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MODULATORS & MODBOX | **iXblue**



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# **iXblue stands as a global leader in the design and manufacturing of innovative solutions for navigation, positioning, seabed mapping, mecatronics and photonics markets.**

The French Group offers its unique advanced technology solutions to its defense & civil customers to address increased challenges and carry out their maritime, land and space operations with optimum efficiency and safety.

iXblue is recognized throughout the industry for its pioneering work on the development of fiber-optic gyroscope (FOG) technology which has revolutionized the maritime and naval inertial systems in the last decade, providing unequalled performance and cost of ownership benefits.

Underpinned by 30 years of expertise, iXblue is currently achieving annual growth of 15-20%, with 80% of its business conducted in over 35 countries worldwide. The Group can count on full value-chain expertise: all of its systems are developed internally, from design to manufacturing.

**Photonics activities**  
At the core of the most accurate sensors, such as fiber-optic gyros, there are devices capable of manipulating photons (light) and using them as “perfect” sensing elements. Special iXblue optical fibers can guide the light, selecting specific wavelengths and maintaining its polarization (the direction of the light field). iXblue optical modulators are able to modify the properties of the light passing through them, inducing local slowing or acceleration. By combining these technologies, iXblue creates gyroscopic sensors, lasers and devices for very high speed space communications.

## iXblue at a glance

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**30**  
YEARS OF  
EXPERIENCE

---

**100+**  
MILLION EUROS  
OF TURNOVER

---

**80%**  
OF TURNOVER  
ACHIEVED ABROAD

---

**600+**  
EMPLOYEES

---

**Serving  
more than  
1,000**

---

**20%**  
OF TURNOVER  
REINVESTED  
EACH YEAR IN R&D

---

**Worldwide  
presence**  
8 sites in  
France,  
10 abroad

---

**defense  
and civil  
customers**  
in more than  
35 countries

---

**Global  
training  
and  
24/7 support**

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**iXblue**

iXblue Photonics specializes in the design and manufacture of lithium niobate optical modulators for fiber optic systems. Manufacturing is carried out in an ISO 6 clean-room facility featuring microelectronics technologies, employing advanced (50Gb/s) integration, packaging and test processes for optoelectronic components. iXblue Photonics has also developed a production line for microwave amplifiers used to drive the modulators. The company has extended its product lineup with bias control systems (Modulator Bias Controllers - MBC) to deliver optimal modulator operation.

Mastering all of the basic building blocks of an efficient modulation system, iXblue Photonics is able to offer a range of complex optoelectronic modulation instruments known as «ModBox», featuring custom integration of active and passive optoelectronic modules, controllable through an adapted and reconfigurable human-machine interface.



# MODULATORS





COMPRESS



MODULATE  
Wavelength **0.8  $\mu\text{m}$**



## NIR Band | 800 nm Amplitude Modulator

### Amplitude Optical Modulation at 800 nm

The NIR-MX800-LN series are intensity modulators designed for a use in the 800 nm wavelength band. These modulators offer an unparalleled stability and a superior optical power handling thanks to the use of the annealed proton exchanged waveguide process with a doped  $\text{LiNbO}_3$  substrate. A specific microwave electrode design offers superior bandwidth and voltage performances.

### Key Features

- From 780 nm up to 950 nm
- High bandwidth
- Optical power handling
- Low drive voltage
- Very low electrical return loss

### Applications

- Quantum optics
- Atom optics
- Short Pulse Generation
- Pulse Picking
- Pulse Shaping
- SR4 100 GbE testing

### Related Products

- DR-DG DiGital Driver amplifiers
- DR-AN ANalog Driver amplifiers
- DR-PL PuLse Driver amplifiers
- MBC-DG Modulator Bias Controller
- MBC-AN Dither-less Modulator Bias Controller





## NIR Band | 800 nm Phase Modulator

### Phase Optical Modulation at 800 nm

The NIR-MPX800-LN series are phase modulators especially designed to operate in the 800 nm wavelength band. They are available with various modulation bandwidths. As other NIR-MX800-LN, these phase modulators offer an unparalleled stability and a superior optical power handling thanks to the use of the annealed proton exchanged waveguide process combined with a doped  $\text{LiNbO}_3$  substrate.

### Key Features

- From 780 nm up to 950 nm
- High bandwidth
- Optical power handling
- Low drive voltage
- High electrical power handling

### Applications

- Quantum optics
- Atom optics
- Frequency shifting
- Pound-Drever-Hall laser frequency stabilization
- Interferometric based sensors

### Related Products

- DR-DG DiGital Driver amplifiers
- DR-AN ANalog Driver amplifiers





MODULATE  
Wavelength **1.0  $\mu\text{m}$**



## NIR Band | 1000 nm Amplitude Modulator

### Amplitude Optical Modulation at 1000 nm

The NIR-MX-LN series are intensity modulators especially designed for operation in the 1000 nm wavelength band. Their specific design relies on the combined use of the iXblue "Magic Junction" (patent n° US7,577,322) with Annealed Proton Exchanged (APE) waveguide process. The result is a modulator with low insertion loss characteristics, high extinction ratio capabilities and a high optical power handling.

