

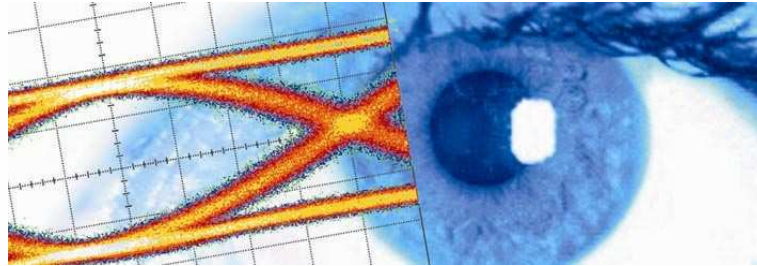


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56G and 32G Broadband BERT 40G Production BERT

Product Overview



Bit Pattern Generators Error Analyzer Amplifier Plug-in



56 and 32 Gbps Broadband BERT

A complete electrical bit error rate test (BERT) system for OC-768, multi-channel OC-192 or all 100GbE applications can be configured using one of the broadband pattern generators and the broadband error analyzer described in this brochure.

An optical transmission test system can be completed by using a wide range of optical transmitters/receivers, clock recoveries and further miscellaneous modules.

To realise the full broadband capabilities of the BERT system, it is recommended to use an external clock source such as a synthesized sweeper at a frequency of either half or full of the desired operating bit rate.

General Features

- Scalable and modular
- Windows style BERT Control Center software package with advanced measurement utilities such as jitter analysis, system Q-factor and eye contour measurement
- Computer controlled operation over the Ethernet which also enables remote access
- Extensive PRBS patterns, and internal programmable memory for user-defined patterns
- Available PRBS pattern lengths: 2^7-1 , 2^9-1 , $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{23}-1$, $2^{31}-1$
- Implementation of user pattern by internal pattern editor or user-defined data formats
- Hardware pre-coding for DQPSK transmission experiments
- Full- and half clock operation
- Extensive clock output signals provisioning
- Independent programmable frame trigger outputs
- Feature enhancement through firmware & software upgrades
- > 100 Gbps aggregated data rate



SHF 12103 A Broadband Quad-32 and Dual-56 Pattern Generator

The SHF 12103 A bit pattern generator can provide either 2 or 4 synchronized data channels operating up to 28 or 32 Gbps and/or single or dual synchronized channels up to 56 Gbps. Various combination of 32G and 56G capabilities are possible as outlined below.

Hardware DQPSK pre-coding, one Gbit of internal memory for arbitrary user patterns, an extensive clock provisioning and other advanced features render the new SHF 12103 A an excellent solution for all 100GbE applications.



- SHF 12103 A Bit Pattern Generator -

Typical Specifications

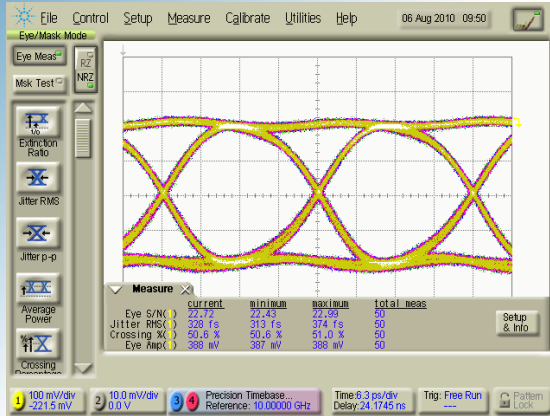
All combinations of full- and sub-rate data outputs are possible! A later upgrade to the higher bit rate limit at the sub-rate outputs and retrofitting additional outputs is possible at any time required¹.

	Singe 56	Dual 56	Dual 28	Quad 28	Dual 32	Quad 32
Type	Full-Rate Outputs		Sub-Rate Outputs			
No of differential channels	1	2	2	4	2	4
Total number of outputs	2	4	4	8	4	8
Data Rate Range	6–56 Gbps	6–56 Gbps	3–28 Gbps	3–28 Gbps	3–32 Gbps	3–32 Gbps
Typical max. output level	400 mV		800 mV			
Typical jitter (RMS)	500 fs		550 fs			
Typical rise/fall time (20%..80%)	10 ps		10 ps			

