ModBox-OBand-56GBaud-PAM4

O-Band, 56 Gbaud PAM-4 Reference Transmitter

ModBox

The ModBox-OBand-56Gbaud-PAM4 is a 4-level Pulse Amplitude Modulation (PAM-4) Optical Reference Transmitter that generates in the O-band excellent quality optical data streams up to 56 GBaud. The PAM-4 ModBox is a highly linear optical transmitter featuring Very High Quality and Robust PAM-4 Eye Diagrams coming with low jitter and really fast rise and fall times.

The ModBox-OBand-56GBaud-PAM4 provides R&D and Production engineers with a user friendly turn-key instrument delivering state of the art performance. It is being used in optical telecommunications laboratories and production test beds.

The equipment incorporates a modulation stage based on a chirp-free $LiNb0_3$ Mach-Zehnder modulator, coupled with a highly linear RF driver and an automatic bias control circuitry. In option, it also integrates ER4/LR4-CWDM or LAN-WDM lasers sources.

In addition to the O-band, iXblue offers optical reference transmitters in the C-band and at 850 nm.

FEATURES

- Full O-band Reference Transmitter
- Up to 56 Gbaud
- Reliable & reproducible measurements
- High eye diagram stability
- Extinction Ratio Adjustable

APPLICATIONS

- Transmission system test
- Components characterization
- Production test
- R&D laboratories

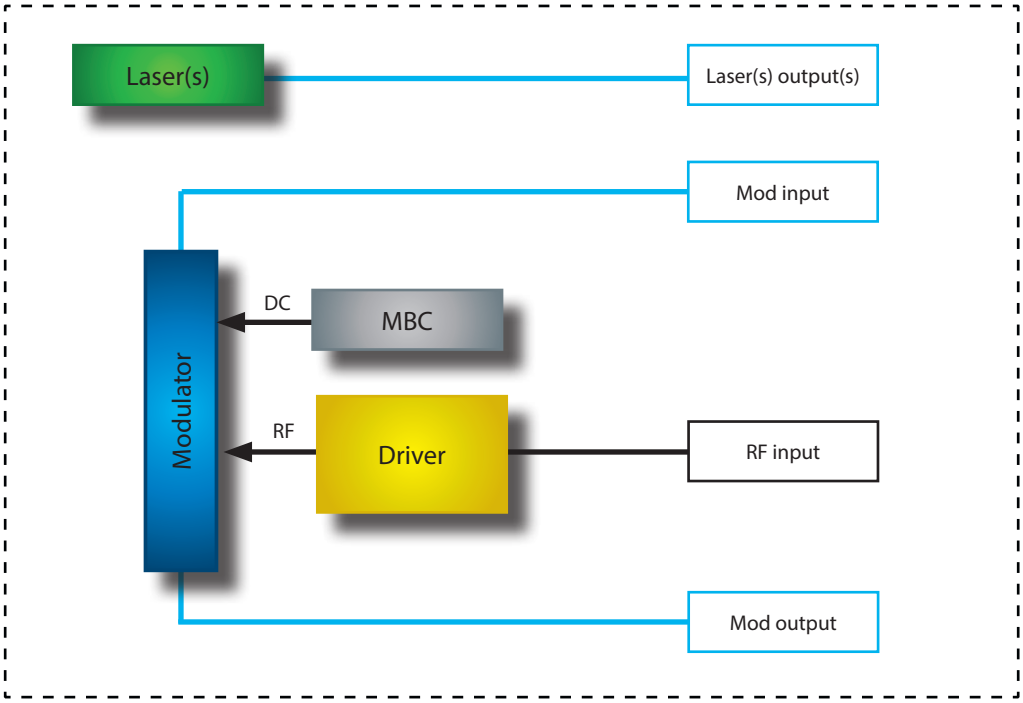
OPTIONS

- ER4/LR4-CWDM, LAN-WDM lasers
- Multi-Channel
- 850 nm, C-band

Performance Highlights

Parameter	Min	Typ	Max
Operating wavelength	1270 nm	1310 nm	1330 nm
Modulation format	PAM-4		
Modulation bandwidth	56 Gbaud		
Modulated optical output power	2 dBm	-	-

Functional Block Diagram



The ModBox-OBand-56GBaud-PAM4 features:

- A chirp-free X-cut $LiNb0_3$ (Lithium Niobate) Mach-Zehnder Analog Intensity modulator. It is selected for its high electro-optic bandwidth and flat, low ripple, electro-optic response curve.
- A high bandwidth and highly linear RF driver with gain and crossing levels adjustment for eye diagram optimization.
- A Modulator Bias Controller. The internal $LiNbO_3$ modulator is a X-cut device with very low drift. However an automatic bias control circuit is provided to lock the operating point of the modulator at the quadrature point whatever the environmental conditions. The MBC ensures a highly stable optical output signal to provide reliable and reproducible measurements.
- A 1310 nm low RIN laser is integrated by default. A set of 4 laser sources is embedded in option to cover the wavelengths demand for the ER4/LR4-CWDM, (20 nm spacing) or the LAN-WDM (5 nm spacing). For convenience, an external patch cord is delivered to connect the laser output to the optical input of the modulation stage. Wavelength and power are tunable through the front panel controls or the ModBox software interface.

The ModBox-OBand-PAM4 is controlled from the front panel via the Smart interface with a simple rotary knob and keypad. The Smart manual interface allows for bias control circuit, driver gain and laser settings. It comes also with a simple GUI solution, Windows based and implemented through the USB interface of the user PC.

