

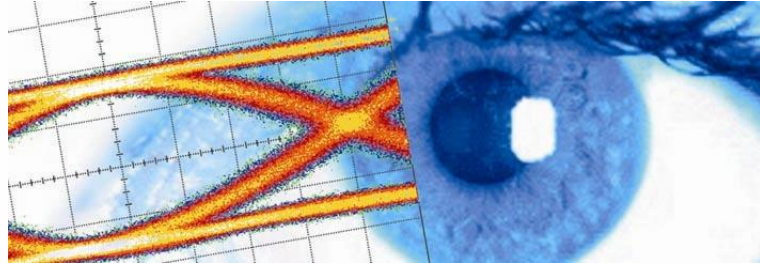


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# Datasheet

## SHF 46215 B

### Optical DP-QAM Transmitter





## Description

The SHF 46215 B is an optical transmitter unit featuring QAM modulation format in two orthogonal Polarization planes, (DP-QAM). It is a field replaceable plug-in module which needs to be installed in a mainframe type SHF 10001 A/B or SHF 10000 A/B/C. Together with other plug-in modules from this instruments series, a modular and scalable measurement system can be put together.

In a QAM (Quadrature Amplitude Modulation) transmission system, the data is transmitted in the optical phase and amplitude change between the symbols. Since one transmitted symbol includes the information of  $n$  bits the symbol rate is reduced by the factor  $1/n$ . Therefore one advantage of a QAM transmission system is a high spectral efficiency.

In a **DP-QAM** transmission system the capacity is doubled by transmitting the data in two orthogonal polarization planes.

The SHF 46215 B uses two modulators (one modulator per polarization plane) integrated in parallel, and converting four electrical data streams (I and Q in X- and Y-polarization) of up to 32 GSymbols/s into 1 optical data stream of up to 32 GSymbols/s, and hence a total capacity of up to 256 Gbps. The output optical data in the two orthogonal polarization planes are bit-synchronized in time.

If the input data streams consist of binary signals, the optical output format will be DQPSK. Multilevel input data streams will generate the PAM/QAM modulation.

The 4 data channels can be switched On and Off independently, thus permitting to generate either PAM or QAM signals in single- or dual polarisation mode.

The DC biases of the MZ modulators are controlled automatically as other SHF optical transmitter instruments, to ensure stability for long term measurements.

An optical pulse carver is available as an option.

## Features

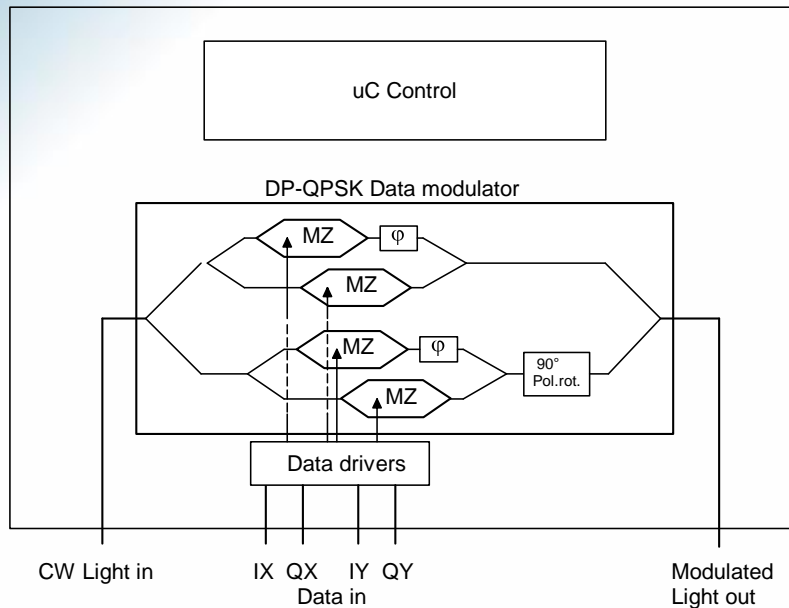
- 4 x 32 GSymbols/s optical data streams
- All modulators' bias conditions controlled automatically
- Selectable automatic and manual bias control (ABC circuit)
- All features are computer controlled via Bert Control Center software
- Linear operation for QAM
- Compressed operation for QPSK (4-QAM)

## Options

- Option add RZ  
Additional pulse carver for RZ (return to zero) or CS-RZ operation



