

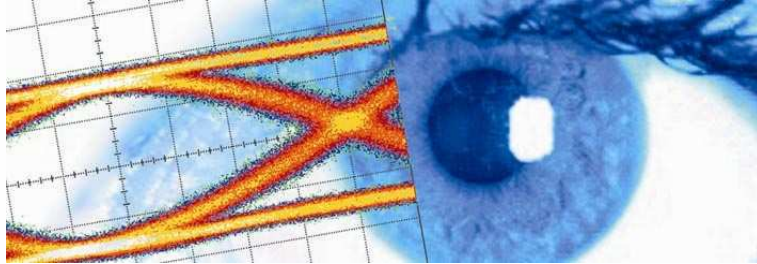


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SHF Optical Transmitters and Receivers

Product Overview





Description

Our optical transmitters allow the generation of optical signals of up to a total capacity of 128 Gbps in NRZ, RZ, and CS-RZ formats. In addition to the well-known ASK format (also known as OOK), we also produce instruments for the generation of DPSK, DQPSK, DP-QPSK and Duobinary signals. A range of optical receiver plug-in modules is also available to enable electrical BER measurements.

The parts discussed in this brochure are field-replaceable plug-ins for one of the SHF mainframes and perfectly compatible with SHF pattern generators and error analyzers. The computer controlled modules enable all settings to be set up, monitored and changed over the Ethernet via remote access with the complementary software package (BCC). No external components apart from some cable connections and a simple CW laser source are required to set up the instruments.

To enable our customers to perform reliable, repeatable long term measurements, all optical transmitters feature an automatic bias control of the built-in optical modulators.

Overview

Input data rate of optical transmitter [Gbps]

Multiformat (ASK and DPSK)	
SHF 46210 C	NRZ: 06 to 50 RZ/CS-RZ: 36 to 44
SHF 46211 A	NRZ: 2 to 12.5 RZ/CS-RZ: 8 to 12.5
DQPSK	
SHF 46213 C	NRZ: 2 x 05 to 30 RZ/CS-RZ: 2 x 18 to 30
SHF 46214 C	NRZ: 2 x 10 to 50
DP-QPSK	
SHF 46215 A	NRZ: 4 x 03 to 32
Duobinary	
SHF 46212 A	40 to 44

Output data rate of optical receivers [Gbps]

ASK and Clock Recovery	
SHF 41210 B ASK Receiver Clock Recovery	up to 50 39.5 to 45.5
SHF 41211 A / C ASK Receiver Clock Recovery	up to 32 19 to 26 or 25 to 32
DPSK	
SHF 47211 A / C	9.9 to 10.8
SHF 47213 A / C	19 to 22
SHF 47215 A / C	26 to 30
SHF 47210 A	39.8 to 43
SHF 47214 A	48 to 55

Optical Multiformat Transmitter

The optical multiformat transmitters convert electrical signals into optical signals. They are able encode the data in ASK (amplitude shift keying) and DPSK (differential phase shift keying) formats. With NRZ, RZ and Carrier Suppressed RZ, a total of six formats are supported.

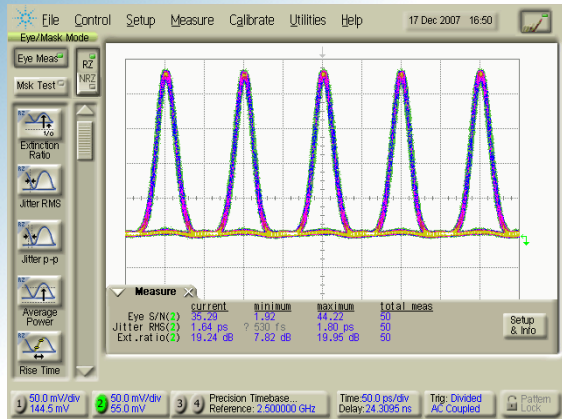


- Auto bias control for the built-in optical modulators
- Quick optimization of optical performance by user adjustable gain and modulator bias control
- Change of modulation format is executed via computer control

