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Agilent ParBERT 81250 43G
Parallel Bit Error Ratio Tester

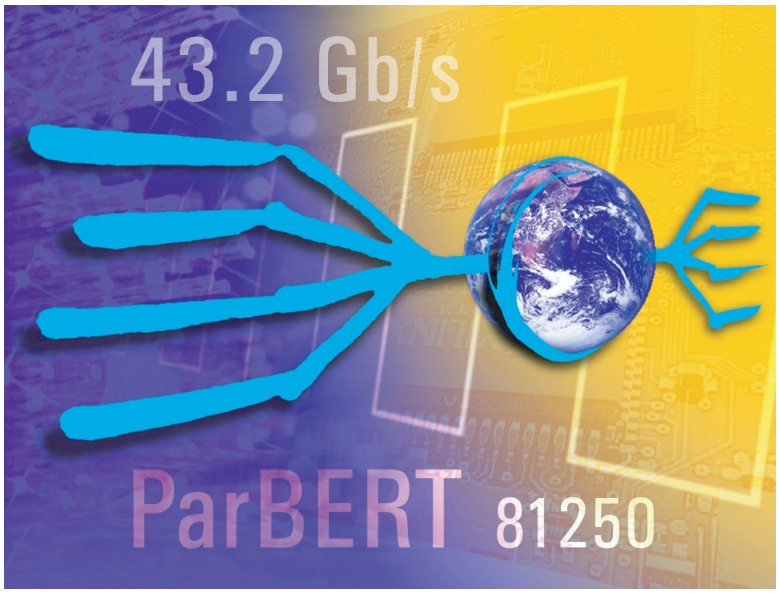
Agilent BERT E2150A 43G Electrical/Optical System

Product Overview
Version 1.6





Accelerate Your Time to Market With The Ideal Electrical/Optical Solutions for Testing Both the Parallel and Serial Sides of OC-768



Agilent Technologies

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Agilent 40G BER Test Solutions for Electrical/Optical OC-768

The Agilent family of 40G BERT products are the ideal solutions for testing both the parallel and serial sides of optical and electrical OC-768. The 40G BERT solutions enable fast time to market by testing all critical optical/electrical elements in OC-768 digital transmission lines-from components and modules to line cards.

The Agilent ParBERT 81250 43G is ideal for stimulating and analyzing electrical 16:1 and 4:1 OC-768 MUXes (multiplexers) and DeMUXes (demultiplexers).

The Agilent BERT E2150A 43G offers a fully integrated turn-key solution that has both electrical and optical test capabilities.

The Agilent ParBERT 81250 43G and the BERT E2150A 43G are modular, VXI-based systems that can be adapted for a variety of testing needs. Both systems provide the flexibility to generate and analyze 43.2 Gb/s and 2.7 Gb/s data streams. The systems generate standard pseudo random binary sequences (PRBS) and user-defined patterns on serial interfaces, and pseudo random word sequences (PRWS) on parallel lines. Bit error ratios can be analyzed for user-defined patterns or PRBS/PRWS. Easy-to-use interfaces allow data setup.

ParBERT 81250 43G test system is particularly suitable for the following applications:

• Serial BER Test

Perform serial, up to 43.2Gb/s, BER testing on trans- impedance amplifiers (TIAs), clock recovery circuits, laser drivers, etc.

•OC-768 16:1 Mux/Demux Test

•OC-768 4:1 Mux/DeMux Test

•SFI 5
Stimulate and analyze 1:16 multiplexer and demultiplexers at 2.7Gb/s and 43.2Gb/s. Modularity for stimulating and analyzing with additional channels according to the SFI-5 (SERDES-Framer Interface-5) Interface.

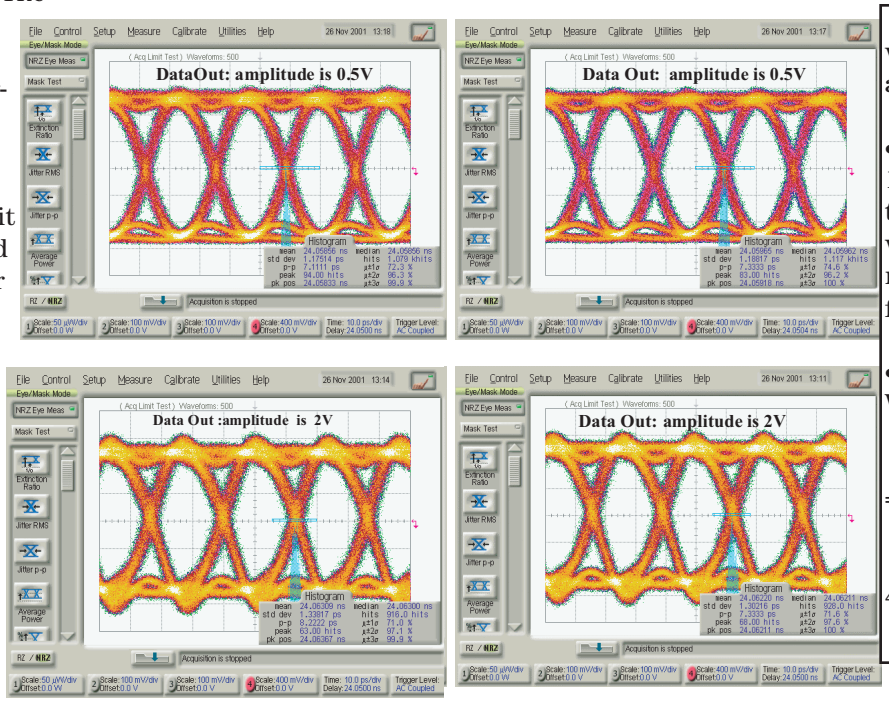
•FEC device test

Test at 43.01841 Gb/s to include the FEC rate resulting from 255/236 overhead.

The BERT E2150A 43G is a powerful tool for the testing of:

- OC-768 Systems and line-cards due to its emulation capability of static OC-768 SONET and STM-256 SDH frames
- OC-768 Electrical to optical, optical to electrical and optical only devices

For more information on the BERT E2150A 43G, please refer to page 20.



•Output of mux with data amplifier

•Jitter is approx. 1.3ps rms in these particular waveforms (2ps rms typ. is specified)

•Acquisition=500 Waveforms

•Length of cable = 20” (50.8cm)

•Frequency = 43.2Gb/s

Figure1: ParBERT 43G Waveform Measurement

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ParBERT 81250 43 G
Key Features Overview

Features	Benefits
• Generate and analyze 43.2Gb/s and 2.7 Gb/s signals within one system	• Ideal for testing the parallel and serial sides of OC-768 16:1 MUXES/DeMUXES
• Generate and analyze 43.2 Gb/s signals	Ideal for • 43.01841 Gb/s FEC device test • Serial 40 Gb/s testing e.g trans-impedance amplifiers (TIAs) clock recovery circuits and laser drives
• Generate pseudo random word sequences (PRWS) (up to 2.7 Gb/s) and standard PRBS up to 2^{31} -1 (up to 43.2Gb/s) • Analyze bit error ratios with user defined data and PRBS	•Perform parallel BER measurements - ideal for MUX/DeMUX (serializer/deserializer) circuits
• Program remotely via Agilent VEE, National Instruments' Labview ® Agilent TestExec, C/C++ Microsoft ® visual Basic and Excel	•Builds measurements into your test executive easily
• External input up to 10.8/21.6 GHz	
• Sub rate clock outputs at 21.6GHz, 10.8 GHz,[1] 2.7GHz/675 MHz	
• 43.2 G DeMUX module has CDR mode	• Clock is delivered automatically from Data stream - no need for an external clock
• Mix of channels (generator/analyzer) and speed classes • Modular and expandable architecture	• Test complex devices with many channels and many frequencies e.g MUX/DeMUX (SERDES), FEC circuits
•Intuitive Windows- NT ® based user software	• 'Standard' and 'detail' views show you only the parameters you want to perform the measurement
• SONET editor	• Generate SONET frames

