Anritsu

SEMINAR TEXT

MP1570A SONET/SDH/PDH/ATM Analyzer

SDH/SONET Jitter Measurement Solution

MEASUREMENT SOLUTIONS
ANRITSU CORPORATION

Seminar Text

SDH/SONET Jitter Measurement Solution

MP1570A SONET/SDH/PDH/ATM Analyzer

Anritsu Corporation
Measuring Instruments Division
Marketing Department

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Slide 1

Contents

- **SDH/SONET Jitter Measurement**
  - Jitter Standardization Trends
  - Jitter Measurement Solution
  - Jitter Calibration
- **MP1570A Outline**
  - Market Trends and Function Outline
  - IP Measurement Solution
  - WDM Measurement Solution

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Slide 2

SDH/SONET Jitter Measurement

- Jitter Standardization Trend
- Main Features of MP1570A New Jitter Unit
- 10Gbit/s Jitter Measurement Solution
- Jitter Calibration Method
- Measuring Instrument Comparison

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Main Standardization Bodies (Transmission Systems)

- **ITU-T** (International Telecommunication Union - Telecommunication Sector)
- **ETSI** (European Telecommunications Standards Institute): Europe
- **ANSI** (American National Standard Institute) : N. America
- **Bellcore** (Bellcore): N. America
- **TTC** (Telecommunication Technology Committee): Japan

(Note) ****: STM-64/OC-192 Jitter/Wander Standards & Investigation Bodies

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ITU-T Main Jitter & Wander Standards

SG No.	Rec. No	Recommendation Name
SG4	O.171	Jitter and wander measuring equipment for PDH
	O.172	Jitter and wander measuring equipment for SDH
SG13	G.811	Timing requirements of primary reference clocks
	G.812	Timing requirements of slave clocks
	G.813	Timing characteristics of SDH equipment slave clocks
	G.823	The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy
	G.824	The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy
	G.825	The control of jitter and wander within digital networks which are based on the SDH
SG15	G.958	Digital line systems based on the synchronous digital hierarchy for use on optical fibre cables
	G.783	Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks

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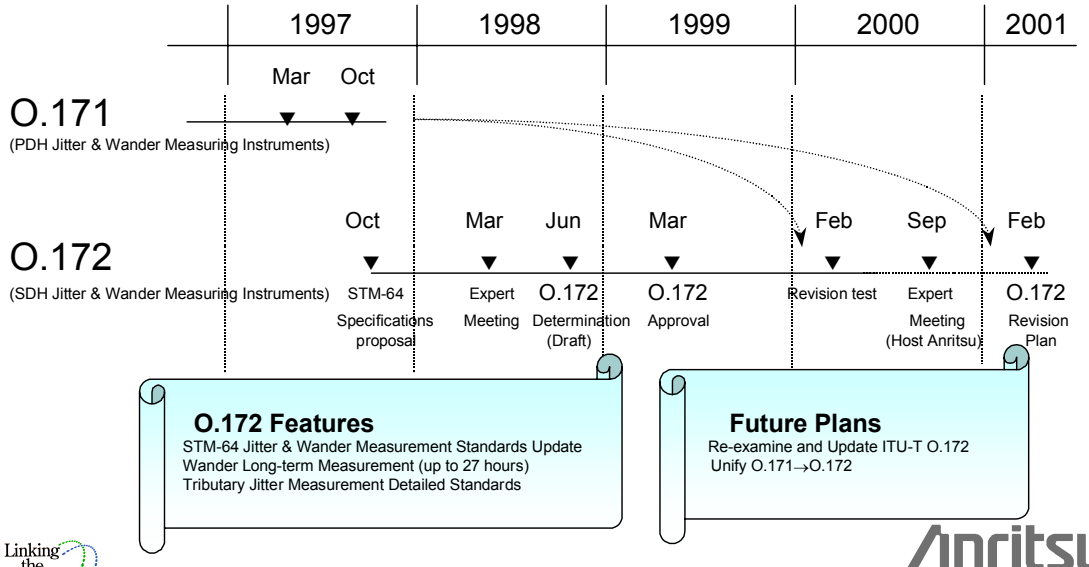
Trend in Standards Examined by SG4

Question 11: Jitter and wander test and measurement techniques and instrumentation for use on transmission systems and their constituent parts



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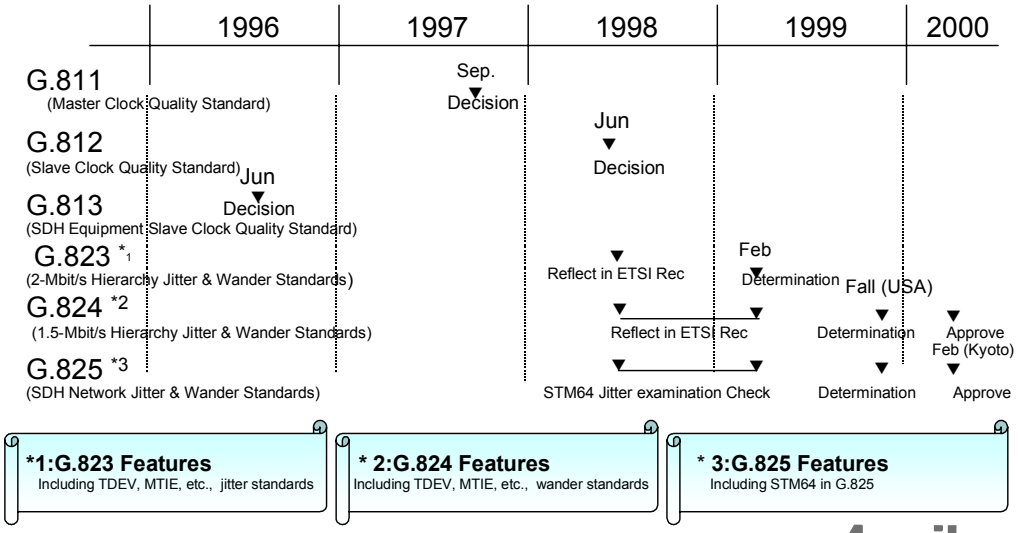
Trend in Standards Examined by SG13

WP4: Quality
Question 18: Network synchronization and time distribution performance



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Comparison of G and O Standards

G Series	O Series
G.811/G.812 • TDEV, MTIE Measuring equipment standards • Frequency drift rate	O.172 • TDEV, MTIE Measuring equipment standards • Frequency drift rate (under study)
G.813 • TDEV, MTIE Measuring equipment standards • Noise (TDEV) tolerance measurement • Noise (TDEV) transfer characteristics	• TDEV Noise modulation standards (under study) • TDEV Noise modulation standards (under study)
G.823/G.824/G.825 • Tributary jitter measurement standards • Jitter standards (up to STM-64)	• Tributary jitter measuring equipment standards • STM-64 Jitter measuring equipment standards

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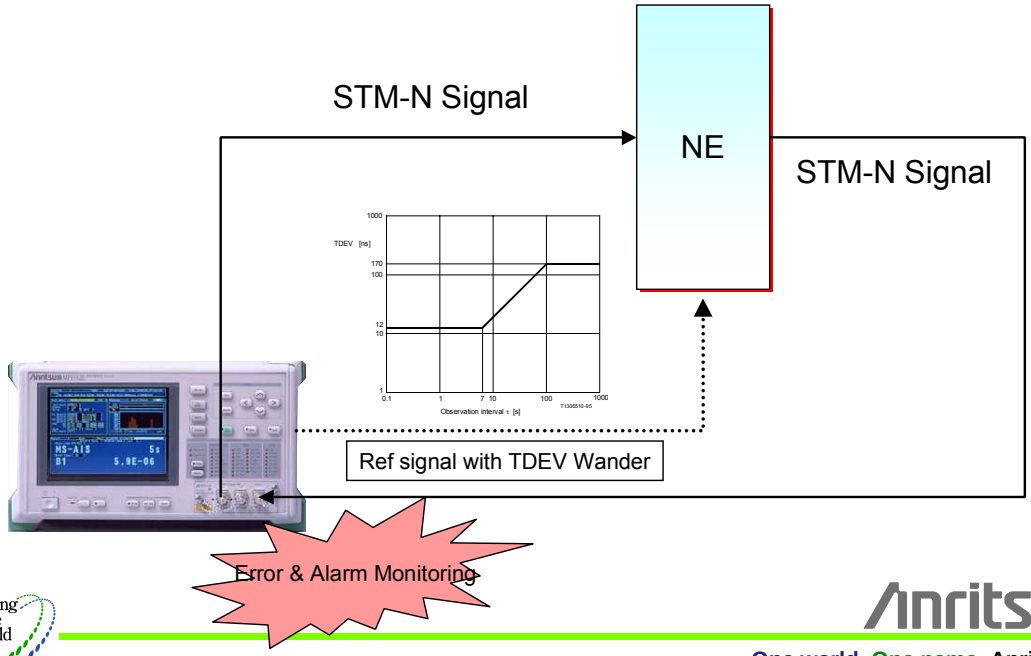
Outline of Noise(TDEV) Tolerance Measurement



