SB1604
14.5 Gb/s Quad-Channel Programmable BERT

Data Sheet

SmarTest

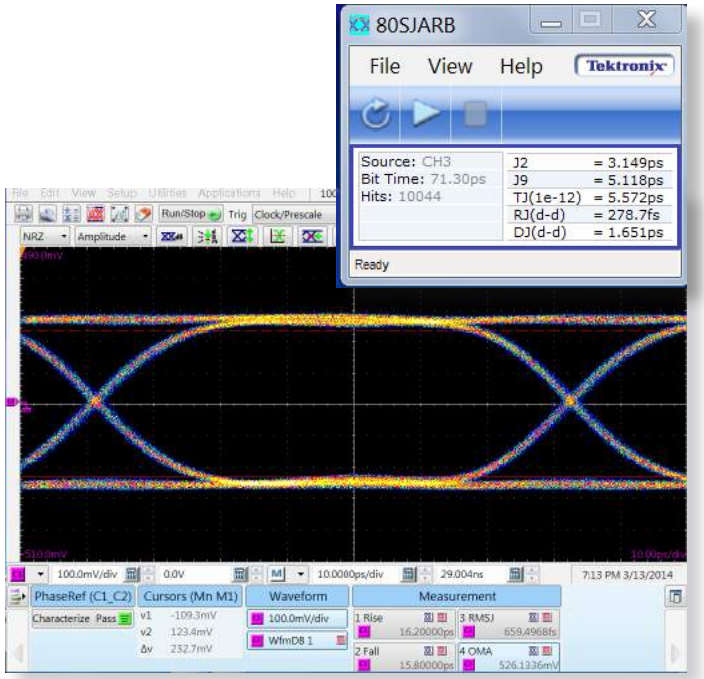
PG 4 ED

The BERT Re-imagined

- Complete 4 channel BERT system
- 14.5 Gb/s with excellent signal fidelity
- Plug & play error detection with built-in CDR
- Flexible, compact and expandable

Remember when BERTs needed two people to lift them? Or when multi-channel meant a huge VXI system that was almost unusable by normal people? We do, and decided it doesn't have to be that way. When you see an SB1604 in real life, you'll be amazed at how small and light it is. However, don't be deceived – this is a high quality, flexible and feature-rich platform designed to be at the heart of any high speed digital testing.

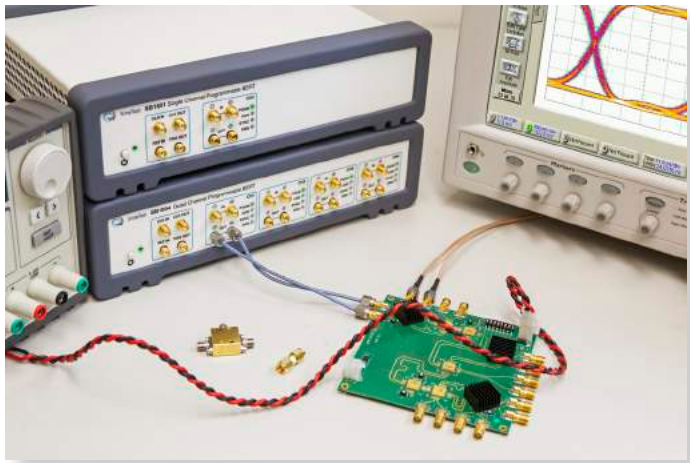
Most test setups start with a high quality test source. Look closely at the front panel and you'll see a high quality 2.92mm connector, the first hint at the impressive output waveform. Fast rise times and low jitter are evident in the high fidelity output eye, ensuring you will measure the performance of your test device, and not your test equipment.



Example PG output at 14.0125 Gb/s, PRBS-31 showing fast rise and fall times, low jitter

Error detectors used to be hard to set up, with the first challenge being where to get a suitable clock from. Taking usability to new levels, connect to Data In, press Auto-align and you are ready to go - the built in CDR on each channel derives a clock typically within 10 µs, and the system runs. This doesn't mean that you are limited in ED clocking options - an internal switch means a cable-free pass-over of PG clock if that suits your test needs better.

Usability is key to a fast time-to-productivity, and is designed in from the ground up with the SmarTest SB1604 as we'll see.

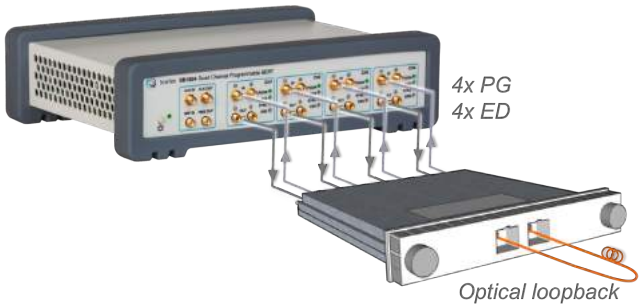


Applications

Many test set ups have a BERT at their core for good reason. Whether you are in an R&D lab evaluating silicon, or a transceiver test line in production we have you covered.