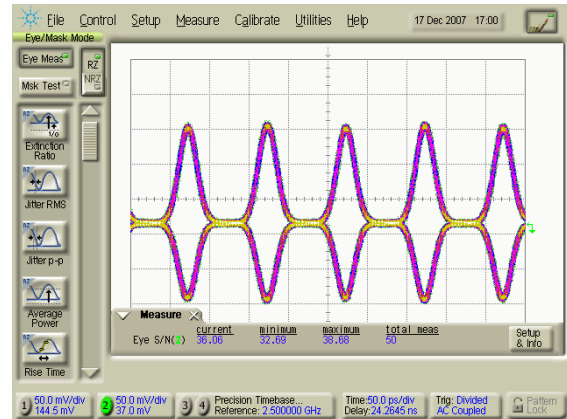


46211 A

- Operation from 2 to 12.5 Gbps in NRZ and 8 to 12.5 Gbps RZ and CS-RZ mode



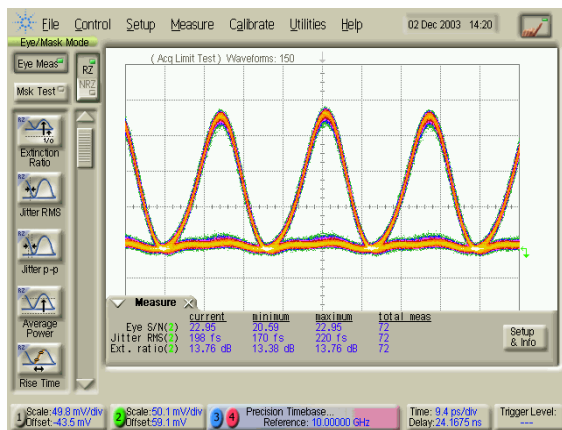
ASK RZ optical output signal at 10Gbps



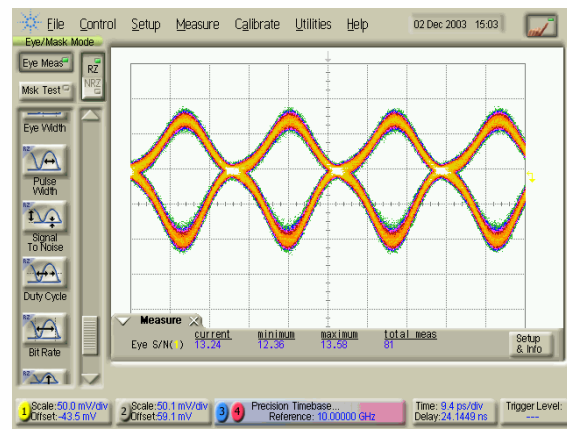
DPSK RZ optical output signal at 10Gbps (balanced detection)

46210 C

- Operation from 6 to 50 Gbps NRZ and 36 to 44 Gbps RZ and CS-RZ mode



ASK RZ optical output signal at 40Gbps



DPSK RZ optical output signal at 40Gbps (balanced detection)

DQPSK Optical Transmitter

The DQPSK transmitters convert 2 electrical data streams (I and Q) into an optical signal with four different phase stages. The 2 data channels can be switched ON and OFF independently, thus permitting to generate either DPSK or DQPSK signals.

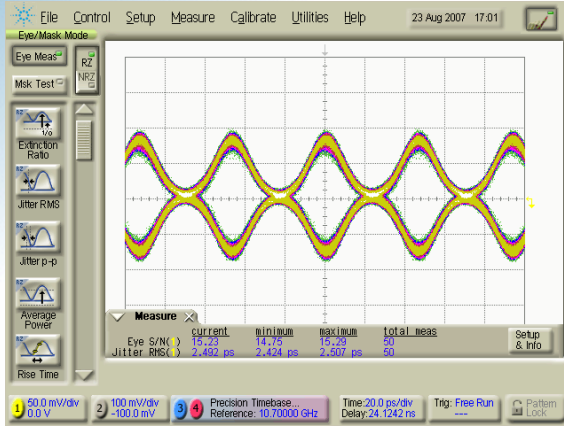


- Integrated dual-Mach Zehnder DQPSK modulator for I and Q data generation
- Quick optimization of optical performance by user adjustable modulator bias control
- Data modulators' bias conditions controlled automatically
- Selectable automatic and manual bias control (ABC circuit)
- Automatic or manual 90° phase tuning for I & Q