[1] 9.5 to 10.8 GHz and 19 to 21.6 GHz

[2] MUX module only

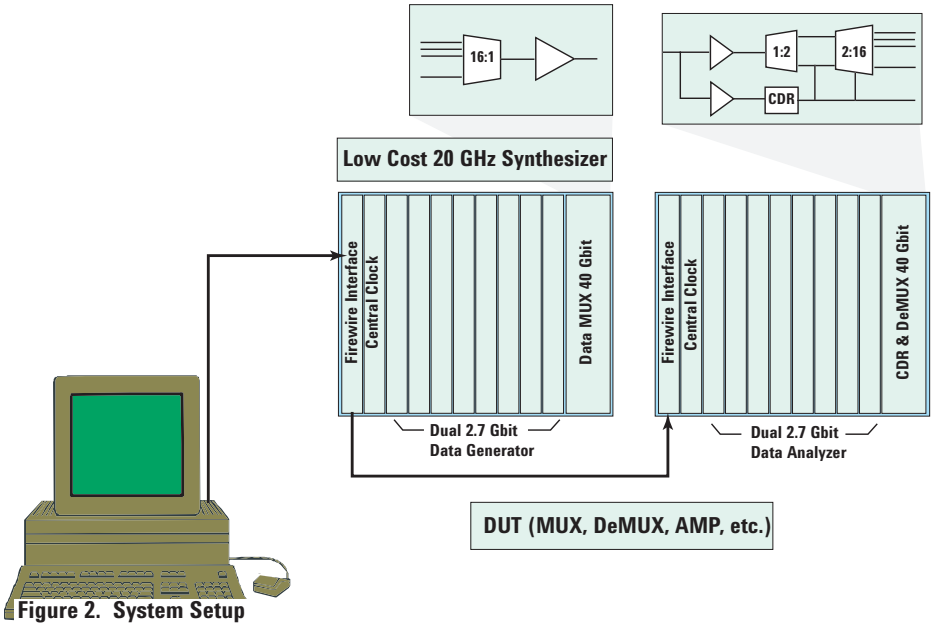


Figure 2. System Setup

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ParBERT 81250 43G
Fundamental Platform Description

The ParBERT 81250 bit error ratio tester is a modular system, which can be tailored to your specific testing needs. This document focuses on the ParBERT 81250 43G, which consists of VXI mainframe(s), MUX (multiplexer) module(s), DeMUX (demultiplexer) module(s), generator modules, analyzer modules, a high-performance clock module, user (operating) software, and all electrical interconnections.

VXI Mainframes

For 40 Gb/s MUX and DeMUX testing, two mainframes are required. One VXI mainframe contains 13 slots. It can hold up to 16 channels at the data rate of 2.7 Gb/s and the 43.2 Gb/s MUX or DeMUX module.

Modules

Modules are available individually or in pre-configured bundles (see page 16). Bundles are recommended for new ParBERT customers wanting 40 Gb/s capability. Individual modules are recommended for customers expanding an existing 2.67 Gb/s ParBERT system to 40 Gb/s capability. On-site support is available for customers who expand a 2.67 Gb/s system to a 43.2 Gb/s system.

Analyzer/Generator Module

- Agilent E4861A 2.7 Gb/s module (holds up to two front ends)

43.2 Gb/s MUX Module

- Agilent E4868A 43.2-Gb/s, three-slot MUX module (includes one 40 Gb/s cable and 32 2.7 Gb/s cables and a software upgrade)

43.2 Gb/s DeMUX Module

- Agilent E4869A 43.2-Gb/s, three-slot DeMUX module (includes one 40 Gb/s cable and 32 2.7 Gb/s cables and a software upgrade)

Clock Module

- Agilent E4808A high-performance clock module

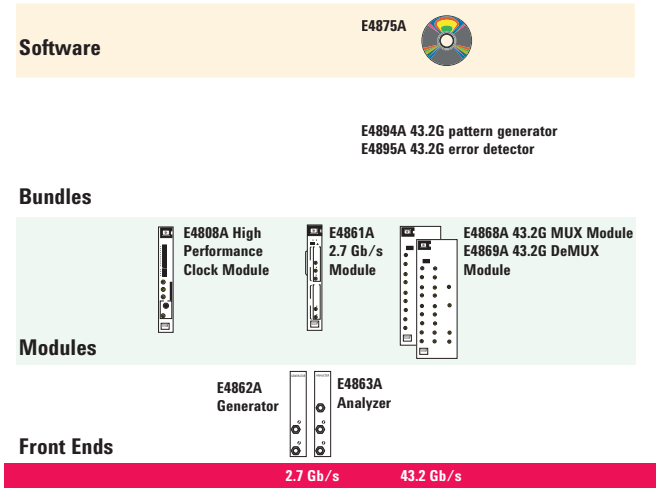


Figure 3. ParBERT 43.2 G product family

Front Ends

Generator and analyzer front ends are available with three speeds 675 MHz, 10.8 GHz and 2.7GHz. Please refer to the Agilent ParBERT 81250 product overview, publication number 5968-9188E, for details on front ends.

Generator Front Ends

- Agilent E4862A 2.7 Gb/s front end

Analyzer Front Ends

- Agilent E4863A 2.7 Gb/s front end

Pre-Configured Application Bundles

Two pre-configured bundles are available for key 43.2 Gb/s applications:

- Agilent E4894A 43.2 Gb/s pattern generator bundle
- Agilent E4895A 43.2 Gb/s error detector bundle

Please see page 16 for details of the bundles.

Software

- Agilent E4875A ParBERT 81250 software

The ParBERT 81250 43.2 Gb/s user software runs on an external PC with MS Windows NT® 4.0 or Win2000 operating system. The software currently supports PCs connected to the system via an IEEE 1394 PC link to VXI (plug and play drivers are supplied).

Clock Source

An internal clock source is included. However, a 20-GHz, 26-GHz, or 50-GHz clock source is also recommended for getting the best clock performance possible, e.g. the Agilent E8244A signal generator, with options 1EA and UNJ.

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43.2 Gb/s MUX/ DeMUX Module Architecture

E4868A MUX Module

The MUX module is a 16:1 multiplexer. The data inputs on the parallel side are 16 differential data inputs, which are connected with 32 cables to 16 2.7-Gb/s data generator channels. Furthermore, this module includes a clock distributor providing sub-rate clocks at 1/2 and 1/4 and 1/16 or 1/64 of master period. The internal oscillator (MCLK) can be substituted by an external source (external clock output) (signal generator) still providing the sub rates.

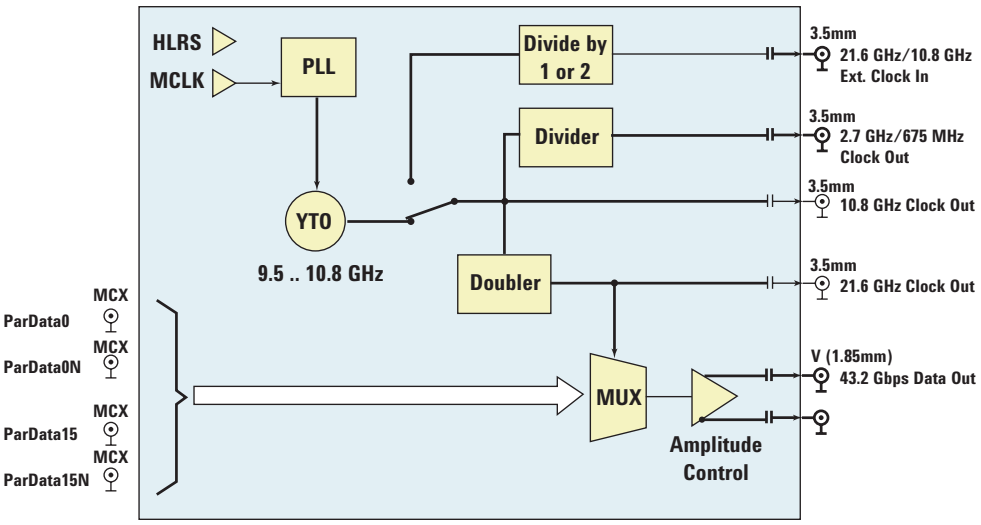


Figure 4. 43.2 G MUX Module Architecture

E4869A DeMUX Module

The DeMUX module can operate in two modes:

- CDR mode
- external clock mode

In the CDR mode the module can recover the clock from the data input. It is not necessary to supply a clock to the module in this mode.

In the external clock mode the clock phase in reference to the data phase has to be controlled externally.