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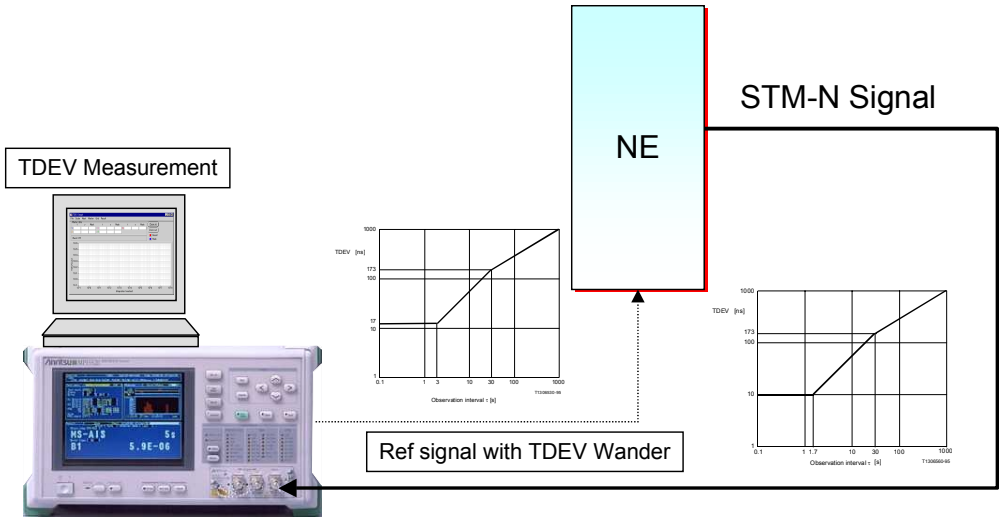
Outline of Noise (TDEV) Transfer Characteristics Measurement



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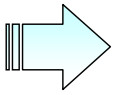
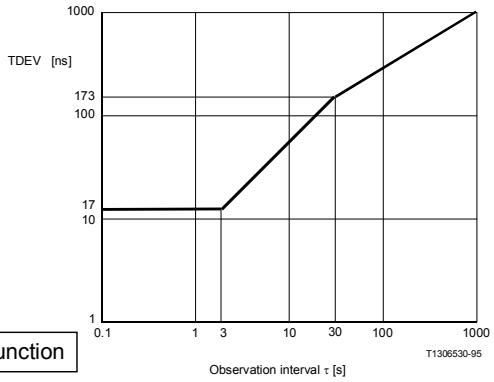
Functions Required for ITU-T G.813 Evaluation

- Noise (TDEV) Modulation Function
- Wander Measurement Function (TDEV)

TDEV Measurement





TDEV Generation Function

Main Features of New Jitter Unit

- Conforming to ITU-T O.172 Rec. (exceeding O.172)
- Various (7 types) high-speed auto measurements of jitter and wander
- Various wander generation functions (Transient, TDEV wander)
- DSP-based variable jitter filter (up to 622 Mbit/s)
- Combined jitter measurement
- Various wander application software (MX150001B)
- 400,000UIp-p wander generation function (sine wave)
- Selectable bandwidth settable jitter transfer characteristics measurement
- Through jitter function (SDH only)
- Long-term jitter evaluation function (Peak Jitter)

Various (7) High-speed Jitter & Wander Auto Measurements

(1) Jitter Tolerance Measurement
(2) Jitter Sweep Measurement
(3) Jitter Transfer Measurement
(4) Frequency Sweep Measurement
(5) Jitter vs. Frequency Offset Measurement
(6) Wander Sweep Measurement
(7) Wander Measurement

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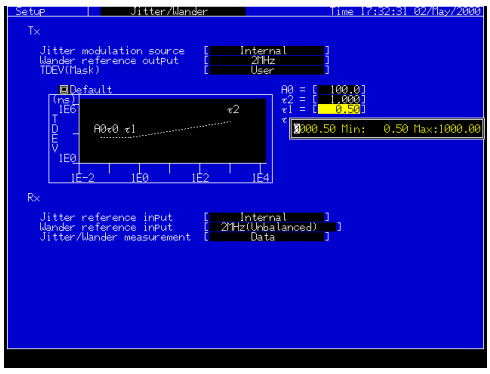
Various Wander Generation Functions

Various wander generation functions for evaluating TDEV wander tolerance, TDEV wander transfer characteristics, holdover, phase transients, etc., specified by the ITU-T, ANSI, ETSI, etc., standards.

(1) Variable TDEV wander generation
(2) Phase transient



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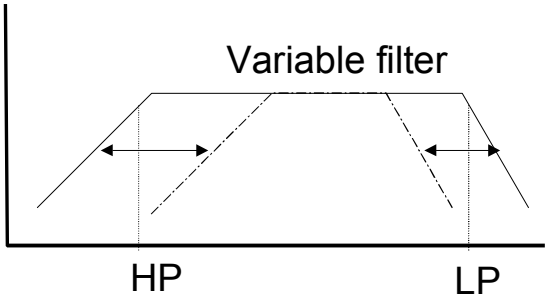
DSP-based Variable Jitter Measurement Filter (up to 622 Mbit/s)

Provides pre-set filter ITU-T O.172, O.171, G series, ANSI, Bellcore, ETSI, etc., as well as any user settings for analyzing causes of jitter trouble.



Jitter measurement band (Hz)

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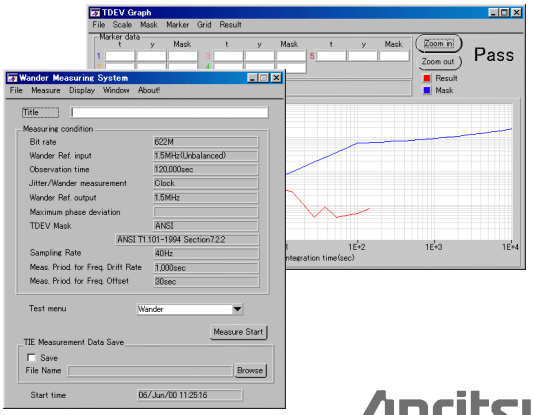
Various Wander Application Software

Real-time MTIE and TDEV measurements using external host PC and wander application software (MX150001B). In addition, other wander measurements such as holdover, wander tolerance (TDEV), wander transfer (TDEV), etc., also possible.

(1) Real-time Wander Measurement
(2) Wander Tolerance (TDEV)Measurement
(3) Wander Transfer (TDEV) Measurement



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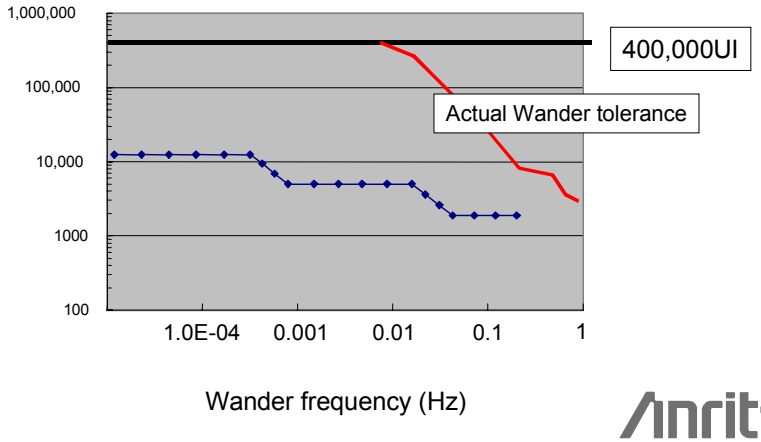
400,000UI Wander Generation Function (Sine Wave)

Wander generation up to 400,000UI (excluding 2.5G) required for wander tolerance efficiency evaluation. Moreover, wander tolerance efficiency evaluation also possible by generating by far exceeding wander value specified by ITU-T and G Series.



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STM-64/OC-192 Jitter Solution

(Main Standards and Features)

- **GR-1377 (Bellcore): (1994~)**
  - ***80MHz jitter band*** specified in OC-192 transmission equipment standards
- **O.172 (Feb 1999~)**
  - Standards for STM-64 jitter & wander measuring instruments ***(80MHz jitter band)***
- **G.825 (Feb 2000~)**
  - Addition of standards for STM-64 networks ***(80MHz jitter band)***

STM-64/OC-192 Jitter Solution

MP1777A 10G Jitter Analyzer

MP9677B 10G E/O, O/E Converter

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MP1777A Features

First Analyzer in World to Implement Evaluation at Jitter Frequencies up to 80 MHz!