## Functional block diagram



## Specifications – SHF 46215 B

Parameter	Unit	Min.	Typ.	Max.	Comment
<b>Optical parameters</b>					
Wavelength range		C- and L-band			
Insertion loss (for each polarization)	dB		14	16	connector to connector, maximum transmission without modulation, without option add RZ
DC Extinction ratio	dB	20			
Return loss	dB	30			without optical connector
<b>Electrical and electro-optical parameters</b>					
Electro-optical bandwidth of Data modulator	GHz	23			-3dB optical
Symbol rate DP-QPSK RZ/ CS-RZ DP-QPSK	GSym/s	5 20		33 33	
Drive amplifier electrical return loss Data	dB			-10	
Data input level QAM (linear operation) QPSK (binary signals, limiting)	V <sub>pp</sub>	0.4		0.25 0.9	
Clock input level (for RZ generation)	V <sub>pp</sub>	0.5		1.2	
Dynamic signal to noise ratio DPSK-mode, either Data IX, QX, IY or QY		9	11		measured with SHF 47215 DPSK-receiver. @ 28 Gbps



## Absolute maximum ratings

Parameter	Unit	Min.	Typ.	Max.	Conditions
Optical input power	dBm			17 18	with option add RZ w/o option add RZ
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 Front panel - Connectors
Power consumption	W		20.5		
Operating temperature	°C	10		35	
Electrical data input connectors					female K (2.92mm)
Optical connectors					FC/PC <sup>1</sup>

<sup>1</sup> Other connectors available on request.



# Direct Detection Performance Results

The following equipment was used in obtaining these results:

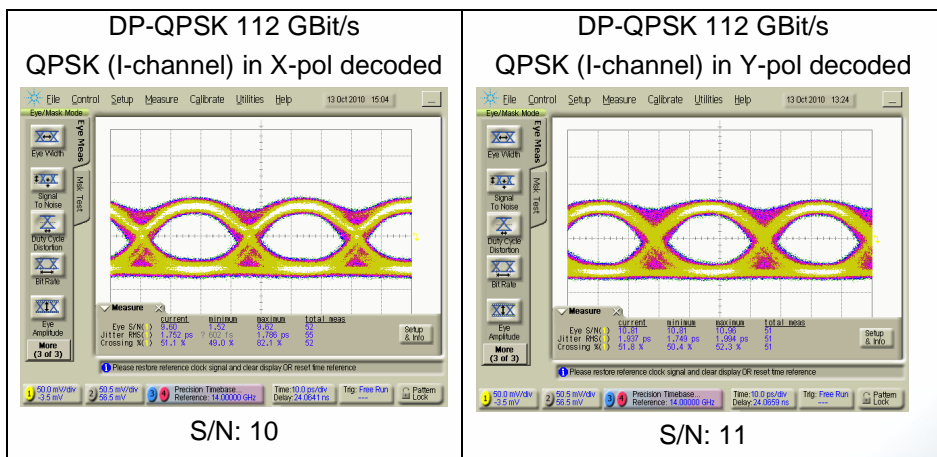
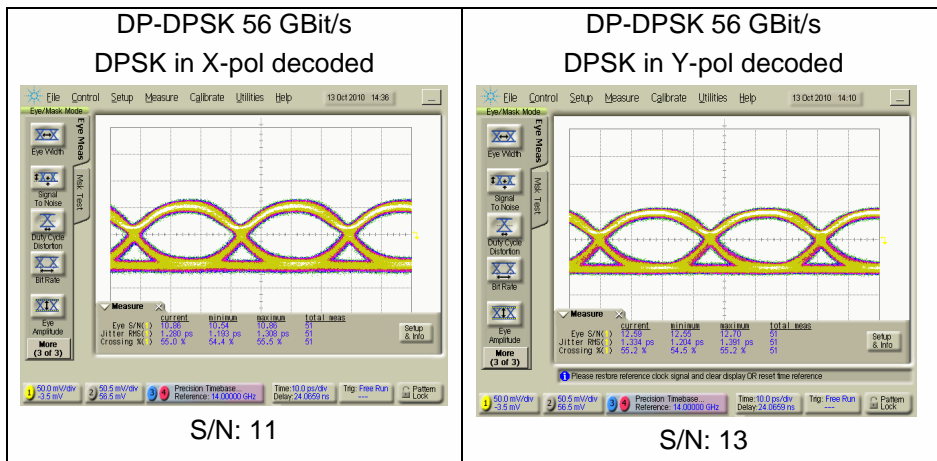
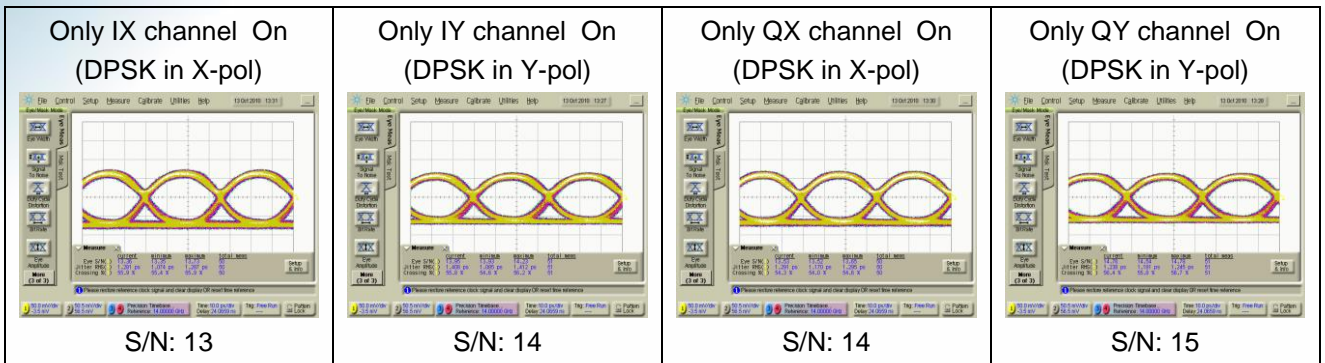
SHF 12103 A Pattern Generator at 28 Gbps, PRBS  $2^{31}-1$