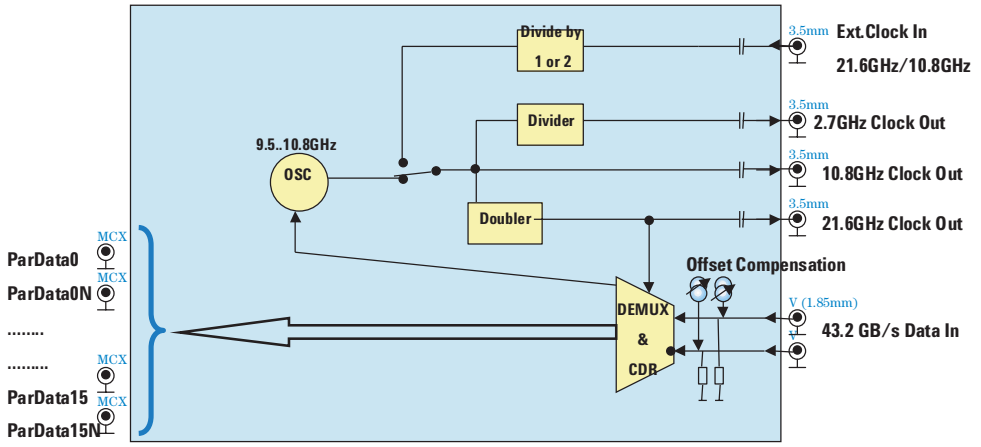


Figure 5. 43.2 G DeMUX Module Architecture

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ParBERT 81250 43G
Ease of Use (43G MUX and DeMUX)

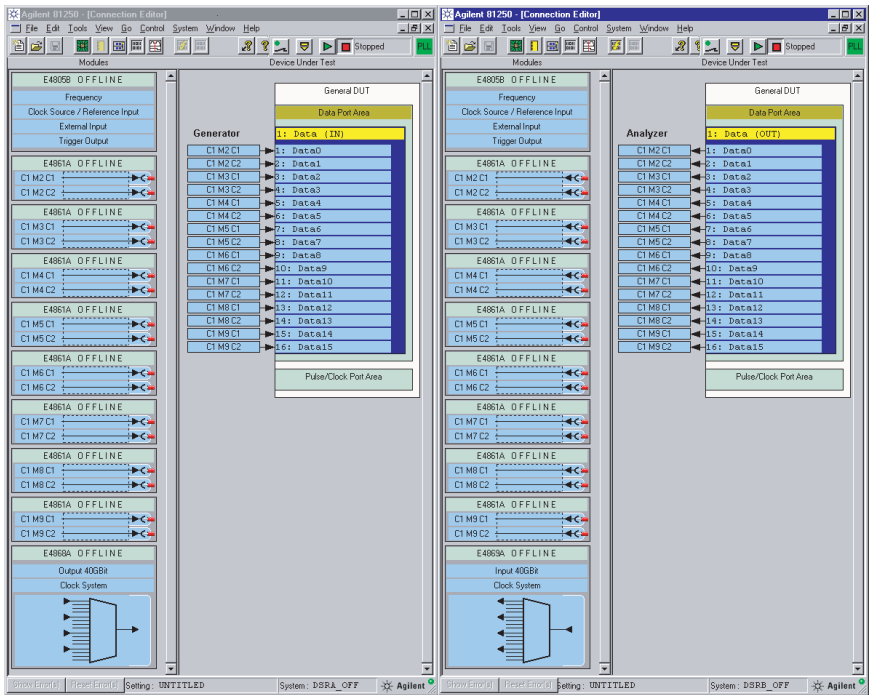


Figure 6. The connection window for setting up the MUX/DeMUX module

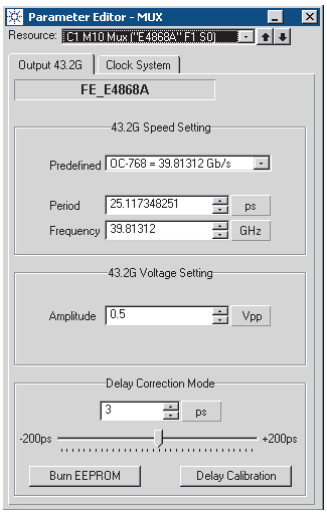
The ParBERT 81250 43G user interface includes the control of the E4868A MUX module and E4869A DeMUX module.
There are specific symbols added to the system resources.

The MUX and DeMUX module properties are accessible from the screens shown in figures 6,7 and 8. The properties for the MUX module are:

- Clock system- here you select between internal clock (MCLK) or external clock
- Output- here you control the output voltage swing

The DeMUX module properties are:

- Clock system- here you select the clock recovery with CDR or external clock input.
- Input- here you select the input frequency.



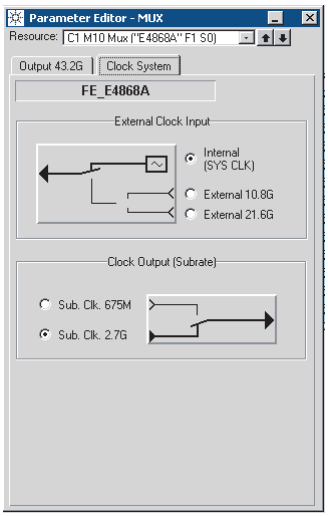
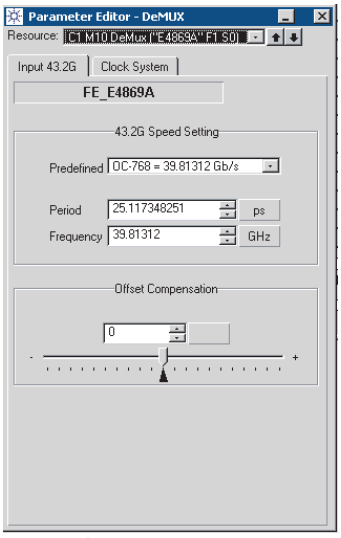


Figure 7. MUX property window



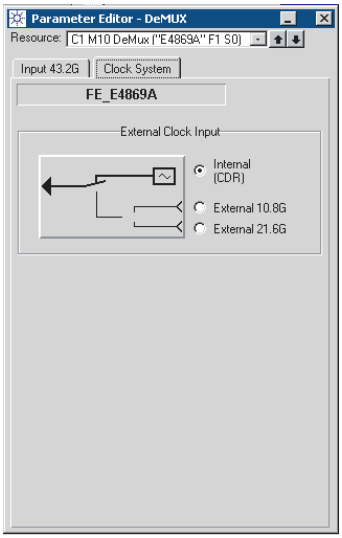


Figure 8. DeMUX property window

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ParBERT 81250
DUT Output Timing Measurement (for the tributary 2.7Gb/s channels, only)

Measure the BER of a DUT's (device under test) output versus sample point delay, which is shown graphically as a bathtub curve with the DUT output timing measurement. The delay is always centered to the optimum sampling delay point of the port (terminals). If a clock is defined, the clock to data alignment is measured. If the absolute delay can be measured, it will also be displayed. Relative timing, where edges are compared, is also possible.

Measurement results provided:

- Clock out to data out timing relations (setup/hold time)
- Skew between outputs
- Delay at optimum sample point
- Phase margin
- Pass/fail results

There is also a numerical view that shows the "numerical return values" for the selected BER threshold only.

This measurement can be used on the parallel side of the 43.2 G MUX/DeMUX, for example.

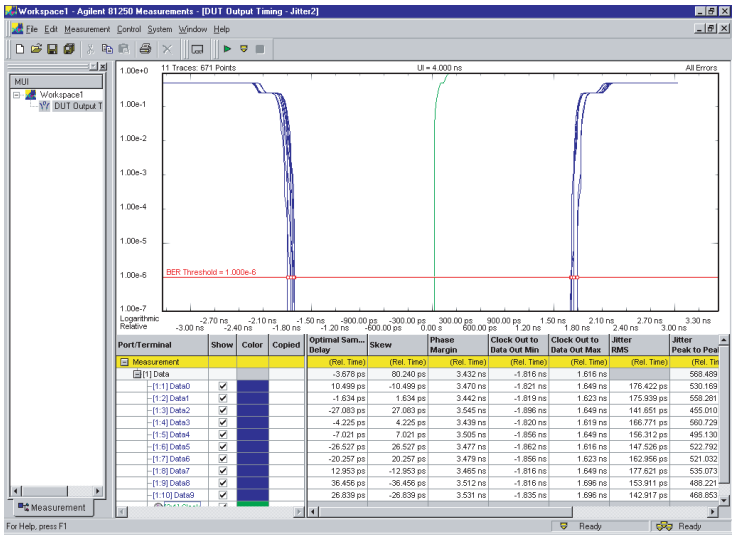


Figure 9. View the DUT output measurement results as a bathtub curve

Table 2: DUT Output Timing Measurement	
Timing Parameters	Optimum sample point delay Phase margin Clock to data out min Clock to data out max Skew between channels
Jitter Parameters	RMS Jitter Mean value Peak-to-Peak Jitter for specific BER
Pass /Fail	For all timing and jitter parameters, each parameter can be individually enabled
Graph	View of BER versus sample delay two markers: delay, BER

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ParBERT 81250 43G Use Models

The three key applications are:

- **38 to 43.2 Gb/s serial BER testing (electrical)**
- **MUX testing (OC-768)**
- **DeMUX testing (OC-768)**

38 to 43.2 Gb/s serial BER testing (electrical)

In the following use models, a synthesizer is included to ensure the best performance for clock signals.