- Measurements conforming to ITU-T O.172(3/99) recommendations
- 80 MHz Jitter band width
- 3200UIpp Jitter modulation amplitude
- Addition of bit rates for two undersea systems simultaneously
  - Option 01: 2494.16 MHz, 4988.32 MHz, 9976.64 MHz
  - Option 02*: 2666.0571 MHz, 5332.1142 MHz,10664.2284 MHz
  - Option 04*: 3062.3625 MHz, 6124.725 MHz, 12.24945 MHz
  - Option 05*: 3069MHz, 6138 MHz, 12.276 MHz
  - (* Options 02, 03, 04 and 05 cannot be installed simultaneously)
- Three types of jitter auto measurement (jitter tolerance, jitter transfer)

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MP9677B Features

First O/E Converter in World reaching 80 MHz Clock Recovery Band

- Measurements conforming to ITU-T O.172(3/99) recommendations
- 80 MHz Jitter band width
- 10.664 Gbit/s Optical jitter measurements by changing units (MU967702A)
- Connection of external TLS (for WDM) by addition of Option 01

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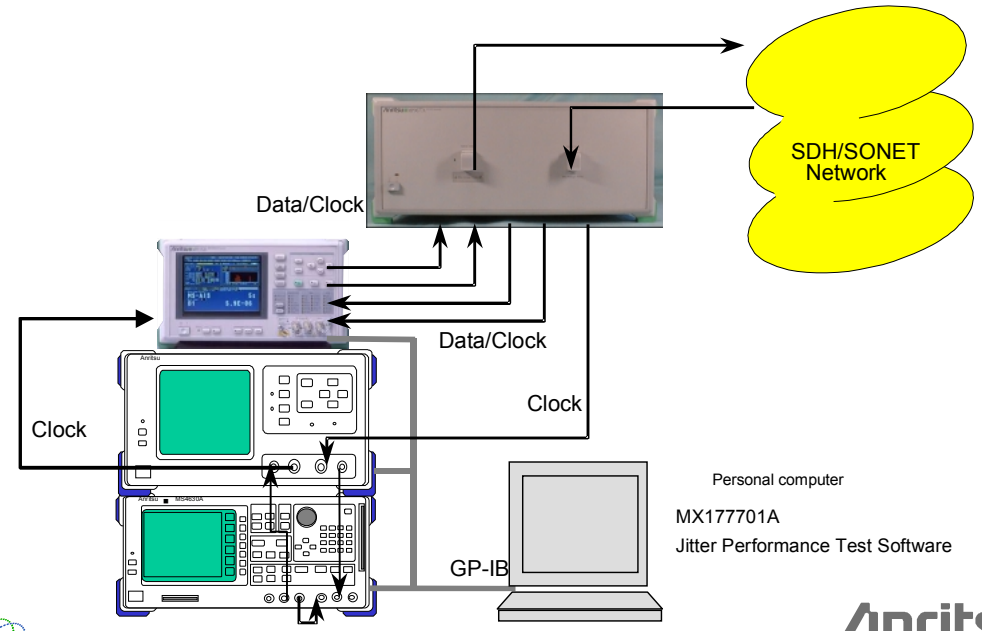
SDH/SONET Jitter Solution



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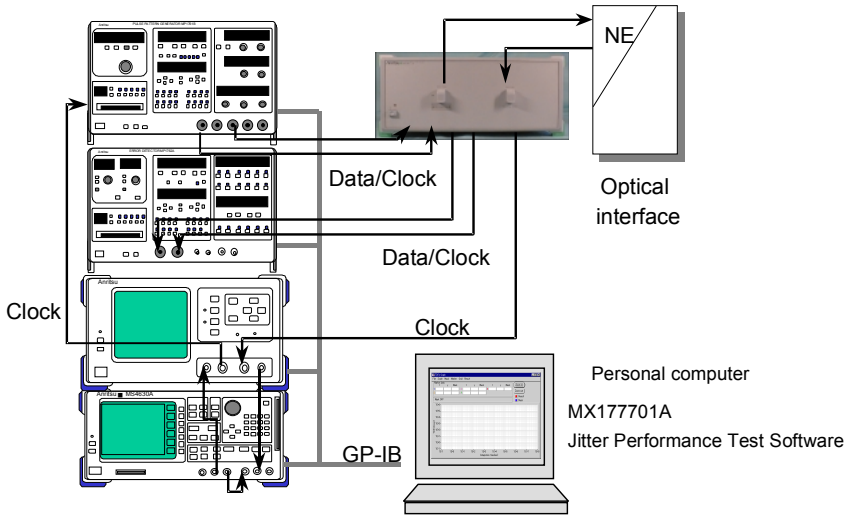
FEC Jitter Solution



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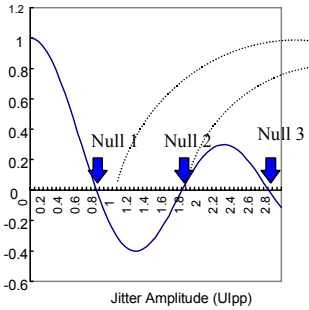
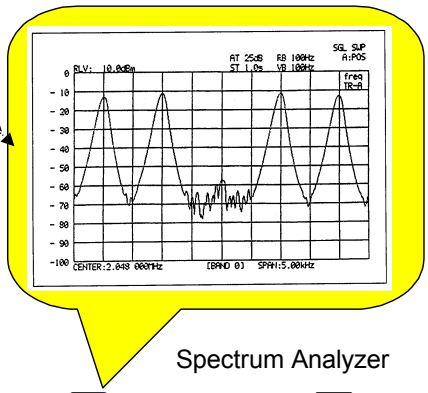
Jitter Measuring Instrument Calibration Method 1 (Transmitter)

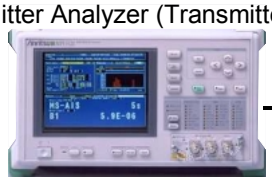
- Jitter Generator

Calibrated using Bessel Null point

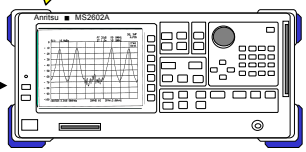




Jitter Analyzer (Transmitter)



Spectrum Analyzer



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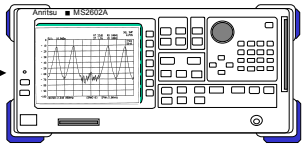
Jitter Measuring Instrument Calibration Method 1 (Receiver)

- Jitter Measuring Instrument

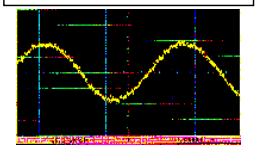
Calibrated using Bessel Null point

Spectrum Analyzer



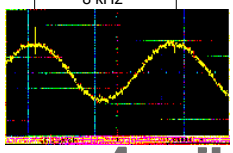
Jitter Analyzer (Transmitter)

Demod. Output (Clock)



Demod. Output (SDH)

8 kHz



Data signal can't use for jitter calibration

Data

O/E with CDR

Clock

Jitter measuring instrument

Demod. Output

•Include pattern-dependent jitter

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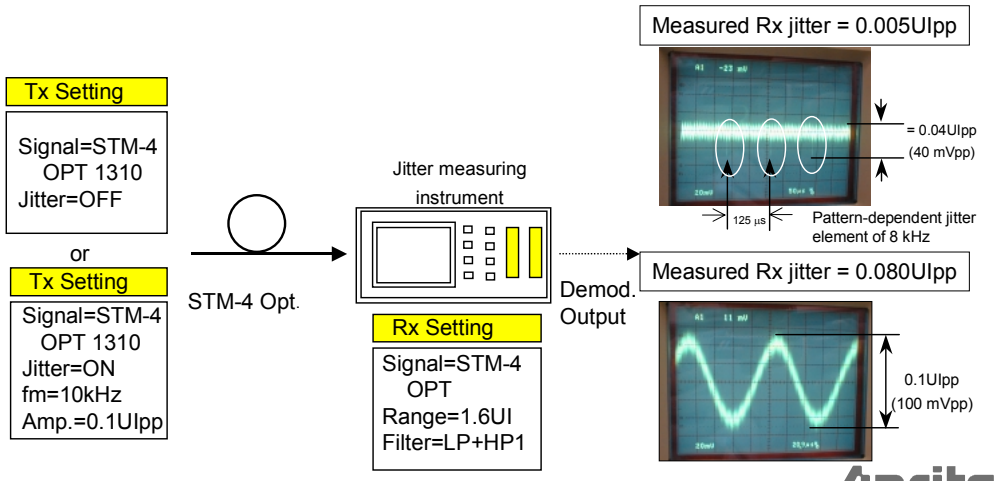
Choosing Jitter Measuring Instrument

- Can be calibrated at clock interface?
- Demod. output peak value and measured jitter match?

