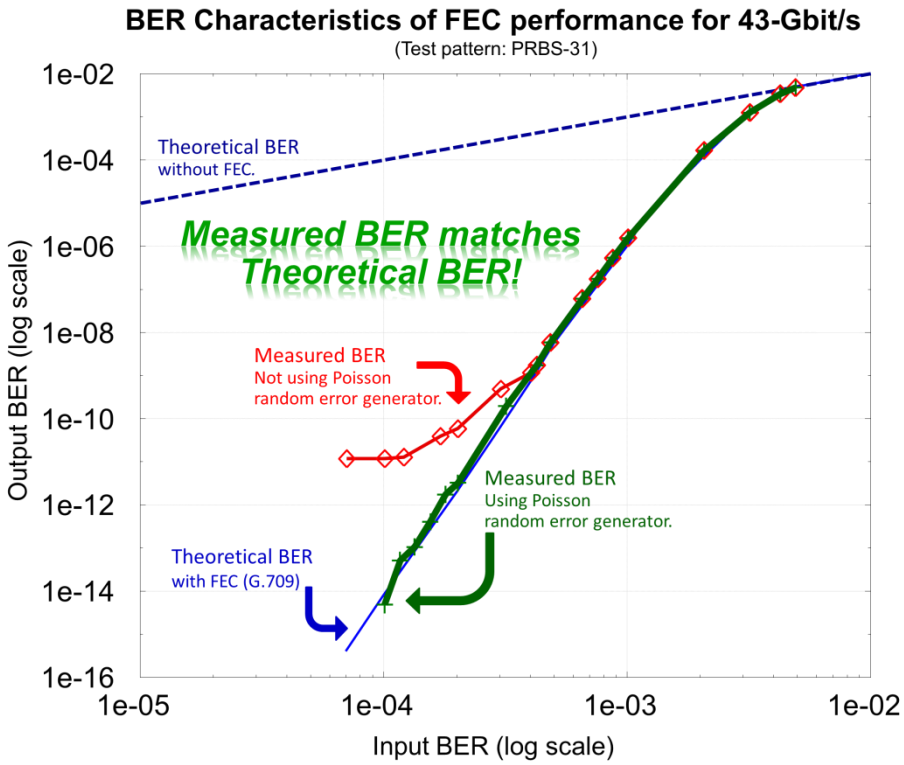
Back to Index page

- ITU-T O.182 Compliant FEC Test
  - Anritsu's proposed FEC performance tests using Poisson distribution random errors adopted by ITU-T O.182 in July 2007
  - Reproducible/accurate FEC error correction tests by generating random signal errors (Poisson distribution)



Bad Random Distribution

Good Random Distribution

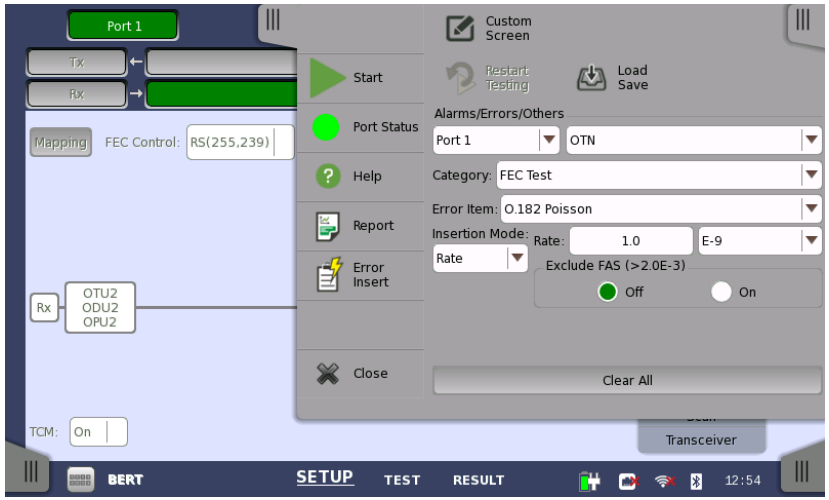


Error Correction Curve

MT1000A OTN FEC Test

Back to Index page

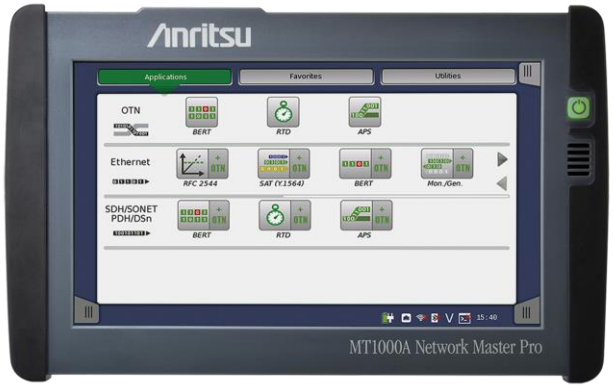
- ITU-T O.182 Compliant FEC Test
  - FEC error insertion with MT1000A



Network Master Pro MT1000A

Back to Index page

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



MT1000A Product Highlights

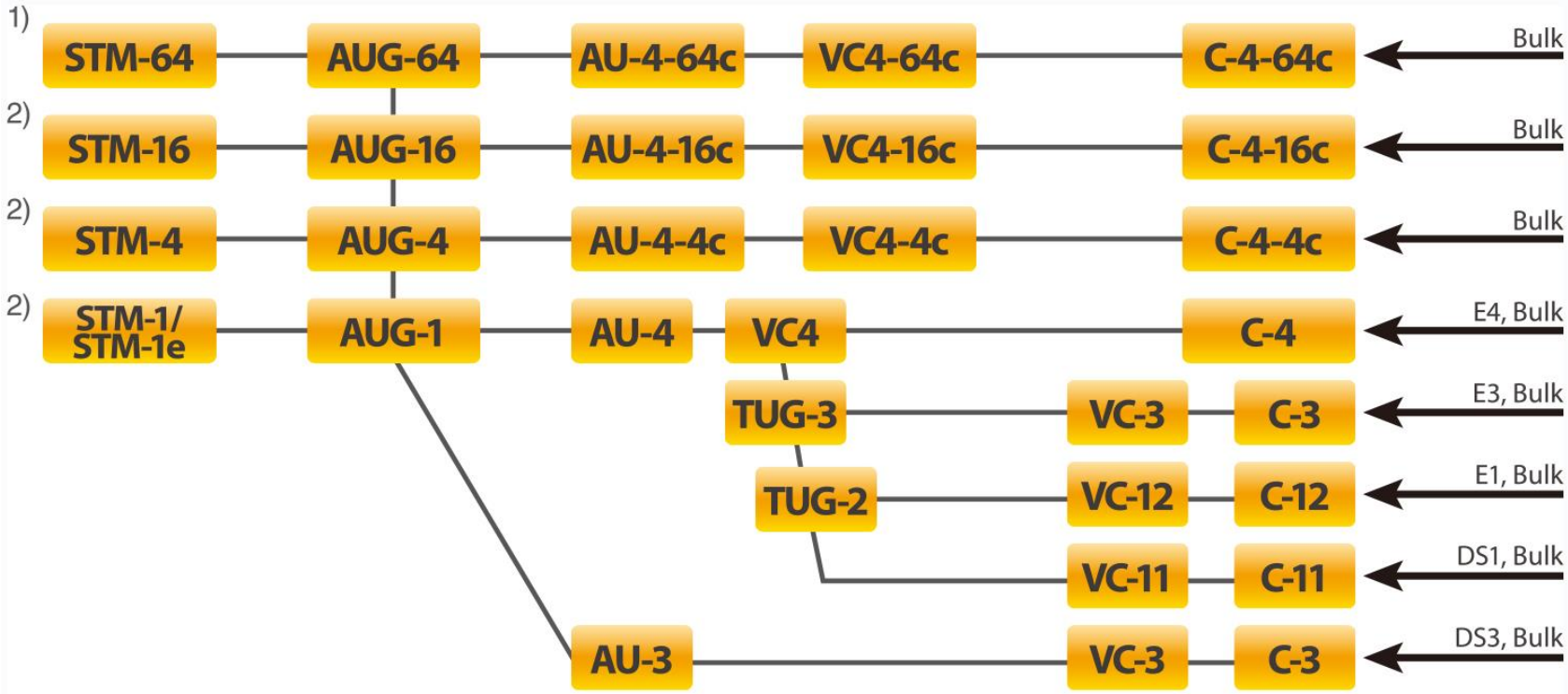
Back to Index page

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

MT1000A Product Highlights

Back to Index page

- SDH mappings

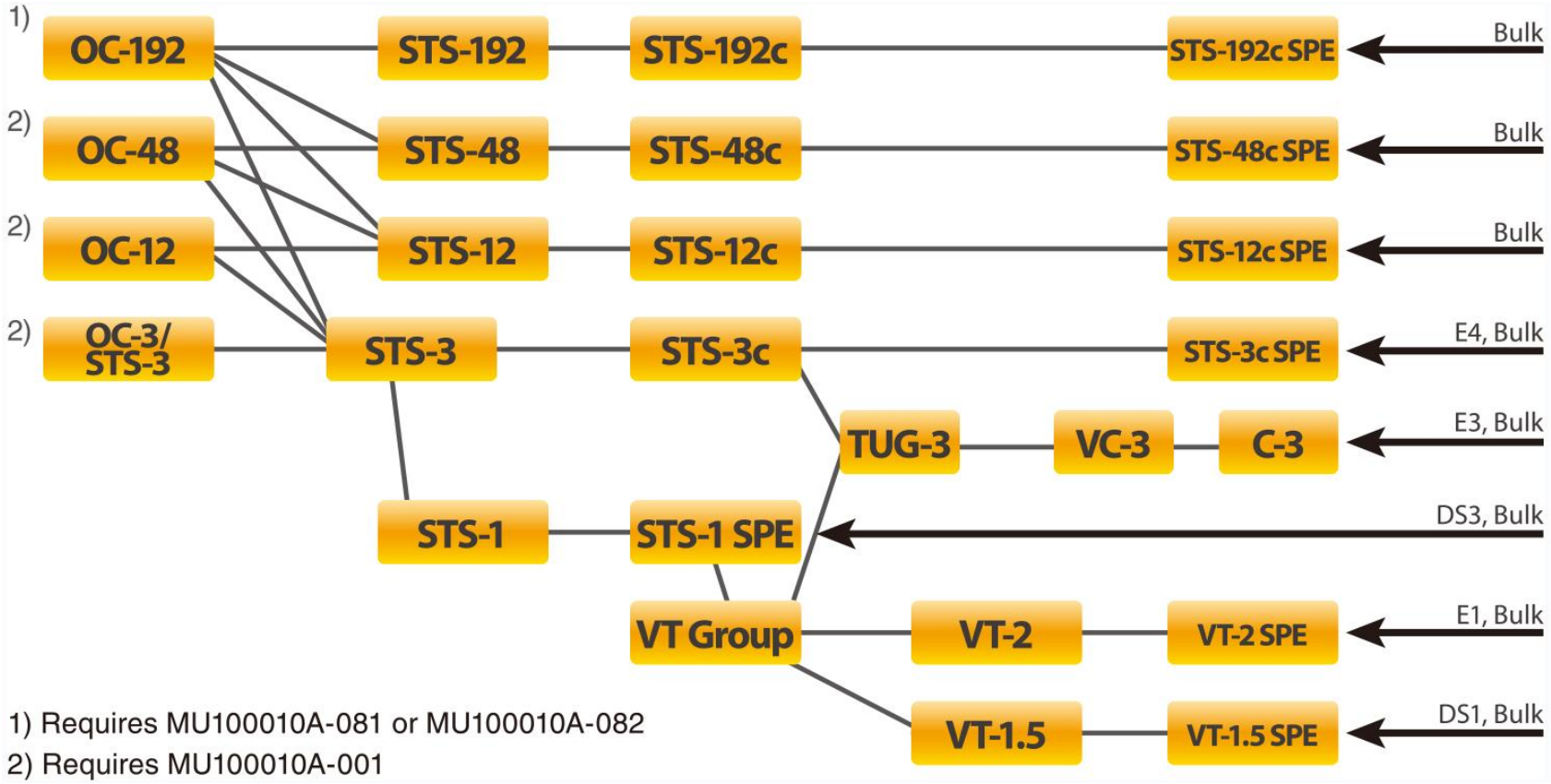


1) Requires MU100010A-081 or MU100010A-082
2) Requires MU100010A-001

MT1000A Product Highlights

Back to Index page

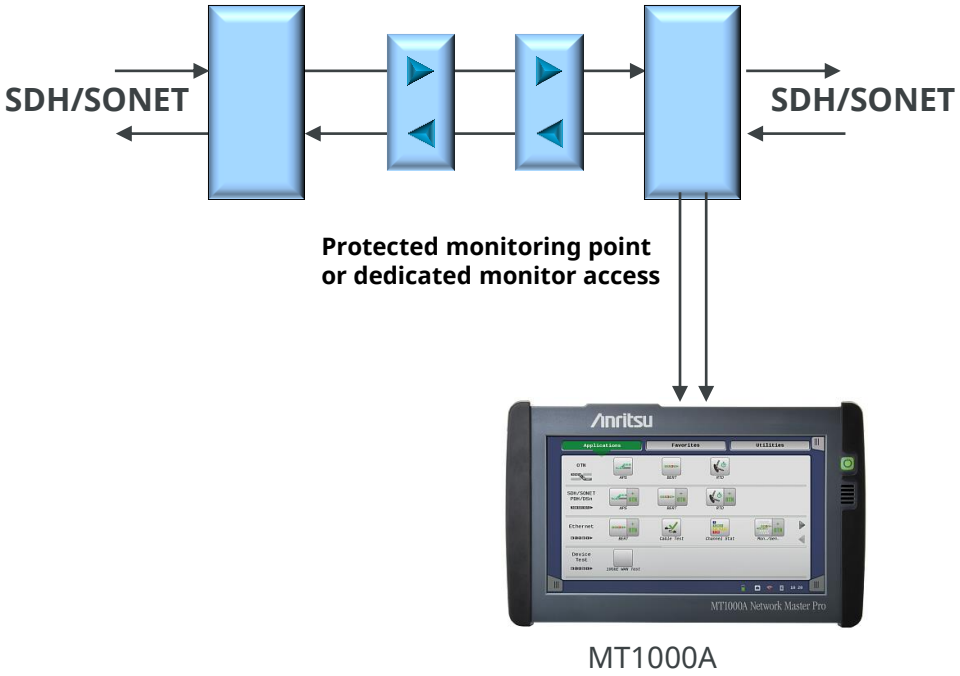
- SONET mappings



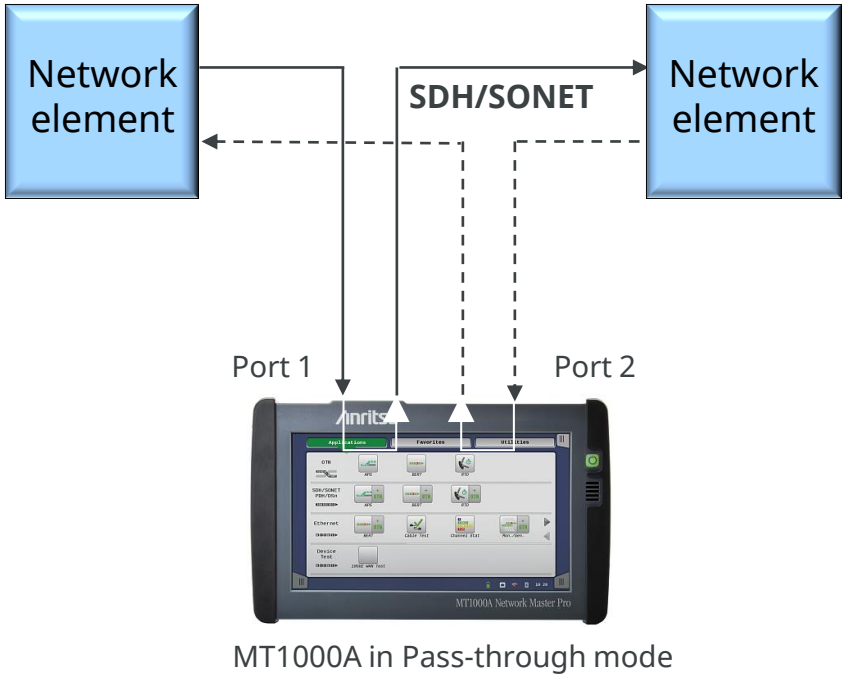
MT1000A SDH/SONET In-Service Measurements

