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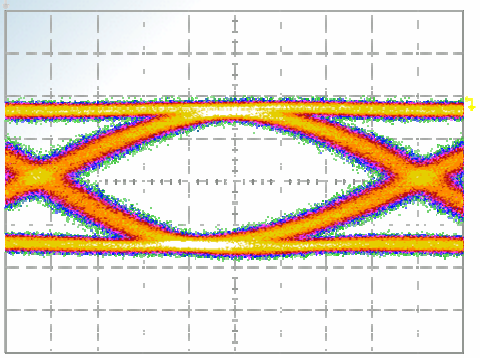


Preliminary

Datasheet

SHF 46213A

Optical DQPSK Transmitter

Description

The SHF 46213A is an optical DQPSK transmitter unit. It is a field replaceable plug-in module which needs to be installed in a mainframe type SHF 10001A or SHF 10000A. Together with other plug-in modules from this instruments series, a modular and scalable measurement system can be put together.

In a DQPSK (Differential Quadrature Phase Shift Keying) transmission system, the data is transmitted in the differential optical phase change between the symbols. The data is encoded in four different phase states. Since one transmitted symbol includes the information of two bits the symbol rate is reduced by the factor ½. Therefore one advantage of a DQPSK transmission system is a high spectral efficiency.

The SHF 46213A is a parallel modulator which converts 2 electrical data streams (I and Q) of up to 22 Gbps into 1 optical data stream of up to 22 GSymbols/s. Both electrical data streams modulate the light by a thermally stable Chirp-free Lithium Niobate Mach-Zehnder modulator with a phase difference of $\pi/2$. Before superposition of the two light streams the Q part gets $\pi/2$ shifted in order to have four different phase states in the transmitted signal.

The 2 data channels can be switched On and Off independently, thus permitting to generate either DPSK or DQPSK signals.

To detect and to demodulate either the I or the Q channel, our new 20 Gbps DPSK optical receiver SHF 47211A is the ideal instrument. It is possible to switch between the I and the Q channel for eye analysis or BER measurement of both channels separately.

For a 40 Gbps BER measurement the SHF 12100B Bit Pattern Generator provides the I and Q data streams as sub channel option

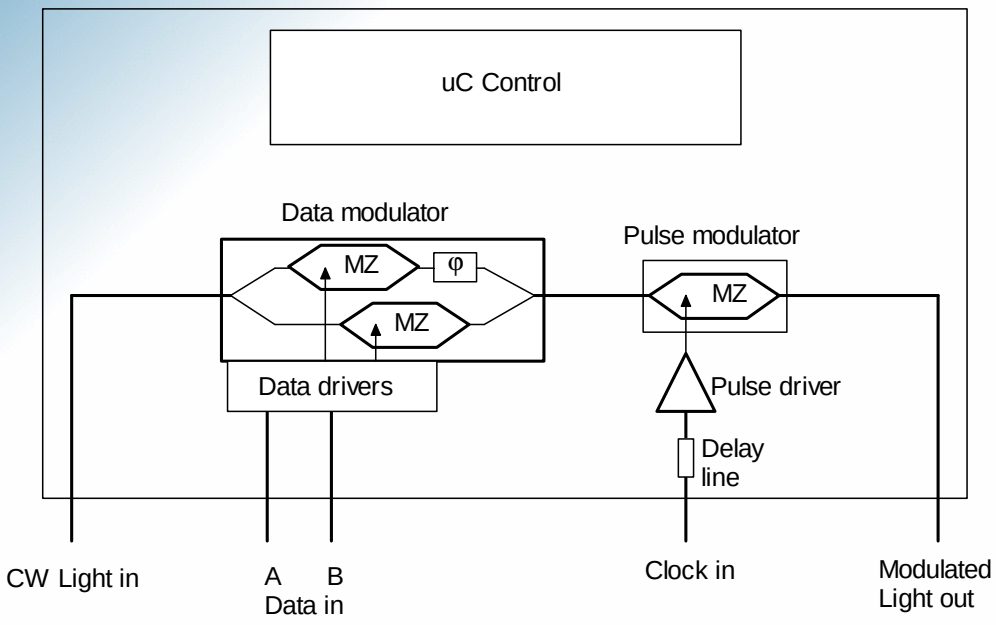
For the RZ modes, an amplifier amplifies a clock signal which is used to drive a third modulator. The output from this modulator is a train of pulses of constant width. For the NRZ-D(Q)PSK modes, the third modulator is biased to allow light through continuously.

The temperature stable modulators and an automatic bias circuit for the data channels ensure high stability of the output signal.