  (following measuring instrument not suited to jitter measurement)



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Comparison of Jitter Measuring Instruments

Measurement	Anritsu	Agilent	WWG	Tektronix	
[G.813]					
TDEV/MTIE	MP1570A	Omni BER718	ANT-20SE	CTS-850	
Noise Tolerance	MP1570A	None	None	None	TDEV Generation
Noise Transfer	MP1570A	None	None	None	TDEV Generation
[O.172/G.825]					
10G Jitter	MP1777A (Ele)	None	None	None	Jitter band = 80 MHz
	MP9677A (Opt)	None	None	None	Jitter band = 80 MHz
Tributary jitter	MP1570A	Omni BER718	ANT-20SE	CTS-850	
Wander meas.	MP1570A	Omni BER718	ANT-20SE	CTS-850	
etc.					

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MP1570A product outline

- Market trend and 10Gbit/s measurement solution
- Plug-in structure
- Function outline (APS · Dummy setting · Monitor · TCM)
- IP measurement solution
- WDM measurement solution

Bit rates from 1.5M to 10Gbit/s in Single unit

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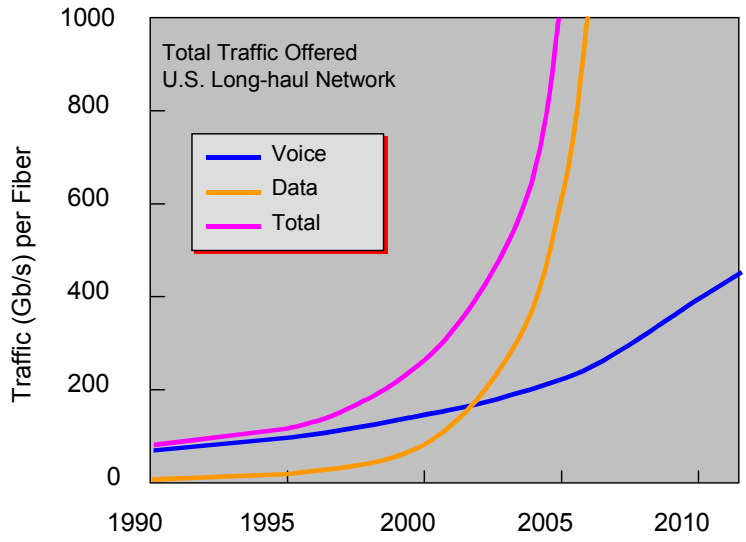
Traffic through Fiber



K.Coffman and A.Odlyzko, "The size and growth rate of Internet," October 1998.

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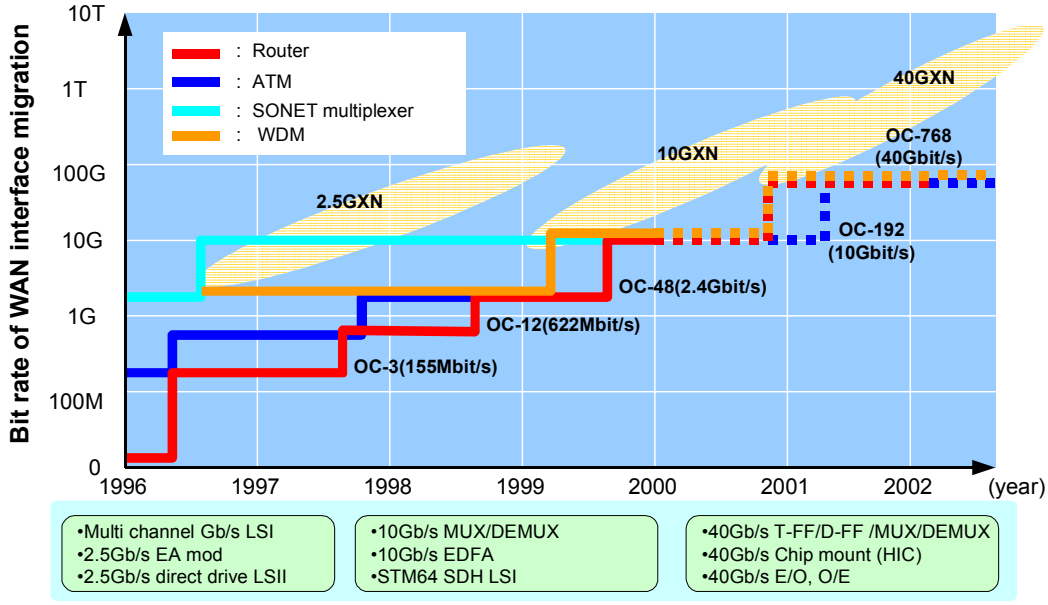
Technical trend of high capacity transmission system



•Multi channel Gb/s LSI •2.5Gb/s EA mod •2.5Gb/s direct drive LSII	•10Gb/s MUX/DEMUX •10Gb/s EDFA •STM64 SDH LSI	•40Gb/s T-FF/D-FF /MUX/DEMUX •40Gb/s Chip mount (HIC) •40Gb/s E/O, O/E

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OC-192/STM-64 Measurement Solution

SDH/SONET system test

MP1570A
SONET/SDH/PDH/ATM Analyzer

BER testing for component and modules
MP1763B/64A + MX176401A

10GHz Jitter
MP1777A+MS4630B

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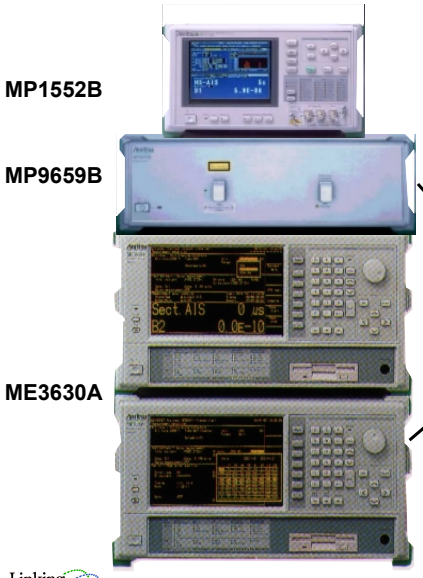
Making small size and saving power consumption



MP1570A
SONET/SDH/PDH/ATM analyzer

Weight ratio : 1/7 (10kg)
Power consumption: 1/4(500VA)

- Plug-in has 10Gbit/s function
- Existing plug-in units for MP1552/55B can be applicable.

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Plug-in Structure

Right Side Cover of MP1570A

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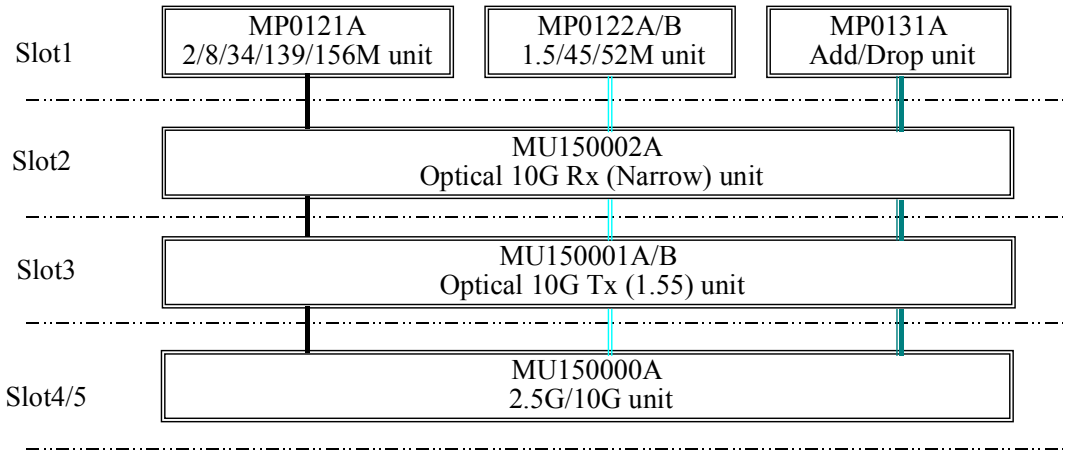
Plug-in Structure

- **10G**



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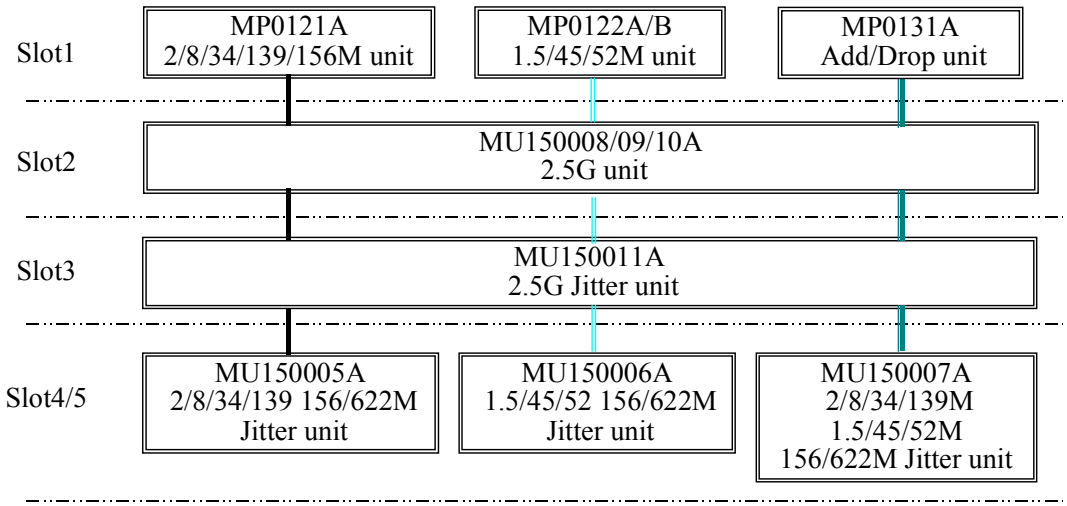
Plug-in Structure