In R&D there are times when you need every corner-case control a BERT was ever equipped with, but more often you just want to get testing fast, and here we shine. With the ability to link several 4 channel SmarTest BERTs together, testing of parallel backplanes, optical or electrical transceivers and complex ICs just got a whole lot easier. The continuous clock source means easy characterization of maximum data rates up to an impressive 14.5 Gb/s.

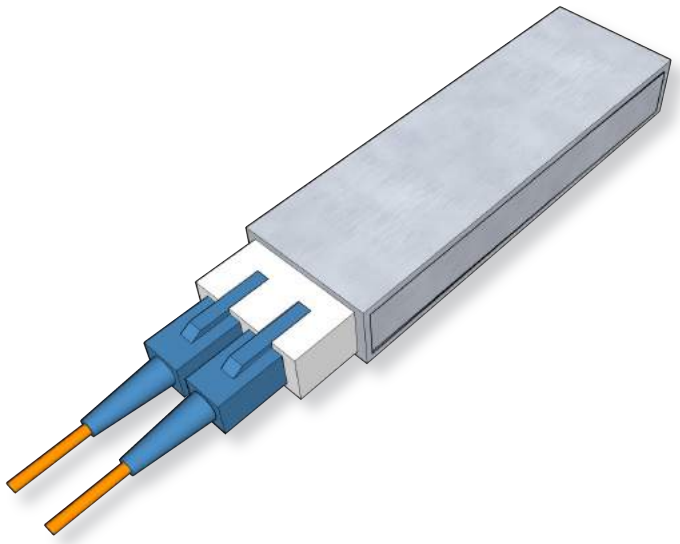
Our experience in production environments also shows through with features such as real-time BER display to help TOSA/ROSA alignment operations and many trigger divide ratios enabling sampling scope mask measurements.



Four channels of pattern generation and four independent error detectors make transceiver test easy for multi-channel devices

Frequency Point	Data Rate (Gb/s)	Standard
1	1.25	Ethernet
2	2.125	Fibre Channel
3	2.5	Ethernet
4	3.125	XAUI
5	4.25	Fibre Channel
6	5	Infiniband
7	6	SATA/SAS
8	6.25	XAUI2
9	8.5	Fibre Channel
10	9.95328	Telecom
11	10	Infiniband
12	10.3125	Ethernet
13	10.51875	Fibre Channel
14	10.70922	Telecom
15	11.181	Telecom
16	11.317	Fibre Channel
17	11.5	Telecom
18	12.5	Ethernet
19	12.8	Telecom
20	14.0125	Fibre Channel

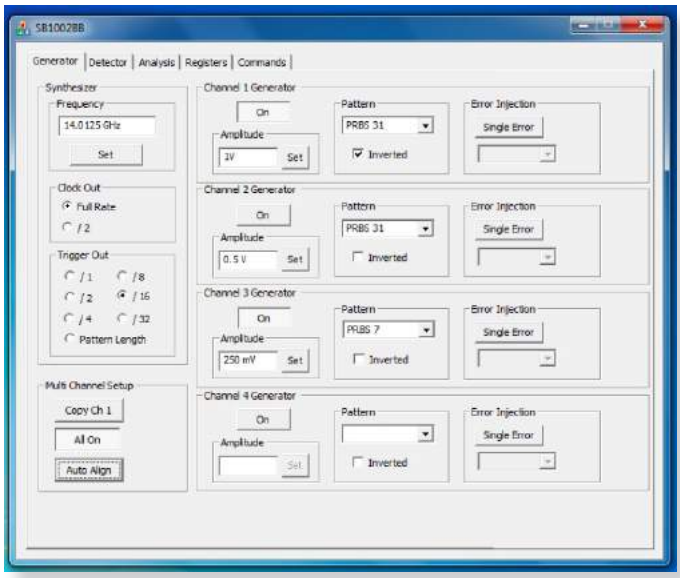
While the system is data rate agile, in addition all common data rates are easily available using built in presets