### Key Features

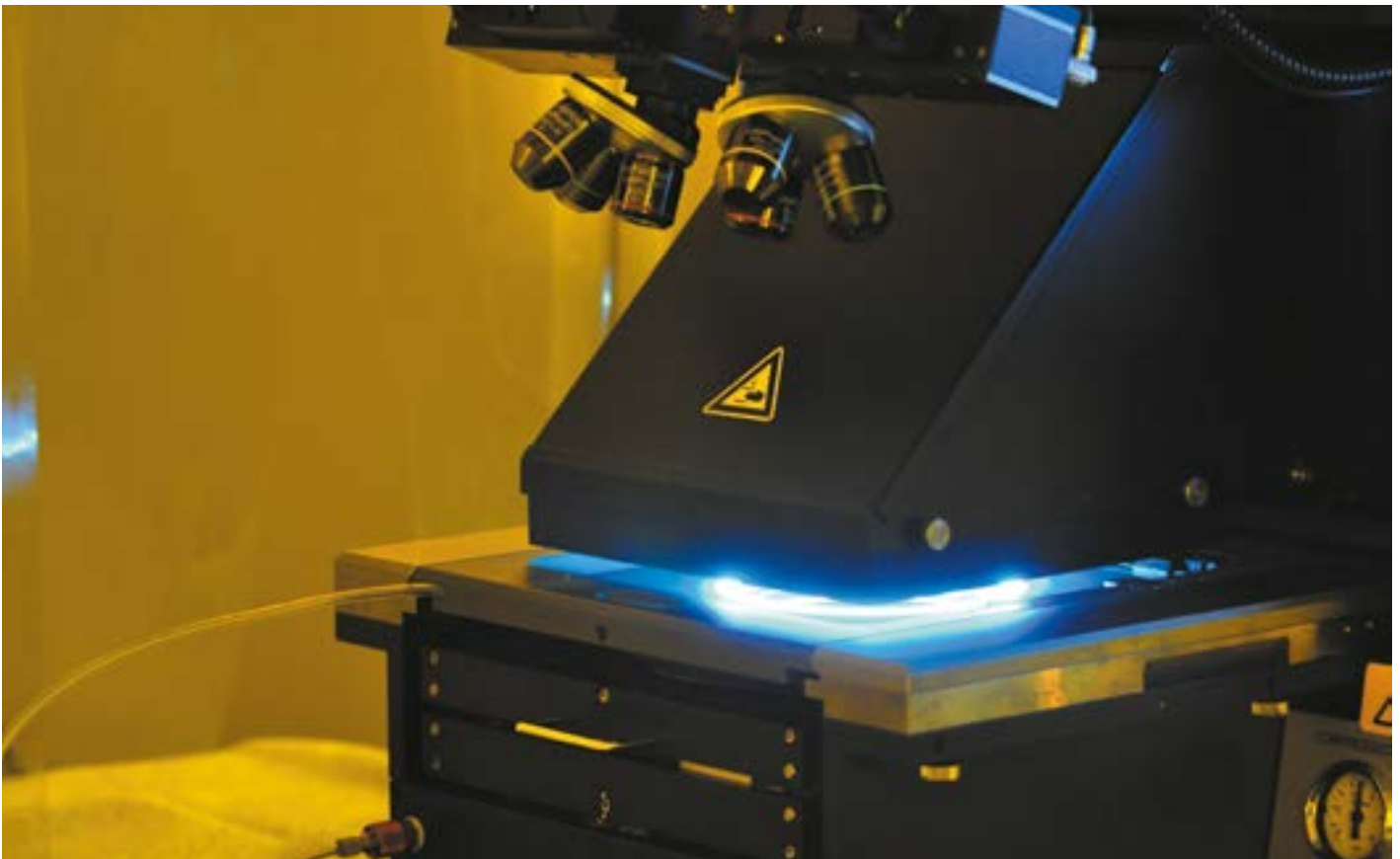
- From 980 nm up to 1150 nm
- High extinction ratio
- Low insertion loss
- High optical power handling
- High bandwidth

### Applications

- Short Pulse Generation
- Pulse Picking
- Pulse Shaping

### Related Products

- DR-PL PuLse Driver amplifiers
- MBC-DG Modulator Bias Controller





## NIR Band | 1000 nm Dual Stage Modulator

### High Extinction Ratio Optical Modulation at 1000 nm

The NIR-DSM-LN is a lithium niobate ( $\text{LiNbO}_3$ ) intensity modulator specially designed for operation in the 1000 nm wavelength band. The two cascaded Mach-Zehnder into the single LN-chip allow reaching ultra high extinction ratio up to 60 dB with all the benefits of the NIR modulators.