- **2.5G**



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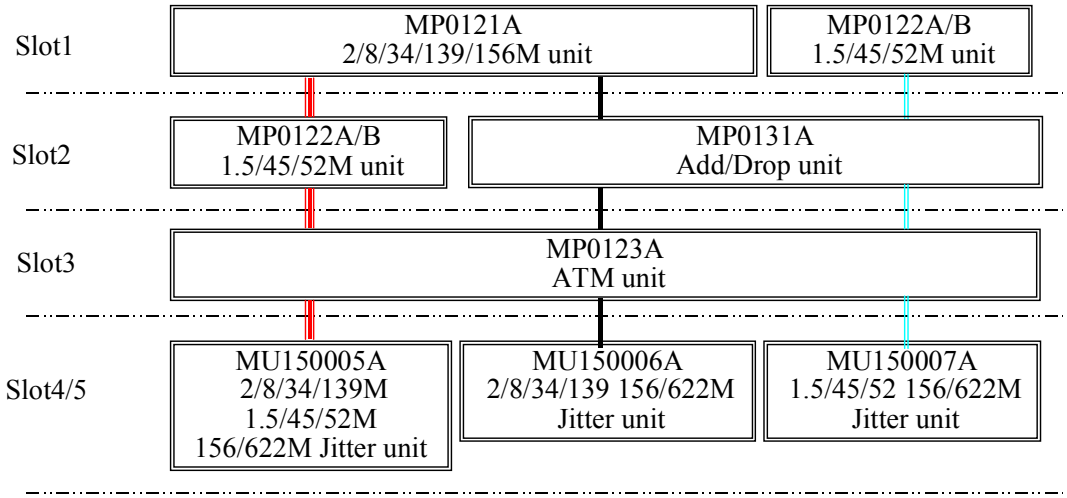
Plug-in Structure

- **622M**



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SONET/ITU-T Compliance Tests

- Mixed Payload
- TC (Tandem Connection)
- Alarm Detection/Release Condition Setting
- CID Pattern, Non-frame Pattern Measurement
- APS(Auto-switching) Time Measurement
- OH Test (OH change, PTR 64 Frame, OH BERTS)
- Linear/Ring System K1, K2 Byte Setting
- Two Path Trace Types (16 Byte/64 Byte)

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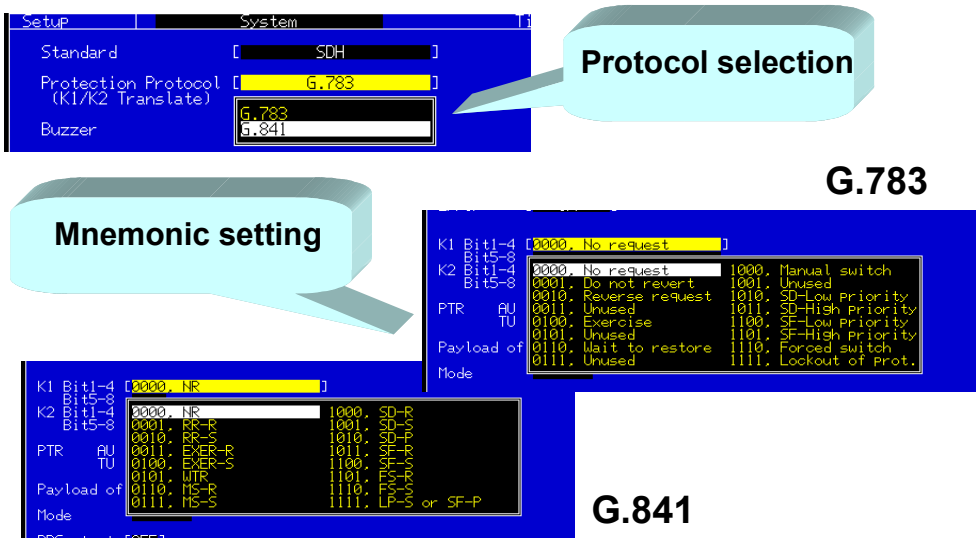
APS measurement

- **Linear/Ring System K1 and K2 Byte Setting**



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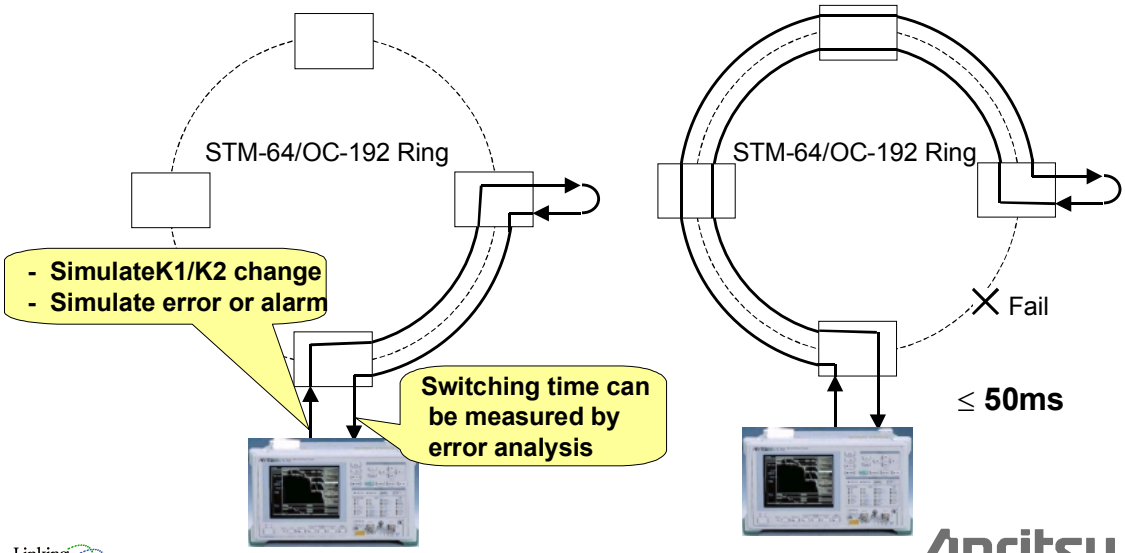
APS measurement

Switching time measurement(ITU-T Rec.G783/841)



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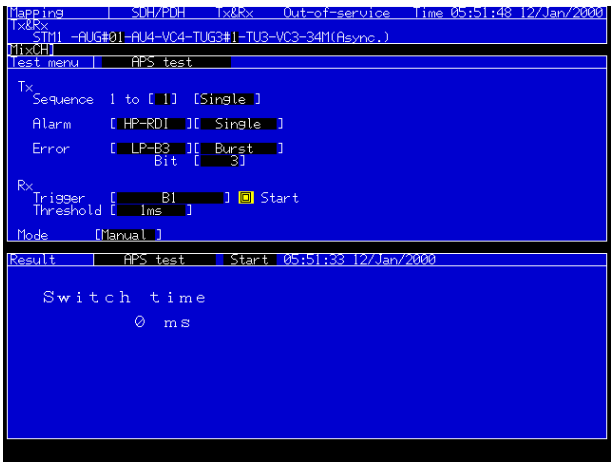
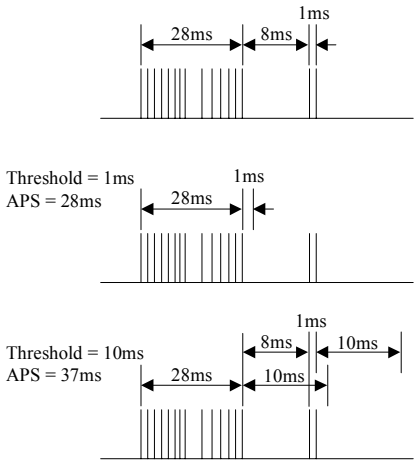
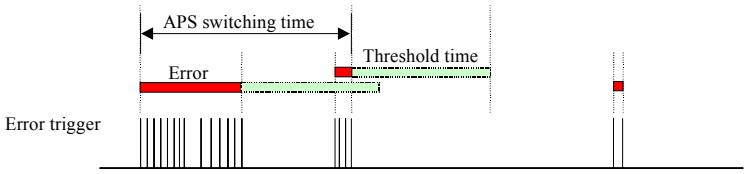
APS measurement