The 43.2 G pattern generator / error detector bundles are ideally suited for serial BERT testing.

The 43.2 G pattern generator provides the data stream with PRBS/memory-based patterns in the NRZ format. Output is available differentially. Besides data out, clock subrates are also available.

In the example shown in fig.10 there is an external signal generator (E8244A) providing a high performance clock signal to the external clock input of the E4868A mux module. The signal generator is used to achieve the lowest clock jitter performance. If this is not critical, the internal osillator of the clock module (E4808A) can be used as clock for the E4868A mux module.

The 43.2 G error detector takes the NRZ data stream and provides CDR (clock data recovery). This recovered clock is used to keep the data processing either based on PRBS or memory based data in proper clock phase.

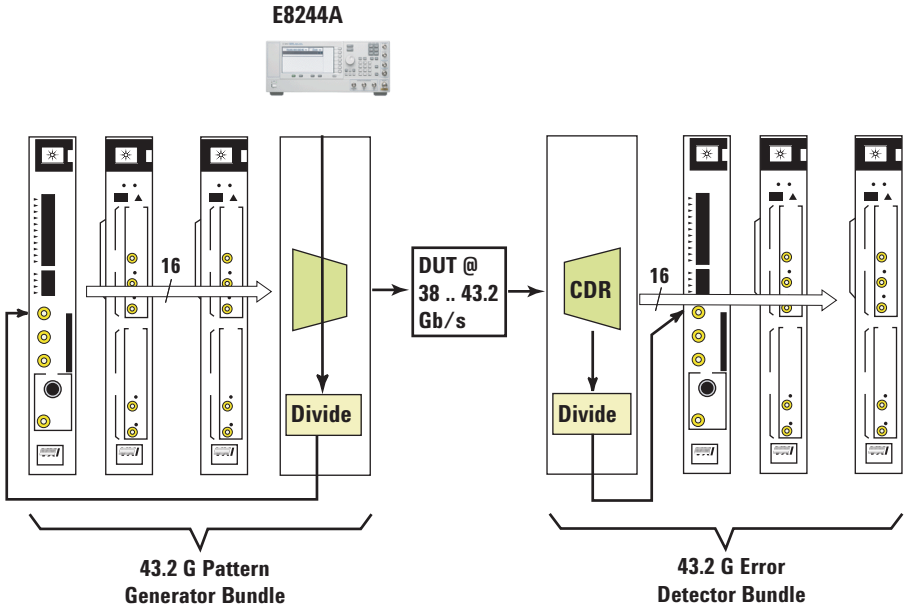


Figure 10. 43.2 G Serial BER Testing

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ParBERT 81250 43G Use Models (cont.)

MUX Test (OC-768)

To set up a MUX test, first take a look at the clock system of the MUX (right).

There are several possibilities for the internal or external clock source. The example shown has the choice of using an internal high speed clock source, which also offers a clock at the parallel speed. But it is also possible to apply an external high-speed clock.

Secondly there are two clocks of 2.5 GHz on the parallel side. One is provided to the protocol ASIC (framer) , the other is returned together with the parallel data. A programmable phase shift circuit compensates for the round trip.

The following are two recommendations of how to set up the clock scenario:

1. The more economical setup (Fig 12) just provides a 675 MHz or 2.7 GHz clock signal by means of a 17th generator channel. This eliminates the E4868A 43.2 G MUX module. The analyzer consists of the E4895A 43.2 G error detector bundle.

2. The most flexible setup (Fig 13) includes the E4868A 43.2 G MUX module which offers various clock subrates derived from a synthesizer, providing a master clock with ultimate phase noise characteristics:

This setup includes both the E4894A 43.2 Gb/s pattern generator and the E4895A error detector bundle. Please note that the pattern generator bundle is wired with all the 2.7 Gb/s generators to the DUT instead of the MUX inputs (see page 16 for further details).

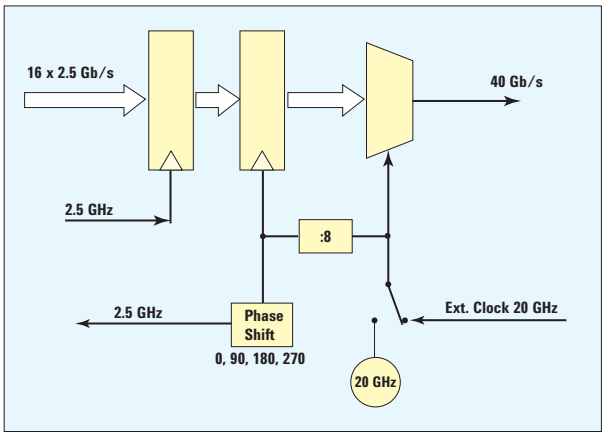


Figure 11. Multiplexer Architecture

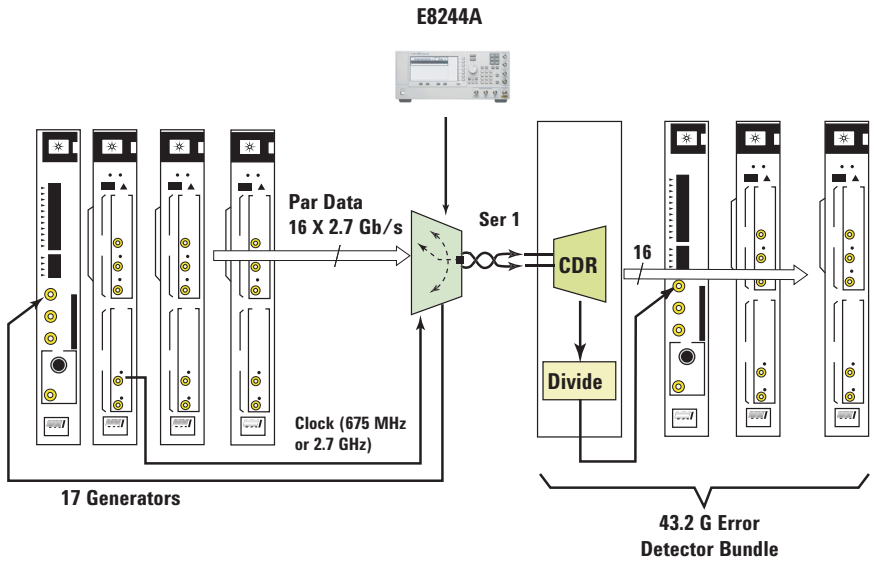


Figure 12. MUX Test Setup (1)

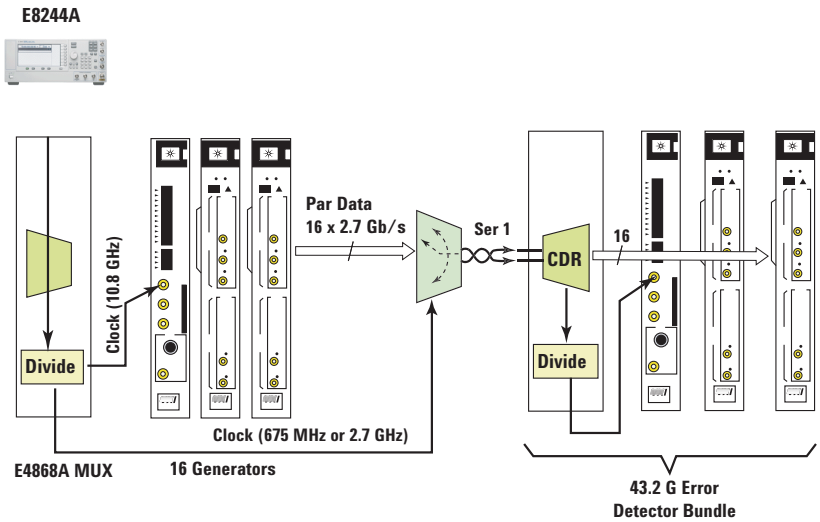


Figure 13. MUX Test Setup (2)

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ParBERT 81250 43G Use Models (cont.)

DeMUX Testing (OC-768)

The DeMUX test setup uses the E4894A 43.2 G pattern generator bundle for stimulating the DeMUX.

