Product Introduction

MP1595A
40G SDH/SONET Analyzer
MP1595A 40G SDH/SONET Analyzer
Product Introduction

Anritsu Corporation
What is MP1595A?

- With the rapid spread of high-speed broadband networks offering triple-play services, FMC, etc., core networks are moving to 40G. Anritsu’s MP1595A is a next-generation 40G SDH/SONET Analyzer that builds on Anritsu’s broad experience in SDH/SONET Analyzer technologies. It is an all-in-one solution supporting all measurements required for evaluation of 40G SDH/SONET/OTN networks and equipment.

- Supports new 40G I/F while keeping familiar GUI and operability of popular MP1590B for 10G SDH/SONET/OTN equipment.

- Adding the MP1595A jitter modules support 40/43G jitter/wander generation and analysis as well as conventional SDH, SONET and OTN frame evaluation.
What is MP1595A?

- 1-Box Analyzer for STM-256/STS-768, OTU-3
- SDH/SONET/PDH/DSn/OTN support from 1.5Mbit/s to 10.7Gbit/s
- Error and alarm insertion/detection and in-service monitoring
- Jitter and Wander Configurations Available
Outline

- **Main Frame**
- Integrated Screen
- Windows XP OS
- USB x 2, PS/2 Keyboard Connectors
- Pointing Device
- Error/Alarm Monitor LEDs

Dimensions: 320(W) x 221(H) x 350(D) mm
Weight: 14 kg max. (excl. measurement units)
Outline

- **Supported Bit Rates**
  - 1.5 Mbit/s – 43 Gbit/s
    - SDH/SONET: STM-0/STS-1 to STM-256/STS-768
    - OTN: OTU1/OTU2/OTU3
    - PDH: E1/E2/E3/E4
    - DSn: DS1/DS3
    - Non Frame: Setting supported for all above bit rates

- **Mapping (40/43G)**
  - 40G
    - VC4*256c/STS768c, VC4*64c/STS192c, VC4*16c/STS48c, VC4*4c/STS12c
    - Supports Low Order mapping in combination with MU150100A
  - 43G
    - OTU3, ODTU23
Outline

Mapping Setting Screens

SDH

With MU150100A

SONET

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Slide 6

MP1595A-E-L-1
Outline

- Supported Specification
  - ITU-T O.172/O.173

- Jitter Measurement
  - Supported Bit rate
    - 40Gbit/s and 43Gbit/s
      - SDH/SONET: STM-256, STS-768
      - OTN: OTU3
  - Measurement Item
    - Jitter Generation
    - Jitter Tolerance
    - Jitter Transfer

- Wander Measurement
  - Measurement Item
    - TIE
    - MTIE
    - TDEV
Main Applications

- Error/Alarm insertion and detection
- Monitoring
- APS Measurement
- Frame memory/capture
- Through mode
- Delay time measurement
- Jitter / Wander Measurement
Application Examples (1/7)

- **Error/Alarm Insertion**
  - Inserts Errors, such as FAS, BIP-8, and B1/B2/B3, as well as Alarms, such as LOF, LOM, AIS
  - Supports selection of various insertion timings, such as Rate, Alternative, Single, Burst, All, and Frame
  - Specifies error bit insertion position for B1/B2/B3, and BIP-2 errors

- **Error/Alarm Detection**
  - Count and Rate results at Result screen
  - Monitor generation history at Monitor screen

Error Alarm Monitor Screen
Application Examples (2/7)

- Insert ITU-T O.182-compliant Random Errors
  - Evaluates FEC efficiency using ITU-T O.182-compliant error signal (errors fitting Poisson distribution)

![Error Correction Curves]

- Output Bit Error Rate vs. Input Bit Error Rate
- Theoretical figure with FEC
- Theoretical figure without FEC
- Digital Method with Bad Random Distribution
- Digital Method with Good Random Distribution

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MP1595A-E-L-1
Monitoring Functions

- Full Line of Versatile Functions for Network Monitoring
  - Error/Alarm monitor
  - Frequency monitor
  - Optical Input level monitor
  - Pointer monitor
  - OH Monitor

- Error/Alarm and Pointer Monitors Displayed as Graphical Log

39,813,118,000.0 Hz
- 2,000.0 Hz
- 0.1 ppm
APS (Automatic Protection Switch) Measurement

- Measures equipment circuit switching time with 0.1-ms resolution using any Error/Alarm as trigger

APS Measurement Setting Screen

APS Measurement Results Screen
Application Examples (5/7)

- **Frame Memory/Capture Function (MU150140A-10)**
  - Demonstrates usefulness when collecting fault data to reproduce problem
  - **Frame Memory Function**
    - Set all bytes except B1, B2, HP-B3/B3-P, and Pointer
    - Set max. of 16 STM-256/STS-768 frames
    - Set max. of 256 OTU3 frames
  - **Frame Capture Function**
    - Set any Error/Alarm as trigger
    - Capture max. of 16 STM-256/STS-768 frames
    - Capture max. of 256 OTU3 frames