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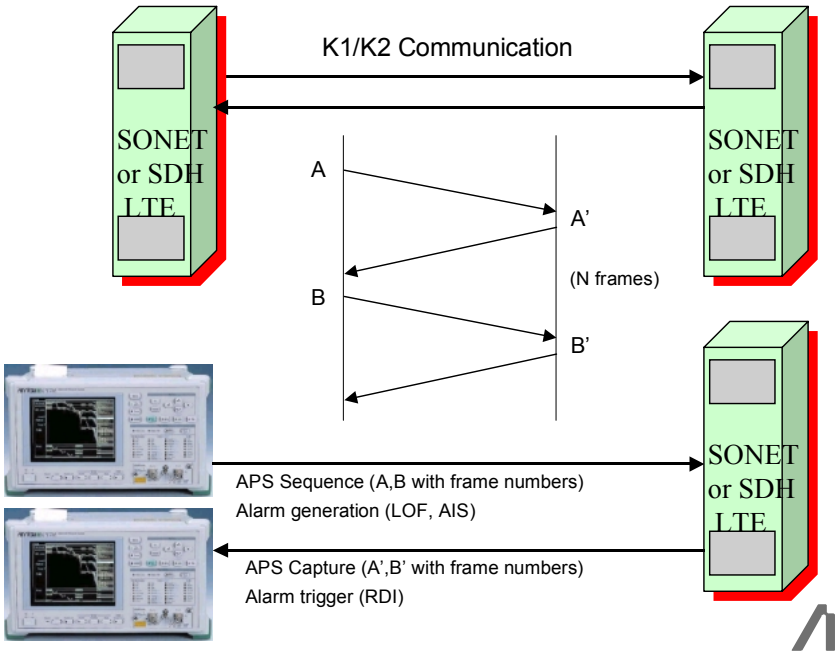
APS measurement



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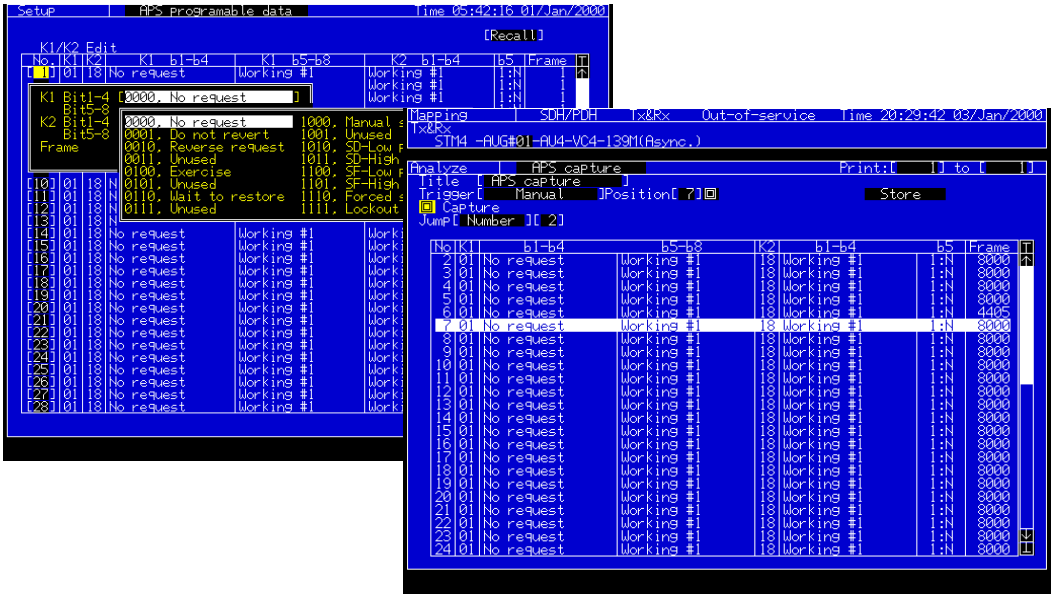
APS measurement



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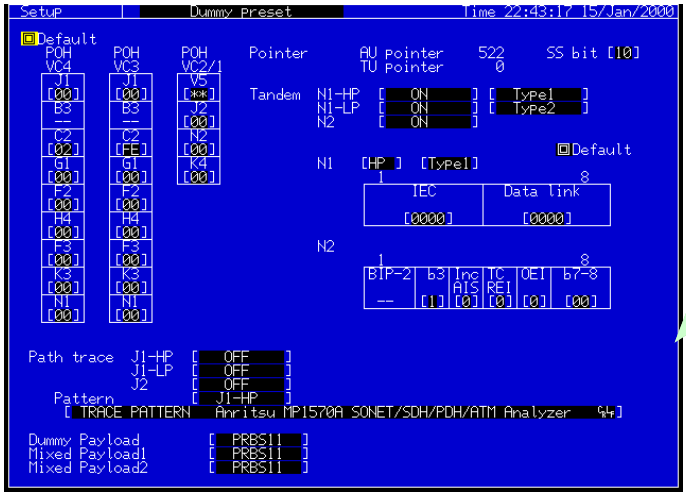
Dummy Channel Setting

Copy: Copy measurement channel setting

Dummy: Dummy preset setting



Set OH send data at dummy selection

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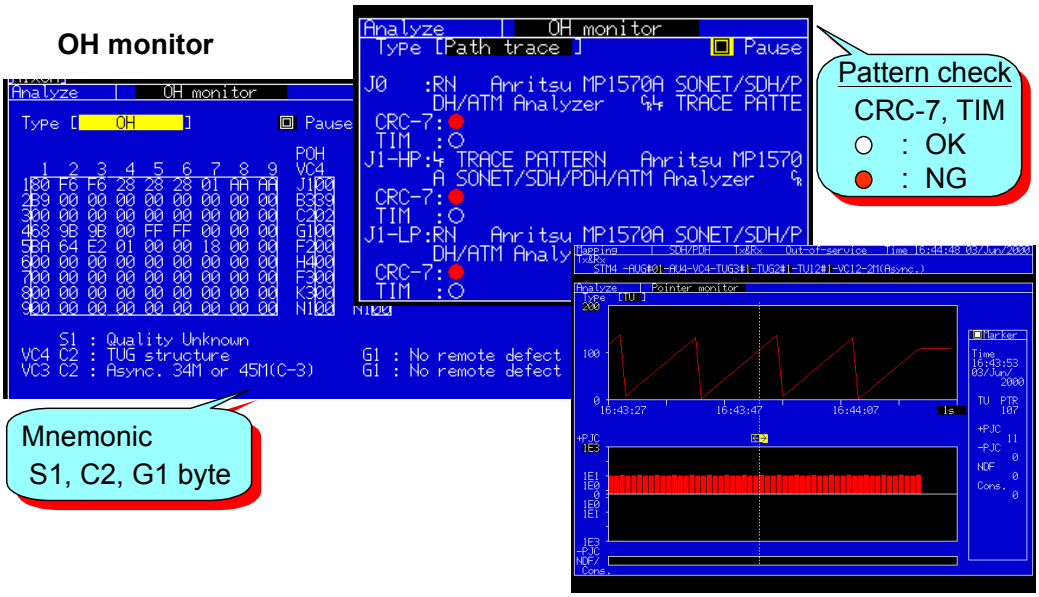
Monitor

OH monitor



Pattern check
CRC-7, TIM
○ : OK
● : NG

Mnemonic
S1, C2, G1 byte

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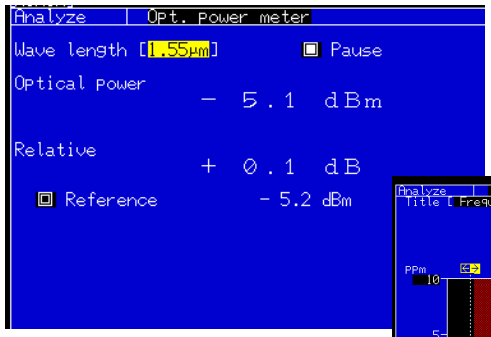
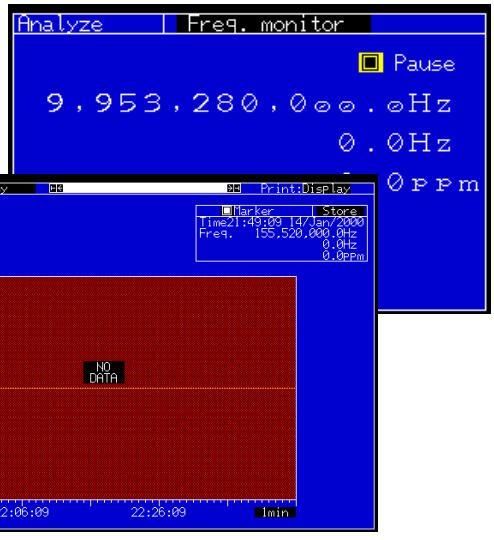
Monitor