For the analysis, 16 additional analyzers at 2.7 Gb/s are needed. These use the E4808A 10G clock module which receives the recovered clock for reference. These analyzers can be used from the E4895A bundle, but will need some re-wiring (see configuration chapter for further details)

Some consideration should be given to the kind of measurements which are desired. The setup in figure 14 is good for pure BER testing. For further testing on the DeMUX output timing see DUT measurements page 7. It is recommended that a 17th analyzer channel be connected to the recovered clock (see figure 15), as well as the clock input of the clock module (E4808A).

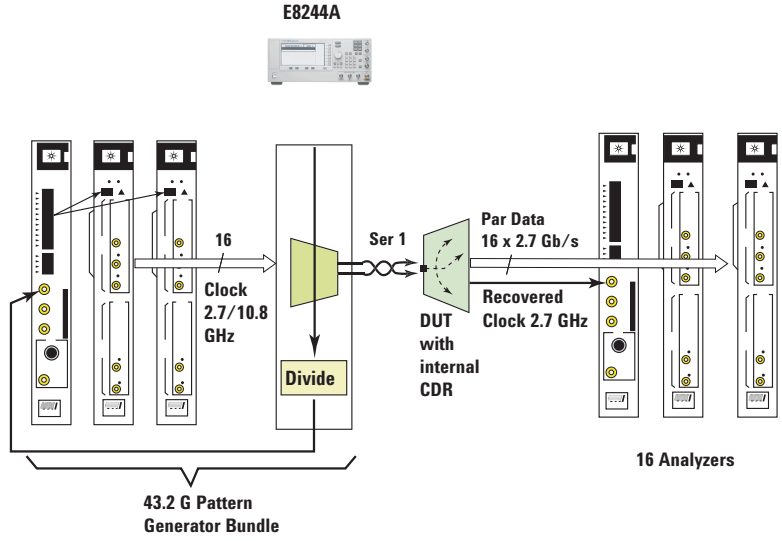


Figure 14. DeMUX Test Setup (1)

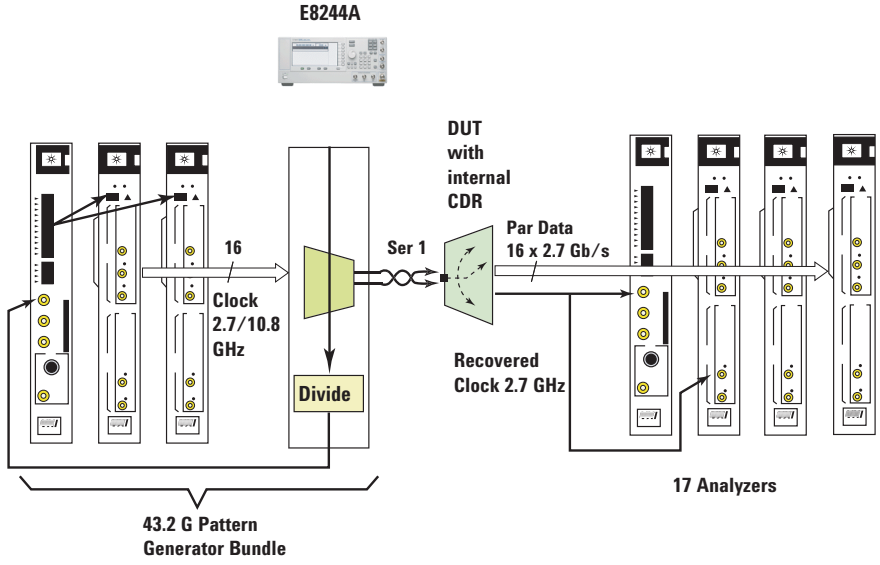


Figure 15. DeMUX Test Setup (2)

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ParBERT 81250 43G Technical Specifications

These specifications describe the instrument's warranted performance. Non-warranted values are described as typical. All specifications are valid from 20 degrees C to 35 degrees C ambient temperature after a thirty minute warm-up phase, with outputs and inputs terminated with 50 Ω.

Mux module E4868A

This 3-slot VXI module is supplied with 16 x 2.375 Gb/s..2.7 Gb/s differential data DØ...D15). It can work with internal clock (to be wired from E4808A to the MCLK connector) or with an external clock to the external clock input.

There are three subrate clock outputs providing a 20 and10 GHz clock signal and a 2.7GHz/675MHz signal. Any performance should be based on the 10GHz/20GHz clock outputs only. The data output multiplexes the data supplied at DØ...D15 is a cyclical form.

Therefore the frequency relation of the parallel port and the serial imput need to be a 1:16 ratio with fixed phase relation.

Overall Timing: Based on standard 2.7 Gb/s ParBERT 81250 modules (E4861A + E4862A/E4863A) + clock module (E4808A) and 3-slot MUX module (E4868A) and 3-slot DeMUX module (E4869A)

Table 3	System Data Rate
Data rate range	38 Gb/s to 43.2 Gb/s
	See table 7 for further parameters

Table 4	MUX Module E4868A			
Data Output	differential			
Format	NRZ			
Characteristics	50 Ohm, 1.85mm Connectors			
Coupling	AC coupled			
Swing	500mV .. 2V single ended, doubles differentially			
Swing Resolution	10mV			
max. ext. Voltage	+/- 3V			
On/Off	No relays provided, unused output needs external termination			
Transition Time	10ps typ.			
Jitter	1.5ps rms typ.			
Subrate Clock Outputs	3, single ended			
Rate (GHz)	½ and ¼ and 1/16 or 1/64 of data rate			
Output Characteristics	50 Ohm, 3.5mm Connectors			
Coupling	AC coupled			
Output Swing and phase noise			Level	Phase Noise@10KHz offset
	1/64	675MHz	500 mVpp typ.	-100dBc/Hz typ.
	1/16	2.7GHz	300mVpp typ.	not specified
	1/4	10.8GHz	500mVpp typ.	-81 dBc/Hz typ
	1/2	21.6GHz	500mVpp typ.	-75 dBc/Hz typ
External Clock Input	1, single ended			
Characteristics	50 Ohm, 3.5mm Connector			
Coupling	AC coupled			
Frequency Range	9.5 to 10.8GHz or 19 to 21.6GHz selectable			
Input Power	-10dBm to 0dBm			
Parallel Data Inputs	16, differential			
Format	NRZ			
Characteristics	50 Ohm, MCX Connectors			
Coupling	DC, center tapped to Ground			
Input Swing and Termination	400mV around -200mV (CML)			

Note: Recommended trigger source 10.8/21.6 GHz output.

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Table 5	DeMUX Module E4869A
Modes	- Active CDR (Clock Data Recovery) / Phase Recovery (auto matically sample point adjustment at 50 % of cycle) Ext. Clock Mode (sampling based on ext. clock
Measurement	BER as summary of 16 2..7Gb/s tributary channels
Data Input	differential
Characteristics	50 Ohm, 1.85mm Connectors
Coupling	DC coupled
Sensitivity	50mVpp typ.
Input Voltage window	+/- 250 mV
Max Input amplitude	250 mVpp single ended
Absolute maximum input voltage window	+/- 350mV
Format	NRZ
Clock Data Recovery Bandwidth	>1MHz
Subrate Clock Outputs	3, single ended
Rate (GHz)	½ and ¼ and 1/16 of data rate
Characteristics	50 Ohm, 3.5mm Connectors
Coupling	AC coupled
Swing	>400mV (-4dBm) fixed
External Clock Input	1, single ended
Characteristics	50 Ohm, 3.5mm Connectors
Coupling	AC coupled
Frequency Range	9.5 to 10.8GHz or 19 to 21.6GHz selectable
Input Power	-10dBm to 0dBm
Parallel Data Outputs	16, differential
Format	NRZ
Characteristics	50 Ohm, MCX Connectors
Coupling	DC
Output Swing and Termination	400mV around -200mV (CML) into 2x 50 Ohm center tapped to Ground

Demux module E4869A

This is a 3 slot VXI module.
A 38....43.26 Gb/s signal will be demultiplexed in a cyclical way into 16x 2.375 Gb/s ..2.7 Gb/s signals (DØ... D/15)

The data processing (individual Ber analysis) is performed with the 16 2.7 Gb/s channels. The system software summarizes the measurements of each subrate channel and displays the result for the serial channel. The output timing of the demux module data channels is automatically adjusted with the synchronization capability of the 2.7Gb/s analyzer channels.

The E4869A Demux module can operate in CDR (clock data recovery) mode or with an external clock. In CDR mode the alignment for 50% criteria within the eye of the incoming signal is done automatically. In external clock mode a delay adjustment between clock and data has to be performed externally. In both clock modes there are three subrate clock outputs providing a 20/10 GHz clock signal and a 2.5 GHz clock signal.