### Key Features

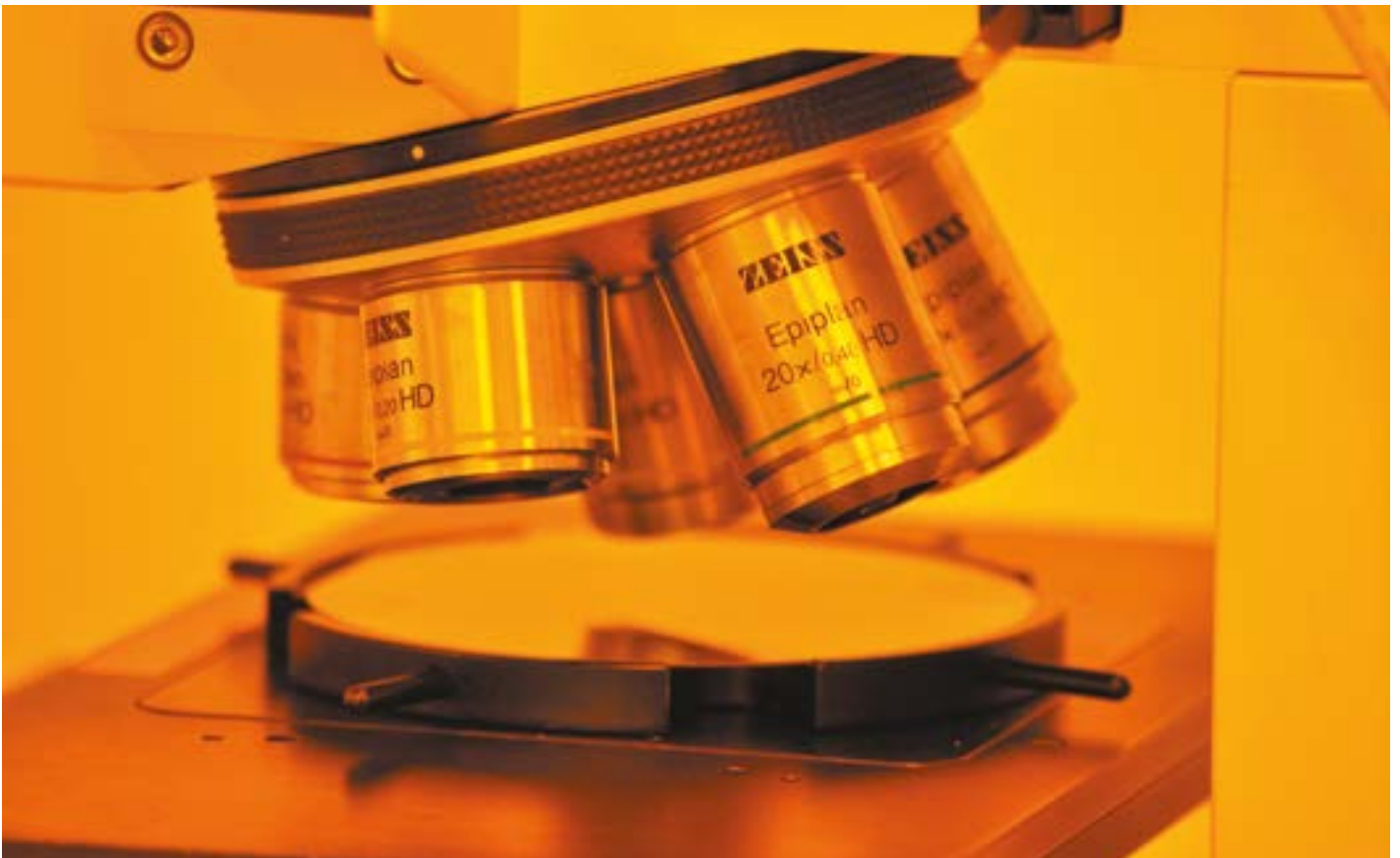
- From 980 nm up to 1150 nm
- Superior extinction ratio > 60 dB
- Low insertion loss
- High optical power handling
- High bandwidth

### Applications

- Inertial confinement fusion
- Interaction of intense light with matter
- Laser Plasma interaction

### Related Products

- DR-PL PuLse Driver amplifiers





## NIR Band | 1000 nm Phase Modulator

### Phase Optical Modulation at 1000 nm

The NIR-MPX-LN are phase modulators especially designed to operate in the 1000 nm wavelength band. They are available with various modulation bandwidths. As other iXblue near infrared modulators, the NIR-MPX-LN series use a proton exchanged based waveguide process that confers them an unparalleled stability even when operating at high optical power. The NIR-MPX-LN phase modulators come with high PER and low IL options.

### Key Features

- High bandwidth
- Low insertion loss
- High Polarization Extinction Ratio
- High optical power handling
- High electrical power handling

### Applications

- Spectral broadening
- Frequency shifting
- Pound-Drever-Hall laser frequency stabilization
- Interferometric based sensor
- Laser combining

### Related Products

- DR-DG DiGital Driver amplifiers
- DR-AN ANalog Driver amplifiers





MODULATE  
Wavelength **1.3  $\mu\text{m}$**



## O Band | Amplitude Modulator

### Amplitude Optical Modulation at 1310 nm

The MX1300-LN is a lithium niobate ( $\text{LiNbO}_3$ ) intensity modulator specially designed for operation in the 1310 nm wavelength band. Thanks to its 1310 nm optimized optical waveguides and its 1310 nm selected fibers, the MX1300-LN can be claimed as a genuine full O-Band intensity modulator.

### Key Features

- From 1260 nm up to 1360 nm
- Low driving voltage
- Low insertion loss
- High bandwidth
- Zero chirp

### Applications

- Up to 50 Gb/s optical transmission
- NRZ, RZ, DPSK, Duo Binary formats
- Test and measurement

### Related Products

- DR-DG DiGital Driver amplifiers
- DR-AN ANalog Driver amplifiers
- MBC-DG Modulator Bias Controller
- MBC-AN dither-less Modulator Bias Controller





## C & L Bands | Amplitude Modulator

### Amplitude Optical Modulation at 1550 nm

Lithium niobate ( $\text{LiNbO}_3$ ) intensity modulators MX-LN and MXAN-LN series are designed for modulation frequencies larger than 30 GHz. The X-cut design of these Mach-Zehnder modulators confers them an unmatched stability in a wide range of operational conditions, as well as a zero chirp performance. iXblue proprietary waveguide design offers a low insertion loss combined with a high contrast.

### Key Features

- Low insertion loss
- High bandwidth
- Zero chirp
- Low driving voltage
- High second harmonic rejection

### Applications

- Up to 50 Gb/s optical transmission NRZ, RZ, DPSK, Duo Binary modulation formats
- Test and measurement
- Analog modulation

### Related Products

- DR-DG DiGital Driver amplifiers
- DR-AN ANalog Driver amplifiers
- MBC-DG Modulator Bias Controller
- MBC-AN dither-less Modulator Bias Controller







## C & L Bands | Optical Phase Modulator

### Phase Optical Modulation at 1550 nm

Lithium niobate ( $\text{LiNbO}_3$ ) phase modulator series are designed for modulation frequencies up to 40 GHz. The X-cut design and titanium diffusion technology of the MPX-LN phase modulators confers them an unmatched stability in a wide range of operational conditions and are specifically optimized to be used at low frequencies (100 MHz). The Z-cut design of MPZ-LN modulators offers a very high bandwidth combined with low driving voltage.