Optical power meter



Frequency monitor



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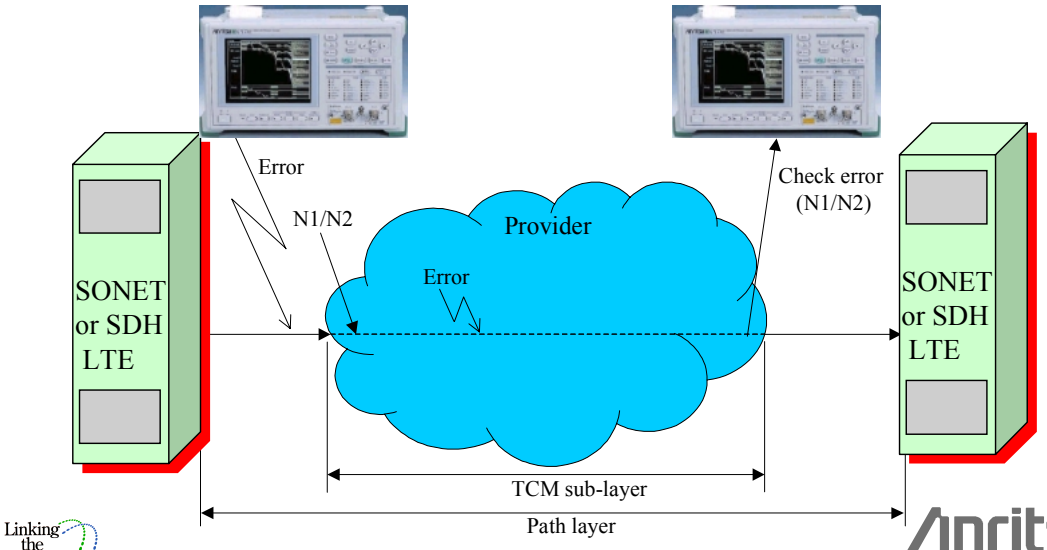
Tandem Connection Monitoring

Using N1/N2 byte for network monitoring (ITU-T Rec.G.707)
- discrimination where error has happened among network providers.



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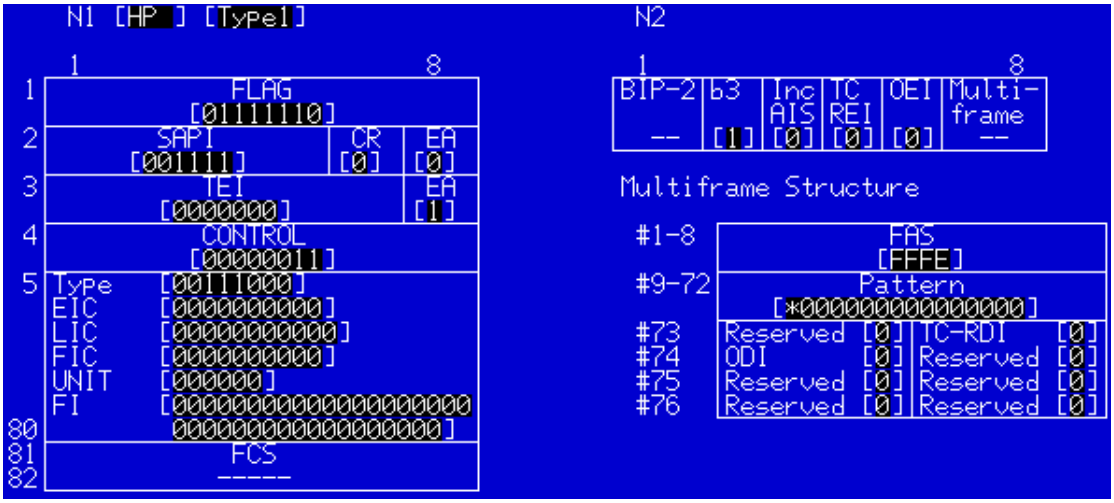
Tandem Connection Monitoring



Alarm measurement: VC-AIS, ISF, FAS, In-coming AIS, RDI, ODI

Error measurement: IEC, REI, OEI

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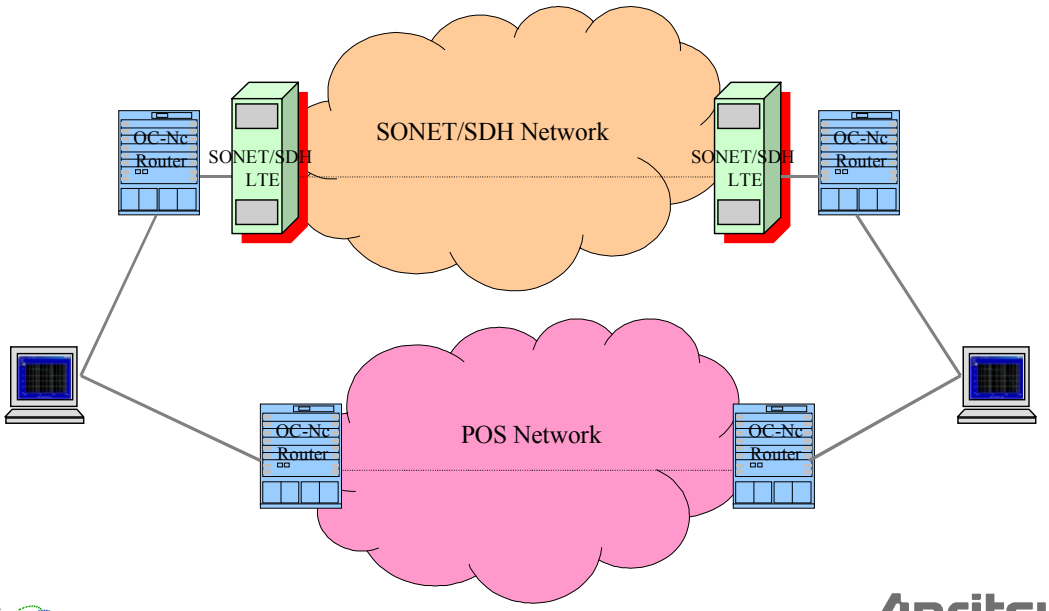
IP over SONET (POS)



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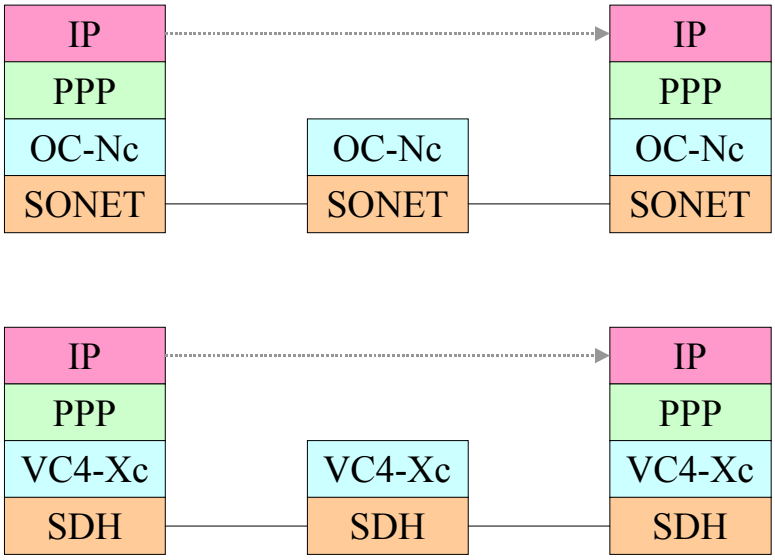
IP over SONET (POS)



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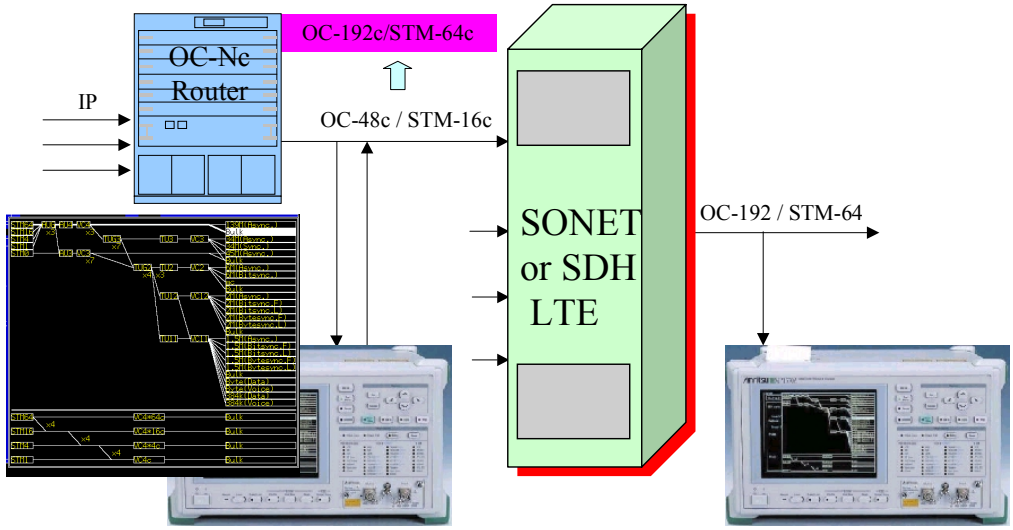
Slide 48