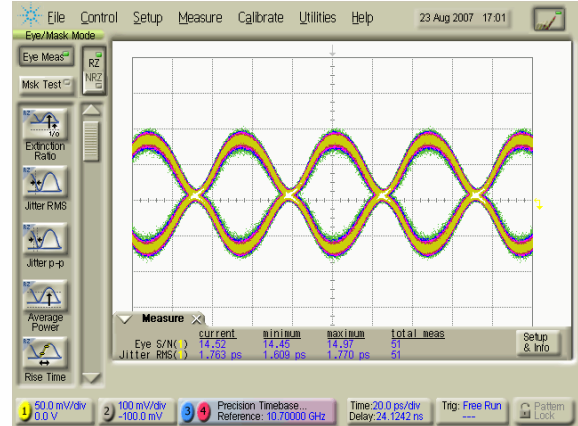


46213 C

- Broad band operation from 5 to 30 Gbps per electrical input data channel (up to 60 Gbps total)
- Input data skew control for perfect synchronisation
- Support of DQPSK in NRZ, RZ and CS-RZ format
- Auto-switch between RZ and CS-RZ



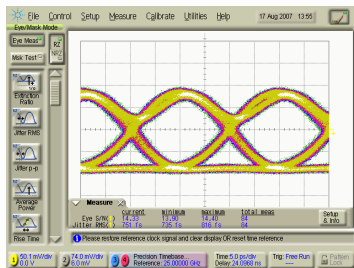
RZ DQPSK optical output signal at 40Gbps (balanced detection)



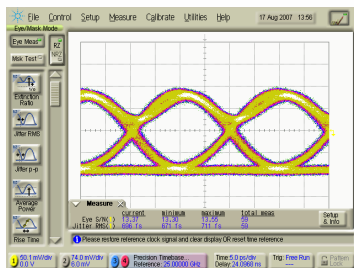
CSRZ DQPSK optical output signal at 40Gbps (balanced detection)

46214 C

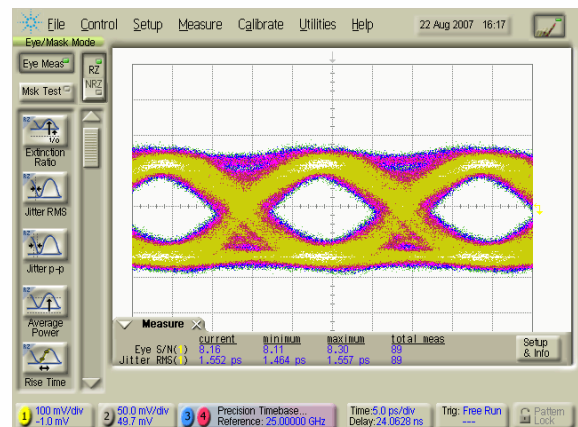
- Broad band operation from 5 to 54 Gbps per electrical input data channel
- > 100 Gbps optical data streams
- DFF input modules for data regeneration to minimize impact of input cables
- Matched driver amplifiers
- External pulse carving for RZ and CS-RZ possible
- Separate analysis of I and Q channel possible



DPSK optical output signal at 50Gbps (only data B, balanced detection)