Back to Index page

- 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



MT1000A

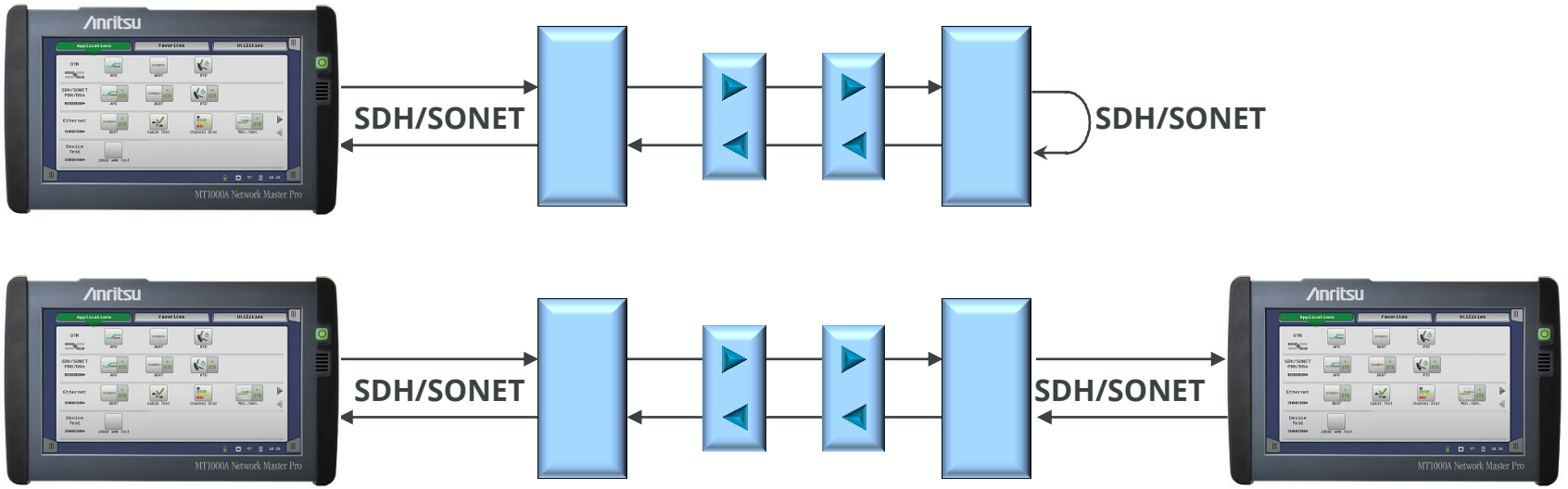


MT1000A in Pass-through mode

MT1000A SDH/SONET Out-of-Service Testing

Back to Index page

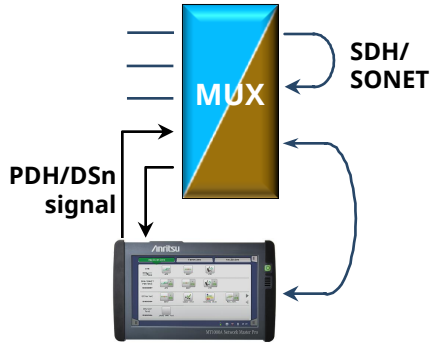
- Installing, commissioning and troubleshooting SDH/SONET lines
- Stressing system by generating alarms, errors, pointer operations, slip and frequency offset
- Testing synchronization circuits
- Generating embedded PDH/DSn signals
- G.826/G.828/G.829/M.2100 error performance
- Propagation time
- Alarm, error, slip and frequency-deviation measurements



MT1000A SDH /SONET Out-of-Service Testing

Back to Index page

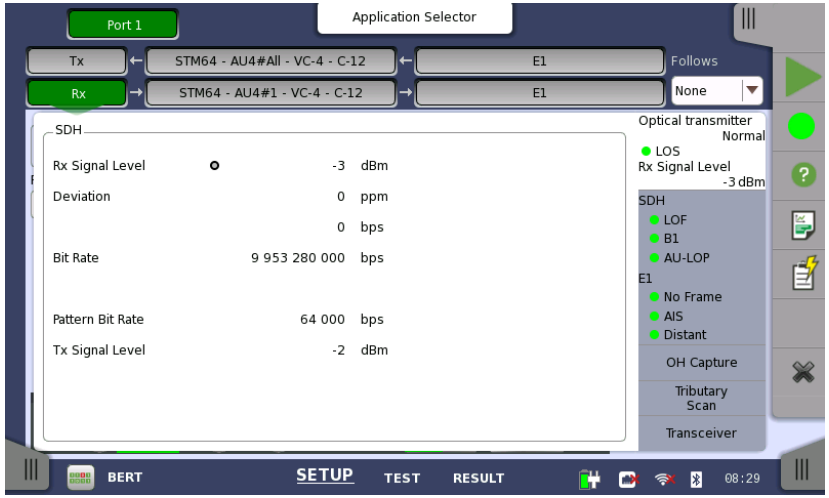
- Installing/commissioning
- G.826/G.828/G.829/M.2100 error-performance measurements
- System stressing by generating alarms, errors, slip and frequency offset
- Testing synchronization circuits
- Alarm, error, drift and frequency-deviation measurements
- Propagation time measurements

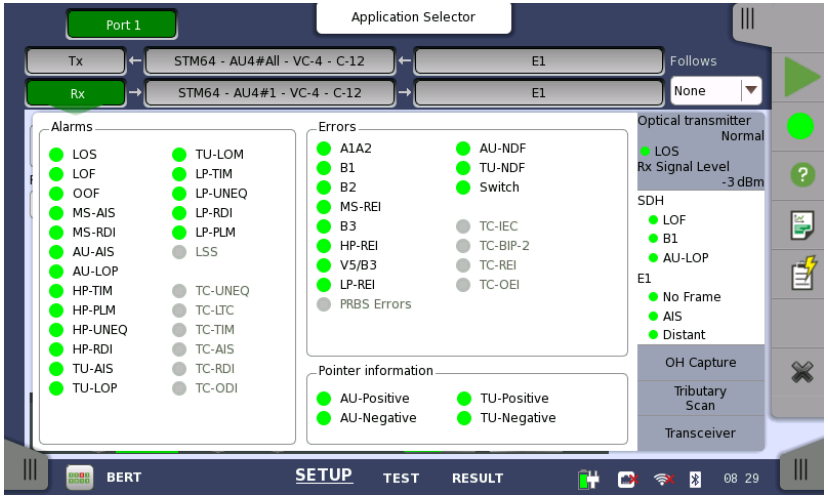


MT1000A SDH/SONET Line Status

Back to Index page

- Physical line information
- Current alarms and errors

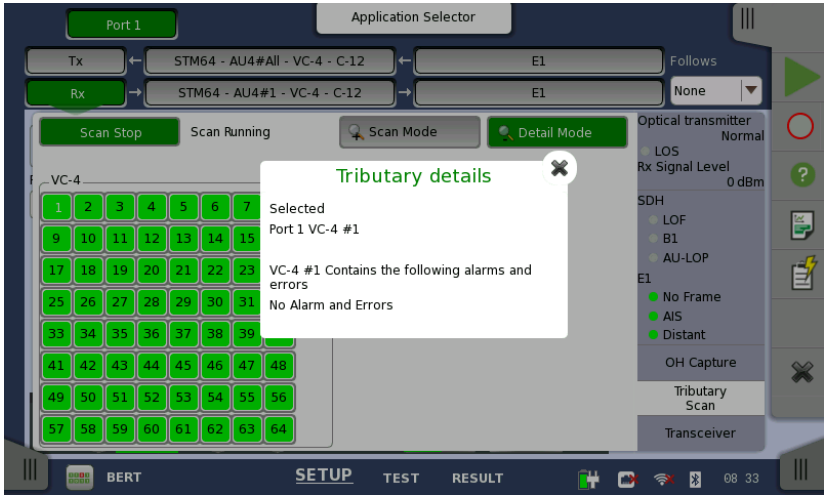




MT1000A SDH/SONET Tributary scan

Back to Index page

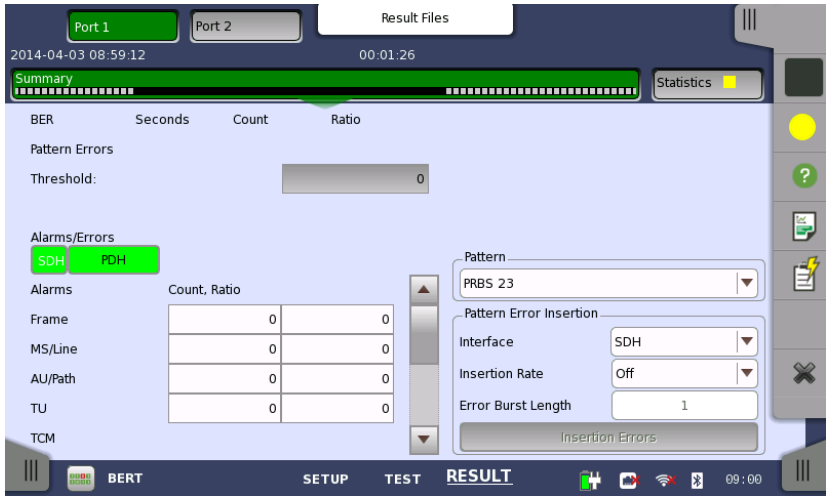
- Quick overview of problems in monitored SDH/SONET signals
- Detailed problem description when required
  - Click tributary for more details

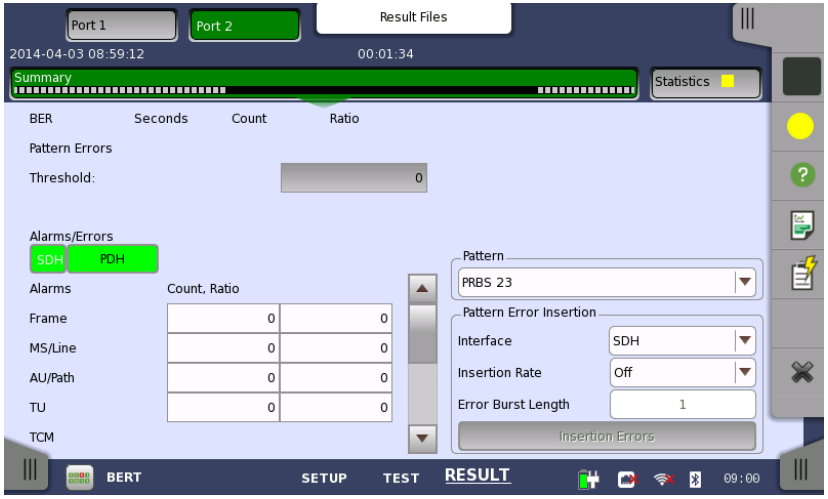


MT1000A SDH/SONET Performance Measurements

Back to Index page

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

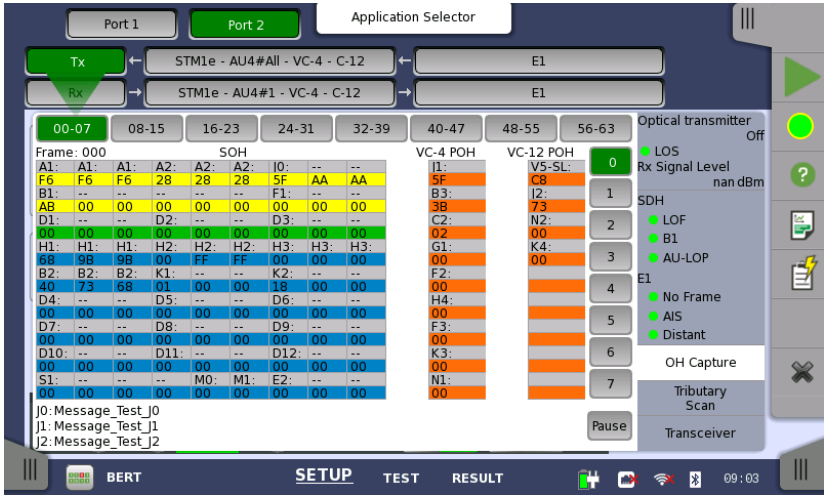


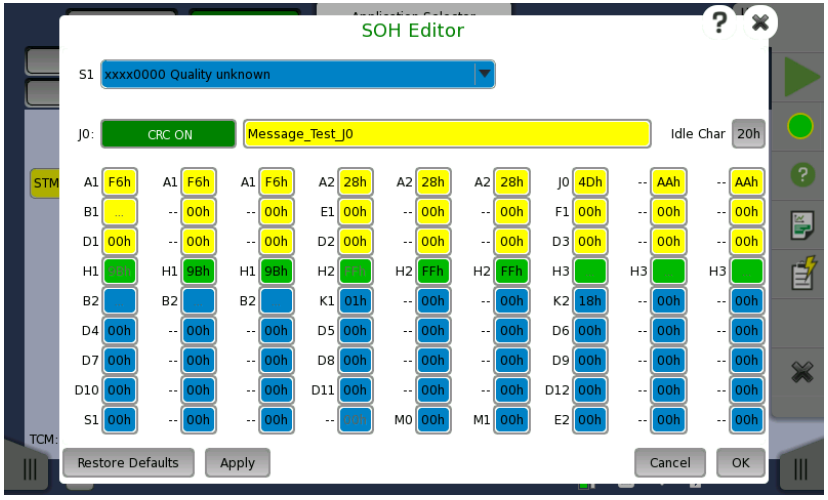


MT1000A SDH/SONET Overhead Byte Analysis

Back to Index page

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

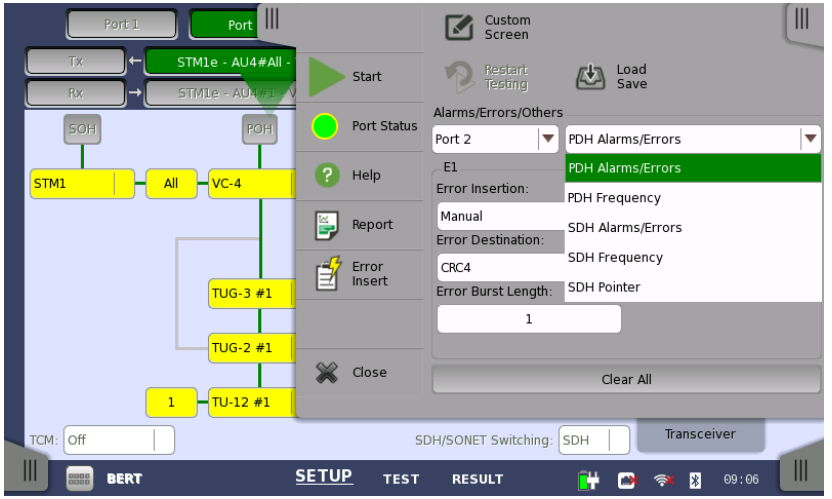




MT1000A SDH/SONET Event Insertion

Back to Index page

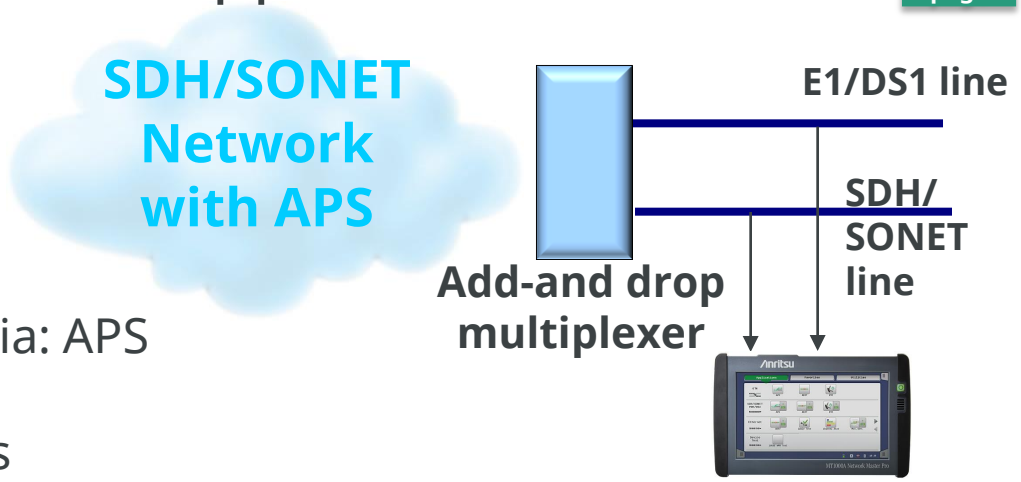
- Stress-test network elements by inserting events in test signal
- Inserted Events:
  - Alarms
  - Errors
  - Frequency deviations
  - Pointer operations



MT1000A SDH/SONET APS Test Application

Back to Index page

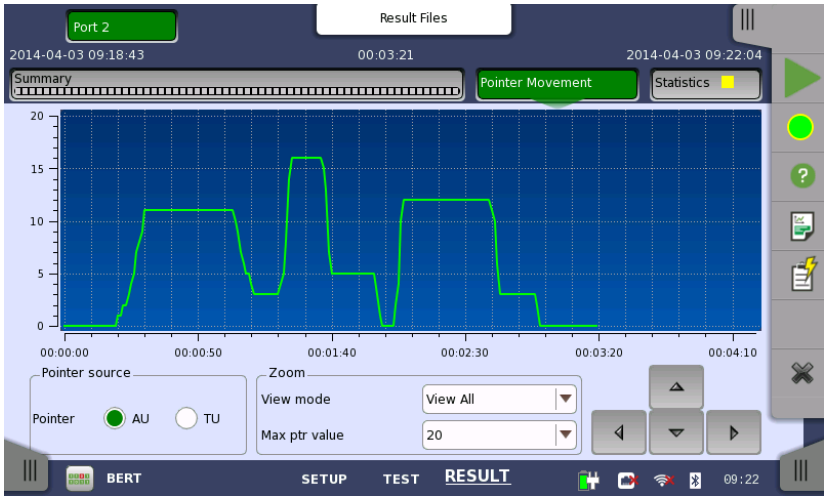
- Max switchover time measurement
  - User-defined max. time
  - User-defined switching criteria: APS measurement triggered by SDH/SONET or E1/DS1 events
  - Average time display
- APS protocol events can be generated and detected
  - No. of switchovers based on APS protocol events count
- Measurement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