Concatenation Mapping Tests

Evaluating router concatenation mapping



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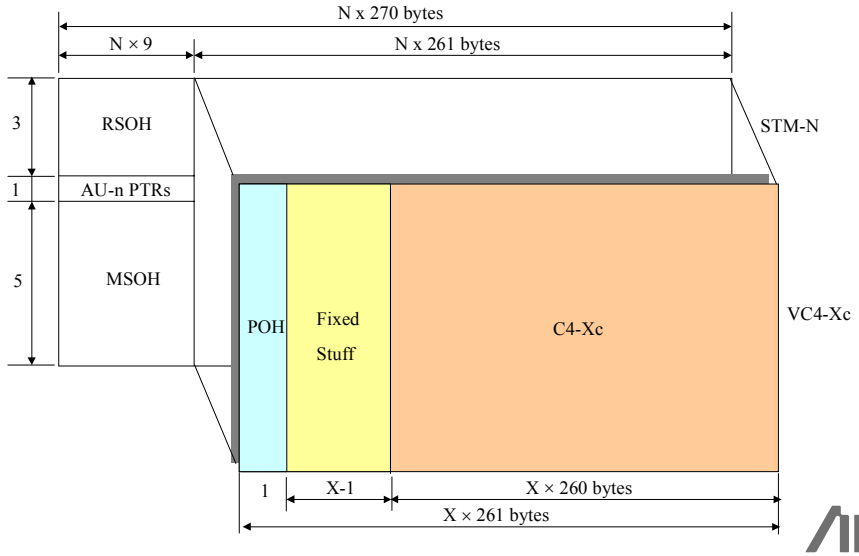
Concatenation Mapping Tests

Supporting VC4-Xc (ITU-T G.707) and OC-Nc mapping tests

-IP packets are mapped into payloads via the PPP frames.



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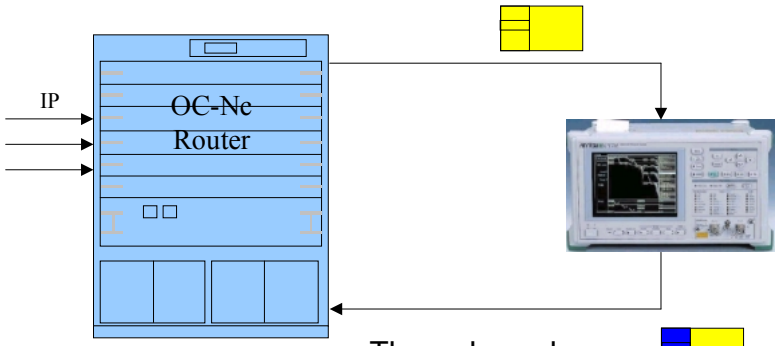
Slide 50

Tests in Through Mode

Evaluating router SONET/SDH functions



Through mode: TOH/SOH tests

OH overwrite: POH tests

Error/alarm insertion tests

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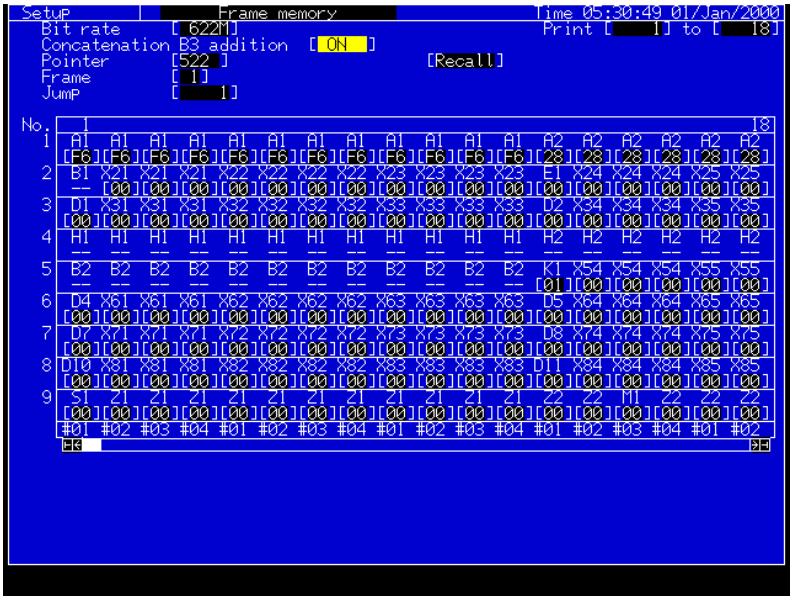
Frame memory (Option)



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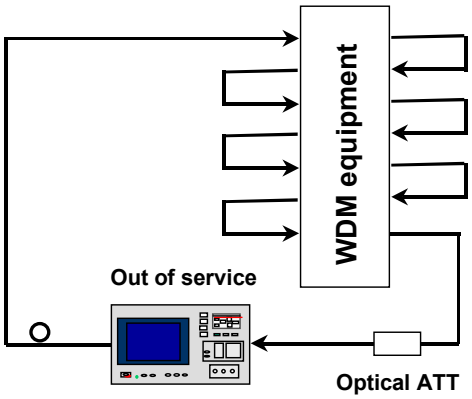
WDM Measurement Solution

Tx&Rx: 1
Measurement system



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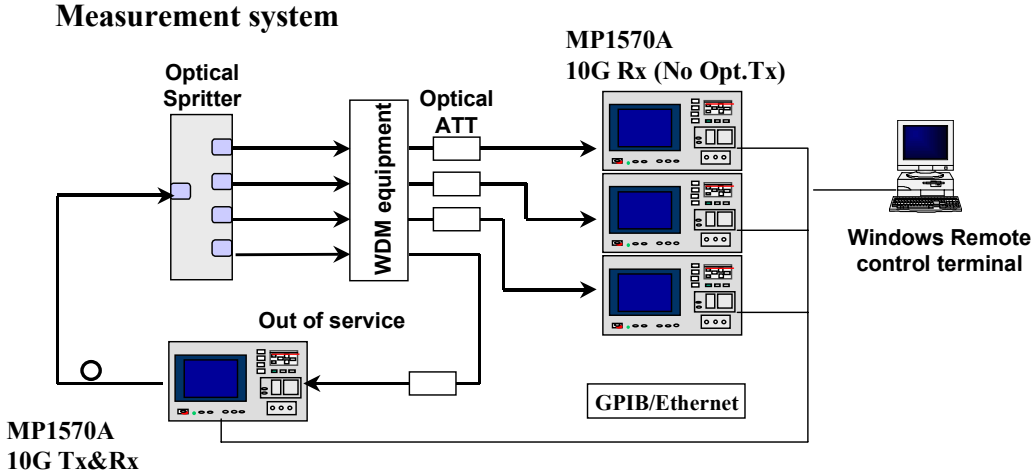
WDM Measurement Solution

Tx: 1
Rx: 4
Measurement system



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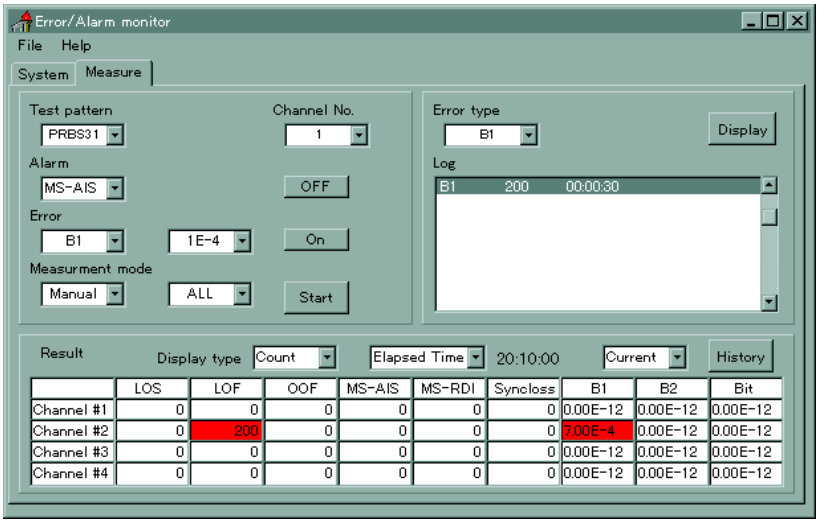
WDM Measurement Solution (Proposal example)

Screen example



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Specifications are subject to change without notice.

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