

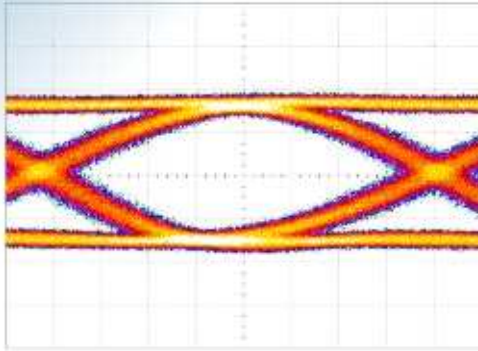


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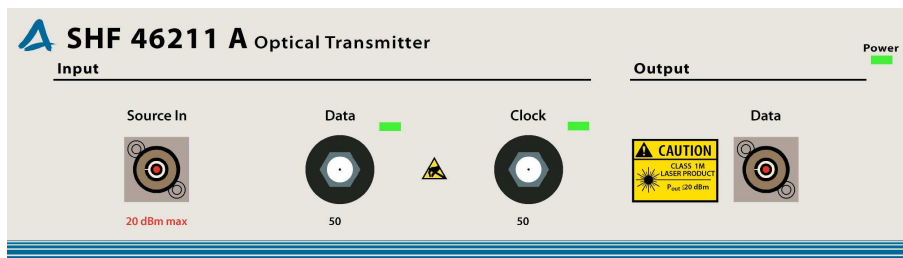


„Preliminary“

Datasheet

SHF 46211A

**10 Gbps Multifformat Optical
Transmitter**





Description

The SHF 46211A is an optical transmitter unit. This is a half-width plug-in for the SHF 10000A mainframe. Field installation or upgrade by the end-user is possible for this equipment.

The SHF 46211A Optical Transmitter converts electrical signals into optical signals at a data rate of up to 12.5 Gbps. It is able to encode the data in ASK (amplitude shift keying) and DPSK (differential phase shift keying) formats. With NRZ, Conventional RZ and Carrier Suppressed RZ, a total of six formats are supported. When used in DPSK mode, the SHF 47211A DPSK Optical Receiver is an ideal instrument for decoding the signal.

ASK is the most popular method used in optical communications. The light intensity is varied so that light on corresponds to "1" and light off corresponds to "0", or vice versa. DPSK is a well known coding method which has recently received interest in the transmission of high bit rate signals through optical fibers. Data is encoded by changing the phase of the light. Compared to the more conventional ASK, DPSK offers higher sensitivity and enhanced robustness against the impact of non-linear effects in DWDM transmission.

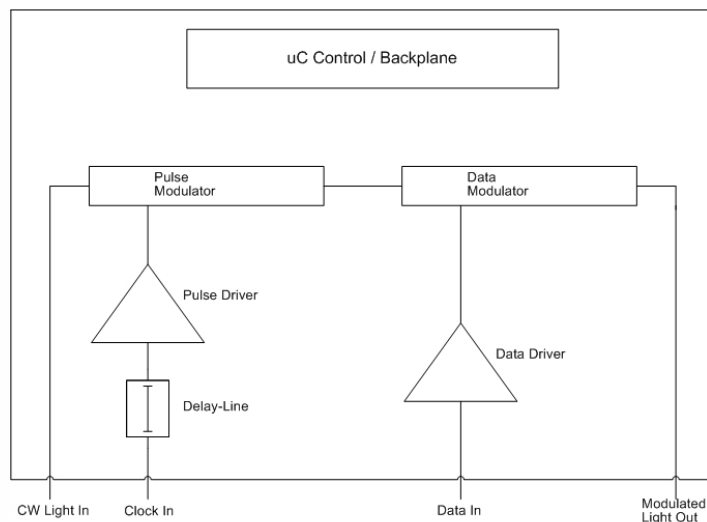
The main elements of the SHF 46211A are two thermally stable Chirp-free Lithium Niobate Mach-Zehnder modulators which are each driven by an individually optimized amplifier. For the RZ modes, an amplifier amplifies a clock signal which is used to drive the first modulator. The output from this modulator is a train of pulses of constant width. These pulses are fed into the second modulator. The pulsed light is then modulated by the data signal. In this way, RZ signals are produced from an incoming NRZ signal. For the NRZ modes, the first modulator is biased to allow light through continuously.