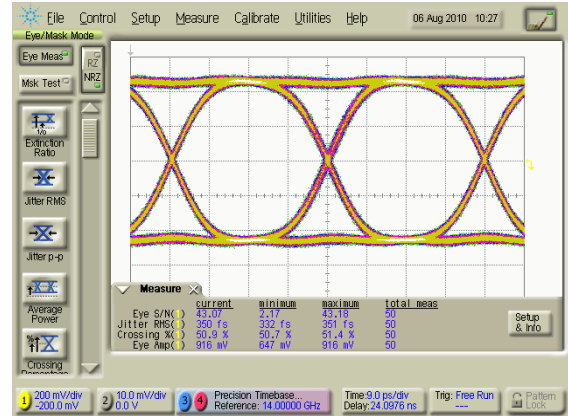
¹ In case the maximum number of outputs is not already exceeded.



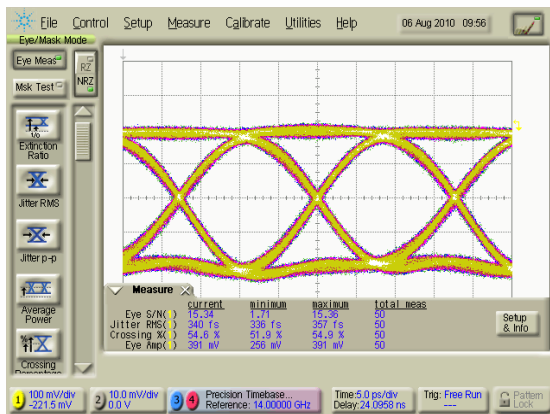
Typical output signals



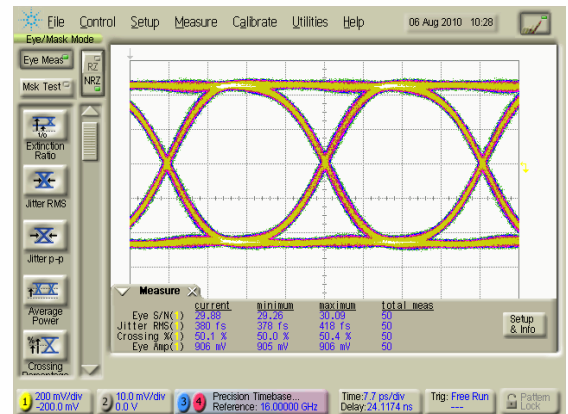
-Full-Rate Output Signal @ 40 Gbps-



-Sub-Rate Output Signal 28 Gbps-



-Full-Rate Output Signal @ 56 Gbps-



-Sub-Rate Output Signal 32 Gbps-

BERT Control Center software package



-Screenshot from the SHF BERT control software showing the SHF 12103 A window-

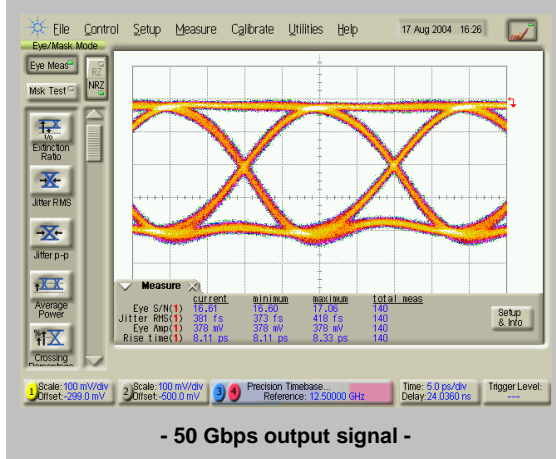


SHF 12100 B Broadband Bit Pattern Generator

The high speed data outputs of the SHF 12100 B provide excellent signal quality over the entire bit rate range up to 56 Gbps.