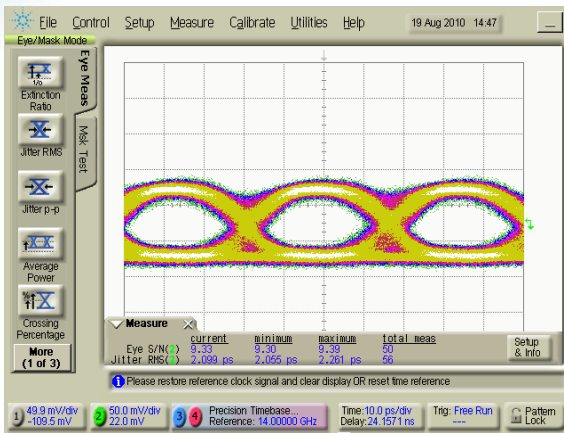
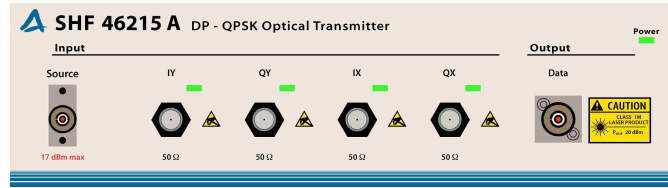
DPSK optical output signal at 50Gbps (only data A, balanced detection)



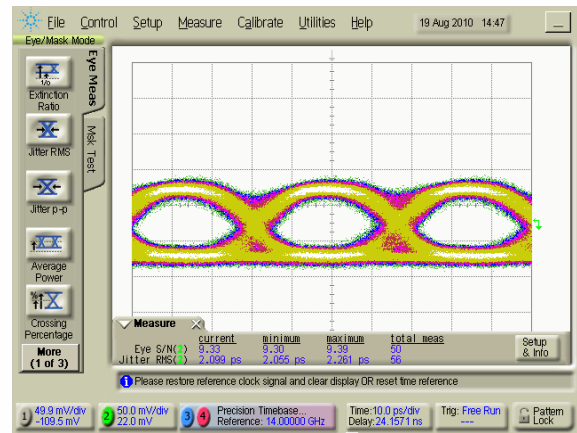
DQPSK optical output signal at 100Gbps (Data A and B ON, balanced detection)

The SHF 46215 A optical transmitter combines four electrical data streams of up to 32 Gbps into one DP-QPSK (Dual-Polarization Quadrature Phase Shift Keying) encoded optical source.

Each two of the input signals will be E/O converted by an integrated dual-Mach Zehnder modulator. The resulting two optical QPSK signals are then internally combined with two orthogonal polarizations.



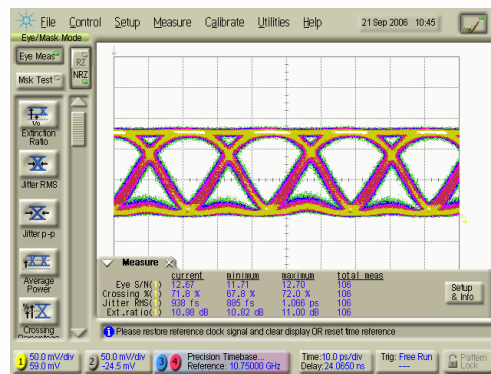
I channel of X polarized QPSK output signal at 28 Gsym/s detected with a SHF 47215 A DPSK receiver



I channel of Y polarized QPSK output signal at 28 Gsym/s detected with a SHF 47215 A DPSK receiver

Duobinary Optical Transmitter

The SHF 46212 A Optical Transmitter generates an optical Duobinary signal at a data rate of 40 - 44 Gbps. The main element is a chirp-free Lithium Niobate Mach-Zehnder modulator driven by an optimized duobinary driver amplifier. The amplifier generates an electrical 3-level signal, driving the modulator at $2 \times V_{\pi}$.



43 Gbps duobinary optical output signal



Optical ASK Receiver

The optical ASK receivers are available as an optical receiver with or without a clock recovery unit. Both options are separate building blocks, they are not connected internally! For further information regarding the clock recovery, please refer to the clock recovery brochure.



The optical receiver converts optical signals into electrical signals. The wide output dynamic range combined with excellent pulse behavior makes the device ideal for optical system research.