MT1000A SDH/SONET Pointer Movement Graph

Back to Index page

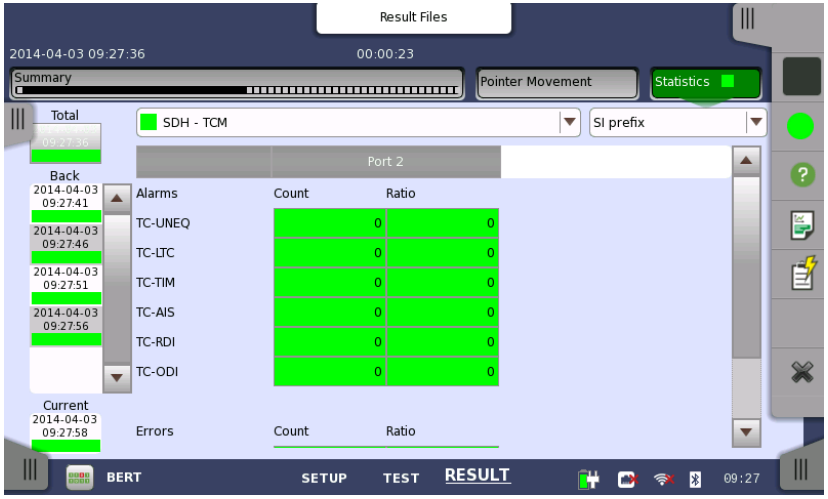
- Graph of pointer movements
  - Good overview of pointer operations
- Information on AU and TU pointer
- Magnify graph points of interest
- Results stored in MT1000A memory



MT1000A SDH/SONET TCM Functions

Back to Index page

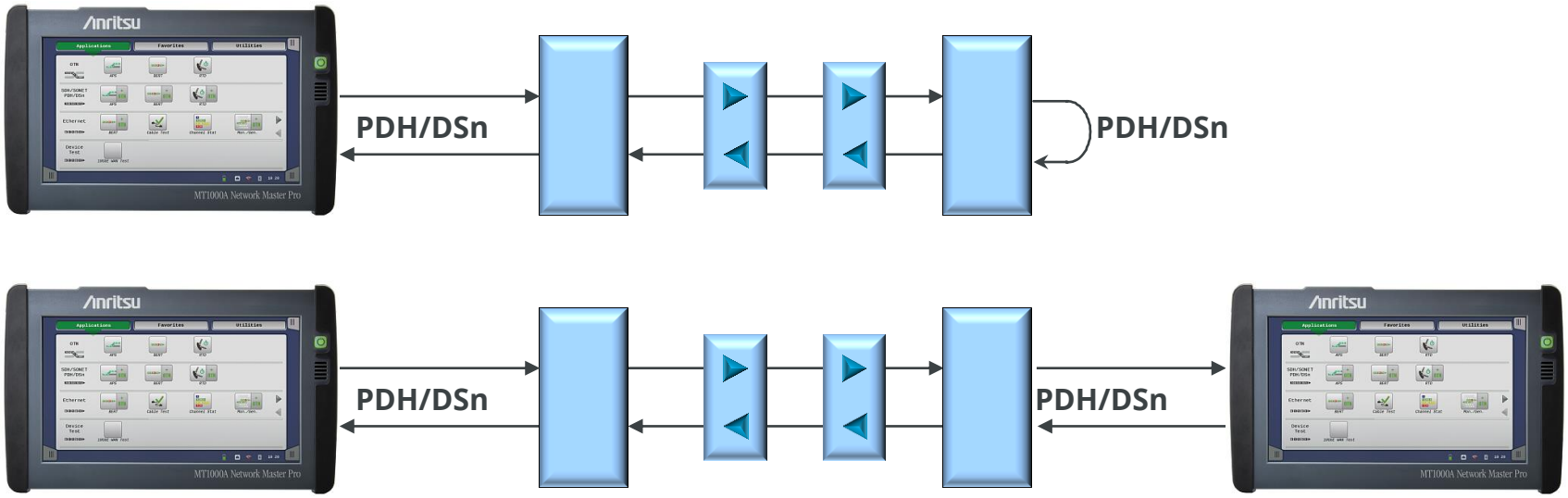
- Analyze TCM (Tandem Connection Monitoring) function in SDH/SONET systems
  - Simultaneous bi-directional monitoring of TCM information on SDH/SONET lines
  - Comprehensive TCM error and alarm statistics
  - Inject TCM events to stress-test network elements



MT1000A PDH/DSn Out-of-Service Testing

Back to Index page

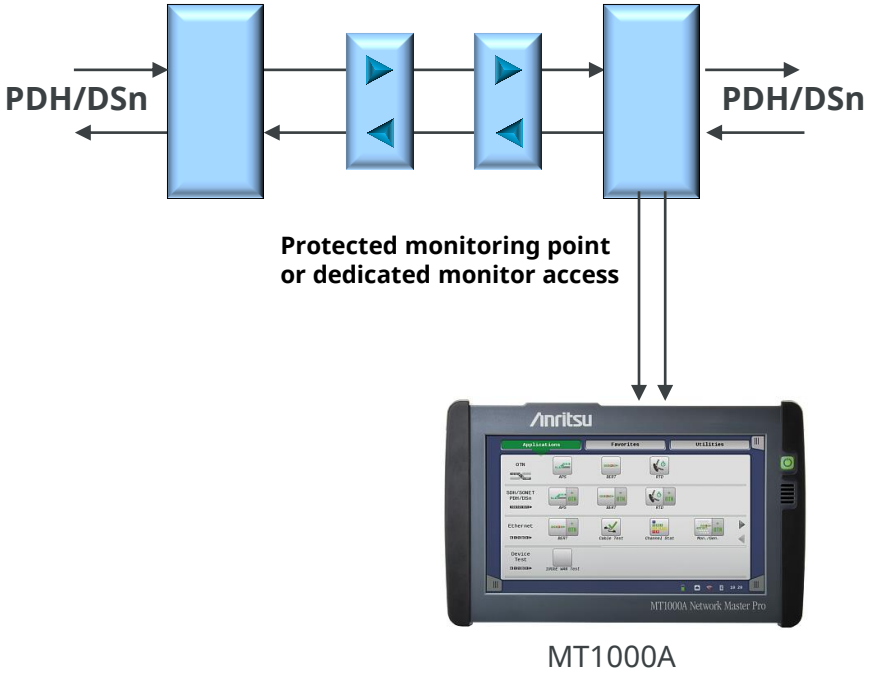
- Installing, commissioning and troubleshooting PDH/DSn lines
- Stress system by generating alarms, errors, slip and frequency offset
- Testing synchronization circuits
- G.821(E1/DS1)/G.826/M.2100 error performance
- Alarm, error, slip and frequency-deviation measurements
- Propagation time with far-end loopback



MT1000A PDH/DSn In-Service Measurements

Back to Index page

- 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

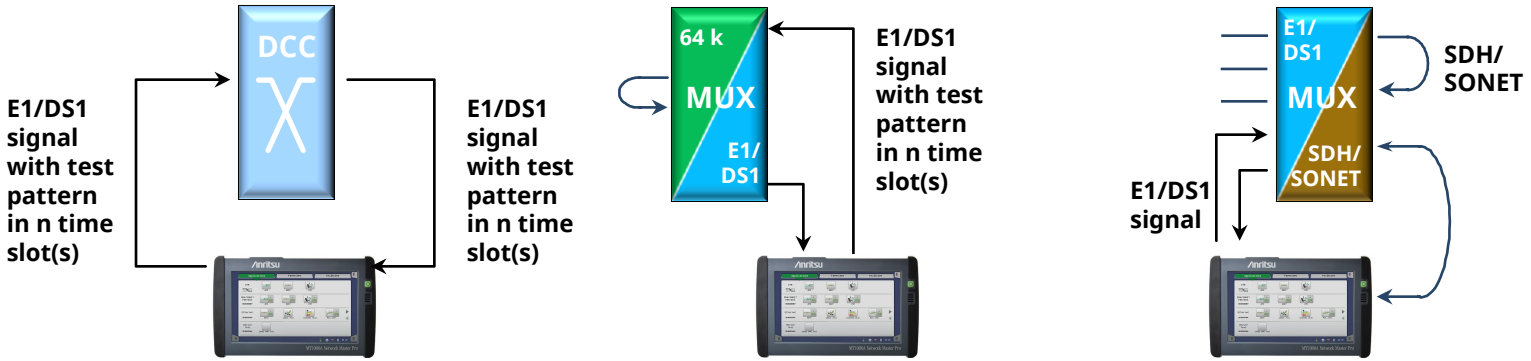


MT1000A

MT1000A E1/DS1 Network-Element Testing

Back to Index page

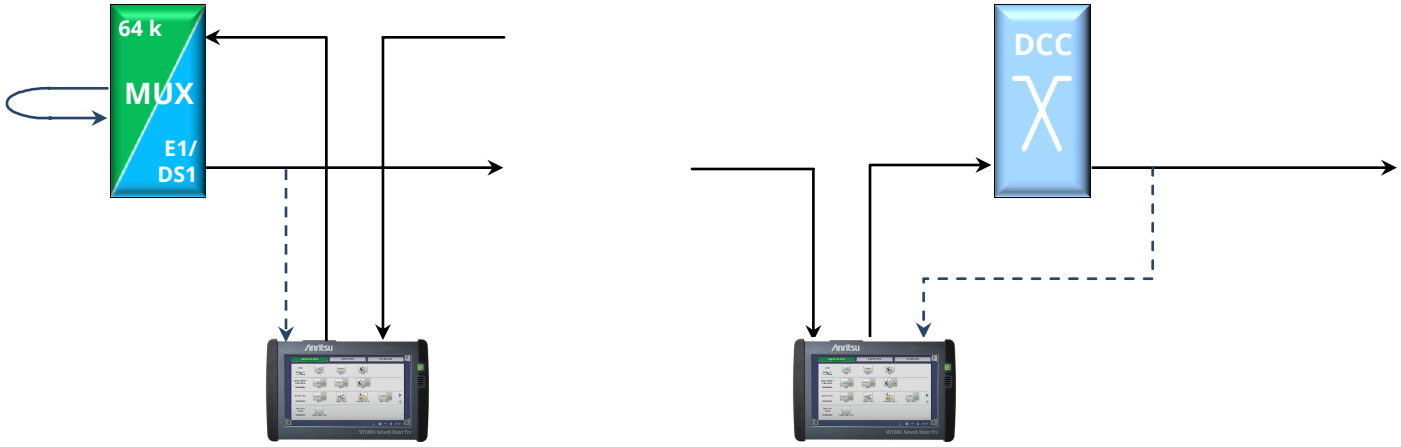
- Installing/commissioning
- G.821, G.826 or M.2100 error-performance measurements
- System stressing by generating alarms, errors, slip and frequency offset
- Testing synchronization circuits
- Alarm, error, slip and frequency-deviation measurements
- Propagation time measurements



MT1000A E1/DS1 Drop-and-Insert Testing

Back to Index page

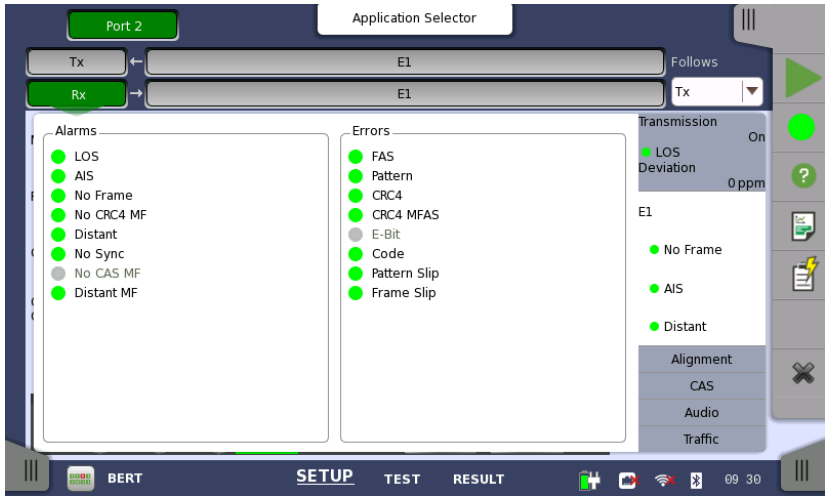
- Pseudo in-service testing on live PCM systems
- Add and drop N*64 kbps signals
- Alarm, error and slip generation and measurement
- Inject errors in live traffic channel
- G.821, G.826 or M.2100 error-performance
- Frequency deviation

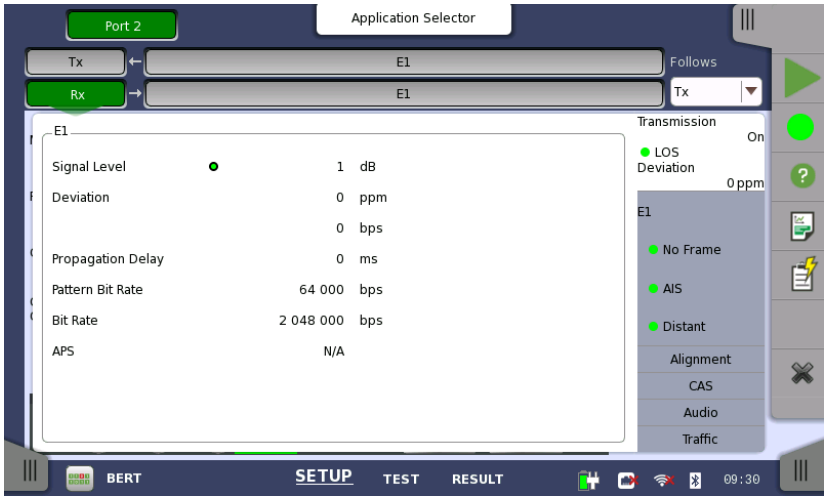


MT1000A PDH/DSn Line Status

Back to Index page

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



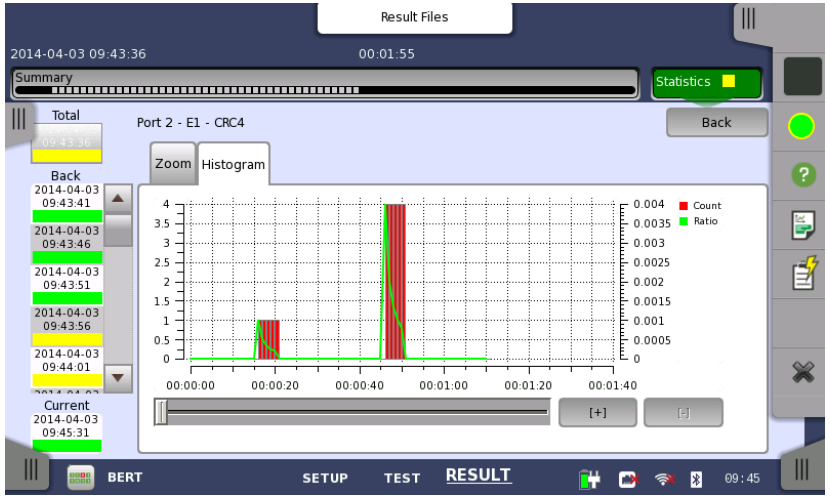


MT1000A PDH/DSn Alarm and Error Statistics

Back to Index page

- Alarm-second counts and ratios
- Error counts and ratios
- M.2100, G.826 or G.821 parameters

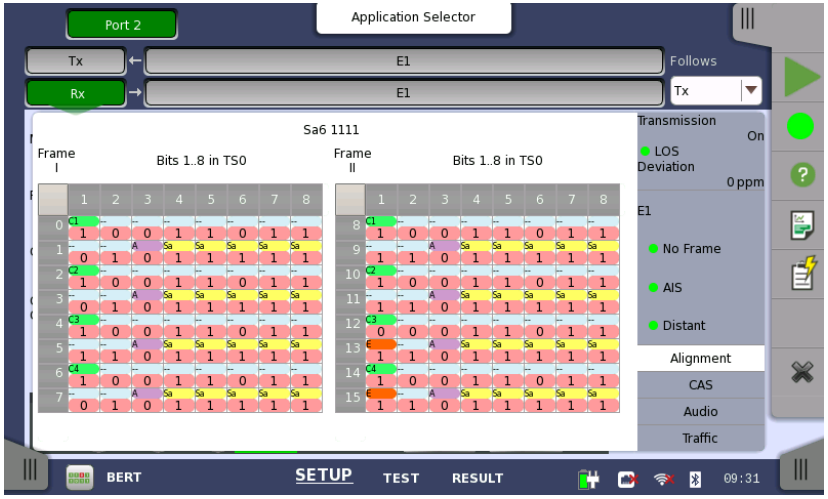
- Histograms show measurement overview
  - Click parameter to activate histogram