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Table 6	System Data Capability
pure PRBS	2^n-1, n = 7,9,10, 11, 15, 23, 31
Errored	2^n-1, n=7,9,10,11,15
Marker density	1/8, 1/4, 1/2 ,3/4, 7/8 at 2^n-1, n=7,9,10,11,15
Extended one and zeros	2^n-1, n=7,9,10,11,15
Memory	128 MBit (16x8 MBit)

The system data capability is:
-PRBS: signal side
-PRWS parallel side
-memory data: both sides

To achieve PRBS data at the serial side, PRWS must be applied to the parallel side. Using memory based data, provides an equivalent memory of 128 Mbit (16x8 Mbit)

The SONET/SDH editor automatically puts the data cyclical converted to the proper parallel channels.

You can use memory-based data to produce a SONET frame using the editor. For OC-768 a SONET frame = 4976640 bits. So the memory can hold up to 25 frames.

Table 7	Clock Module E4808A
Central Clock Frequency Range, applicable in bundles E4894A/E4895A	2.375GHz.. 2.7GHz (MUX output / Analyzer sampling rate is 16 times faster)
Resolution	1Hz (At MUX/DEMUX effective 16Hz)
Accuracy	(+- 50 ppm with internal reference)
Ext. Clock Input	50 Ohm, single ended, SMA Connector
Coupling	AC coupled
Input Frequency Range	up to 10.8GHz
Input Frequency Ratio m/n ratio input frequency must fit Clock Frequency Range	m,n = 1,2,...256; m*n <= 1024; input frequency / n >= 1.3MHz
Sensitivity	100mV < 3.3GHz, 400mV > 3.3 GHz typ
Transitions required	< 20 ns
Duty Cycle required	40% .. 60%

Clock Module E4808A

The clock module is necessary to drive the group of 2.7Gb/s channels clock syncronously. There is a built-in oscillator as well as an external clock input up to 10.8 GHz with a programmable divider/multiplexer.

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Table 8 General Characteristics	E4894A	E4895A
Factory Installed	E8403A 13-slot VXI frame	E8403A 13-slot VXI frame
	E8491B FireWire interface E4808A 10G clock module 8 E4861A 2.7G module 16 E4862A 2.7G generator front end E4868A 43G MUX module E4875A ParBERT software	E8491B FireWire interface E4808A 10G clock module 8 E4861A 2.7G module 16 E4863A 2.7G analyzer front end E4869A 43G DeMUX module E4875A ParBERT software
Operating Temperature Timing readjustment required if ambient temperature changes more than 2 deg, relative to the last calibration.	20° to 35°C	20° to 35°C
Storage	-20°C to + 60°C	-20°C to + 60°C
Power Requirements	90-264 Vac, ± 10%, 47-66 Hz	90-264 Vac, ± 10%, 47-66 Hz
Electromagnetic Compatibility	(EN55011/CISPR 11 group 1, class A + 26 dB)	(EN55011/CISPR 11 group 1, class A +26 dB)
Acoustic Noise	48 (56) dBA sound pressure at low (high) fan speed	48 (56) dBA sound pressure at low (high) fan speed
Safety	IEC 348, UL 1244, CSA 22.2#231, CE mark	IEC 348, UL 1244, CSA 22.2#231, CE mark
Physical Dimensions	W:424.5 mm, H:352 mm, D:631mm,	W:424.5 mm, H:352 mm, D:631mm,
Weight Net **Weight Shipping**	26.8 kg 72 kg	26.8 kg 72 kg

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Table 9: Power Requirements of Modules and Front-Ends

Modules	dc Volts	+24V	+12V	+5V	-2V	-5.2V	-12V
E4808A High	dc Current	.35A	.2A	3.0A	1.2A	3.6A	0.2A
Performance Clock Module	Dynamic Current	0.04A	0.02A	0.3A	0.12A	0.36A	0.02A
E4861A 2.67 Gb/s module	dc Current	0.10	0.50A	5.20A	1.80A	4.00A	0.90A
	Dynamic Current	0.01A	0.05A	0.52A	0.18A	0.40A	0.09A
E4868A 43.2Gb/s Mux Module	dc Current	0.3A	0.9A	2.8A	0.15A	1.2A	0.9A
	Dynamic Current	0.04A	0.3A	0.4A	0.01A	0.2A	0.2A
E4869A 43.2Gb/s DeMux Module	dc Current	0.3A	0.9A	3.5A	0.1A	0.7A	0.7A
	Dynamic Current	1.06A	0.2A	0.6A	0.01A	0.2A	0.2A

* These specifications are valid for the module with the front ends installed

Table 10a: Cooling requirements for the modules E4808B and E4861A with the front-ends installed

Modules	ΔPP mm H_2O for 10°C rise	Air Flow Liter/s
E4808B	0.25	3.6
E4861A	0.4	5.2
E4868A	tbd	tbd
E4869A	tbd	tbd

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ParBERT 81250 43G Configurations

On the following pages 6 configurations are described.

The ParBERT 81250 43G offers two bundles:

1. The Agilent E4894A 43.2Gb/s pattern generator bundle which includes:

- One 43.2 Gb/s multiplexer module, includes 32 cables to connect to the 2.7 Gb/s channels (SMA to MCX) and a cable pair to connect to the DUT (1.85mm to 1.85mm)
- Sixteen 2.7 Gb/s generators E4862A built into eight E4861A 2.7 Gb/s modules
- One E4808A high performance clock module
- 15446A 8-line trigger input pod
- One FireWire controller
- One 13-slot VXI mainframe
- One E4875A ParBERT 43G software

The Agilent E4895A 43.2 Gb/s error detector bundle which includes:

- One 43.2 Gb/s demultiplexer module, includes 32 cables to connect to the 2.7 Gb/s channels (SMA to MCX) and a cable pair to connect to the DUT (1.85mm to 1.85mm), 16 x 2.7 G analyzers E4863A built into 8x E4861A.
- One E4808A high performance clock module
- One FireWire controller
- One 13-slot VXI mainframe
- One E4875A ParBERT 43.2 Gb/s Software

These two bundles need an external PC to run the ParBERT 43G software. The external PC is not included. You may run both bundles from the same PC.
For best jitter/phase noise performance, it is recommended that a signal generator (like E8244A) is used as clock source.

2. 38 to 43.2 Gb/s Serial BERT (Electrical) Test Station

By combining both bundles a setup for serial BER testing up to 43.2 Gb/s with one stimulus and one analyzer channel can be obtained. Various clock subrates are also available (see specs for MUX/DeMUX module).

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ParBERT 81250 43G Configurations (cont.)

3. MUX Test Station

Figure 16 shows the two possible configurations for testing the MUX. Both configurations combine two VXI frames controlled via FireWire by an external PC (not shown here). Both configurations make use of a synthesizer for clock generation.

For the MUX test, the analyzer side is covered with the E4895A error detector bundle.

For the generation there are two setups.

Setup 1
The left setup is simpler and more economical. Here a 17th generator provides a clock (rather than the MUX module) together with the 16-bit-wide data. Some multiplexer designs may not need this, so the 17th generator may not be needed.

Table 11 shows the product list for this MUX Test station setup.

Setup 2
For the stimulation, sixteen stimulus channels together with the appropriate clocks are needed. For best performance it is recommended that you use a signal generator together with the E4868A MUX module for the clock.

This setup allows you to use the E4894A MUX bundle, but it is necessary to disconnect all 32 cables between the generator channels and the MUX module and to re-connect the generators to the DUT input. The MUX module acts as a flexible clock subrate source in this test set up.

