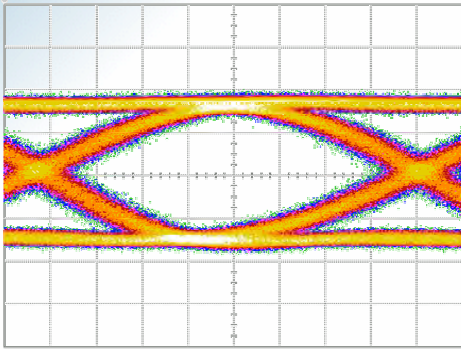




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Datasheet

SHF BPG 44 E

44 Gbps Pattern Generator





Description

The SHF BPG 44 E pattern generator is a versatile test instrument for high bitrate PCM- and SDH-systems as well as for components used within high speed communication systems. The instrument generates true CCITT-type pseudo random bit sequences (PRBS) of various lengths and four additional user programmable patterns.

In combination with the SHF EA 44 error analyzer, the generator can be used to build up a bit error rate test system performing CCITT type transmission tests.

An output signal voltage of more than 2.5 V at 44 GBit/s enables power splitting for driving multiple subsequent circuits. The output drivers are tuned for optimum pulse performance at the end of two 0.5 m low loss, high precision cables, which are supplied with the instrument. The output signal bitrate can either be controlled by a low jitter internal crystal clock oscillator on 6 selected CCITT bitrates or by an external generator. The required external clock frequency is half of the bitrate, i.e. 22 GHz produces 44 GBit/s output signals. All functions can be remote controlled by GPIB.

The SHF BPG 44 E produces :

- two complementary AC coupled output signals at 44 GBit/s of ≥ 2.5 V amplitude,
- four single ended clock outputs Bitrate/2, Bitrate/4, Bitrate/16 and Bitrate/64 referenced to 44 Gbit/s,
- one word frame synchronized trigger signal,
- optionally: eight complementary 1/4 PRBS shifted AC coupled output signals at 11 GBit/s of 1 V amplitude (adjustable) plus DC shift (Option 02)

In conjunction with the pulse shaping 45 GHz amplifiers, the very low rise time of the internal multiplexer circuits allows the generation of excellent 44 GBit/s PRBS-signals. This enables easy testing of ultra high speed components and their assembly in complex communication systems.