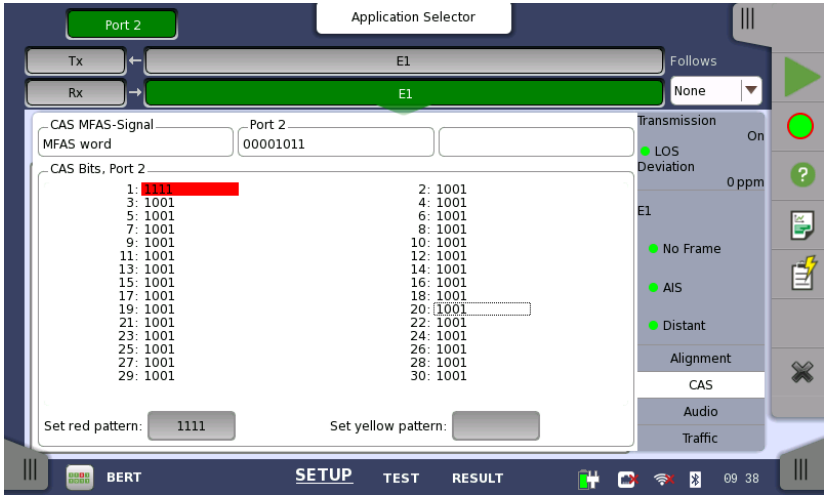


MT1000A E1 Alignment and CAS Displays

Back to Index page

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

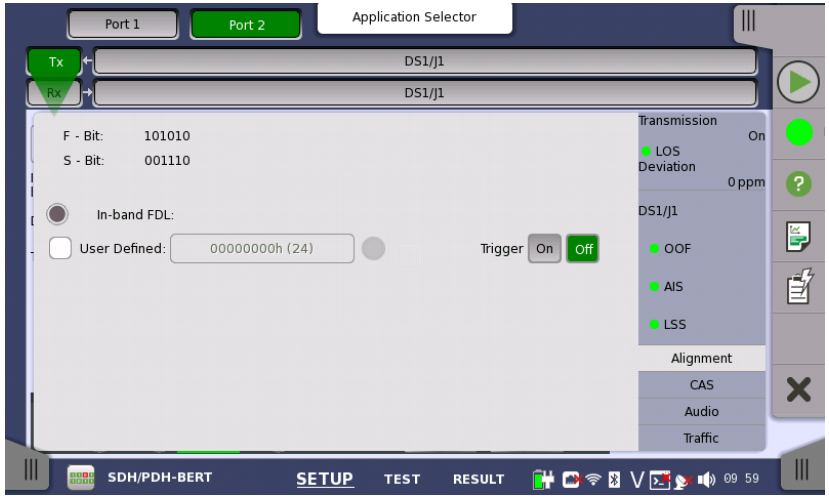


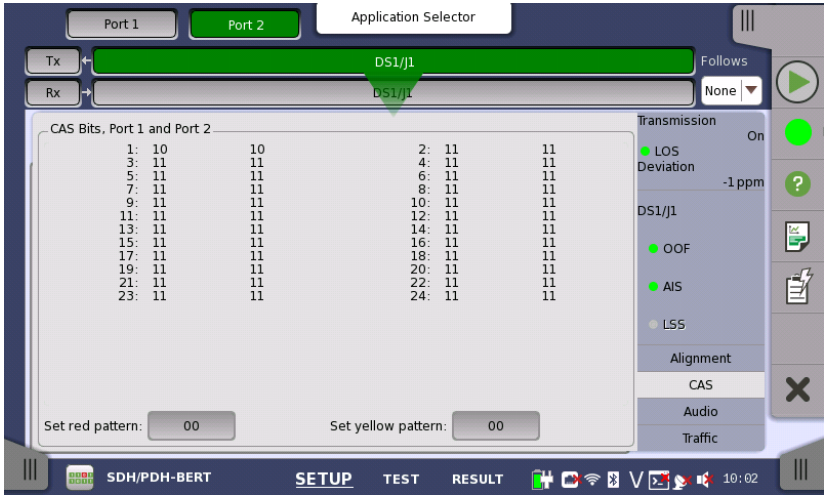


MT1000A DS1 Alignment and CAS Displays

Back to Index page

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

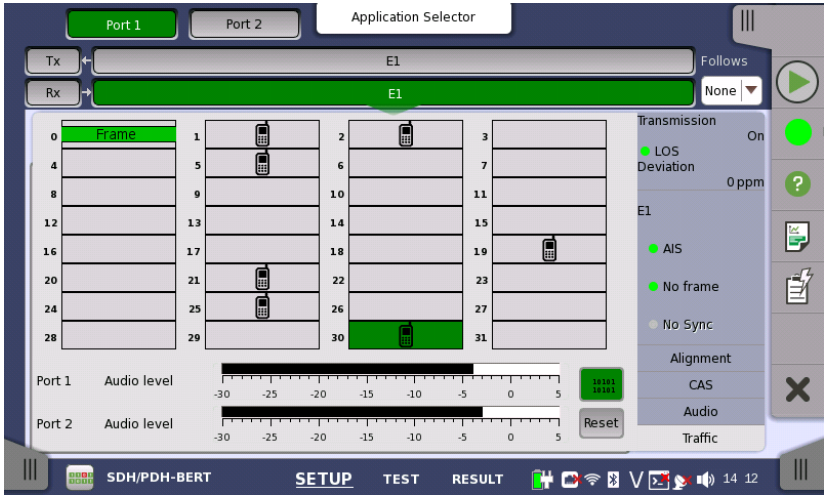


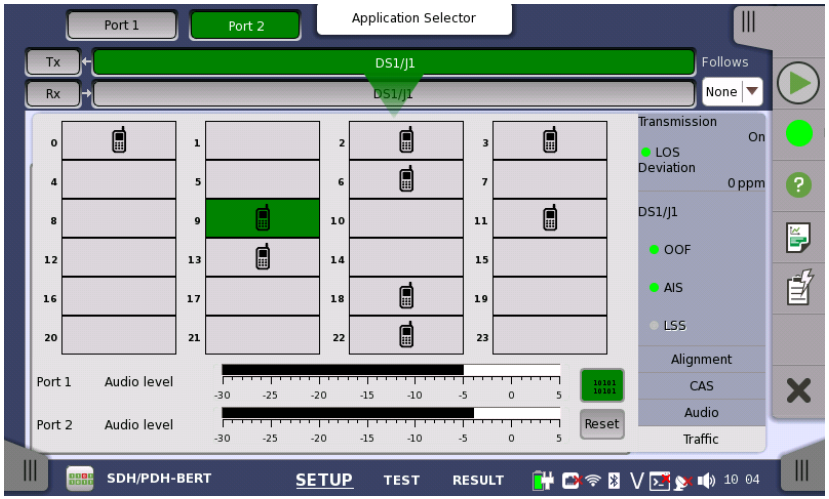


MT1000A E1/DS1 Channel Status Display

Back to Index page

- Fast overview of E1/DS1 line status

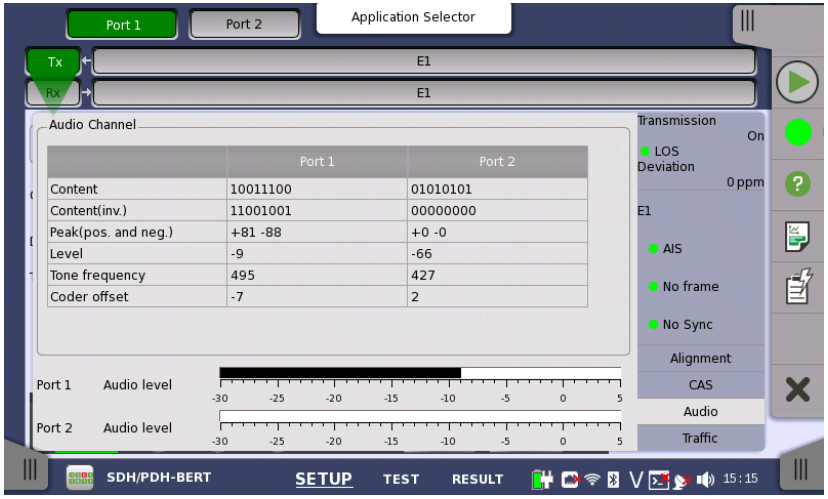




MT1000A E1/DS1 Audio Display

Back to Index page

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

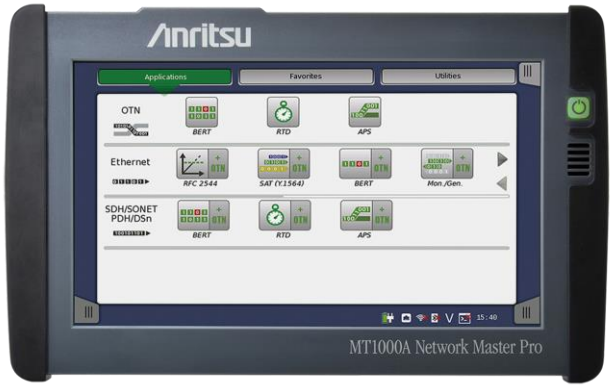


	Port 1	Port 2
Content	10011100	01010101
Content(inv.)	11001001	00000000
Peak(pos. and neg.)	+81 -88	+0 -0
Level	-9	-66
Tone frequency	495	427
Coder offset	-7	2

Network Master Pro MT1000A

Back to Index page

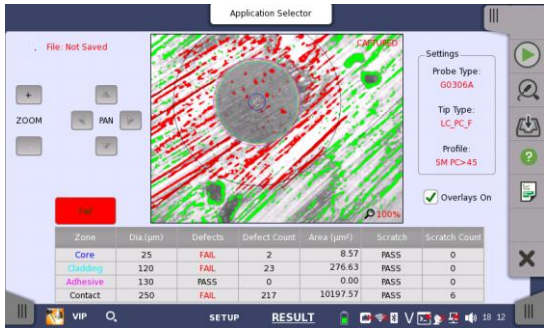
- VIP: Video Inspection Probe



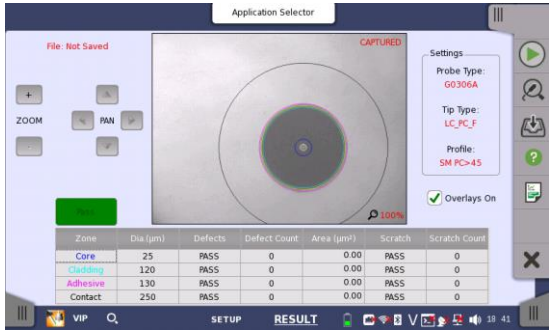
VIP: Video Inspection Probe

Back to Index page

- 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…
  - 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)
- MT1000A supports G0382A/G0306B VIP option
  - Table View identifies endface “defects” or “scratches”
  - Automatic fiber endface pass/fail determination made in accordance with IEC61300-3-35 standard



Clean up



VIP - Ordering items 1/2 -

Back to Index 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

Application 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 (SC APC Female)	H0397A	MU-PC-F (MU PC Female)
H0386A	FC-PC-F (SC PC 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 - Ordering items 2/2 -

Back to Index page

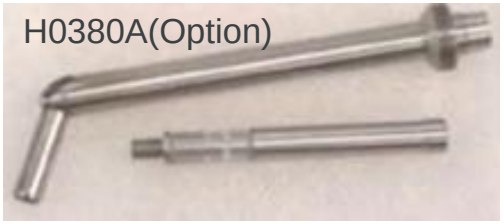
Model No.	
G0306B	400x Video Inspection Probe
- Standard accessories -	Operation manual (Printed) Soft Bug Seven Connector Tips - 1.25mm PC Male, - 2.5mm PC Male, - 2.5mm APC Male - 1.25mm PC Female(LC), - 2.5mm PC Female(FC) - 2.5mm PC Female(SC), - 2.5mm APC Female(SC)

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

G0306B + Standard Accessories

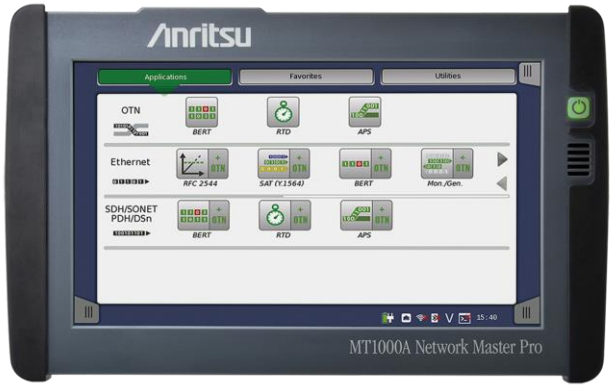
H0380A(Option)



Network Master Pro MT1000A

Back to Index page

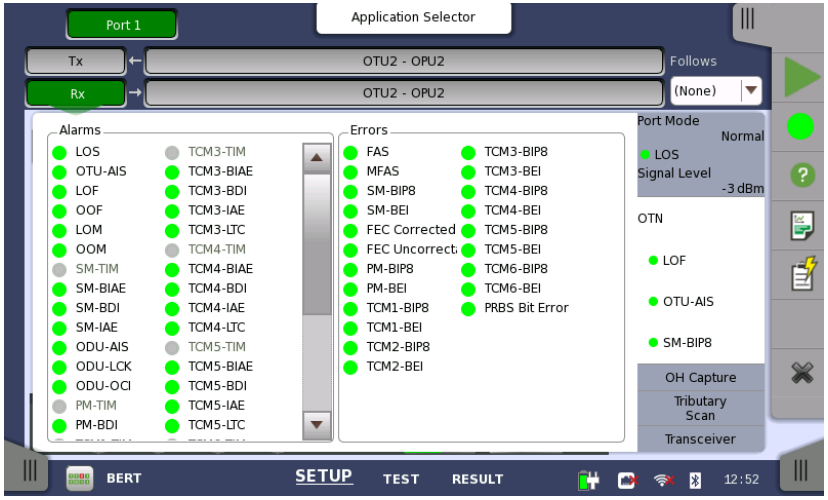
- Operation and Presentation



MT1000A Operation and Presentation

Back to Index page

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

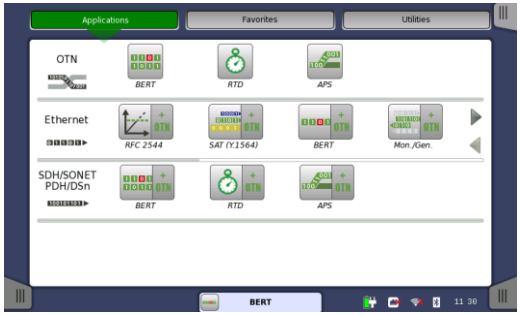


MT1000A GUI

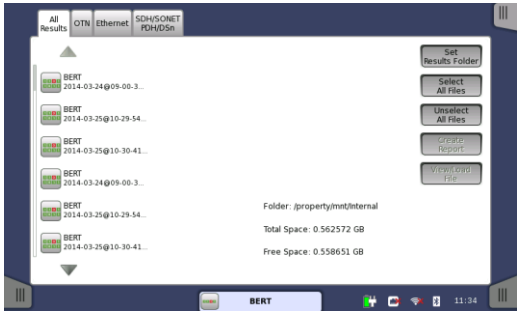
Back to Index page

- Five main groups

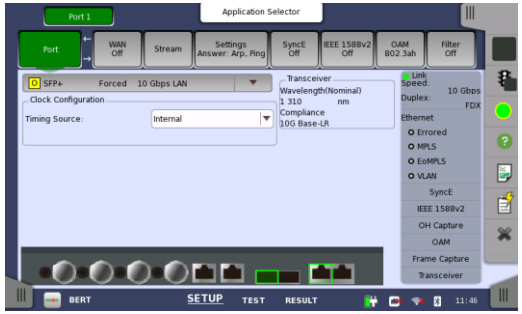
Application Selector



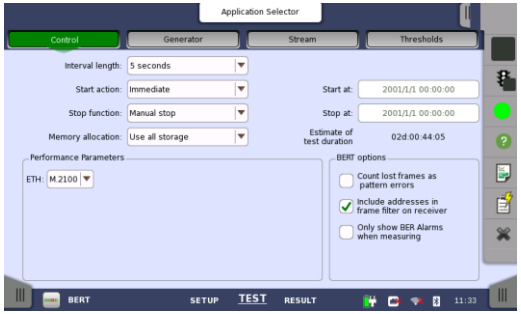
Results Files



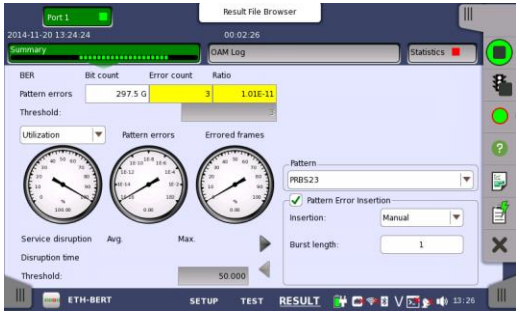
Application work space



Port Setup



Test Setup

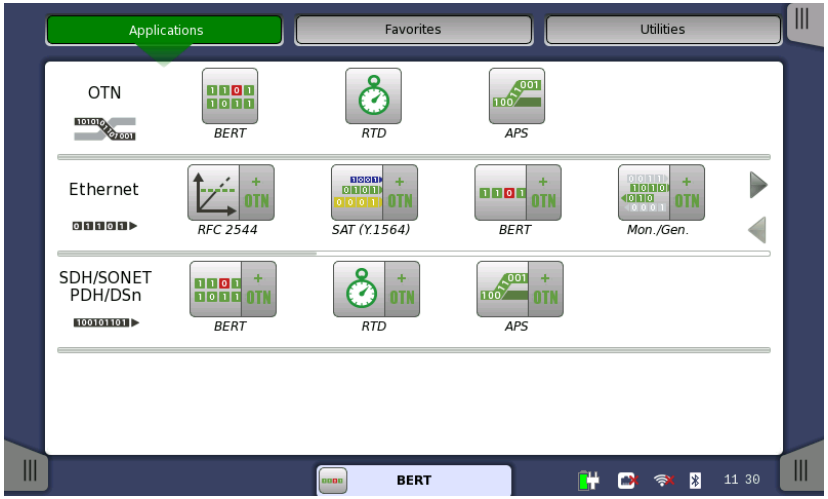


Test Results

MT1000A GUI

Back to Index page

- 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



MT1000A GUI

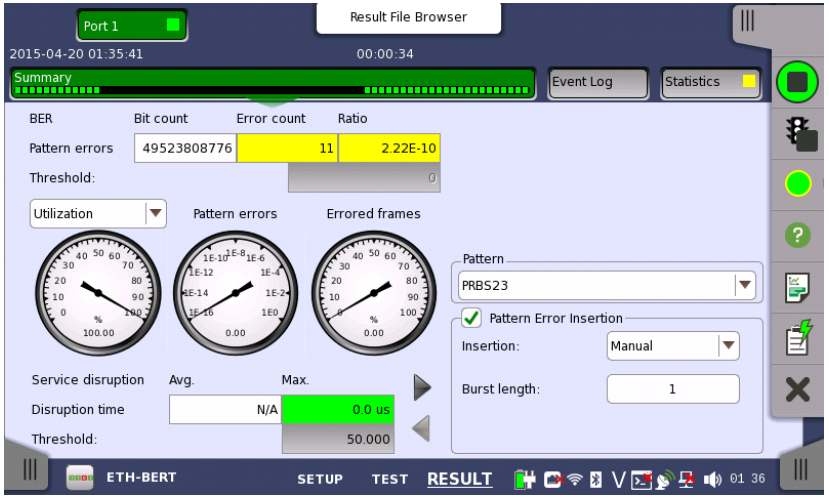
Back to Index page

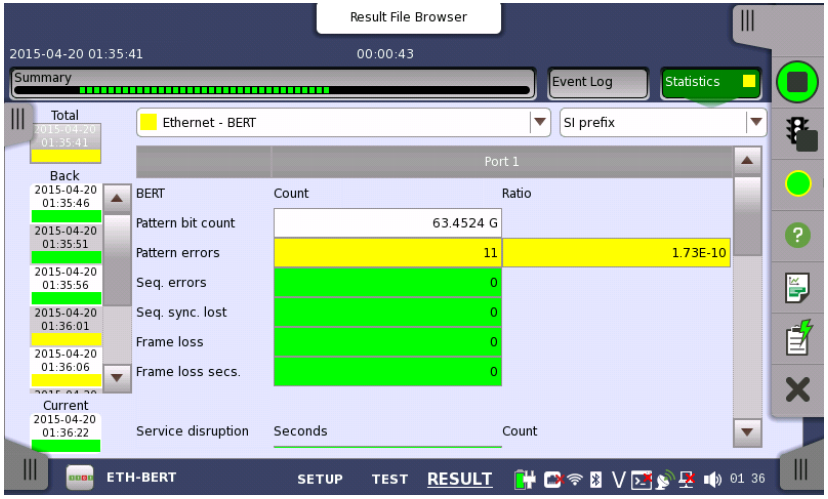
- Select Port display
  - Displayed after selecting application
    - Select one port – or two if available – and press Accept