### Key Features

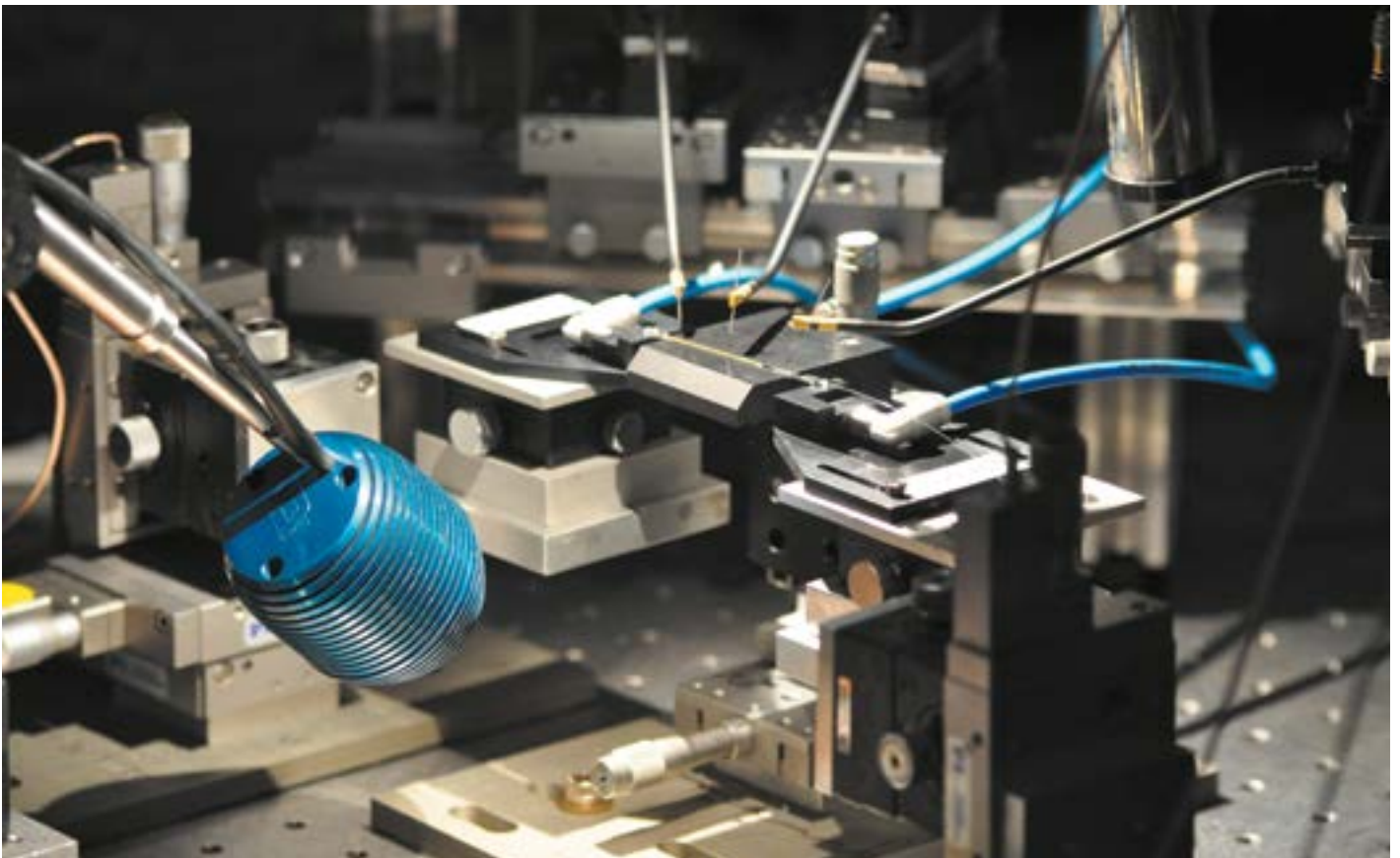
- Low insertion loss
- High bandwidth
- Low driving voltage
- Low residual amplitude modulation

### Applications

- Side bands generation
- Interferometric sensing
- Frequency shifting / broadening
- Chirping
- Quantum key distribution
- PSK modulation formats (up to 50 Gb/s)

### Related Products

- DR-DG DiGital Driver amplifiers
- DR-AN ANalog Driver amplifiers





## C & L Bands | High Extinction Ratio Modulator

### High Extinction Ratio Optical Modulation at 1550 nm

The MXER-LN serie of intensity modulators is a family of high performance modulators exhibiting superior Extinction Ratio. Their specific design relies on iXblue "Magic Junction" (patent n°US7,577,322). The MXER-LN intensity modulators are key devices in all applications where a combination of high extinction and high bandwidth is required: laser pulse picking prior optical amplification, pulse generation or Lidar based sensing systems are a few examples, as well as fiber optics sensors.