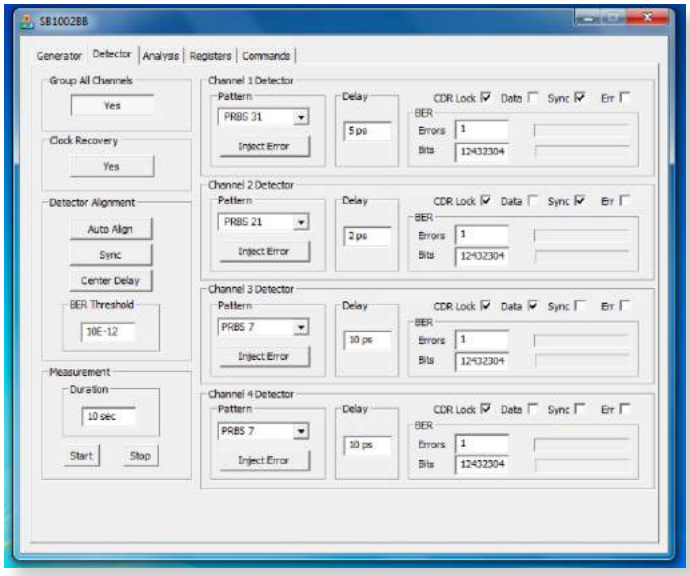
User Interface

Many channels often means many screens, confusing controls and a lot of time wasted. We've put everything you need for the PG on one screen; it's easy to see all operational aspects in one glance, and changes can be made to channels individually, or all together. The same ideas carries through to the ED screen - simple, easy and viewable with one glance. Press Auto Align and the detectors figure the rest out, with easy confirmation on the front panel LEDs. User custom setups can be easily saved and reload for future use.

The graphical user interface may be loaded on any Intel®-based PC running Windows® XP or later, and connects to the SB-series instrument over USB.



Pattern generator setup screen showing fast and simple user interface



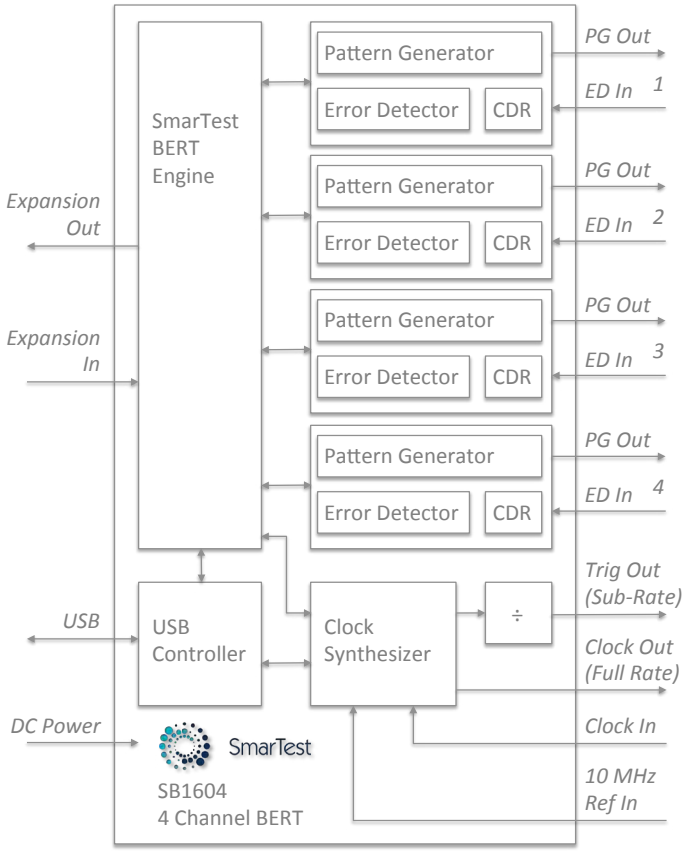
Error detector user interface

Built in Flexibility

The heart of the SB-series instruments is the SmarTest BERT Engine that powers PG and ED channels. An internal synthesizer acts as clock source for the PG, and can be internally switched to also be the ED clock source. Alternatively each ED channel may derive its own clock from the incoming NRZ data stream.

For applications requiring multiple channels, SB-series instruments may be chained together using the Expansion port and special cables (sold separately). This provides sharing of clock and timing as well as communication so that the system may be controlled over a single USB connection from a PC.

SB-series instruments are also available as single-channel (SB1601) and PG-only (PG1604, PG1601) models.



Internal block diagram with front panel (right) and rear panel (left) connections

Rear panel showing power input (left), USB interface (right) and expansion ports (middle)

Specifications

Clock System

Internal Clock

Frequency	625 MHz to 16 GHz Selectable full rate internal clock loopback connection between PG and ED
Intrinsic RMS jitter	<500 fs typical

External Clock Input

Frequency	Full Rate, 625 MHz to 16 GHz

Clock Out

Clock rate	Full rate equal to internal clock setting
Impedance	50 Ω nominal, AC-coupled
Amplitude	400 mV typical
Connector	SMA, single ended, front panel

Divided Clock / Trigger Out

Clock rate	Selectable divided by n, with n=1, 2, 4, 8, 16, 32, 64
Output type	SMA, single ended, front panel
Impedance	50 Ω nominal, AC-coupled
Amplitude	400 mV typical
Connector	SMA, single ended, front panel