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

Features

- Up to 12,5 Gbps optical data streams
- 9 GHz E/O conversion bandwidth (typical)
- Quick optimization of optical eye diagram performance by user adjustable gain and modulator bias control
- All features computer controlled
- Both modulators' bias conditions controlled automatically
- Selectable automatic and manual bias control (ABC circuit)
- SONET/SDH compatible

Functional block diagram





Specifications – SHF 46211 A

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		22		
Return loss	dB		35		without optical connector
Chirp (Alpha parameter)		-0.1	0	+0.1	small signal measurement method ¹
Electrical and electro-optical parameters					
Electro-optical bandwidth of Data modulator	GHz	9	11		-3dB electrical
Bit rate NRZ	Gbps	2		12.5	
RZ		8		12.5	
Drive amplifier electrical return loss Data	dB			-10	
Clock pulse RZ				-10	
ASK-Mode operation (Datarate 8 ... 12.5 Gbps)					
Drive amplifier input level Data input	Vpp (dBm)	0.22 (-9)	0.28 (-7)	0.6 (0)	
RZ clock input		0.5 (-2)	0.6 (0)	1 (4)	
Dynamic extinction ratio NRZ	dB	11	13		measured between data '1' and long sequence of '0'
RZ		12	14		
CS-RZ		12	14		
Dynamic signal to noise ratio NRZ			15		
RZ			18		
CS-RZ			16		
Output rise and fall times NRZ	ps		tbd	tbd	
Pulse width (FWHM) RZ	ps		33		
CS-RZ			67		
Output timing jitter <RMS> NRZ	ps		tbd	tbd	
RZ					
CS-RZ					
Position of crossing point @ NRZ	%	45	50	55	
DPSK mode operation					
Drive amplifier input level Data	Vpp (dBm)	0.36 (-5)		0.8 (2)	



Clock pulse RZ		0.5 (-2)	0.6 (0)	1.2 (6)	
Phase modulation by 2 $V\pi$ drive	Rad	0		π	
Auto-bias control (ABC)					
Dither signal frequency	kHz		10		

¹ (F. Devaux, Y. Sorel and J.F. Kerdiles, "Simple Measurement of Fiber Dispersion and of Chirp Parameter of Intensity Modulated Light Emitter", J. Lightwave Technol., vol. 11, no. 12, December 1993)

Absolute maximum ratings

Parameter	Unit	Min.	Typ.	Max.	Conditions
Optical input power	dBm			16	
NRZ data amplifier input power	dBm			10	NRZ data
RZ clock driver input power	dBm			10	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	°C	10		35	
Electrical data input connector			ruggedized 2.92mm male connector		
Clock input connector			ruggedized 2.92mm male connector		
Optical connectors			FC/PC		

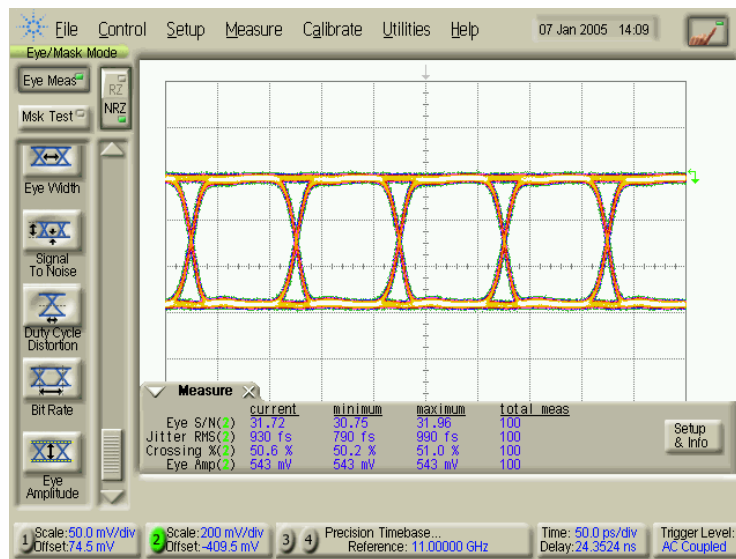


Test Measurements

The following equipment was used in obtaining these results:

- Agilent 86100A Mainframe with 86118A 70GHz plug-in
- 70 GHz Photodetector
- BPG 44E Pattern Generator
- DFB Laser source set to 15mW output power @ 1550 nm.
- AMPAQ EDFA + JDS Fitel optical bandpass
- DPSK measurements received with Mach-Zehnder Interferometer and photodetector on constructive interference arm.