### Key Features

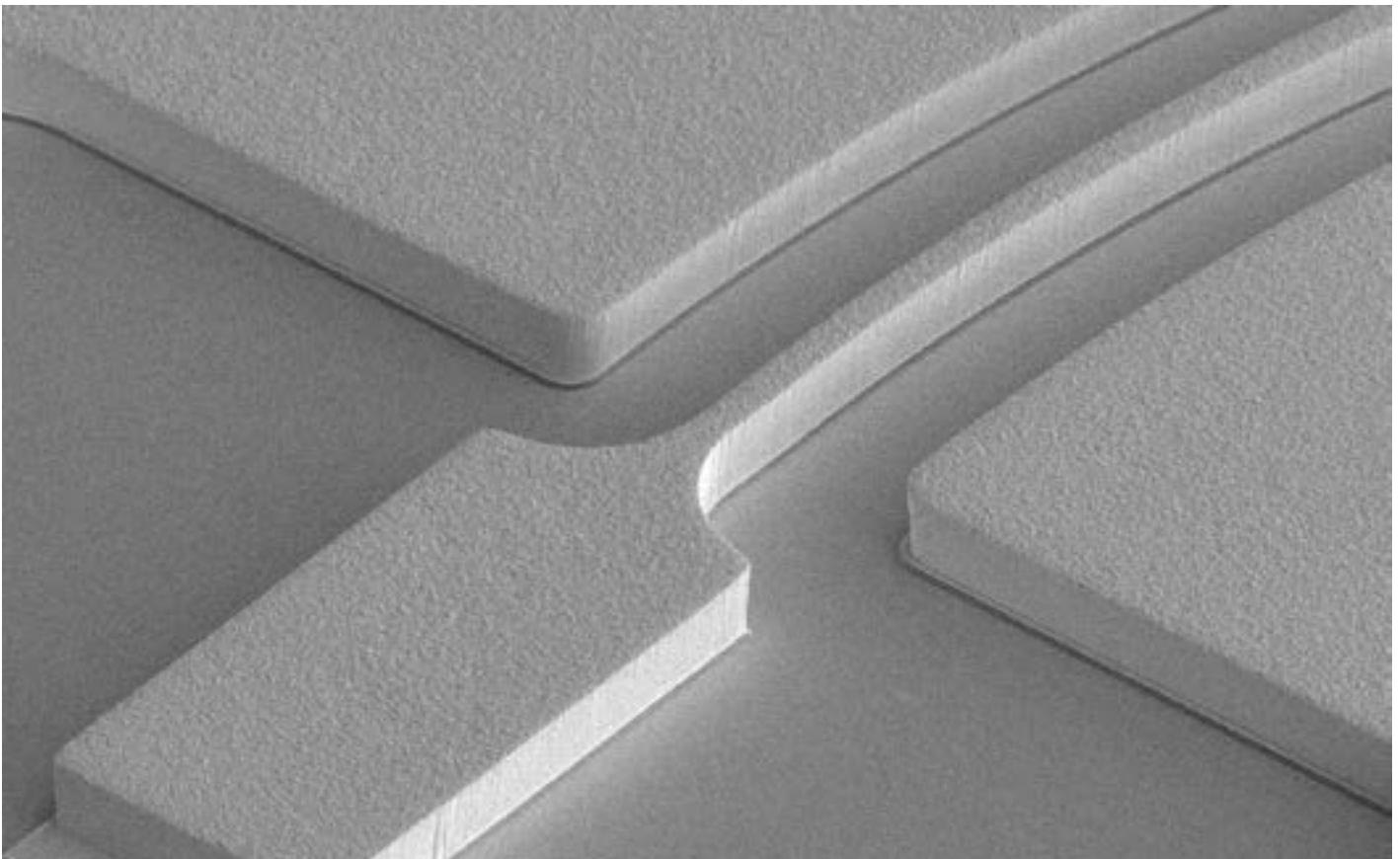
- Superior extinction ratio > 40 dB
- High PER
- X-cut for high stability
- Low drive voltage
- Low insertion loss

### Applications

- Short Pulse Generation
- Pulse Picking
- Pulse Shaping
- Dual Side Band (DSB) modulation & Carrier Suppression (CS)
- Stimulated Brillouin Scattering (SBS)
- Distributed fiber sensors (BOTDA)

### Related Products

- DR-PL PuLse Driver amplifiers
- DR-AN ANalog Driver amplifiers
- MBC-DG Modulator Bias Controller





## C & L Bands | I&Q Modulator

### I&Q Optical Modulation at 1550 nm

MXIQER-LN optical modulator series are high bandwidth, low insertion loss Dual Parallel Mach-Zehnder Modulators. iXblue proprietary "Magic Junction" (patent n° US7,577,322) confers them an unmatched low insertion loss, and their X-cut design guarantees high stability and zero chirp in a wide range of operational conditions.