MT1000A GUI

Back to Index page

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

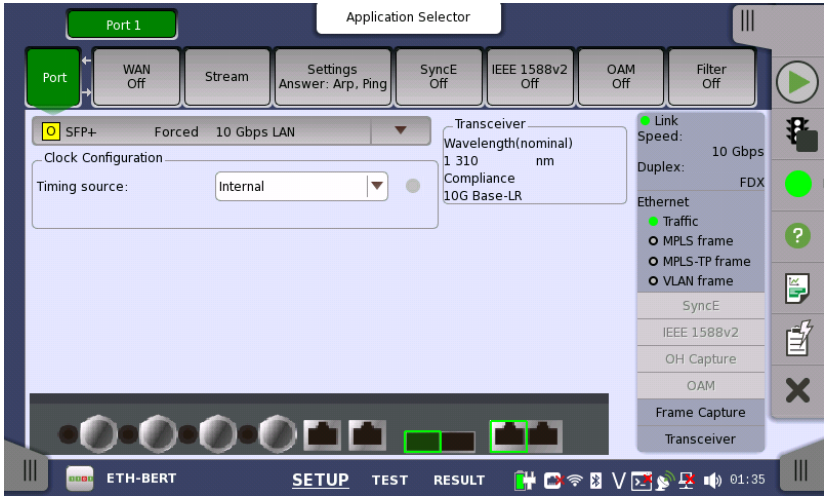


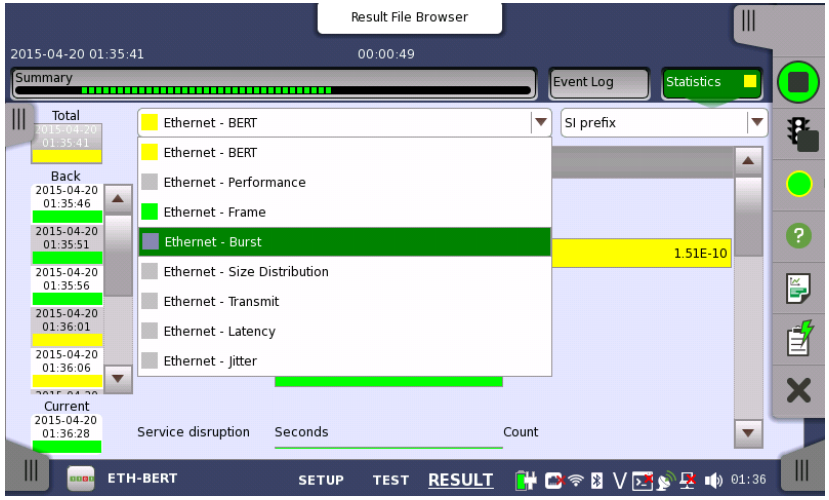


MT1000A GUI

Back to Index page

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

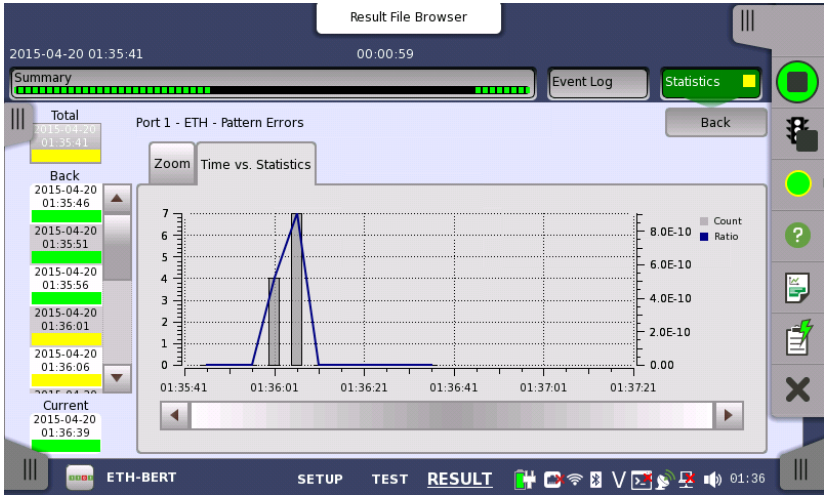


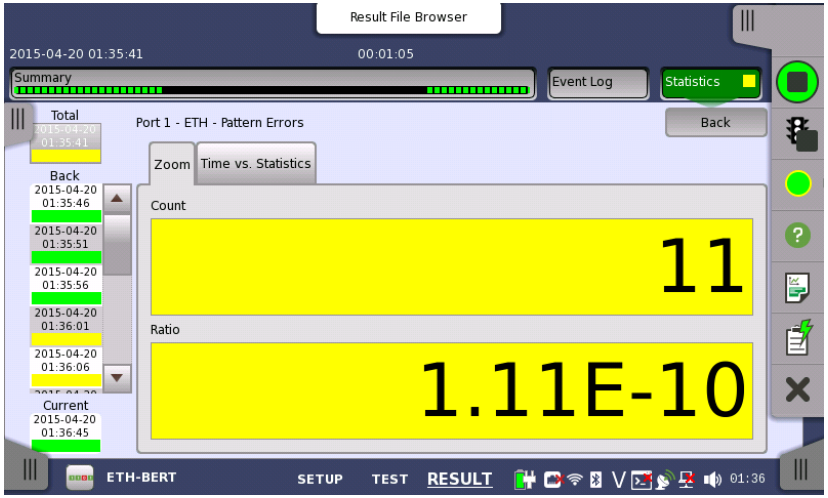


MT1000A Histograms for General Statistics

Back to Index page

- User sees distribution over time for selected parameter easily
  - Click parameter and select histogram
  - Click Zoom: Large numeric makes distance reading easy

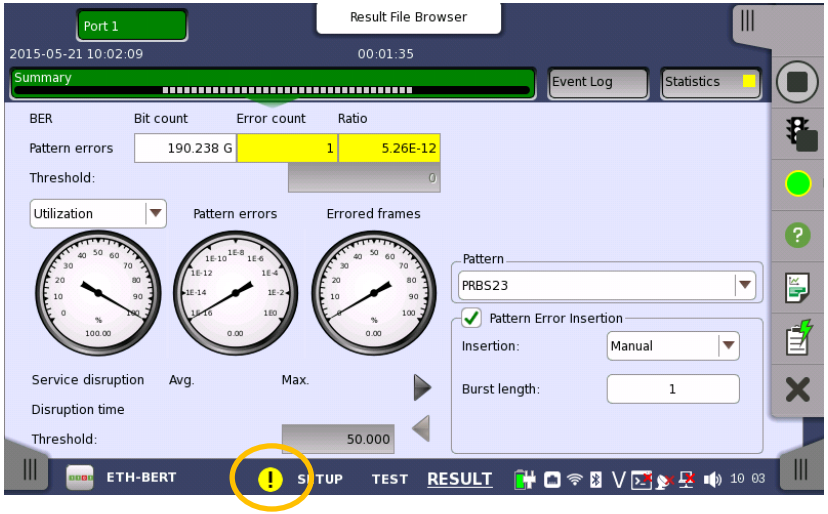




Test Applications Summary

Back to Index page

- Summarizes measurement results for all current Test Applications (applications using port resources) **belonging to one user –** using Remote GUI software up to two users can use MT1000A
- Test Application Summary and Overall Test Status updates only during testing:
  - Green: No trouble
  - Yellow: Errors (but no alarms) pending or occurred in past
  - Red: Threshold violation or Alarms pending or occurred in past



Shows worst Status of all test applications.

All applications OK

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

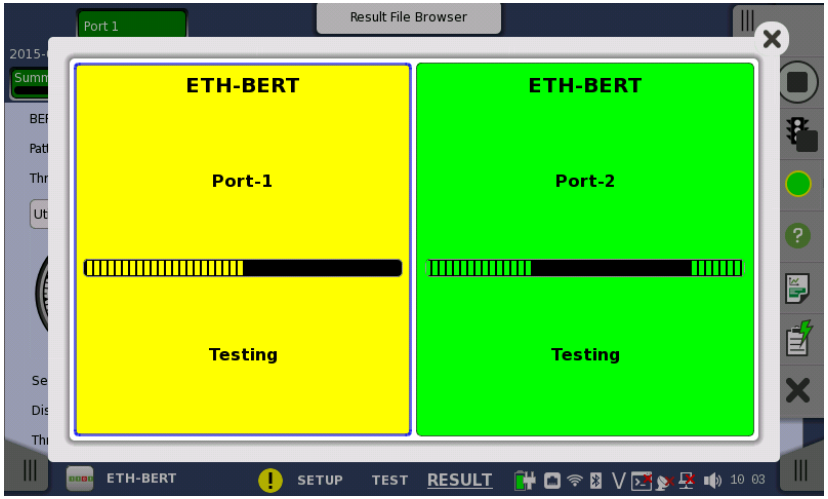
One or more applications have Red Test Status

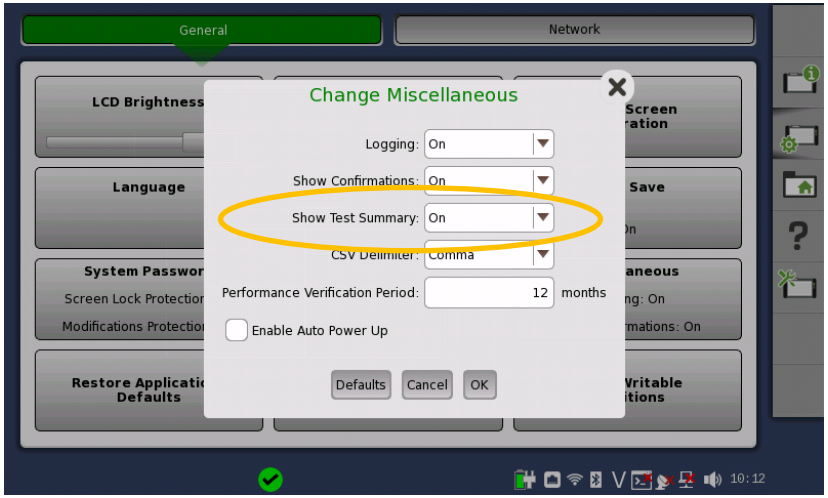
- Clicking Test Applications Summary icon opens Overall Test Status screen

Overall Test Status

Back to Index page

- For remote viewing test status for all current Test Applications
- Test Application Summary and Overall Test Status has no current/history distinction—basically show history.
- To ”clear” Test Status: Restart test.
- User-configurable to show Test Application Summary indicator—and to access Overall Test Status screen



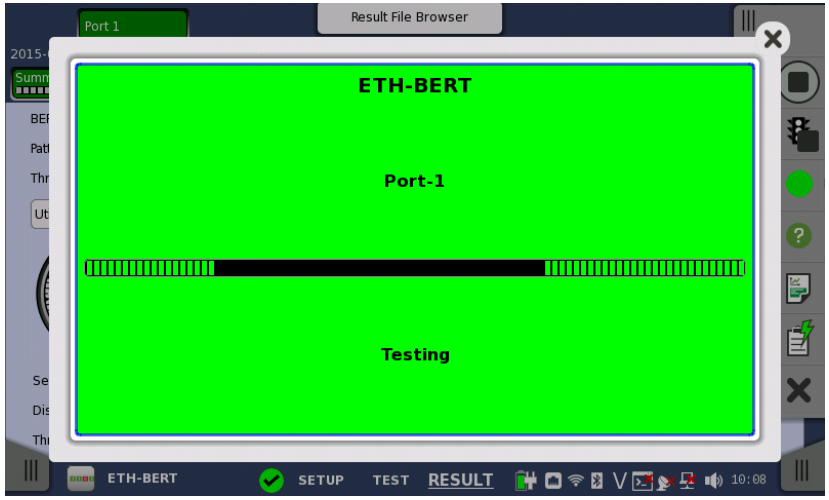


- Overall Test Status updates only during testing:
  - Green: No trouble
  - Yellow: Errors (but no Alarms) pending or occurred in past
  - Red: Threshold violation or Alarms pending or occurred in past