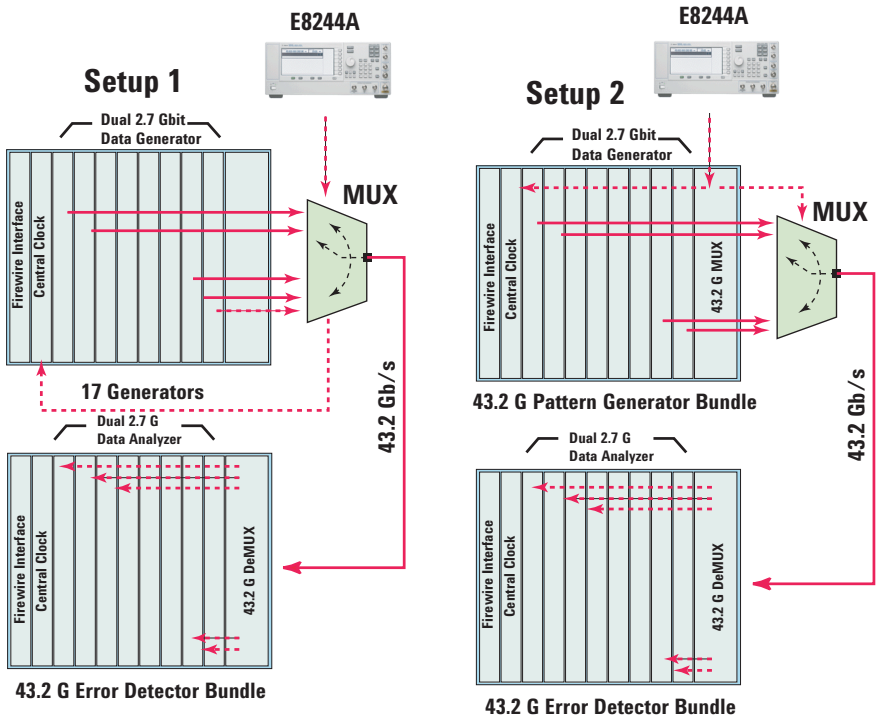


Figure 16. MUX Test Stations

Table 11

With Flexible Clock Subrate Generation	Without Flexible Clock Subrate Generation
one E4894A 43.2 G Pattern Generator	one E8403A
one E4895A 43.2 G Error Detector	one E8491B
external PC	one E4875A
	one E4808A
	8 or 9 E4861A
	16 or 17 E4862A
	one E4895A
	external PC
	15446A 8-line trigger input pod

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ParBERT 81250 43G Configurations

4. DeMUX Test Station

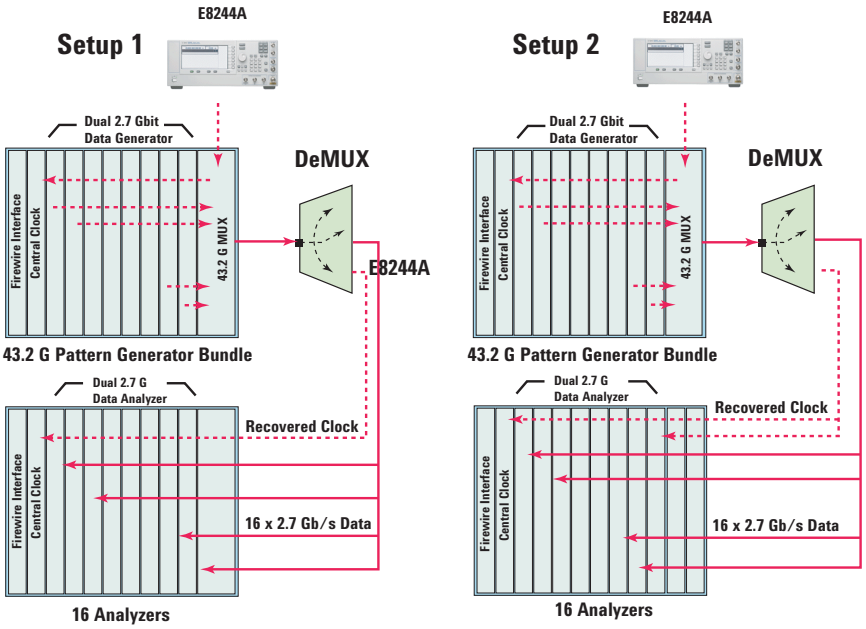


Figure 17. DeMUX Test Stations

Setup 1: BER Measurement

The DeMUX test setup uses the E4894A 43.2 G pattern generator bundle for stimulating the demultiplexer device.

For error detection, 16 additional analyzers at 2.7 Gb/s are needed. These need the E4808A high performance clock, which receives the recovered clock for reference.

These analyzers may be part of the E4895A bundle, but in this case it is necessary to re-wire the inputs from the DeMUX module to the DUT. Alternatively it is recommended that the following be used:

- one E8403A
- one E8491B
- one E4875A
- one E4808A
- 8 or 9 E4861A
- 16 or 17 E4863A
- one E4894A
- external PC

Setup 2: Output timing

When testing the output timing of the 16 data lines in reference to the recovered clock, it is recommended that a 17th analyzer channel be added (one E4861A and one E4863A). The recovered clock will be split using a splitter (11677B) and connected to the external clock input as well as to the analyzer input. If the recovered clock is available differentially, one line may go to the external clock input, the other to the 17th analyzer channel.

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5. SFI-5 Mux/Demux setup

SFI-5- requires more than 16 Generator/Analyzer channels at 2.7Gb/s. So this would require more room than two VXI frames can offer. Therefore it is recommended to add a third frame in the middle between pattern generator and analyzer. This middle frame should house the mux and demux module. So the generator/analyzer channels can log up to count 22. To keep cables short the working height to place the DUT should be established between the bottom and middle frame.

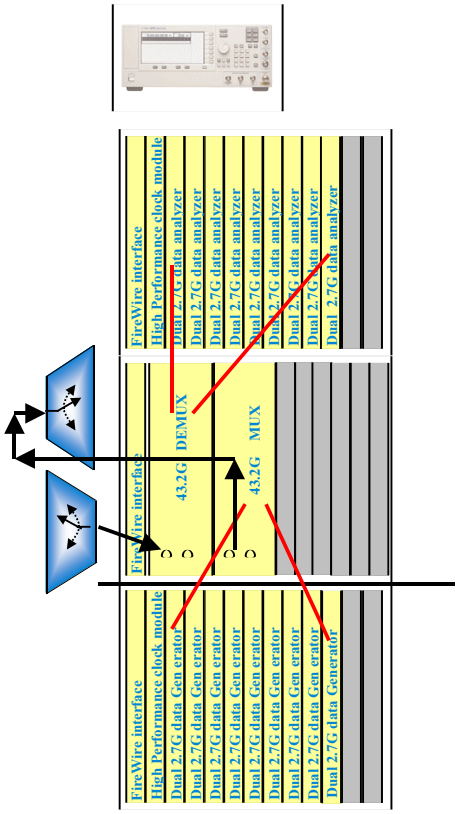


Figure 18 SFI-5-MUX/DEMUX Test Station

6. OC 768 with 1:4/4:1 Architecture

This is a combination of 10.8Gb/s channels with the 43Gb/s bundles

The three frame solutions are recommended to be built into a rack. Contact the factory for details.

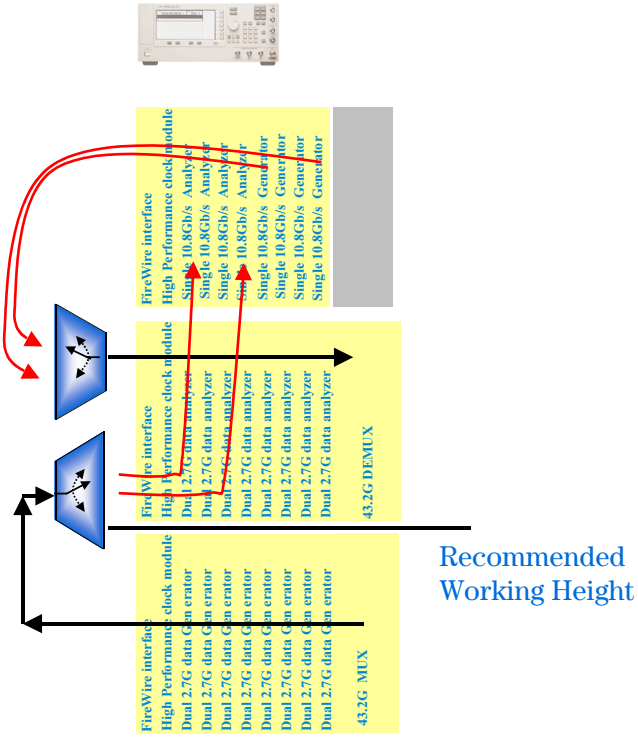


Figure 19: OC 768 with 1:4/4:1 Architecture

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ParBERT 81250
Test Accessories, Commercial Calibration and Support Options

For ParBERT 81250 various test accessories, commercial calibration and support options are available. See table 12.