### Key Features

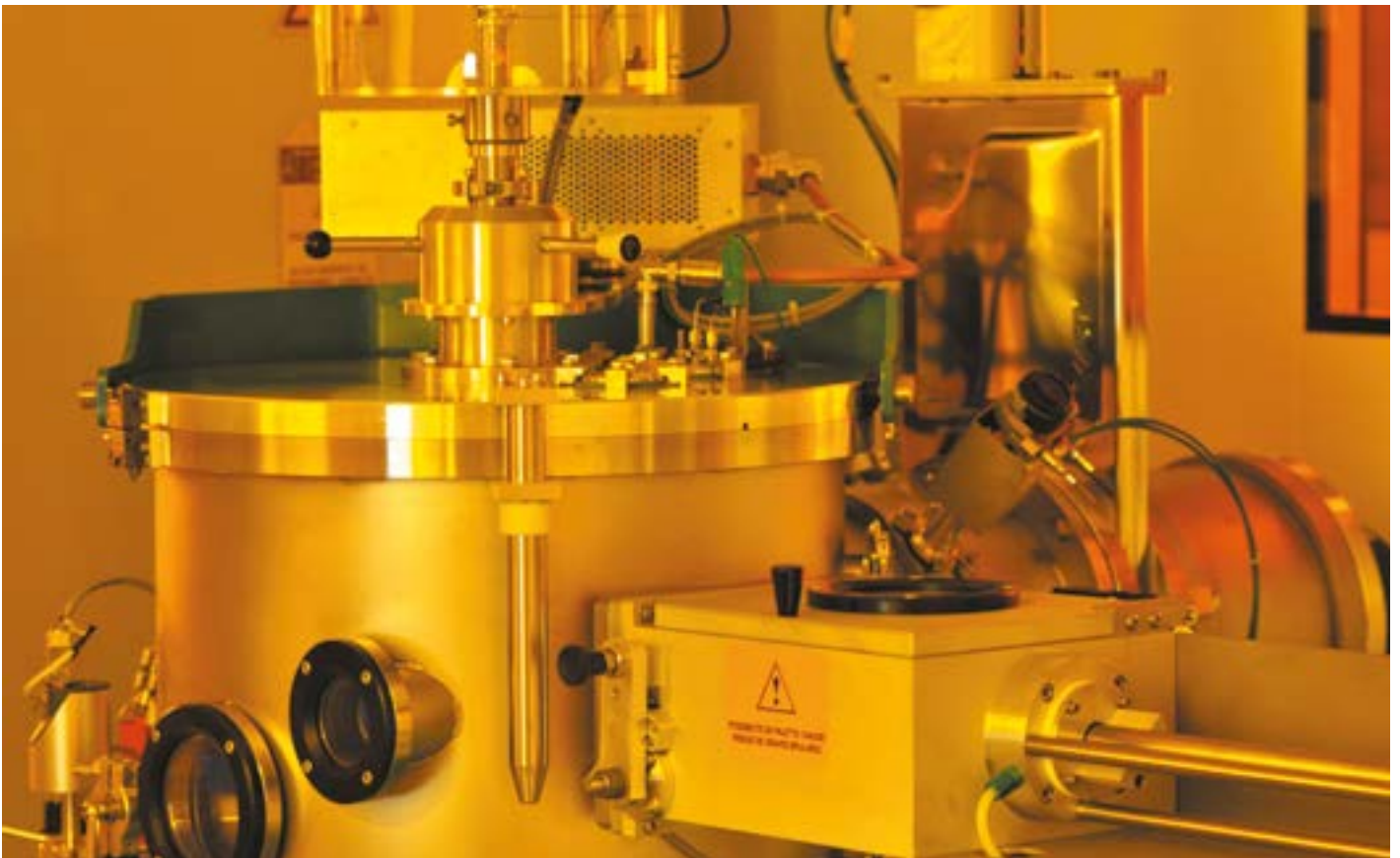
- Optical carrier high extinction ratio
- Low insertion loss
- High bandwidth
- Low driving voltage

### Applications

- CS-SSB: Carrier Suppression Single Side band Modulation
- Frequency Shifting
- DQPSK, QPSK, OFDM optical transmission

### Related Products

- DR-DG-HO High DiGital Driver amplifiers
- DR-AN-HO ANalog Driver amplifiers
- MBC-IQ Modulator Bias Controller





## 2 $\mu\text{m}$ Band | Amplitude & Phase Modulation

### Amplitude & Phase Optical Modulation at 2000 nm

The MX2000-LN & the MPX2000-LN/MPZ2000-LN are intensity and phase modulators especially designed for operations in the 2000 nm wavelength band. The specific waveguide structure combined with 2000 nm polarization maintaining fibers provide low insertion loss and optical stability. The different configurations allow modulation from low frequencies to more than 10 GHz.

### Key Features

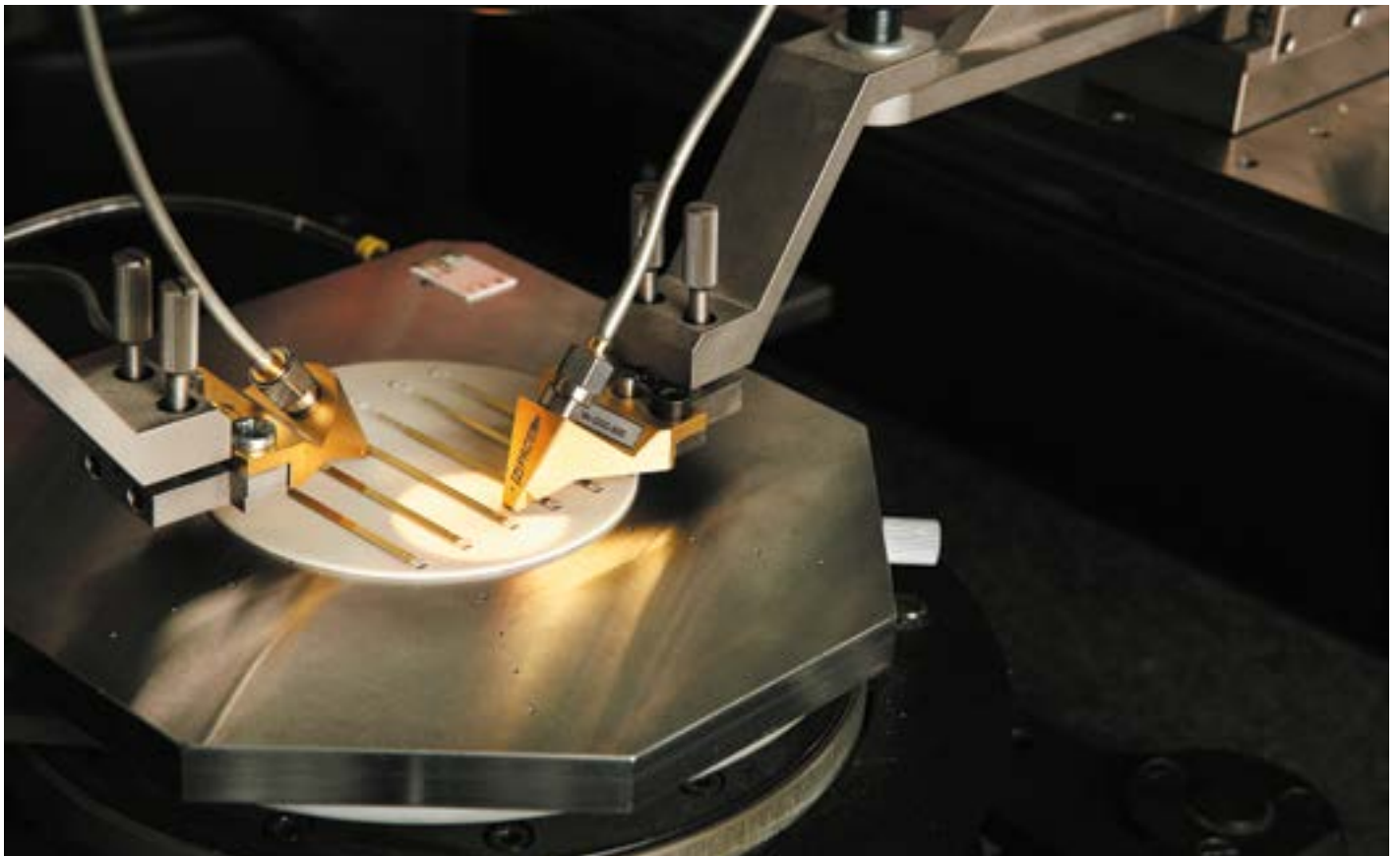
- From 1900 nm up to 2200 nm
- Low insertion loss
- High bandwidth
- X-cut for high stability