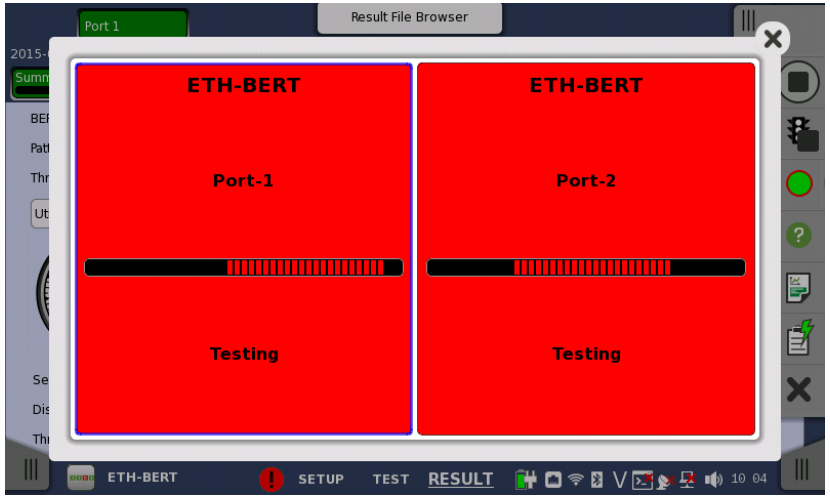
Overall Test Status

Back to Index page

- Adapts to number of running test applications



One test application



Two test applications

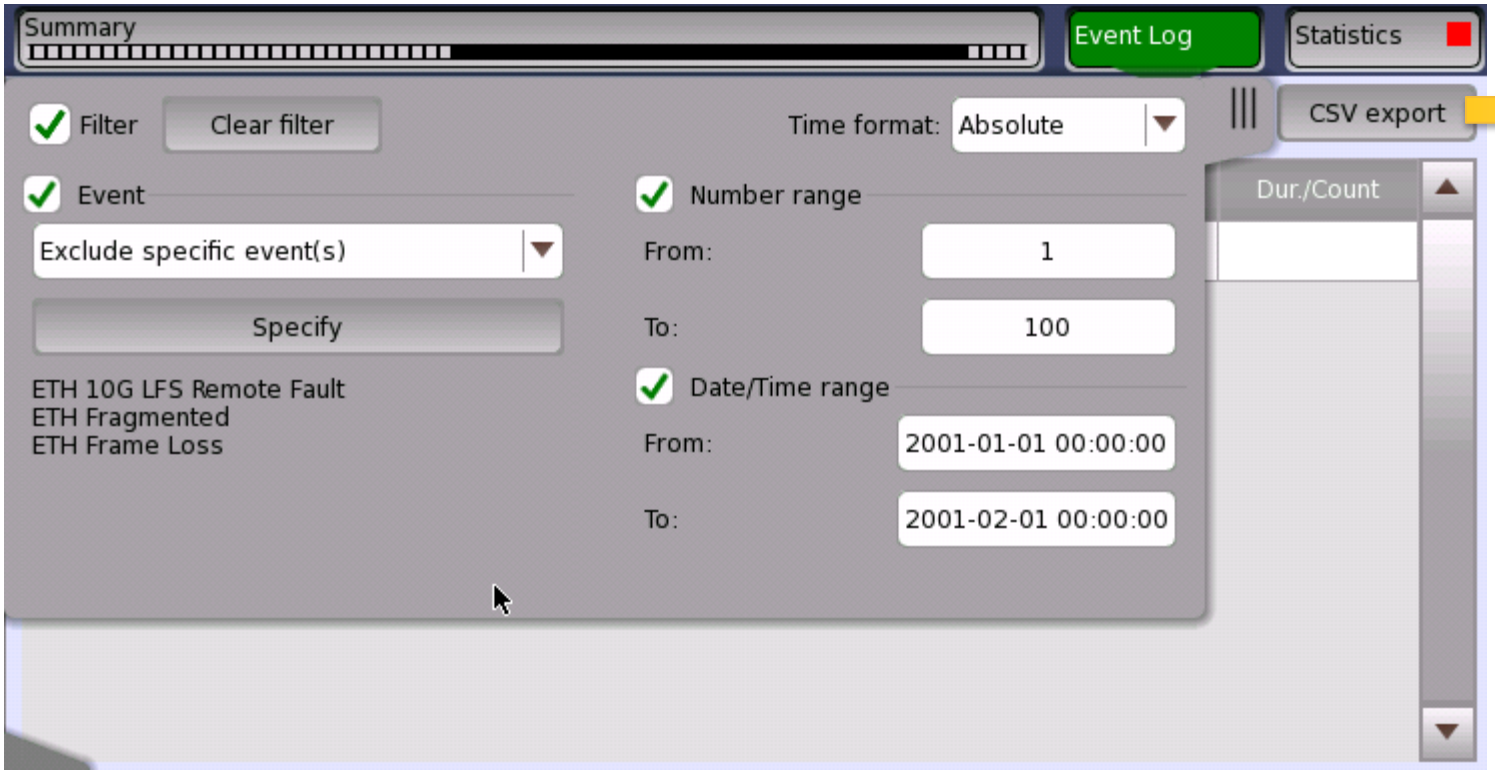
Event Log

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

Event Log

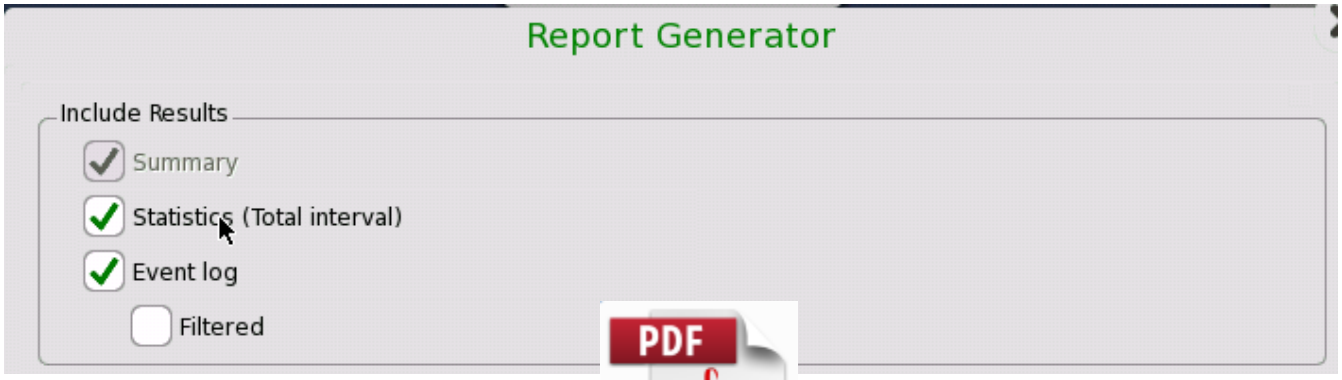
- GUI filter function and CSV export



Event Log

Back to Index page

- Logged events included in report



2015-03-28 07:55:53

Event Log

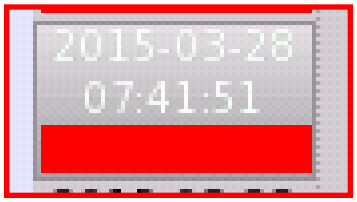
No.	Time	Port	Type	Src.	Description	Dur./Count
1	2015-03-28 07:41:40		Test	Test	Started	
2	2015-03-28 07:41:49	1	Alarm	ETH	10G LFS Remote Fault	00:00:03
3	2015-03-28 07:41:49	1	Error	ETH	Invalid blocks	73.566 k
4	2015-03-28 07:41:50	1	Alarm	ETH	Frame Loss Secs.	00:00:03
5	2015-03-28 07:41:51	1	Error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

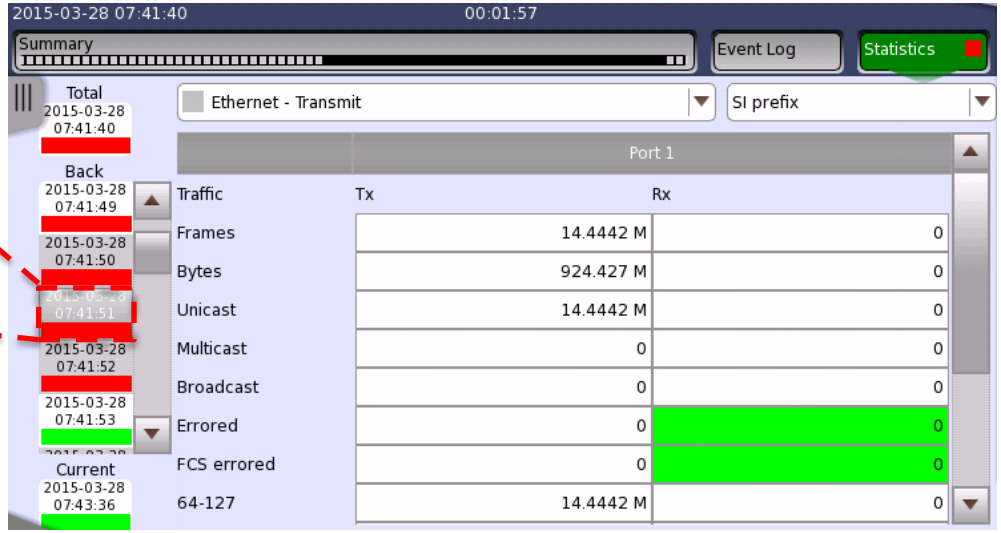
Event Log

Back to Index page

- Time stamp shows relation between event and statistics

No.	Time	Port	Type	Src.	Description	Dur./Count
1	2015-03-28 07:41:40			Test	Started	
2	2015-03-28 07:41:49	1	●	ETH	10G LFS Remote Fault	00:00:03
3	2015-03-28 07:41:49	1	●	ETH	Invalid blocks	73.566 k
4	2015-03-28 07:41:50	1	●	ETH	Frame Loss Secs.	00:00:03
5	2015-03-28 07:41:51	1	●	ETH	Invalid blocks	22
6	2015-03-28 07:41:52	1	●	ETH	Seq. Sync. Lost	00:00:01
7	2015-03-28 07:41:52	1	●	ETH	Pattern Errors	72
8	2015-03-28 07:41:52	1	●	ETH	Invalid blocks	5.763 k
9	2015-03-28 07:41:52	1	●	ETH	Preamble violations	5

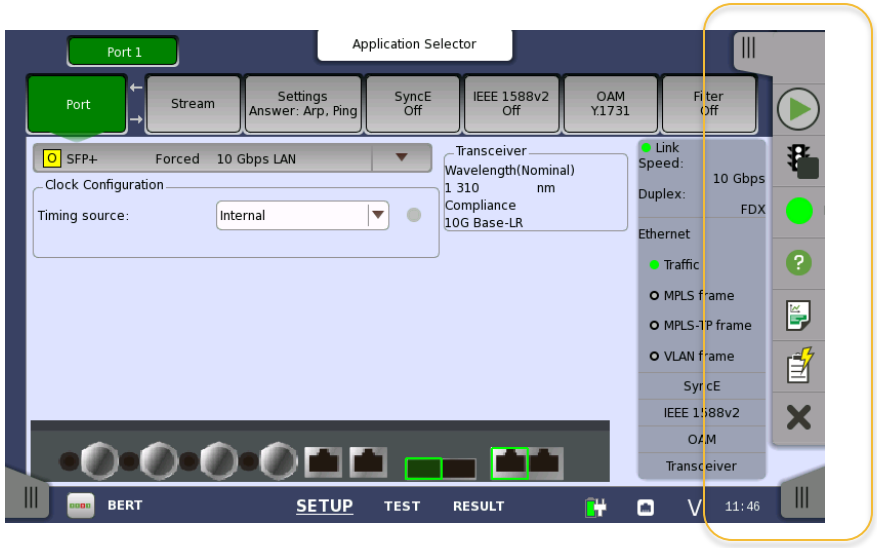




MT1000A GUI

Back to Index page

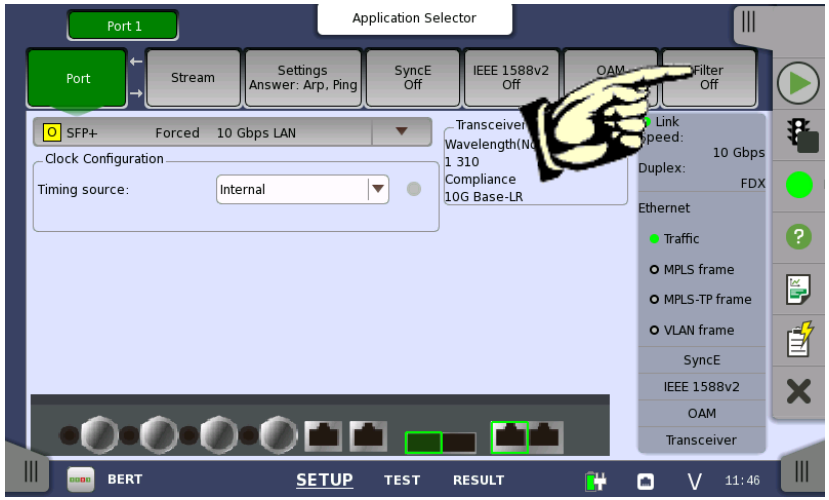
- Control panes
  - Control applications in work space



MT1000A GUI

Back to Index page

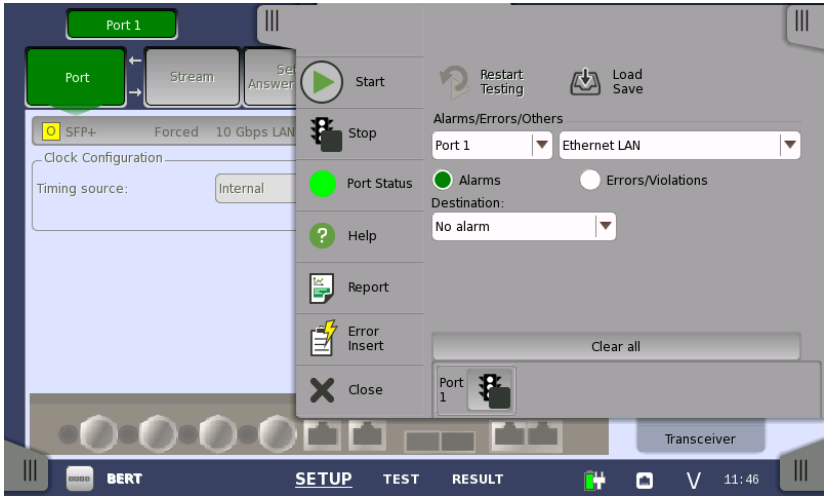
- Control panes
  - Control applications in work space
    - Click to expand



MT1000A GUI

Back to Index page

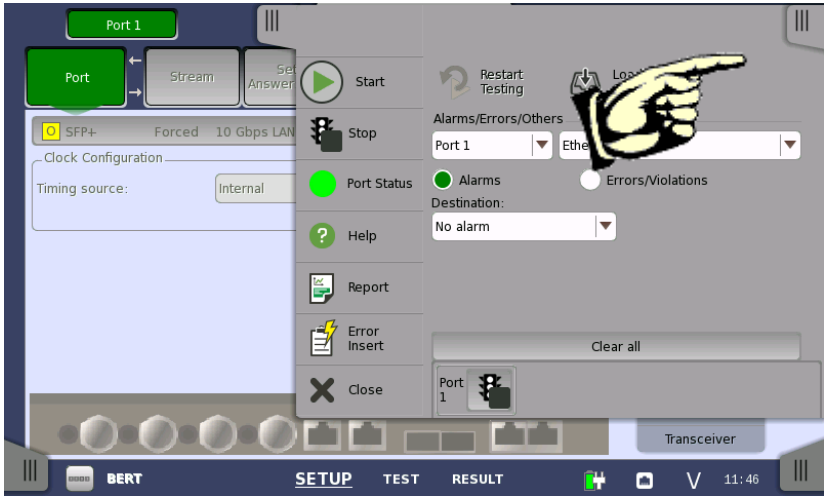
- Control panes
  - Control applications in work space – expanded



MT1000A GUI

Back to Index page

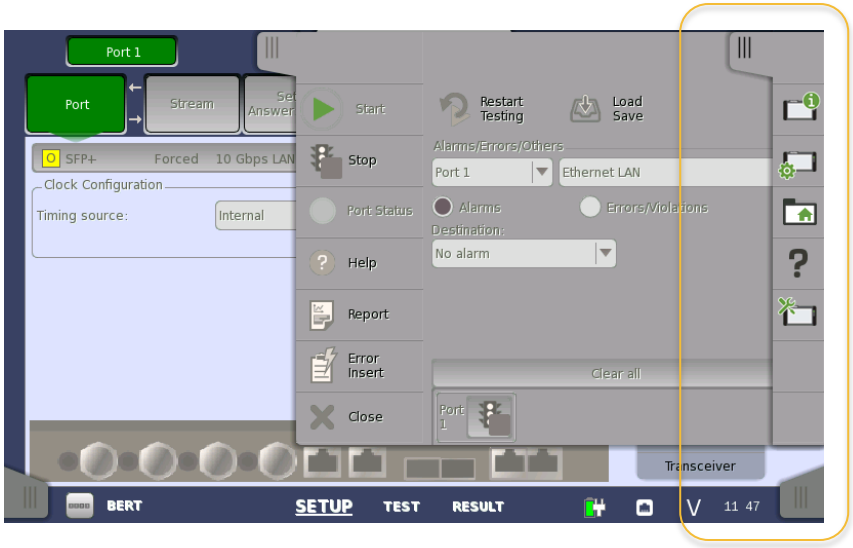
- Control panes
  - Control instrument in application work space – expanded
    - Click to expand instrument control



MT1000A GUI

Back to Index page

- Control panes
  - Control instrument in application work space



MT1000A GUI

Back to Index page

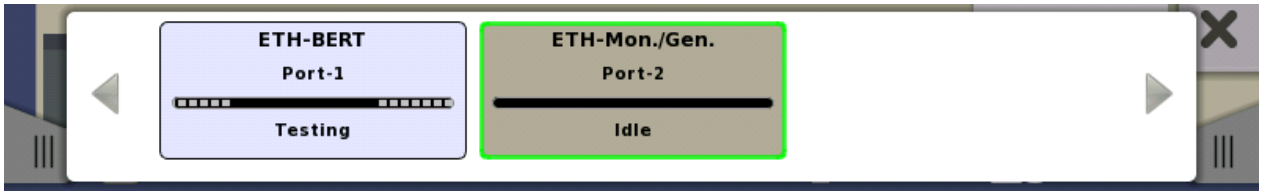
- Control panes
  - Control instrument in Application selector and test Result pages

MT1000A GUI

Back to Index page

- 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



MT1000A Instrument Setup

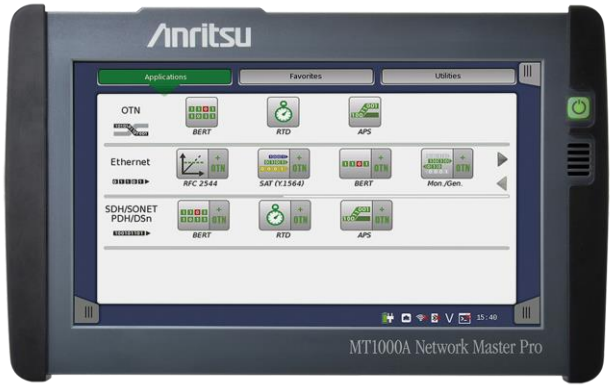
Back to Index page

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

Network Master Pro MT1000A

Back to Index page

- Report Generation



Report Generator

Back to Index page

- 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

Back to Index page

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

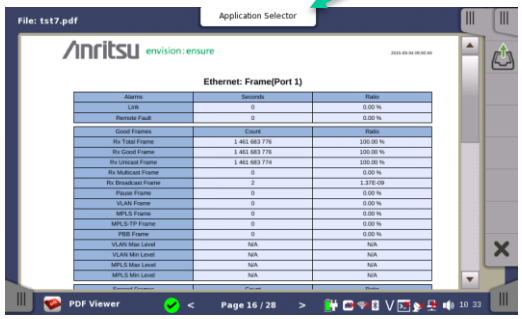
Module Type	Serial no	Software Version
MT1000A	6D60000101	3.01
MU100010A	6D60000087	

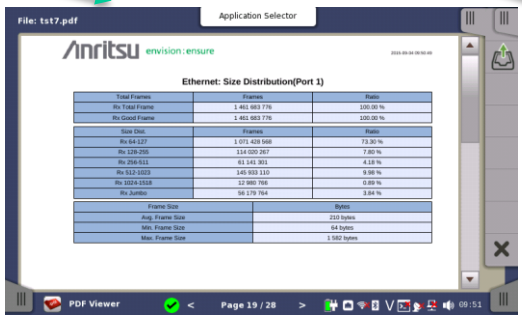
Report Layout

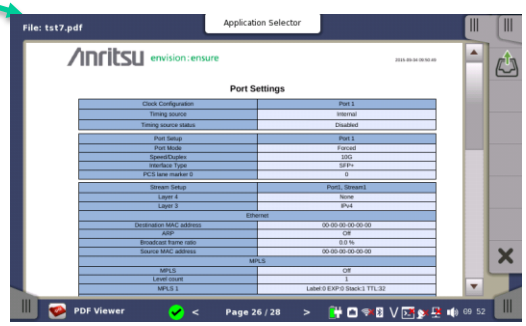
Back to Index page

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

PDF reports are displayed with the built-in PDF viewer

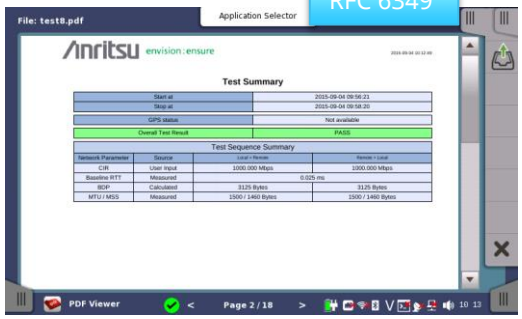




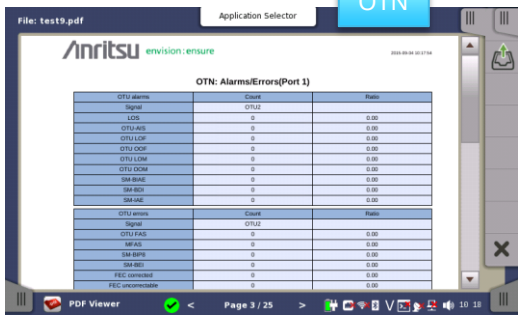


- Look of reports from other applications.