Table 12: Product Structure, Calibration and Support Options - ParBERT 81250

Last updated: 18th September, 2001

valid from Oct 1st, 2001 till March 12, 2002
after March 12, 2002 a different numbering will be in place

P/N	Option	Description	Consists of
E4808A		**High Performance Central Clock Module**	
	#UK6	Commercial calibration	
	W08	Convert standard 1 year on-site warranty to 3 year on-site warranty	
	W32	3 Yrs Customer Return calibration service	
	W34	3 Yrs Customer Return Stds Comp Cal Serv	
	W50	5 Yrs Customer Return repair Service	
	W52	5 Yrs Customer Return calibration service	
	W54	5 Yrs Customer Return Stds Comp Cal Serv	
E4861A		**2.7 Gb/s Gen./An. Module**	
	#UK6	Commercial calibration	
	W01	Convert to 1 year on-site warranty	
	W32	3 Yrs Customer Return calibration service	
	W34	3 Yrs Customer Return Stds Comp Cal Serv	
	W50	5 Yrs Customer Return repair Service	
	W52	5 Yrs Customer Return calibration service	
	W54	5 Yrs Customer Return Stds Comp Cal Serv	
E4862A		**Generator Front-End 2.7 Gb/s**	
	#UK6	Commercial calibration	
	W50	5 Yrs Customer Return repair Service	
E4863A		**Analyzer Front-End 2.7 Gsa/s**	
	#UK6	Commercial calibration	
	W50	5 Yrs Customer Return repair Service	
E4868A		**43.2Gb/S Multiplexer Module**	1 X 3-slot 43.2Gb/s mux module, 32 X 2.7G cables, 1 X 40G cable, on-site productivity assistance & SW upgrade
	#UK6	Commercial calibration	
	W08	Convert standard 1 year on-site warranty to 3 year on-site warranty	
	W32	3 Yrs Customer Return calibration service	
	W34	3 Yrs Customer Return Stds Comp Cal Serv	
	W50	5 Yrs Customer Return repair Service	
	W52	5 Yrs Customer Return calibration service	
	W54	5 Yrs Customer Return Stds Comp Cal Service	
E4869A		**43.2Gb/S Demultiplexer Module**	1 X 3-slot 43.2Gb/s demux module, 32 X 2.7G cables, 1 X 40G cable, on-site productivity assistance & SW upgrade
	#UK6	Commercial calibration	
	W08	Convert standard 1 year on-site warranty to 3 year on-site warranty	
	W32	3 Yrs Customer Return calibration service	
	W34	3 Yrs Customer Return Stds Comp Cal Serv	
	W50	5 Yrs Customer Return repair Service	
	W52	5 Yrs Customer Return calibration service	
	W54	5 Yrs Customer Return Stds Comp Cal Serv	
E4875A		**ParBERT User Software**	

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Application Entry Bundles			
E4894A		**43.2 Gb/s Pattern Generator Bundle**	On-site productivity assistance, 1 X E8403A, 1 X E4808A, 1 X E4875A, 1 X E8491B + E8491B Opt. 001, 8 X E4861A, 16 X E4862A, 1 X E4868A, 1 X 15446A
	#UK6	Commercial Calibration	
	W08	Convert standard 1 year on-site warranty to 3 year on-site warranty	
	W32	3 Yrs Customer Return calibration service	
	W50	5 Yrs Customer Return repair Service	
	W52	5 Yrs Customer Return calibration service	
E4895A		**43.2 Gb/s Error Detector Bundle**	On-site productivity assistance, 1 X E8403A, 1 X E4808A, 1 X E4875A, 1 X E8491B + E8491B Opt. 001, 8 X E4861A, 16 X E4863A, 1 X E4869A
	#UK6	Commercial Calibration	
	W08	Convert standard 1 year on-site warranty to 3 year on-site warranty	
	W32	3 Yrs Customer Return calibration service	
	W50	5 Yrs Customer Return repair Service	
	W52	5 Yrs Customer Return calibration service	
Accessories			
15442A		Cable kit: 4*SMA (m) to SMA (m)	
15443A		Matched cable pair	
15444A		Computer Accessories	Keyboard, mouse, monitor
15445A		External CD-ROM	
15446A		3-line trigger input pod	
15447A		Deskew Probe	

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Agilent E2150A 43G Electrical/Optical BERT

The Agilent BERT E2150A 43G Electrical/ Optical test system is a fully integrated, scaleable bit-error-ratio test system that gives optical or electrical data streams at up to 43.2 Gb/s. It's a modular, VXI-based system which can adapt to fit a variety of testing needs. It works from 38 to 43.2 Gb/s and offers 2.7 Gb/s and 43.2 Gb/s channels. The system generates standard pseudo random binary sequences (PRBS) and user-defined patterns on serial interfaces and can analyze bit error ratios with user-defined patterns or PRBS. A simple editor allows the setup of data as a static frame.

A complete BERT system, the E2150A 43G comes pre-configured with components from the Agilent ParBERT 81250 43G. The standard E4894A 43.2 Gb/s pattern generator and the E4895A 43.2 Gb/s error detector bundles are incorporated into a 2.0- meter rack. The required computer and monitor are installed and loaded with all the required software. In addition, the sixteen 2.7 Gb/s individual channels are brought out to a customer panel for connection to the user's device-under-test (DUT) or wrapped back to the 43.2 Gb/s multiplexer for generation of single serial data stream. The 2.7 Gb/s individual channels for the error detector are likewise routed to the customer panel. All functionality in the Agilent ParBERT 81250 43G's instruments are preserved and made accessible to the user.



Figure 20. Agilent E2150A with option 011

The selection of option 011, 012 or 013 adds optical capability to the system. The optical system is used to create either RZ, RZ-CS, (return to zero) or NRZ (non return to zero) data streams at up to 43.2 Gb/s. The user can define output power levels and wavelengths. The optical subsystem also detects either RZ, RZ-CS or NRZ data stream errors. All data stream types and formats available from the E4894A pattern generator are available as an optical output. The different configuration options allow the user to select the C or L or both wavelength bands.

The BERT E2150A Electrical / Optical 43G Test System provides a complete solution in one package. The computer, software and the electrical and optical instrumentation and required boards and cables are supplied in one fully- tested two-meter rack, ensuring that your BERT E2150A 43G test system will be up and running when received. Agilent design engineers have optimized the system rack layout, cables, instrument placement, thermal flow and DUT interface panel. The system is assembled and tested by Agilent's experienced integration team, providing professional instrument placement and cable routing. A connection kit is also provided with the system to enable the customer to build cables from the interface panel to the DUT.

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Key Electrical/Optical Measurement Capabilities

The Agilent E2150A test system, with the addition of one of the optical options, has the capability of measuring either electrical or optical inputs or outputs, to allow the testing of:

- Systems
- MUX devices/DeMUX recievers
- Electrical to optical devices
- Optical to electrical devices
- Optical only Devices
- Electrical only devices
- OR any combination of the above.

Key Specifications

The optical output wavelength ranges:
- Option 011 - C Band wavelengths from 1530-1565nm
- Option 012 - L Band wave lengths from 1570-1608 nm
- Option 013 - C+L Band wave lengths from 1530-1565 and 1570-1608

The optical input wavelength range: 1510-1610 nm

The optical output power range: -40 to +5 dBm (depends on band of use - L Band to 0 dBm)

Optical input data format: RZ, RZ -CS or NRZ
Optical output data format: RZ, RZ-CS or NRZ

Power cord and power options:
- Option 208 - Voltage 208 - Connector Type L6-20P
- Option 200 - Voltage 200 to 250- Connector
- Option 120 - Voltage 120 - Connector

Option 800 allows the customer a method of customizing the system with additional requirements that can be defined and discussed with the factory.

Quality Assurance

Delivery of the system is followed by an on-site visit from experienced Agilent personnel to ensure the system has arrived fulfilling its performance requirements. This Productivity Assistance is provided with your ParBERT system and is designed to introduce you to the system components, the graphical user interface (GUI) and the programming interface. The Productivity Assistance is delivered in your environment, level of experience and interests and will include the following topics:

•Overview of system functions and capabilities
•General steps for setting up measurements
•Review of system documentation, diagnostics and architecture

If your configuration allows, the Agilent personnel will also create a stimulus/response example using a loopback cable to ensure the system is ready for use.

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Related Literature	Pub. Number
Need to Test BER?, Brochure	5968-9250E
Agilent ParBERT 81250, MUX/DeMUX Application, Application Note	5968-9695E
Agilent ParBERT 81250 Parallel Bit Error Ratio Tester, Photo Card	5980-0830E
Agilent Productivity Assistance for 43G BER Test Solutions	5988-3923EN
Agilent ParBERT 81250 Parallel Bit Error Ratio Tester Product Overview	5968-9188E
Need to Test 40 Gb/s? Brochure	5988-2038EN
ParBERT 81250 Technology Refresh	5988-4174ENUC

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