56 Gbps Outputs

- Broadband from 6 – 56 Gbps
- Low jitter (< 500 fs)
- Adjustable output amplitude
- High back to back Q factor (Typ. 30 for $2^{31} - 1$ PRBS @ 40 Gbps)

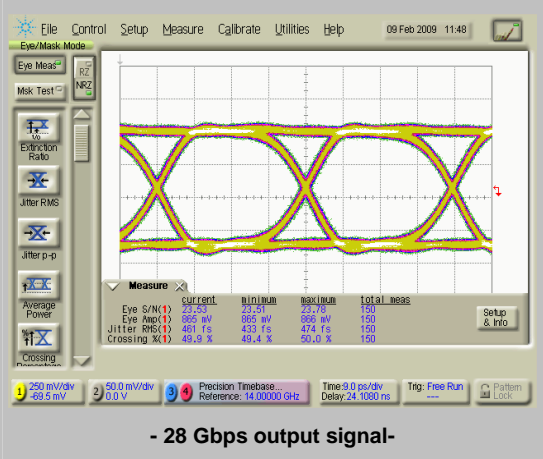


- 50 Gbps output signal -

Option 20

Option 20

- Additional 2 differential output channels broadband from 3 – 28 Gbps
- DQPSK hardware pre-coding



- 28 Gbps output signal-

SHF 11100 B Broadband Error Analyzer

The excellent sensitivity and the high clock phase margin over the entire bit rate range make the SHF 11100 B to the perfect counterpart for one of the SHF broadband pattern generators.

The 128 MBit memory for user-defined patterns and the optional additional substrate channels are only examples for high measurement flexibility of this Error Analyzer.



- SHF 11100 B Error Analyzer -

56 Gbps Inputs

- Broadband from 6 – 56 Gbps
- Input sensitivity of 25 mV typ. @ 40 Gbps
- Clock-data phase margin > 250° @ 40 Gbps
- Error trigger output

Option 20

Option 20

- Additional 2 differential input channels broadband from 3 – 28 Gbps



40 Gbps Production BERT

With particular emphasis on the right balance between cost and functionality, SHF has developed a bit error test system addressing applications in the production environment of 40G components, modules and subsystems.

The system is operated remotely by an intuitive software interface or by common control software.

Both, the Pattern Generator as well as the Error Analyzer are available as plug-ins to be hosted in one of SHF mainframes or as stand alone bench top versions.



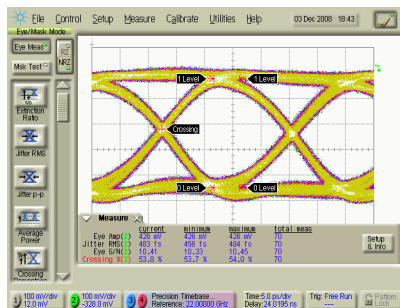
- Bench Top Error Analyzer -



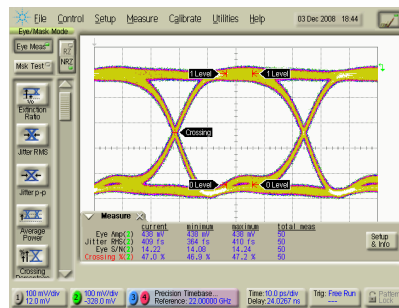
- Plug-In Bit Pattern Generator -

SHF 12110A and SHF 12122A Multi-band Pattern Generator

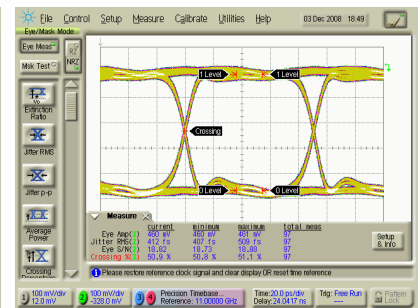
- Support bit rates from 39.8 to 44 Gbps
- Additional sub-rates at 20, 10, 5 and 2.5 Gbps bands
- Differential data output signal
- CCITT PRBS lengths 2^7-1 , 2^9-1 , $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{23}-1$ and $2^{31}-1$
- No external clock source required
- Internal synthesizer for preset rates and continuous bit rate tuning within bands
- External reference clock input @ bit rate /32, /64
- Clock outputs: reference clock, 20 GHz, 10 GHz and 2.5 GHz



Output signal @ 44 Gbps



Output signal @ 22 Gbps



Output signal @ 11 Gbps

SHF 11110A and SHF 11122A 40G Production Error Analyzer

- Support bit rates of 39.8 to 44 Gbps
- Differential data input (single ended supported)
- Single ended input sensitivity < 100 mV (@ 10^{-9} BER)
- Seven built-in PRBS patterns: 2^7-1 , 2^9-1 , $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{23}-1$, $2^{31}-1$
- Internal, automatic clock recovery
- Internal synthesizer for preset rates and continuous bit rate tuning
- Clock outputs: 20 GHz, 10 GHz and 1.25 GHz