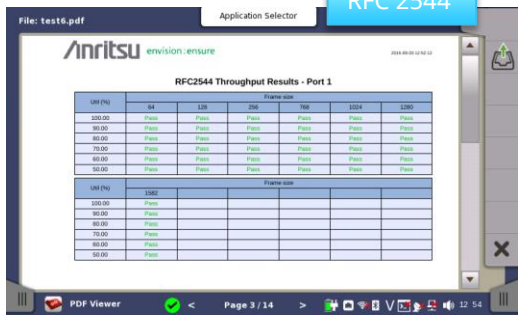
RFC 6349



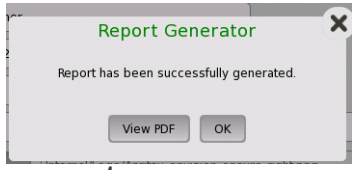
OTN



RFC 2544



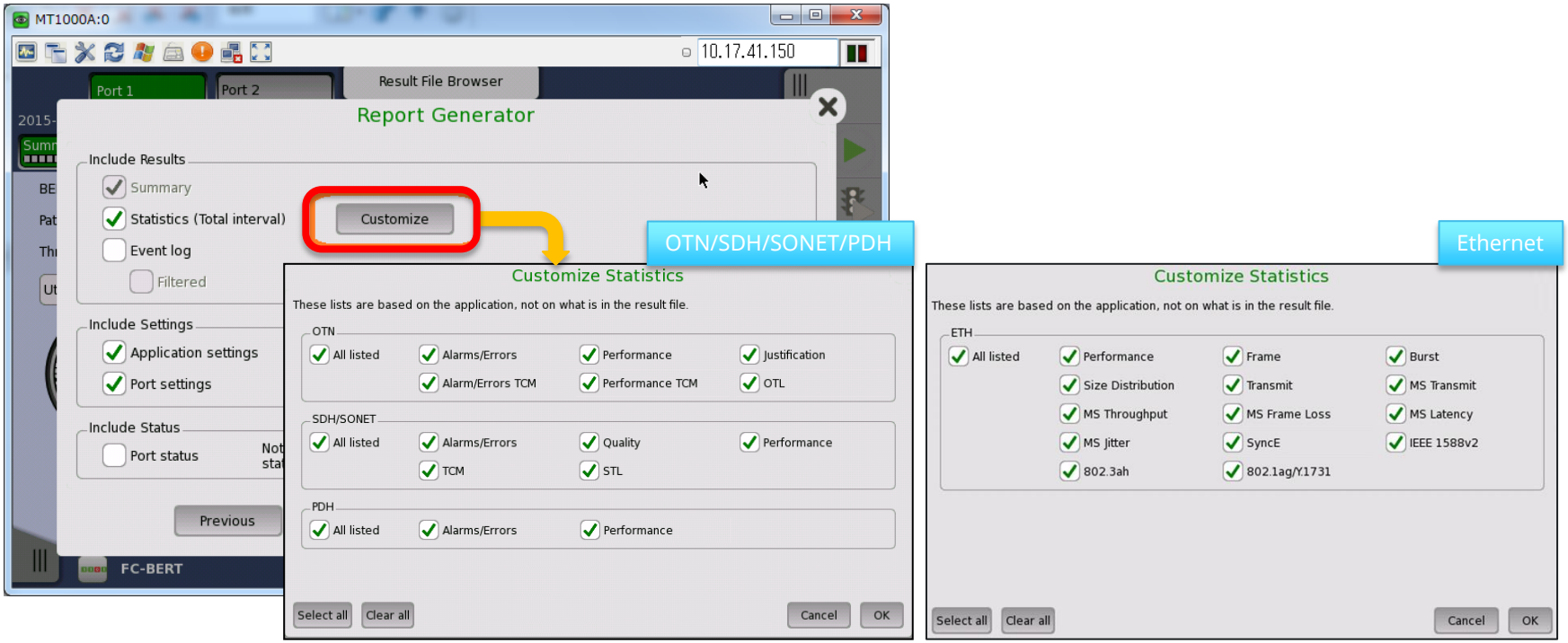
- Reports can be viewed in the built-in PDF viewer immediately after they are generated
  - This makes it simple and easy for the user to inspect the report



Filtering Results Display at Report Output

Back to Index page

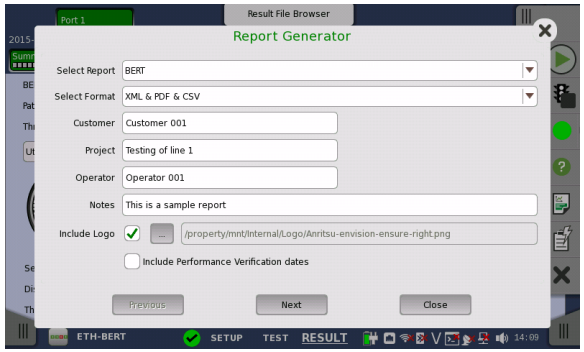
- The user can select the information to output when reporting statistical test results. As a result, file save times are shortened and files sizes are smaller.

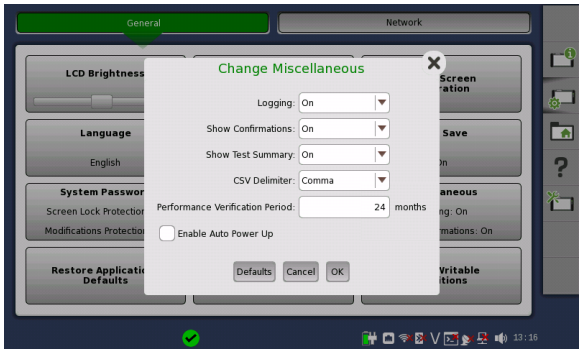


Report Generator

Back to Index page

- Optionally includes Performance Verification information in reports
  - User-programmable performance verification period





Anritsu envision:ensure

2015-05-26 14:11:03

Document Information

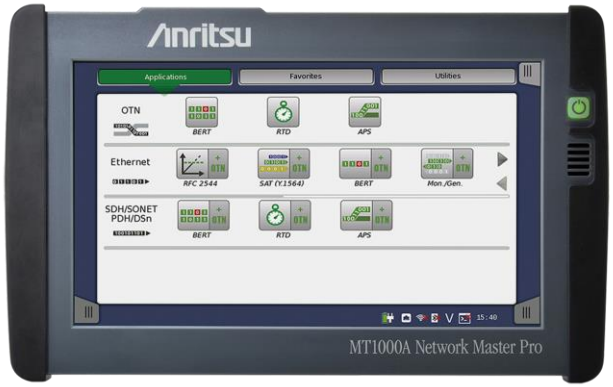
Report Name	BERT
Customer	Customer 001
Project	Testing of line 1
Operator	Operator 001
Notes	This is a sample report

Module Type	Serial no	Performance Verification Date	Performance Verification Due Date	Software Version
MT1000A	6D60000101	2014-05-06	2016-05-06	3.01
MU100010A	6D60000087	2014-05-06	2016-05-06	

Network Master Pro MT1000A

Back to Index page

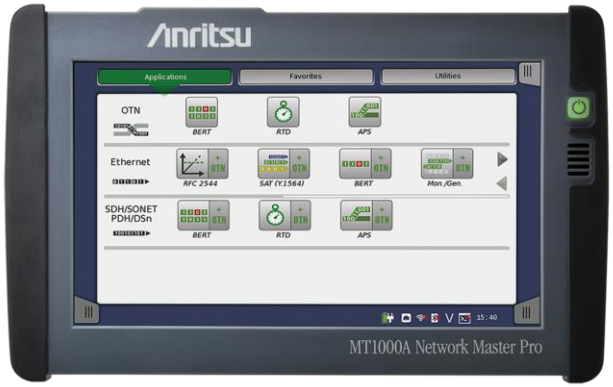
- Automation Testing



Network Master Pro MT1000A

Back to Index page

- Remote Operation



Three Remote Control Types

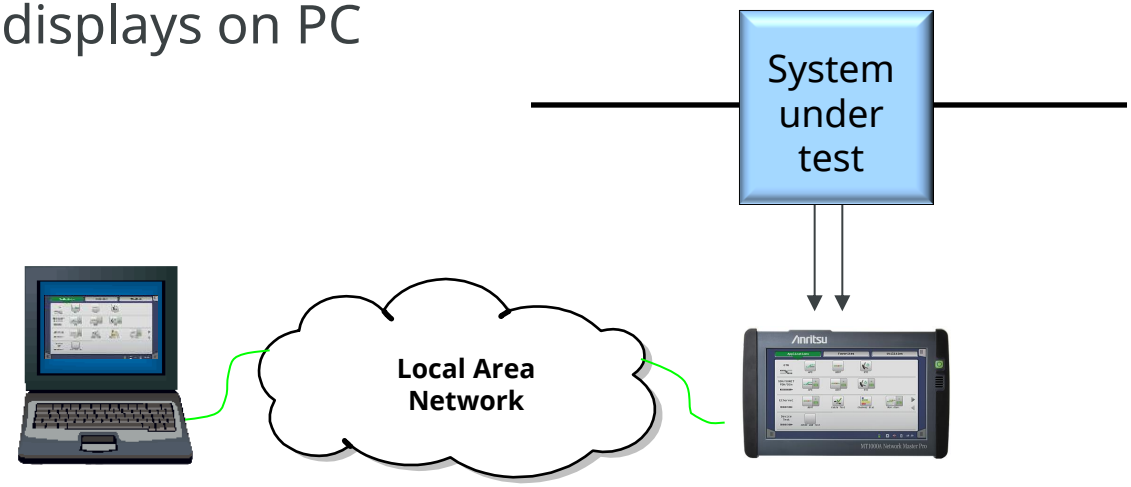
Back to Index page

	Function	Multi-user	File Sharing
VNC	Control from remote site	No	No
Remote GUI (MX100001A)	Control from remote site Port sharing File sharing	OK	OK
SCPI	Automation Control from remote site	OK	OK

MT1000A Remote Operation – Applications

Back to Index page

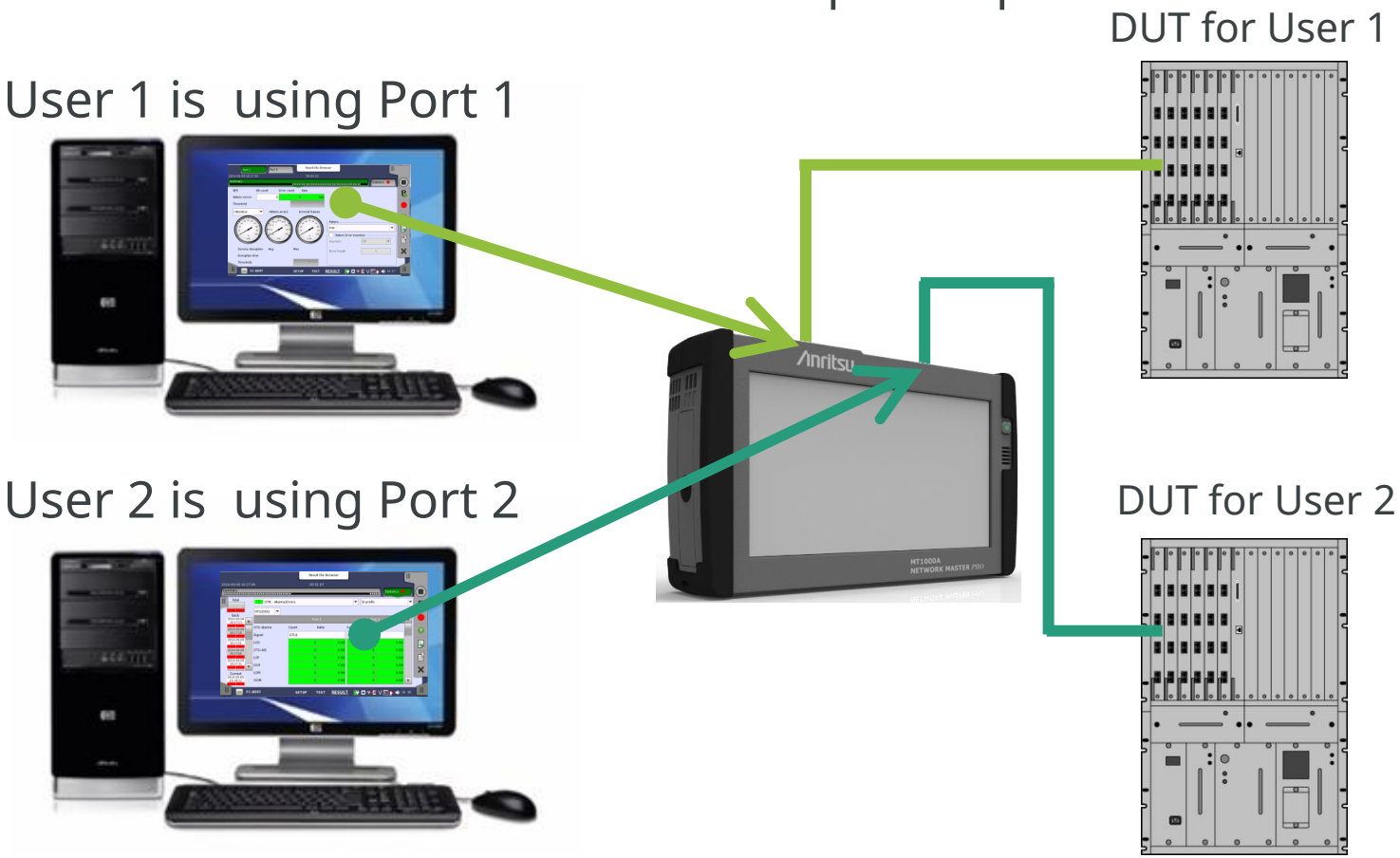
- Remote access
- Troubleshooting spurious errors
- Long-term surveillance and stability tests
- Multi-site surveillance
- Multi-user access
- Display screens via projector
- Documentation and training
- Operate MT1000A from PC with VNC client or new Remote GUI app
- View MT1000A displays on PC



What Can User Do with Remote GUI?

Back to Index page

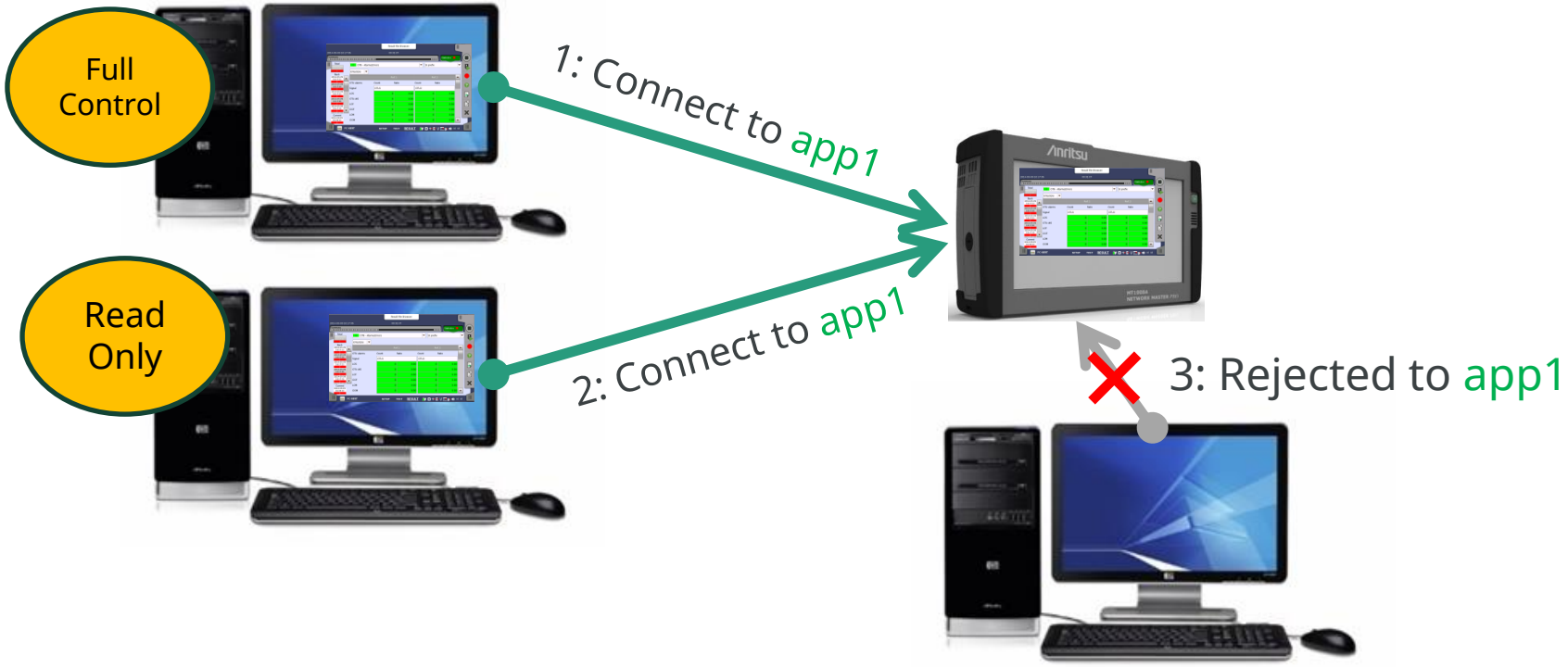
- Remote GUI application runs on Windows 7/8/8.1
- Port-oriented connection not unit-oriented
- Multiple users share same unit and use separate ports



What Can User Do with Remote GUI?