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Application Examples (6/7)

Through Mode Functions

- **Transparent Mode**
  - Monitors circuit quality by outputting looped-back received signal
  - **Emulates actual circuit** by inputting random errors

- **OH Overwrite Mode**
  - Overwrites OH part of received signal with OH specified at MP1595A and outputs signal
  - Inserts various Errors/Alarms into in-service circuit
Application Examples (7/7)

- Delay Time Measurement
  - Supports measurement of network transmission delays with µs resolution

![Diagram of Delay Time Measurement]

Delay Time Measurement Results

- Delay time
  - 10 µs Min 10 µs
  - Max 10 µs

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Other Applications

- OH BERTS Test
- OH Sequence Capture Function
- Pointer Generation Functions
  - NDF, ±Justification, Increment, Decrement
- Path Trace Function
Convenient Functions

- **Report Function**
  - Outputs settings and results in HTML format

- **Remote GUI**
  - Remote operation from PC via LAN using same GUI as main frame

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40/43G Jitter/Wander Measurement
Background

Why should jitter be measured?

◆ The spread of 40G networks across many business sectors is driving the need for reliable jitter measurements to assure the interoperability of the various types of network equipment.
What test is required?

- ITU-T and Telcordia define the Jitter/Wander specifications to secure interoperability.
  - Jitter Tolerance (G.783, G.825, GR-253, G.8251)
  - Jitter Generation (G.7833, GR-253, G.8251)
  - Jitter Transfer (G.783, G.825, G.8251)
  - Wander Measurement (O.172)

### Required Test Items

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Standard</th>
<th>Bit-rate</th>
<th>Jitter limit</th>
<th>Jitter limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wide-band jitter (Ulpp)</td>
<td>High-band jitter (Ulpp)</td>
</tr>
<tr>
<td>OTN</td>
<td>ITU-T G.8251</td>
<td>STM-256</td>
<td>1</td>
<td>0.15</td>
</tr>
<tr>
<td>SDH</td>
<td>Telcordia GR-253</td>
<td>OC-768</td>
<td>1.2</td>
<td>0.15</td>
</tr>
<tr>
<td>SDH</td>
<td>ITU-T G.783</td>
<td>STM-256</td>
<td>0.3</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Key feature

- All-in-one STM-256, OC-768 and OTU3 optical interfaces
- Anritsu makes a contribution for cutting the test time of equipment and module.
  - Jitter measurement time: 1/2 (120sec → 60sec)
  - Jitter transfer measurement time: 1/5 (230sec → 40sec)
  - Cutting the MTIE measurement time in 1/3
- Excellent performance by digital phase detector circuit
  - Good repeatability and jitter sensitivity
  - Wide dynamic range (range free)
- Signal Analysis function for R&D and DVT
- Wander tolerance measurement
- Simple & easy to use GUI

In this document, all of capabilities with options are also described.
Key feature

- All-in-one STM-256, OC-768 and OTU3 optical interfaces -

- The MP1595A new Jitter/Wander solution supports STM-256, OC-768 and OTU3 optical interfaces in one box and supports both Jitter/Wander measurement and SDH/SONET/OTN frame measurement.

- No need to change the connection every test items.

Jitter/Wander + Frame measurement

STM-256
OC-768
OTU3

MP1595A 40G SDH/SONET Analyzer
The MP1595A new Jitter/Wander solution performs the internal phase detector and frequency band filter by digital processing circuit instead of conventional analog circuit.

This contributes high-reliability jitter testing. Moreover, the expanded measurement dynamic range (up to 64UI) eliminates range switching.
Analog PLL and filter is traditional method, but there are some disadvantages.

- Variability of analog filter of each equipment
- Temperature dependence
- Low detection sensitivity of phase detector
Key feature
- High-reliability jitter testing 3 -

Why is digital detection and parallel filter method better?

- High repeatability and reduction in test time of by digital filter
- High detection sensitivity
- Wide dynamic range

- Diagram showing the process:
  - INPUT
  - O/E
  - WCR
  - Wide Clock Recover
  - LO
  - Digital phase detector
  - ADC
  - DPD
  - Digital Measurement Filter
  - LPF
  - HPF
  - Jitter

40/43 Gbps
Parallel jitter measurement can cut your inspection time

- Maximum three types of filters can be measured simultaneously.
- Can confirm the result of jitter measurement for each filter in one screen. Easy to compare the jitter amount in each frequency band.