Features

- 40 Gbps (20 GSymbol/s) optical data streams
- Separate analysis of I and Q channel possible
- Quick optimization of optical eye diagram performance by user adjustable modulator bias control
- All features computer controlled
- Data modulators' bias conditions controlled automatically
- Selectable automatic and manual bias control (ABC circuit)

Functional block diagram



Specifications – SHF 46213A

Parameter	Unit	Min.	Typ.	Max.	Comment
Optical parameters					
Wavelength range		C- and L-band			
Insertion loss	dB		11	13	connector to connector, maximum transmission without modulation
DC Extinction ratio	dB		20		
Return loss	dB		30		without optical connector
Electrical and electro-optical parameters					
Electro-optical bandwidth of Data modulator	GHz	15			-3dB electrical
Symbol rate RZ-DQPSK DQPSK	Gsym/s	 18 5		 22 22	
Drive amplifier electrical return loss Data Clock pulse RZ	dB			 -10 -10	
Drive amplifier input level Data input RZ clock input	Vpp	 0.26 0.5		 0.4 1.2	
Dynamic signal to noise ratio DPSK-mode, either Data A or B		12	15		measured with SHF 47211 DPSK-receiver. @ 20Gbps

Absolute maximum ratings

Parameter	Unit	Min.	Typ.	Max.	Conditions
Optical input power	dBm			16	
NRZ data amplifier input power	dBm			4	NRZ data
RZ clock driver input power	dBm			4	CW

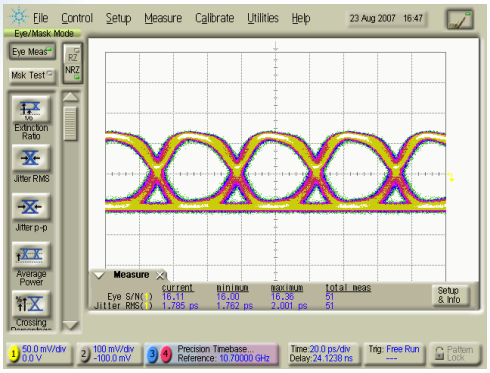
General specifications

Parameter	Unit	Min.	Typ.	Max.	Conditions
Weight	kg		3.3		
Dimensions	mm		59x213x450		w/o Frontpanel - Connectors
Power consumption	W		20.5		
Operating temperature	℃	10		35	
Electrical data input connectors			K (2.9mm)		
Clock input connector			K (2.9mm)		
Optical connectors			FC/PC		

Test Measurements

The following equipment was used in obtaining these results:
SHF12100 A Pattern Generator at 21.4 Gbps, PRBS 2^{31}-1
SHF 1550DFB Laser source set to 15mW output power @ 1550 nm.
AMPAQ EDFA + bandpass filter
Agilent 86100A DCA with 70GHz plugin and precision timebase module
D(Q)PSK signals detected with SHF 47211 21.4 GBit/s DPSK receiver

only Data A switched ON



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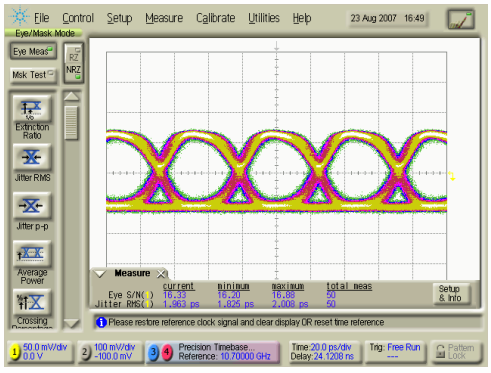
only Data B switched ON



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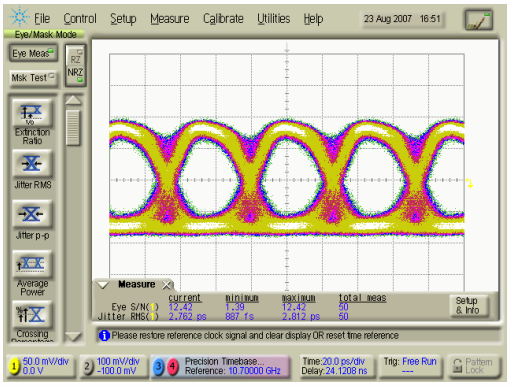
Both Data A and Data B channel switched ON
(DQPSK), 21.4 GSymbols/s:



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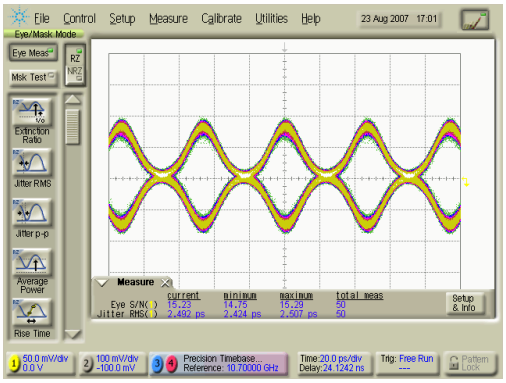
RZ-DQPSK



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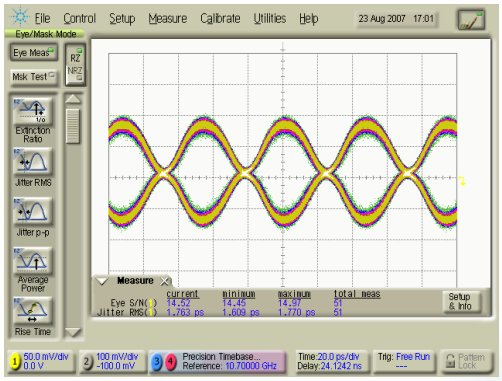
CSRZ-DQPSK



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