Features

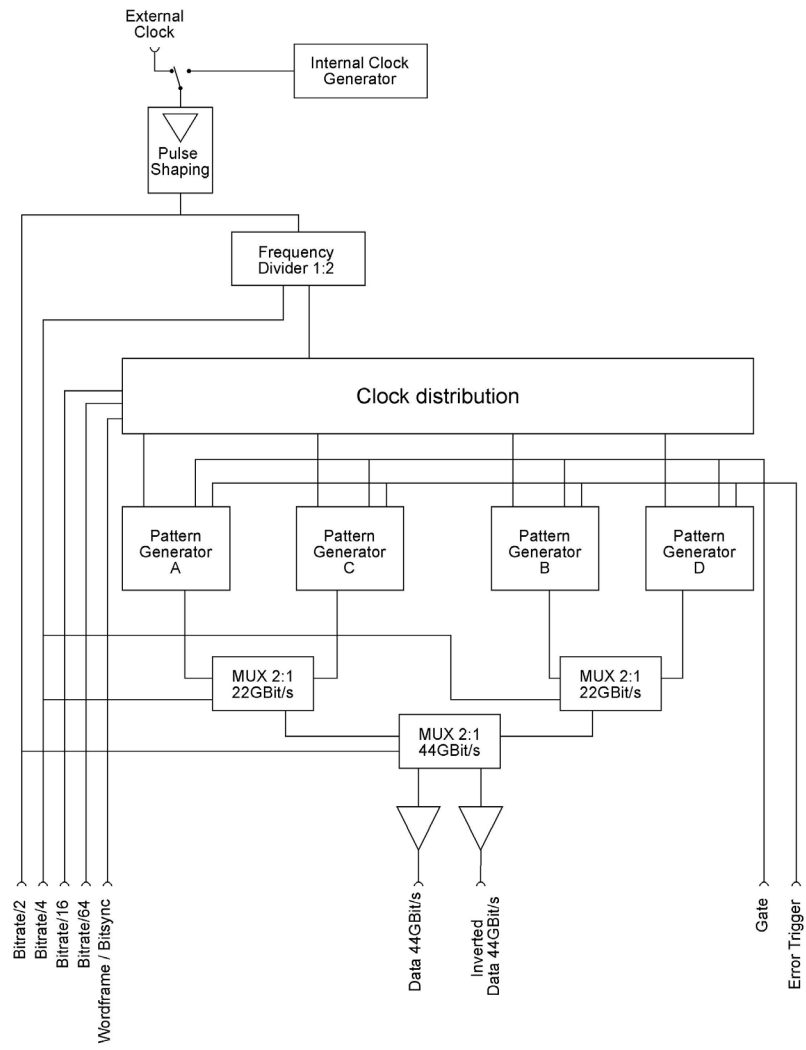
- CCITT conforming PRBS patterns $2^7 - 1$, $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$
- Four 256 bit programmable patterns in four different registers
- Three different error injection modes (front panel, external trigger input and GPIB control)
- Pattern inversion by push button
- Complementary data outputs @ 44 GBit/s, ≥ 2.5 V_{amp} which can be individually disabled
- Low risetime and low overshoot of output signals
- Ruggedized 1.85 mm male output connectors for the data outputs
- Two high precision, very low loss 50 Ω output cables are included—all signal parameter specifications refer to the output of these cables.
- External master clock input at half of the bitrate
- Clock output at Bitrate/n; n=2,4,16,64
- Low noise, low jitter advanced circuit for bit synchronized trigger output
- Burst-Mode gating capability
- External GPIB control

Options

- Option 01: Low noise, high stability internal crystal clock generator
- Option 02: Eight complementary additional outputs (Data and Data) at 11Gbit/s
- Option LJ: Low jitter version
- Adjustable output levels available on request



Functional Block Diagram





Specifications

Parameter	Unit	Min	Typ	Max	Conditions
Bit rate	Gbps	2		44	
External master clock input ¹					
Frequency	GHz	1		22	
S11	dB			-10	
Input level	V _{pp}	0.6		1	
Gating input ²	kΩ		1		Resistance to ground
Error trigger ²	kΩ		1		Resistance to ground
Electrical data outputs at 11 Gbps ¹					Option 02
Output level	V _{pp}	0.25		1	
DC offset	V	-1		1	
Electrical data outputs at 44 Gbps ³					
Data and <u>Data</u> outputs	V _{amp}	2			AC coupled
Low jitter		0.5			DC coupled, ground referenced CML
Rise time (44 Gbps) ⁴	ps			12	
Rise time (11 Gbps) ⁴	ps			30	20% to 80%
Jitter	fs			900	Standard version
				400	Low jitter version
Bitsync/Wordframe	V	0.6		1	
Clock output	V _{pp}	0.6		1	
Power consumption	W	90	110	135	
		180	230	270	
Weight	kg		27		
Operating temperature	°C	10		35	
Size (WxHxD)	mm				450x270x506

¹ ruggedized 2.9 mm precision male connector

² female SMA connector

³ ruggedized 1.85 mm male connector

⁴ a cable of 0.5m length leads to a rise time degradation of approximately 3 ps

Clock output connectors:

Bitrate /2: 50 Ω ruggedized 2.9 mm precision male connector

Bitrate /4: 50 Ω ruggedized 2.9 mm precision male connector

Bitrate /16: 50 Ω SMA female connector

Bitrate /64: 50 Ω SMA female connector

Internal clock generator (Option 01)

60° C ovenized precision crystal oscillator

Available outputs:

1.244 GHz

2.488 GHz

4.976 GHz

9.952 GHz

19.904 GHz

(other frequencies available on request)

oscillator stability: < ± 1 ppm/° C;

warm up time: 15 minutes;

ageing: < 3 x 10⁻⁹/d

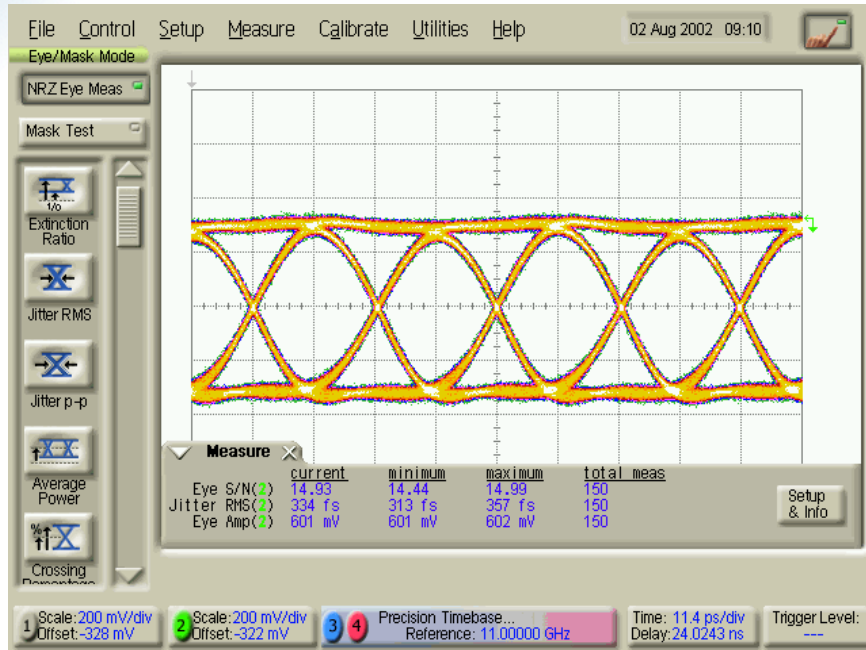


Output Waveforms

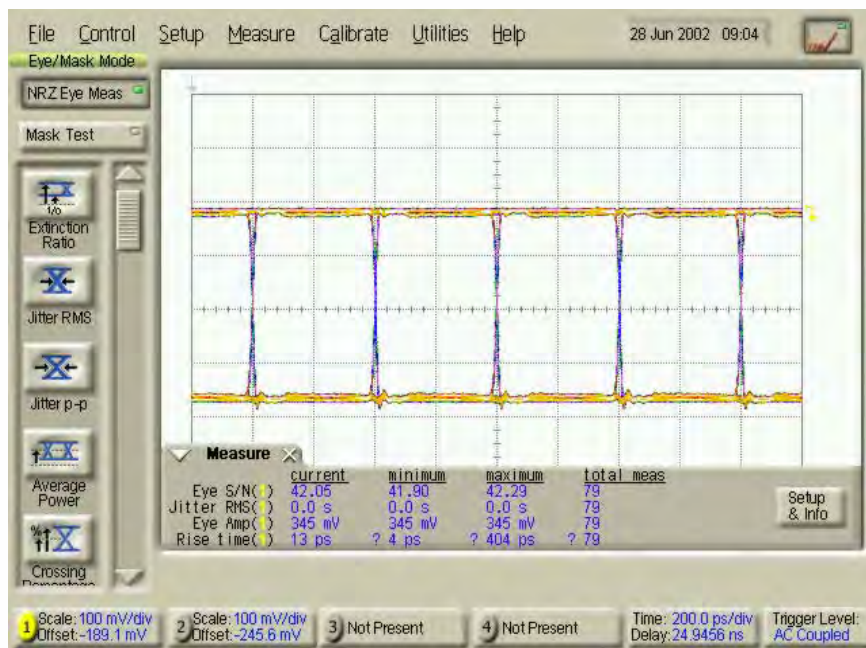
All following tests were performed using an external clock source. The eye diagrams were measured using a Agilent 86116 A digitizing oscilloscope (including enhanced trigger option) and a 50 GHz plug-in sampling head.