Miscellaneous Modules

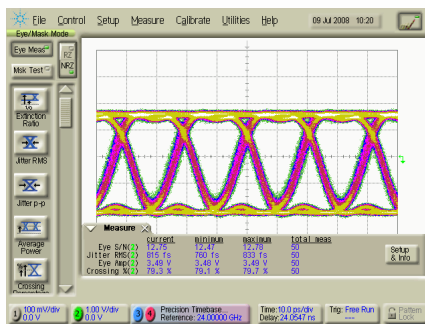
SHF 58211 A Amplifier Plug-in



- Broadband amplifier plug-in to provide high signal level data signals up to 50 Gbps
- High output voltage with excellent signal quality and superior jitter performance
- Adjustable output amplitude from 2 V to y 3.5 V peak to peak
- Adjustable crossing from 20 to 80 %
- Perfectly matched to SHF pattern generators
- Single or dual channel output options

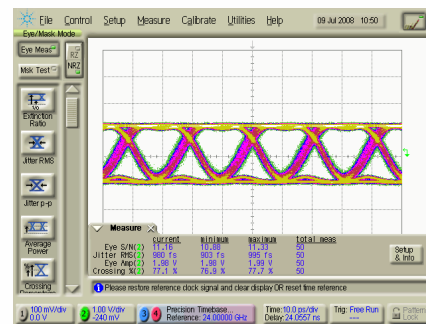
Typical performance @ 48 Gbps

≥ 3.5 V

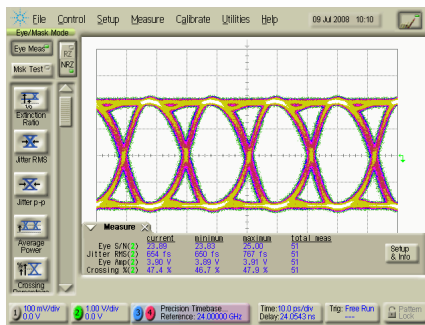


S/N: 12.7, EyeAmp: 3.5V, XC: 80%, JitterRMS: 815fs

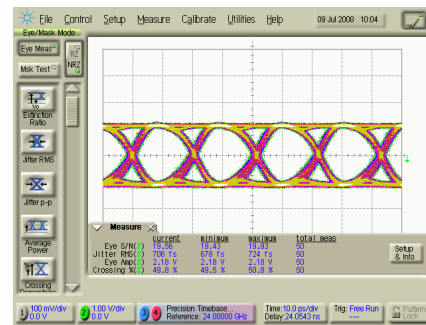
~ 2 V



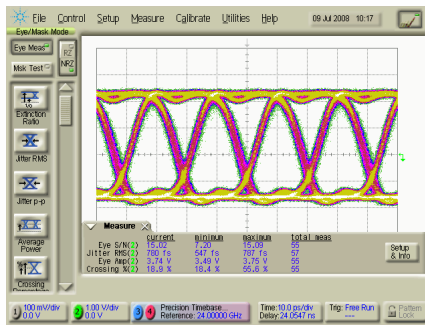
S/N: 11.2, EyeAmp: 2V, XC: 77%, JitterRMS: 980fs



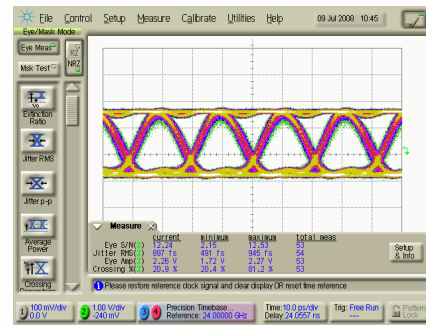
S/N: 23.9, EyeAmp: 3.9V, XC: 47%, JitterRMS: 654fs



S/N: 19.6, EyeAmp: 2.2V, XC: 50%, JitterRMS: 706fs



S/N: 15.0, EyeAmp: 3.7V, XC: 19%, JitterRMS: 780fs



S/N: 12.2, EyeAmp: 2.2V, XC: 20%, JitterRMS: 897fs



The SHF 10000 Series bit error rate test platform received the 2008 Best Practices Award from Frost & Sullivan for an outstanding product line strategy. SHF is proud of being recognized with this prestigious award for systems designed for engineers by engineers.

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