Input Electrical Specifications

User supplied, not a ModBox specification

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Data-rate	-	-	2	-	56	Gb/s
Input voltage	V_{IN}	AC coupled - 50 Ω - Single ended	-	-	500	mVpp
Jitter	J_{RMS}	@ 56 Gb/s	-	1	1.2	ps
Rise / fall time	t_r / t_f	20 % - 80 %	-	7	8	ps
Cross point	-	-	45	50	55	%

Input Optical Specifications

User supplied, not a ModBox specification

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operation	λ	CW	1270	-	1330	nm
Polarization	POL	-	Linear and controlled			-
Optical power	OP_{IN}	CW	-	-	30	mW
Side Mode Supression Ratio	SMSR	-	30	-	-	dB
Spectrum linewidth	δλ	FWHM	-	1	-	MHz
Relative Intensity Noise	RIN	0.2 GHz - 3 GHz	-	-150	-	dB/Hz

Output Optical Specifications

Specifications below are given with embedded 1310 nm laser.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Data-rate	PAM-4	-	2	-	56	Gbaud
Added RMS jitter	J_{RMS}	NRZ mode	-	0.7	1.2	ps
Dynamic Extinction Ratio	DER	NRZ mode	-	8	13	dB
Rise / fall time	t_r / t_f	NRZ mode	-	7	8	ps
Cross point	-	NRZ mode	45	50	55	%
Eye cross point variation	-	NRZ mode	-5	-	5	%
Electrical Return loss	ERL	NRZ mode	-	-10	-12	dB
Optical Return loss	ORL	NRZ mode	-40	-45	-	dB
Average output power	P_{Out}	With embedded 1310 nm laser	2	-	-	dBm
		Other C-WDM or LAN-WDM lanes (1)	1	2	-	dBm

(1): The C-WDM and LAN-DWM lasers specifications are given in page 4.

C-WDM & LAN-WDM DFB Lasers Specifications Option

The laser 1310 nm laser is embedded by default.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Laser type	-	-		DFB		-
Option additional wavelengths	λ_{WDM}	4 lasers 5 nm spacing - LAN-WDM		1295 nm, 1300 nm, 1305 nm		-
		4 lasers 20 nm spacing - CWDM		1270 nm, 1290 nm, 1330 nm		-
Wavelength laser tuning range	$\Delta\lambda$	Diode chip temperature control	-	0.8	1	nm
Optical output power	OP_{OUT}	Other wavelengths	10	20	-	mW
Optical output power adjustment	ΔOP_{OUT}	Diode Injection current control	0	-	100	%
Spectrum linewidth	$\delta\lambda$	FWHM	-	2	-	MHz
Side Mode Suppression Ratio	SMSR	-	30	35	-	dB
Optical Return Loss	ORL	-	30	-	-	dB

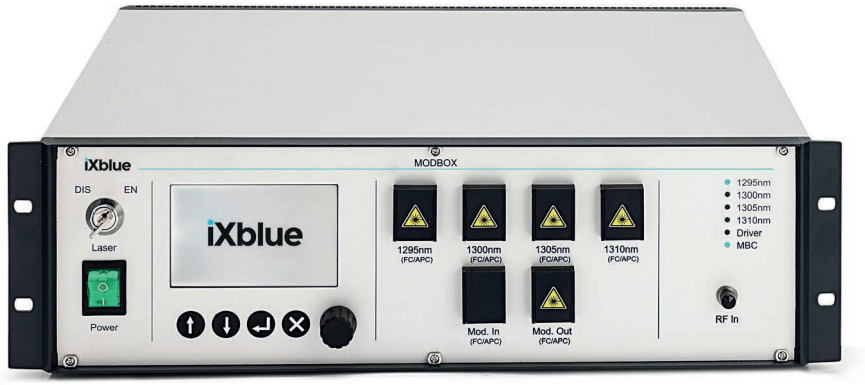
Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
RF electrical signal	V_{IN}	-	1	Vpp
	EP_{IN}	-	4	dBm
Optical input power	OP_{in}	-	20	dBm

Interfaces, Dimensions and Compliance

Interfaces	
Optical	Polarization maintaining fiber PM1300 - FC/APC (by default, other connectors type in option)
RF input	Single 1.85 mm female RF connector - 50 Ω
Control	Smart Interface (front panel), GUI (USB typeB)
Power supply	100-120V/220-240 automatic switch 50-60Hz (Rear panel)
EMC and optical norms	EN61326-1 Ed. 2006 / NF EN 60825-1 & EN 60825-2 Ed.2014
Dimensions / Weight	Rack 19" x 3U, Depth=375mm / 3 kg



4 Laser ModBox-PAM4 - Front panel

Ordering information

ModBox-OBand-56Gbaud-PAM4

OBand = Full band of operation, embeds laser, 1310 nm by default
56Gbaud = Data-rate up to 56 Gbaud

Opt-DFB-YY

DFB laser option:
YY = Optional additional laser - Wavelength in nm

Opt-ZZ

ZZ = Output connectors, FA : FC/APC - FC : FC/UPC - SA : SC/APC- SC : SC/UPC

07-2017_iX_SP_ED1

About us

iXBlue Photonics includes iXBlue iXFiber brand that produces specialty optical fibers and Bragg gratings based fiber optics components and iXBlue Photline brand that provides optical modulation solutions based on the company lithium niobate ($LiNbO_3$) modulators and RF electronic modules.
iXBlue Photonics serves a wide range of industries: sensing and instruments, defense, telecommunications, space and fiber lasers as well as research laboratories all over the world.

3, rue Sophie Germain
25 000 Besançon - FRANCE
Tel. : +33 (0) 381 853 180 - Fax : + 33 (0) 381 811 557