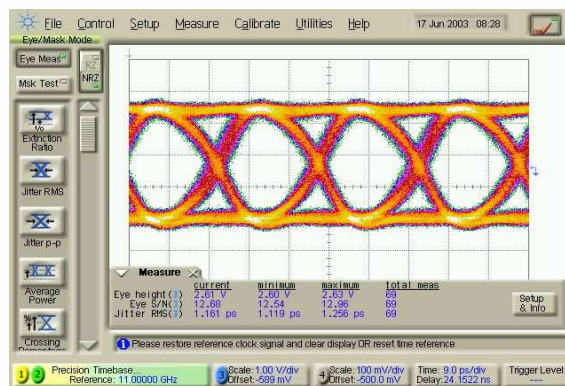
- High optical sensitivity and high conversion gain
- ASK NRZ, RZ and CS-RZ operation
- High output saturation suitable for 2R regeneration
- Excellent pulse behavior and unsurpassed high power handling capability

41211 A / 41211 C

- Single ended output at SHF 41211 A enables broadband operation up to 50 Gbps
- Limiting differential output at SHF 41211 C enables broadband operation up to 32 Gbps
- Optional Clock Recovery with a gap free operating bit rate range 19 to 26 Gbps (option CR25) or 25 to 32 Gbps (option CR28)

41210 B

- Broadband operation up to 50 Gbps
- Single ended output
- Optional Clock Recovery with a gap free operating bit rate range from 39.5 to 44.5 Gbps (option CR)



40 Gbps electrical output signal with 6dBm optical input power

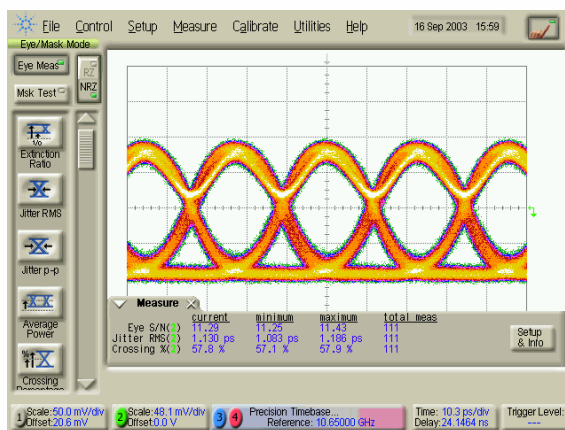
Optical DPSK Receivers

The optical DPSK receivers offer a solution for demodulation of DPSK-encoded (NRZ, RZ and CS-RZ) optical signals and conversion back into electrical signals for further analysis.

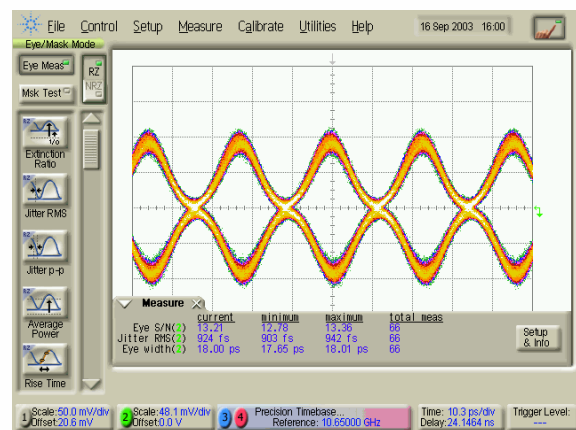


- Balanced detection of optical DPSK signals
- Usable bit rate range of +/- 10% with respect to the nominal bit rate
- Integrated 1 bit delay Mach Zehnder interferometer
- Tracking mode for compensation of laser wavelength changes during long term measurements
- High optical sensitivity
- Available with a single ended or a limiting differential output
- User-specified bit rate (narrowband operation) within the following bit rate ranges:

SHF 47211 A (single ended output) SHF 47211 C (differential output)	9.9 to 10.8 Gbps
SHF 47213 A (single ended output) SHF 47213 C (differential output)	19 to 22 Gbps
SHF 47215 A (single ended output) SHF 47215 C (differential output)	26 to 30 Gbps
SHF 47210 A (single ended output)	39.8 to 43 Gbps
SHF 47214 A (single ended output)	48 to 55 Gbps



42.6 Gbps NRZ optical output signal



42.6 Gbps RZ optical output signal



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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