### Applications

- Lidar
- Gas sensing
- Spectroscopy
- Mid-IR wavelength generation

### Related Products

- DR-DG-HO DiGital Driver amplifiers
- DR-AN-HO ANalog Driver amplifiers
- MBC-DG Modulator Bias Controller





## RF & Microwave | Digital Modulator Driver

### Modulator Digital Driver Amplifiers

The DR-DG family includes drivers for modulators, microwave amplifiers and specific modules such as D flip-flop and delay lines. The modulator drivers are intended to feed modulators with an electrical signal exhibiting optimized peak-to-peak voltage, rise/fall times and jitter. The DR-DG amplifiers are ideally suited to drive optical telecom modulators.

### Key Features

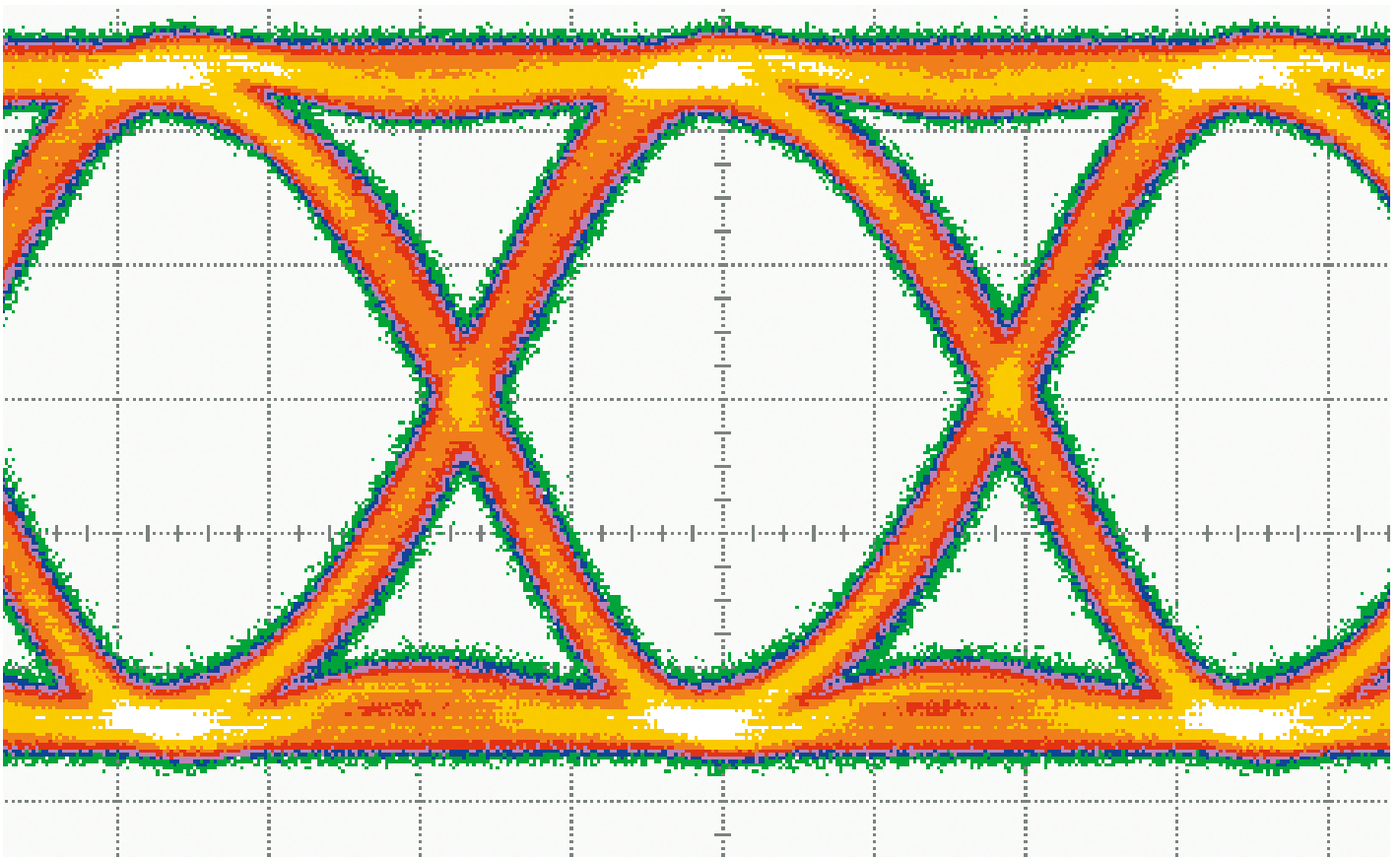
- Medium to high output voltage
- Flat gain
- Gain and crossing point adjustments