10 MHz Reference Input

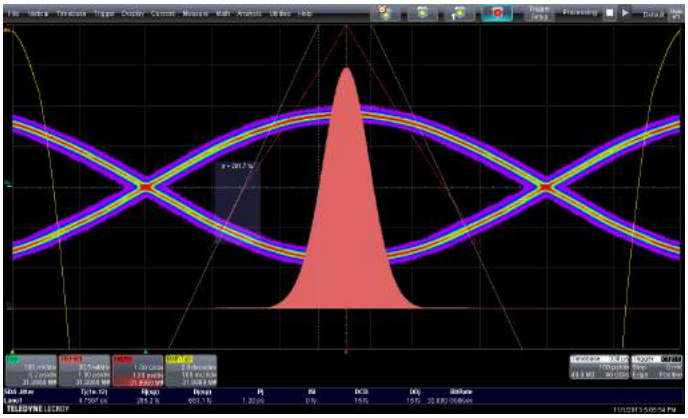
Front panel

Clock to Data Recovery System

Input data rate	From 9.95 to 11.3 Gb/s; 14.0125 Gb/s; automatic rate detection
Type	Internal
CDR reference input	Internal clock synthesizer or External Clock Input
CDR loop bandwidth	Min: 5.5 MHz Typical: 8.2 MHz Max: 11.15 MHz
CDR lock time	10 µs typical
Input connector	ED data input, front panel
Front panel LED	1 per channel, LED on = CDR locked LED blinking = CDR seeking lock

Pattern Generator Specifications

Number of PG channels	4, front panel connectors
Connector	2.92 mm, differential, front panel
Front panel LED	1 per PG channel, green = channel on
Data output	Differential, AC coupled
Line coding	NRZ
Data rate range	1.25 to 14.5 Gb/s (common on all channels)
Output patterns	PRBS 2^n-1, n=7, 9, 10, 11, 15, 23, 31 Up to 20 bits/ch, user defined
Pattern invert	Yes
Output amplitude	400 - 1,000 mVpp differential
Rise/fall times (20%-80%)	< 18 ps typical
Intrinsic jitter (RMS)	< 1 ps typical
Error injection	Yes



Synthesizer output at 16GHz showing RJ <300 fs

Specifications, continued

Error Detector Specifications

Number of ED channels	4, front panel connectors
Front panel LED	1 LED for ED channel Red = ED no synced, Green = ED synced to input patter, ready to test BER
Data input	Differential, AC coupled
Input impedance	100 Ω differential
Sensitivity	25 mV
Line coding	NRZ
Clocking mode	Internal CDR
Data rate range	1.25 to 14.5 Gb/s (common on all channels)
Input patterns	PRBS 2^n-1, n=7, 9, 10, 11, 15, 23, 31 Up to 20 bits/ch, user defined
Input amplitude	0.1 to 1.0 Vpp
BER measurement period	0 to 10 seconds, 1 ms steps
BER measurement	BER (instantaneous and accumulated, all error count, bit count, time)
Connector type	SMA, front panel

General

Control software	Requires Intel®-based computer running Windows® XP or later
Interfaces	USB 2.0 standard, SCPI syntax Exp In, Exp Out proprietary system expansion interfaces
Included power supply	100 V to 240 V AC, 50-60 Hz
Power consumption	150 VA max
Operating temperature	0°C to 55°C
Storage temperature	-30°C to 70°C
Operating altitude	Up to 2000 m
Dimensions (w x h x d)	Bench top Without bumper 10.5 x 7.8 x 2 inches (267 x 198 x 51 mm) With Bumper 11.5 x 8 x 3 inches (292 x 203 x 76 mm)
Weight	4 lbs (1.8 kg)
Warranty	1 year standard For warranty and calibration services, contact SmarTest sales at sales@smartest.us.com

Included Accessories

US power cord with external power supply; regional-specific replacement power cord options available

USB cable

User guide with programing reference on CD

Ordering

SB1604	4 channel 14.5 Gb/s integrated pattern generator, error detector and clock source
SB1604-3C	3 years total calibration service, return to factory
SB1604-3W	3 years total warranty

Power cord options - replace US power cord with region-specific one as follows

SB160x-AC-AU	Australia
SB160x-AC-CN	China
SB160x-AC-EU	Europe
SB160x-AC-JP	Japan
SB160x-AC-UK	United Kingdom

About us

We are an experienced group of test professionals with decades of combined experience at some of the biggest companies in the measurement business. We've brought BERTs, oscilloscopes and many other instruments to market for the big guys, but wanted to take high speed testing in a new direction. We're based in the heart of Silicon Valley, California.

The SB1604 paired with the SB1601 single channel 14.5 Gb/s BERT

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