Key feature
- Reduction of measurement time 1 - Anritsu original
Evaluation of tree Jitter bandwidth at the same time

- When the jitter on client side (G.783) is evaluated, the influence level can be confirmed to network side (G.8251).
- When the jitter on network side (G.8251) is evaluated, the influence level can be confirmed to client side (G.783)

Client side
STM-256 (G.783)

Network side
OTU3

[G.783 Jitter BW]
- 80K to 320M: 0.30UI
- 16M to 320M: 0.14UI

[G.8251 Jitter BW]
- 20K to 320M: 6.0UI
- 16M to 320M: 0.18UI

Key feature
- Reduction of measurement time
- Anritsu original
Jitter Generation Measurement

- The parallel filter specified by ITU-T, Telcordia can cut the Jitter Measurement time in half (120sec $\rightarrow$ 60sec).
- Pass/Fail judgment by each filter.

**Jitter Generation Measurement Screen**

### Jitter Results

**HP1: 20 kHz - LP: 320 MHz**
- Current Ulp-p: 0.220
- Max Ulp-p: 0.280
- Spec. 0.300
- Pass

**HP2: 16MHz - LP: 320 MHz**
- Current Ulp-p: 0.134
- Max Ulp-p: 0.148
- Spec. 0.140
- Fail
Jitter Tolerance Measurement

- Two types of Jitter tolerance measurement are available.
  - Tolerance Measurement
    - Measure the maximum jitter tolerant value of DUT.
  - Fast Tolerance Measurement
    - Simple test of tolerance. OK/NG judgment for the specification line.

Jitter Tolerance Measurement Screen
Key feature
- Fast automatic measurement 2 -

- Jitter Transfer Measurement
  - Two types of Jitter Transfer Measurement are available.
    - Normal Measurement
      - Measure the transfer performance by one frequency point.
    - Fast Transfer Measurement
      - By using Anritsu unique compound signal, cut the jitter transfer measurement time

Jitter Transfer Measurement Screen
Key feature
- Fast automatic measurement 3 -

Fast Transfer Measurement by multi point jitter modulation

- Fast Jitter Transfer Measurement is a unique method to reduce the test time by combining of two or more sinusoidal waves at the same time.
- Cutting the Jitter Transfer Measurement time in 1/5 (230sec → 40sec)
Key feature
- Signal Analysis function -

- Various analysis for the DVT and the trouble shoot
  - This option displays the demodulated jitter signals in time and frequency sequences. This is used for operations such as component analysis of jitter signals.

Signal analysis screen
Fmod: 1MHz, 0.7Ulp-p

No need external oscilloscope and spectrum analyzer to analyze the demodulation
Wander Measurement

- Wander Generation and Measurement
  - The wander signal modulated by sinusoidal can be generated. Various type of display are available (TIE, MTIE, TDEV)

- Wander Tolerance and Transfer Measurement
  - The wander TDEV tolerance and transfer measurement by applying to both test signal and reference clock signal based on O.172.
Key feature
- Wander Measurement -

- The measurement time is shortened to 1/3 (one time) by the MTIE synthesis wander generation function based on O.172.

In the sinusoidal modulation, it is necessary to evaluate it three times.
Demod. Output (option) and Spectrum Analysis (option)
- Outputs demodulated jitter analog waveform.
- In addition, it displays spectrum analysis results on the MP1595A screen without a spectrum analyzer.

1/4, 1/16 Clock Output
- Outputs 1/4 and 1/16 clock synchronized with Tx clock.
- This can be used with a sampling scope as a Tx waveform confirmation trigger because this clock is free of jitter modulation.

1/64 Clock Output
- Outputs 1/64 clock synchronized with Tx clock.
- This can be used as a clock source for a DUT requiring a reference clock because this clock is free of jitter modulation.

Wideband clock offset
- ±100 ppm Tx clock offset. In addition, the Rx side supports jitter analysis up to ±100 ppm, supporting DUT frequency tolerance tests.
Setting and result of measurement are shown in one screen.

The intuitive GUI makes operation easy.
Modules (1/2)

- **MU150140A  40G Unit**
  - 40/43G PPG/ED Unit
  - Installed in Slots 5 and 6
  - Required for 40/43G measurements

- **MU150141A  40G Optical Unit**
  - MU150141B  40/43G Optical Unit
  - 40/43G Optical I/F Unit
  - Installed in Slot 4
  - At least one required for 40G measurements
  - MU150141B required for 43G measurement

*MU150141A/B and MU150147A cannot both be installed simultaneously.*
Modules (2/2)

- **MU150100A 10G/10.7G Unit**
  - 1.5 Mbit/s to 10.7 Gbit/s Unit
  - Installed in Slots 1 and 2
  - Required for measurement at less than 10.7G and when using Low Order Mapping at 40G
  - Add/Drop function is disable.