Typical transmitter data input signal



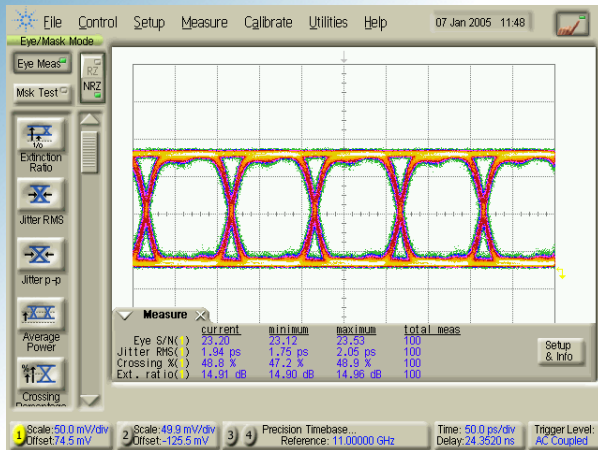
10 Gbps electrical signal



Optical output waveforms at 10Gbps

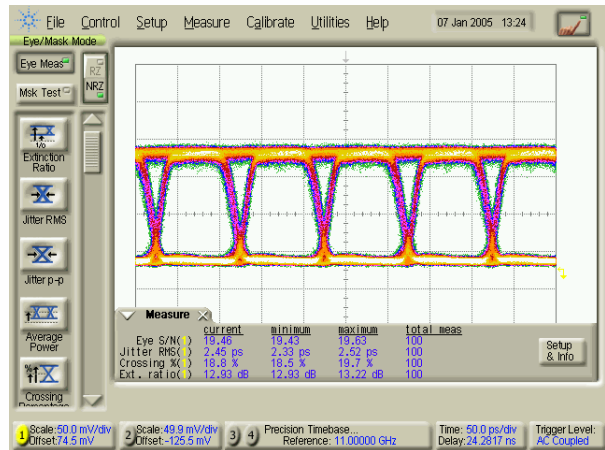
Transmitter in ASK-mode

Transmitter in DPSK-mode



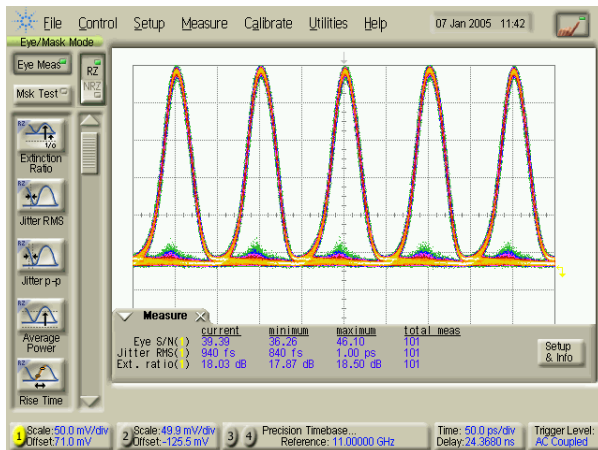
ASK - 10 Gbps NRZ signal

Eye S/N: 23.2; Jitter: 1.9ps; Ext. ratio: 14.9dB



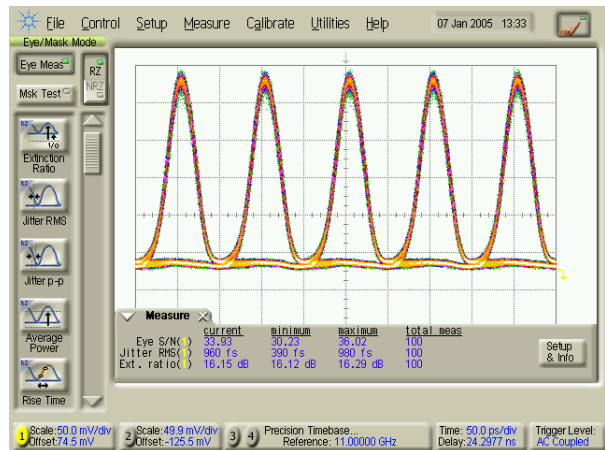
DPSK - 10 Gbps NRZ signal

Eye S/N: 19.5; Ext. ratio: 12.9dB



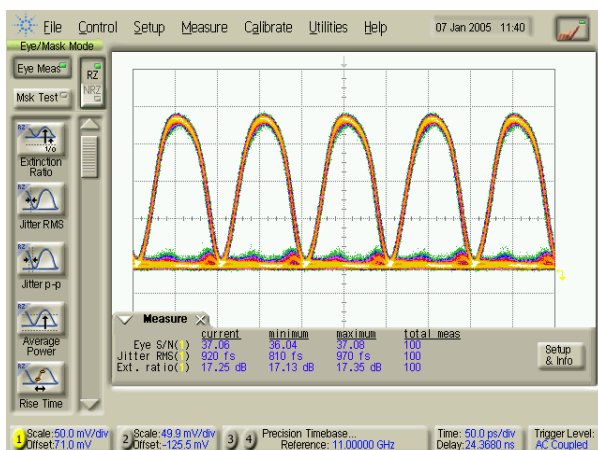
ASK - 10 Gbps RZ signal

Eye S/N: 39.4; Jitter: 0.9ps; Ext. ratio: 18.0dB



DPSK - 10 Gbps RZ signal

Eye S/N: 33.9; Ext. ratio: 16.2dB



ASK - 10 Gbps carrier suppressed RZ signal

Eye S/N: 37.0; Jitter: 0.9ps; Ext. ratio: 17.1dB



DPSK - 10 Gbps carrier suppressed RZ signal

Eye S/N: 28.9; Ext. ratio: 15.5dB