SHF 1550DFB Laser source set to 15mW output power @ 1550 nm.

AMPAQ EDFA + band pass filter.

Agilent 86100A DCA with 70GHz plug-in and precision time base module.

D(Q)PSK signals detected with SHF 47215 28 GBit/s DPSK receiver.



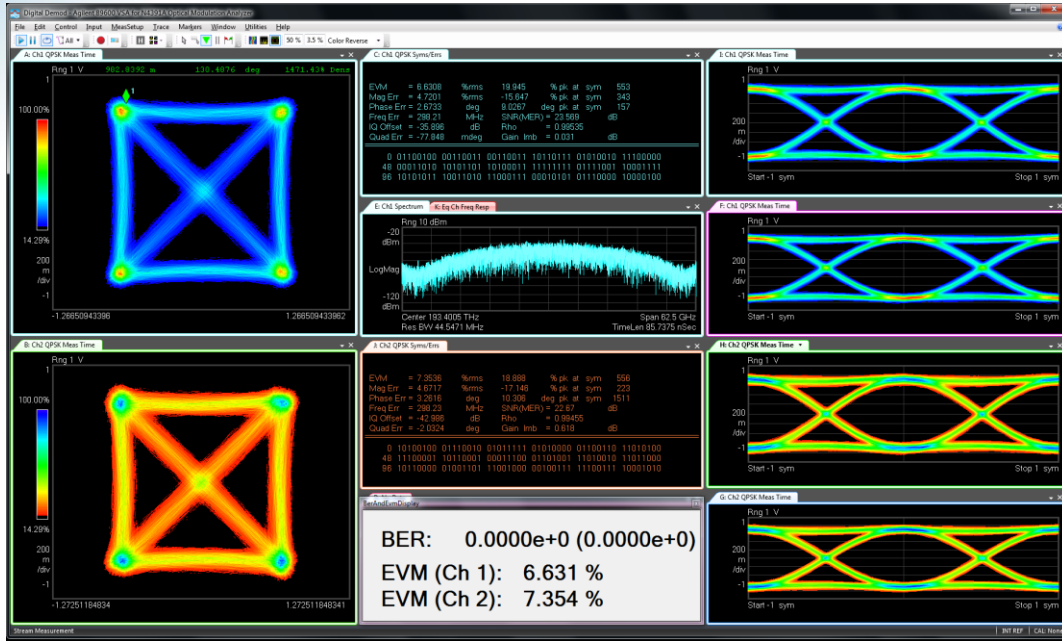


# Coherent Detection Characteristics

Figure below shows the single polarization feature of the transmitter output signal captured by using a commercial high speed coherent constellation analyzer and the corresponding time domain characteristics of the signal. A narrow line width laser source was used at the input.

Dual polarization DQPSK:

The four 28 GBit/s input data channels were provided by using the SHF 12103 A Quad-32 bit pattern generator



Single polarization QAM:

The two 28 GBaud input data channels were provided by using 2x SHF 611 A DACs to generate the 4-level signals and the SHF 12103 A Quad-32 bit pattern generator to drive the DACs.