- **MU150135A 10/10.7G Optical Unit**
  - 10/10.7G Optical I/F Unit
  - Installed in Slot 3
  - Required when using 10/10.7G optical I/F at MU150100A
  - Requires XFP sold separately
Modules for Jitter/Wander

- **MU150147A 40/43G Jitter/Wander Unit**
  - 40/43G generation and analysis of Jitter/Wander and O/E
  - For Slot 1-3

- **MU150149A 40/43G Optical Unit (TX)**
  - 40/43G E/O
  - For Slot 4
Module configuration

- **40G Opt. (NRZ)**
  - 1
  - 2
  - 3
  - 4: MU150141A
  - 5
  - 6: MU150140A

- **40/43G Opt. (NRZ)**
  - 1
  - 2
  - 3
  - 4: MU150141B
  - 5
  - 6: MU150140A

- **Multi Bit rate**
  - 1
  - 2
  - 3
  - 4: MU150141B
  - 5
  - 6: MU150140A

- **40/43G Optical with Jitter/Wander**
  - 1
  - 2: MU150147A
  - 3
  - 4: MU150149A
  - 5
  - 6: MU150140A

- **W/o Jitter/Wander**
## Modules & Software

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<tr>
<th>Model/Order No.</th>
<th>Name</th>
<th>Note</th>
</tr>
</thead>
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<td><strong>Main Frame</strong></td>
<td></td>
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<tr>
<td>MP1595A</td>
<td>40G SDH/SONET Analyzer</td>
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<tr>
<td><strong>Units/Modules</strong></td>
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<td>MU140140A</td>
<td>40/43G Unit</td>
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<td>MU150141A/B</td>
<td>40/43G Optical Unit</td>
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<td>MU150147A</td>
<td>40/43G Jitter Unit</td>
<td>MU150147A is not compliant with the CE marking EMC (electromagnetic compatibility) regulations.</td>
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<td>MU150149A</td>
<td>40/43G Optical Unit(TX)</td>
<td>MU150149A is not compliant with the CE marking EMC (electromagnetic compatibility) regulations.</td>
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<td>MU150100A</td>
<td>10/10.7G Unit</td>
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<td>MU150135A</td>
<td>10/10.7G Optical Unit (XFP)</td>
<td>Requires XFP module (sold separately).</td>
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<td><strong>Option</strong></td>
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<td>MP1595A-01</td>
<td>RS-232C</td>
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<td>MP1595A-02</td>
<td>GPIB</td>
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<td>MP1595A-03</td>
<td>LAN</td>
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<td>MP1595A-004</td>
<td>Clock Source Output for Jitter/Wander</td>
<td>The Jitter and wander measurement must need MP1595A-004/104.</td>
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<td>MP1595A-104</td>
<td>Clock Source Output for Jitter/Wander Retrofit</td>
<td>The Jitter and wander measurement must need MP1595A-004/104.</td>
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<td>MU150140A-05</td>
<td>OTU3</td>
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<td>MU150140A-06</td>
<td>ODTU23</td>
<td>Requires separate MU150140-05 OTU3 option.</td>
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<td>MU150140A-10</td>
<td>Frame Memory/Capture (40/43G)</td>
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<td>MU150147A-002</td>
<td>43.018Gbit/s</td>
<td>MU150147A must need MU150147A-001 and MU150147A-002.</td>
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<td>MU150147A-007</td>
<td>Fast Jitter Transfer Measurement</td>
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<td>MU150147A-008</td>
<td>Demod Signal Analysis</td>
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<td>MU150147A-009</td>
<td>Demod Output</td>
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<td>MU150147A-010</td>
<td>Wander Measurement</td>
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<td>MU150147A-011</td>
<td>Wander Generation</td>
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<td>MU150100A-01</td>
<td>Wavelength 1.31 µm</td>
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<td>MU150100A-02</td>
<td>Wavelength 1.55 µm</td>
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<td>MU150100A-03</td>
<td>Wavelength 1.31/1.55 µm</td>
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<td>MU150100A-04</td>
<td>Optical Output Power Adjustable</td>
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<td>MU150100A-05</td>
<td>OTU1/OTU2</td>
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<td>MU150100A-07</td>
<td>10/10.7G Minus Option</td>
<td>MU150100A-07 factory installed only. MU150100A-07 and MU150100A-09 cannot both be installed simultaneously.</td>
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<td>MU150100A-08</td>
<td>10.3G</td>
<td>External clock source is required.</td>
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<tr>
<td>MU150100A-09</td>
<td>Insert/Extract</td>
<td>MU150100A-07 factory installed only. MU150100A-07 and MU150100A-09 cannot both be installed simultaneously.</td>
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<tr>
<td><strong>Software</strong></td>
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<tr>
<td>MX159501A</td>
<td>40G SDH/SONET Analyzer Control Software</td>
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<tr>
<td>MX159508A</td>
<td>Jitter/Wander Measurement Software</td>
<td>Jitter and wander measurement requires MX159508A.</td>
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Note