Back to Index page

- Connect one application to up to two GUIs



- 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

What Can User Do with Remote GUI?

Back to Index page

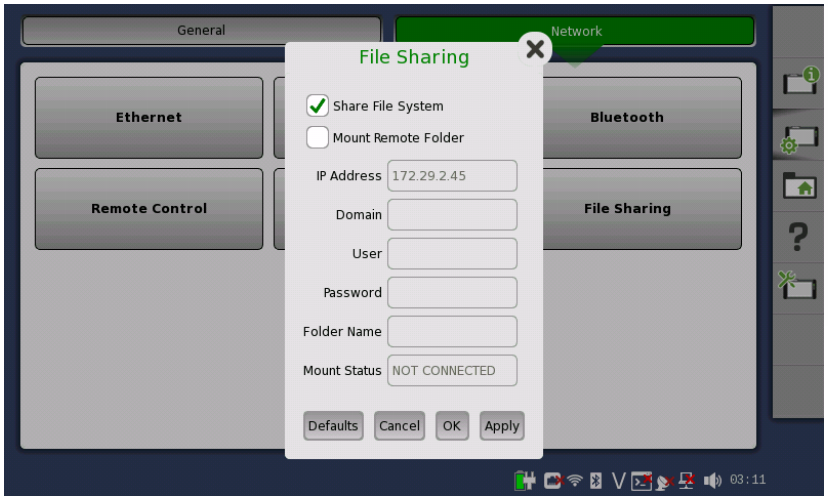
- Remote GUI can run as ‘Standalone’ viewer
- Users can:
  - Generate report(s)
  - Analyze results offline
  - Create setup file(s) for deployment

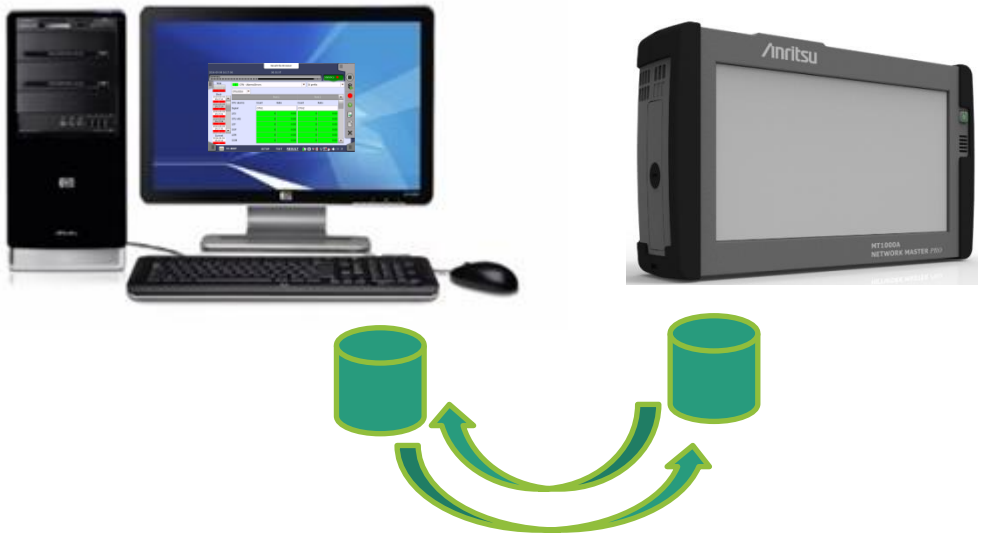
- Remote GUI supports
  - Firmware update via LAN
  - Remote unit reset

What Can User Do with Remote GUI?

Back to Index page

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





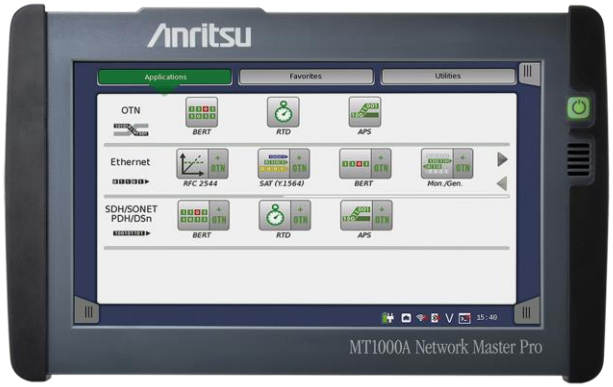
- Remote GUI supports:
  - Firmware update via LAN
  - Remote unit reset

Result files
Setting files
Report files
Capture files

Network Master Pro MT1000A

Back to Index page

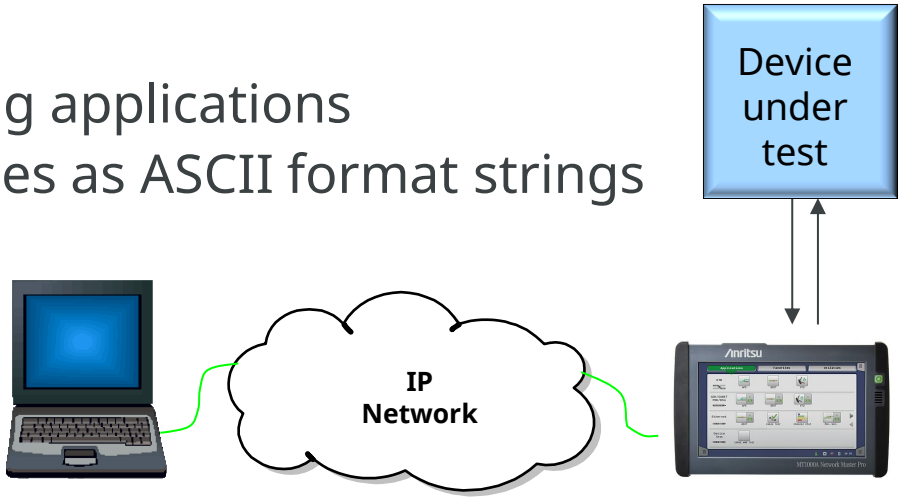
- Remote Control–Scripting



Remote Control Scripting Option

Back to Index page

- Automated testing for developing applications
- Remote control commands/replies as ASCII format strings
  - SCPI 1999.0 compliant with IEEE 488.2 mandatory common commands
- Fast command response
  - Execute up to 8 commands per second
    - Reduces test time at mass production
- Communication between controller (PC) and MT1000A:
  - Via MT1000A Ethernet Service Interface
    - TCP/IP connection
      - Test facility can be isolated LAN
  - Via WLAN
  - Via GPIB
- Includes documentation and scripting example
- LabVIEW driver sample

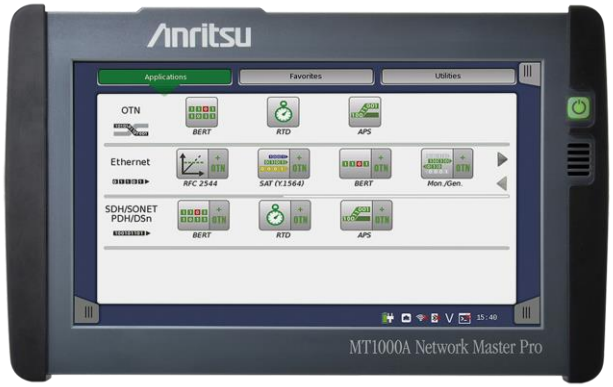


J1667A GPIB-USB Converter available for automated environments based on GPIB.

Network Master Pro MT1000A

Back to Index page

- Remote Control – GUI & Scripting



Remote Control GUI & Scripting Option

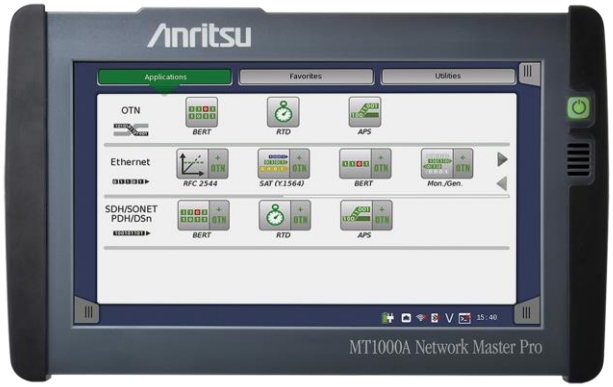
Back to Index page

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

Network Master Pro MT1000A

Back to Index page

- Automation Testing

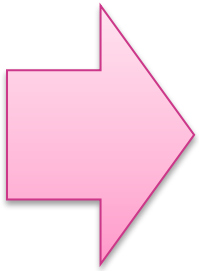


Automation Testing (1/3)

Back to Index page

- Installation and maintenance tests have several challenges.
  - Varying Work Time and Test Results Quality Dependent on Technician's Experience
  - Increasing Risk of Work Errors as Test Items increase
  - Reducing work burn to minimize errors

- Network Master have the One-Button Test Mode by creating a settings file for each manual procedure enables field technicians to run tests and complete pass/fail evaluations with a single click.

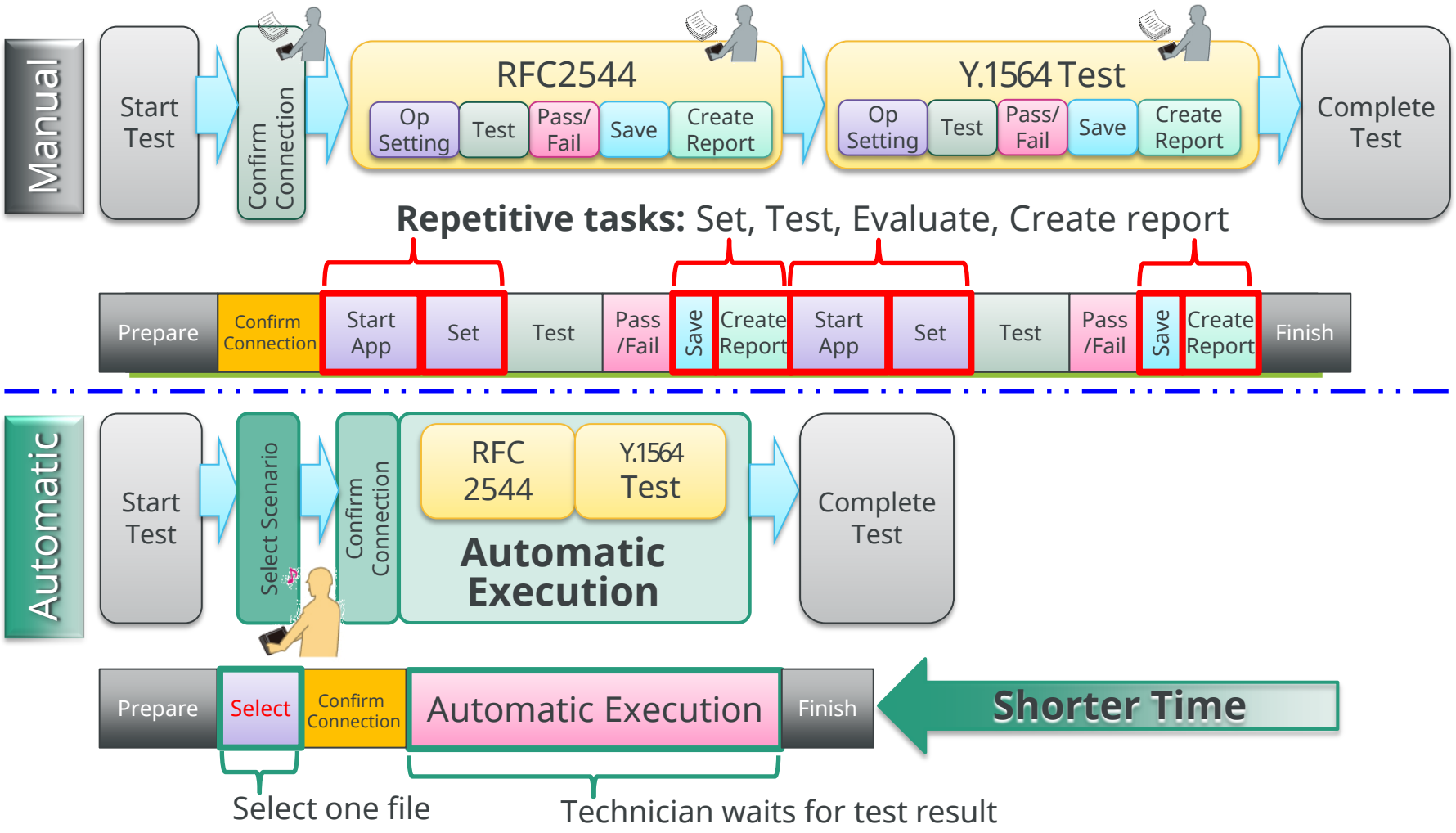


Setting Test Equipment:	**Manual**	Setting Test Equipment:	**NA**
Executing Test:	**Manual**	Executing Test:	**NA**
Evaluating Results:	**Based on data**	Evaluating Results:	**NA**
		→ One-button automation	

Automation Testing (2/3)

Back to Index page

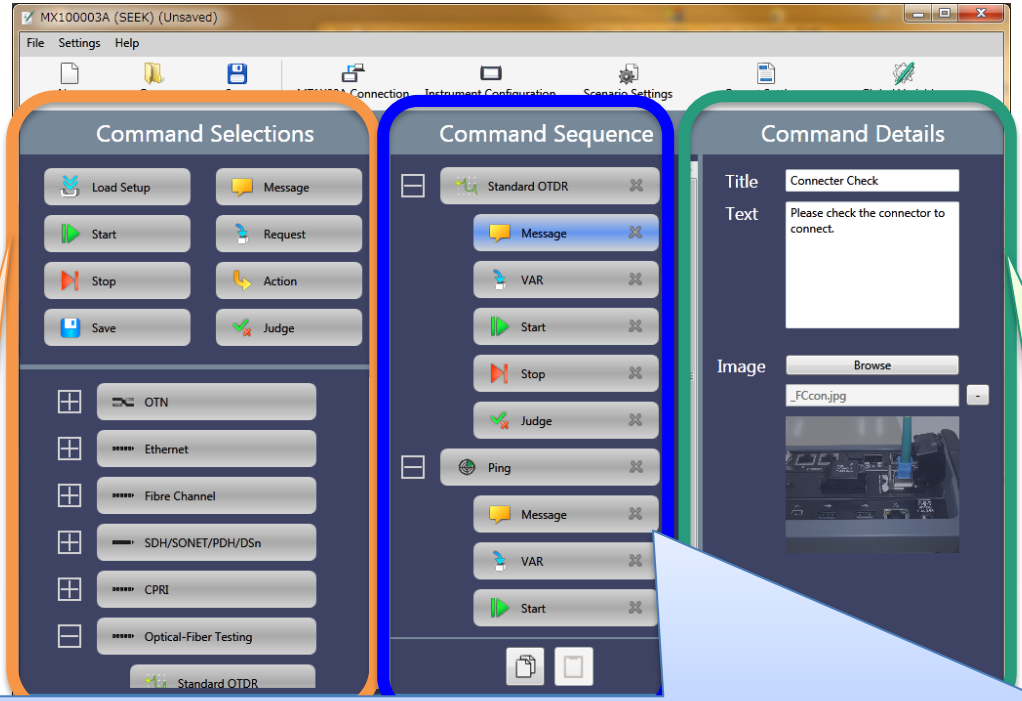
- Anritsu's Automated testing cuts timing time



Automation Testing (3/3)

Back to Index page

- Scenario Environment Editing Kit (SEEK) MX100003A
  - Free tool for creating automatic test scenarios for use on the MT1000A
  - Test scenarios are created using the PC SEEK GUI with drag and drop operations



Command Selection
The MT1000A command functions are listed as icons here to create the test scenario using drag and drop operations.

Command Details
Comments, such as cable connection, test notes, etc., can be displayed here. Parameter input is also supported.

Test Scenario Creation Area
The scenario is created here by dragging icons from the command list into a series.

Anritsu

envision : ensure

公知 2018-5 MJM No. MT1000A-E-L-1-(9.00)