All results measured at the end of a 0.5m cable (supplied with instrument)

44 GBit/s: Low Jitter option:

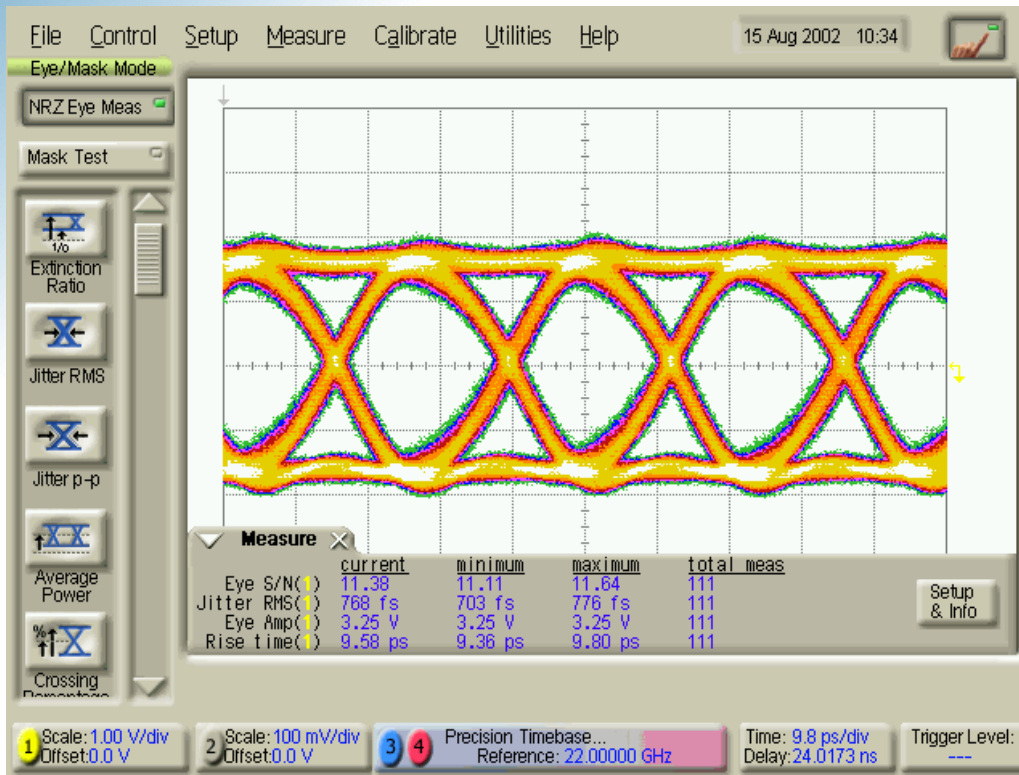


2.5 GBit/s: Low Jitter option:

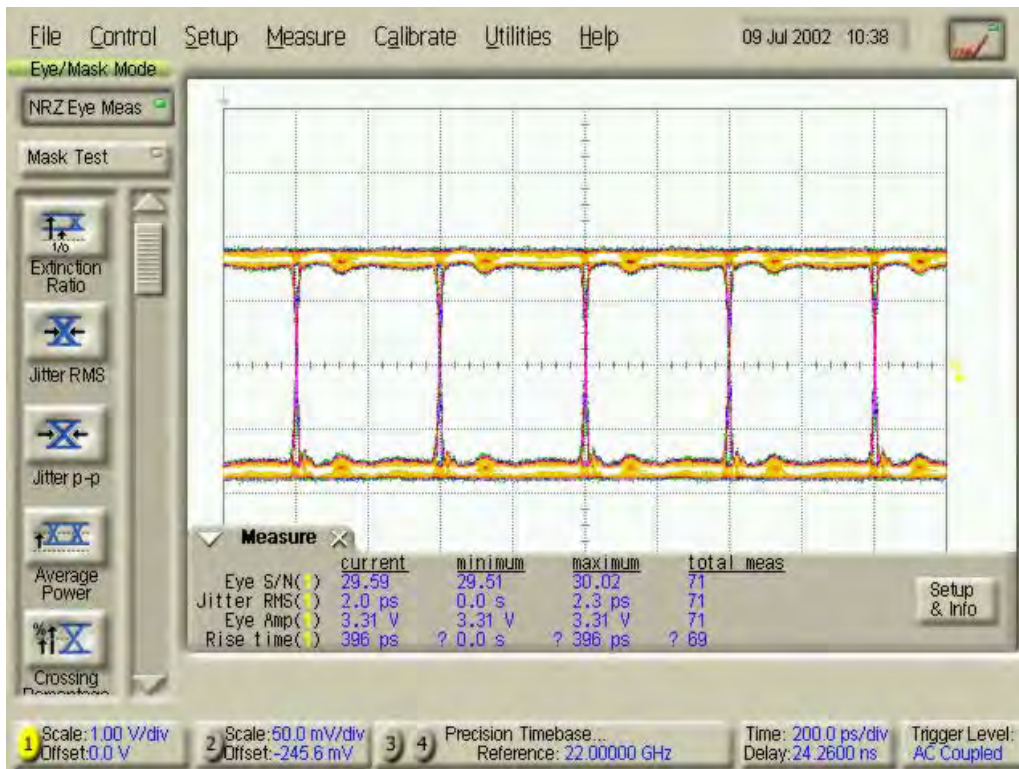




44 GBit/s Standard



2.5 GBit/s Standard



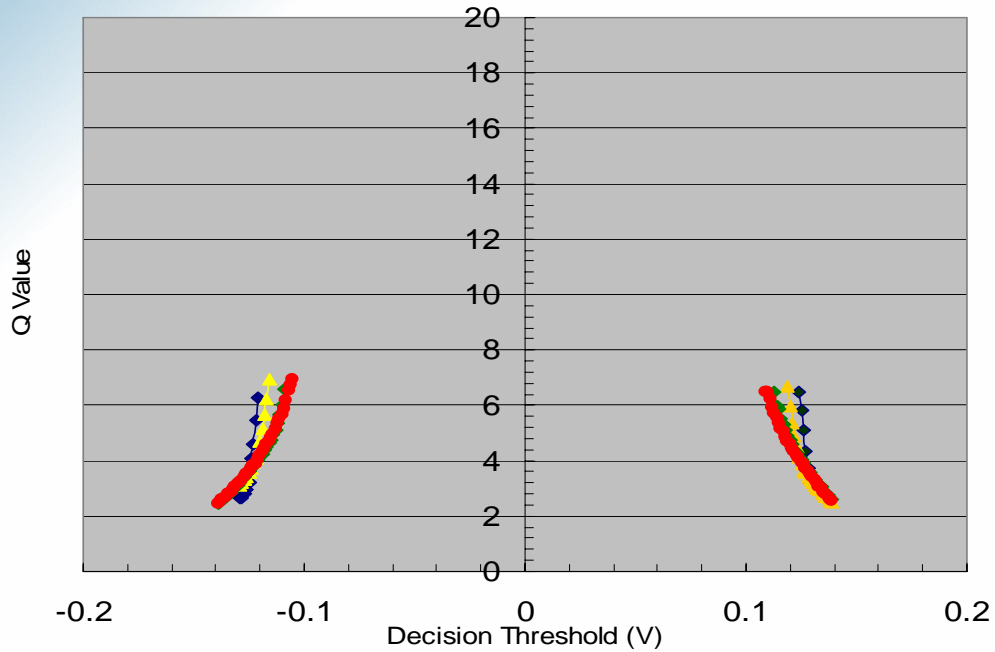


Extrapolated Q-Factor

Taken from back to back measurements using a BPG 44 E Low Jitter in conjunction with the SHF EA44 error analyzer.

Q: 31 for $2^{31}-1$; 95 for 2^7-1 prbs

Eye closure: < 13 % between 2^7-1 and $2^{31}-1$ PRBS



Blue: 2^7-1
Yellow: $2^{15}-1$
Green: $2^{23}-1$
Red: $2^{31}-1$