### Applications

- LiNbO<sub>3</sub> / InP / GaAs optical modulators
- NRZ, DSPK, RZ modulation formats
- Tests & measurements

### Related Products

- DFF: D-type Flip-Flop Module
- DLL: Adjustable Delay Line
- Matched Heat-Sink





## RF & Microwave | Analog Modulator Driver Amplifier

### Modulator Driver Amplifiers

The DR-AN product is a wideband RF amplifier module designed for analog applications. The DR-AN is characterized by a low noise figure and a linear transfer function with optimized 1 dB compression point. It exhibits flat group delay and gain curves with reduced ripple over the entire bandwidth. This amplifier module is ideally suited to drive phase and intensity modulators for analog applications.

### Key Features

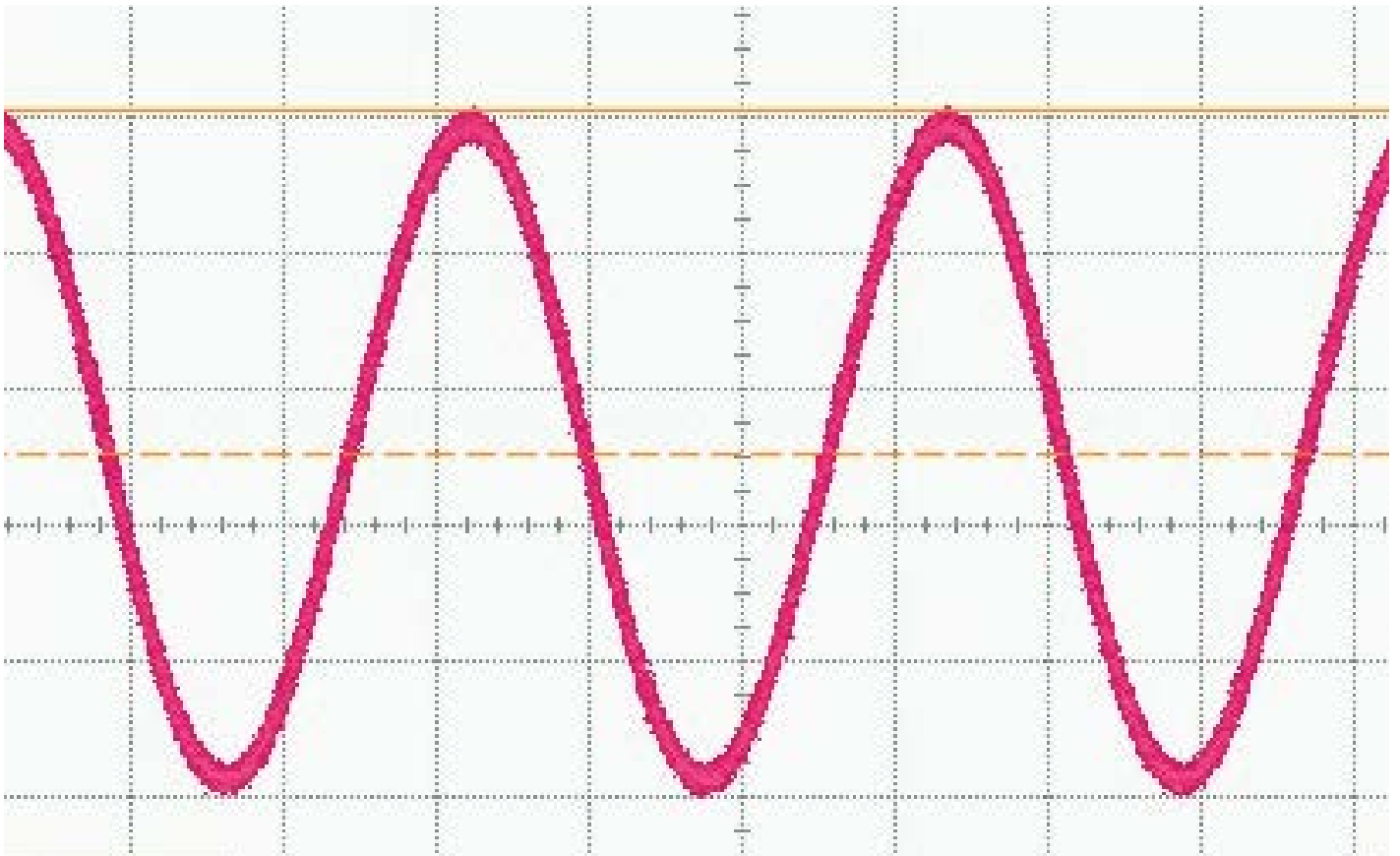
- Medium to high output voltage
- Low noise figure
- Flat gain
- Linear amplifier
- Low group delay variation

### Applications

- LiNbO<sub>3</sub>/InP/GaAs optical modulators
- Tests & measurements
- OFDM, Radio Over Fiber (RoF)
- Linear amplification
- Research & Development

### Related Products

- Analog LiNbO<sub>3</sub> amplitude and phase modulators
- Matched Heat-Sink





## RF & Microwave | Modulator Pulse Driver Amplifier

### Modulator Pulse Driver Amplifiers

The DR-PL modulator Driver is a microwave amplifier module designed to drive LiNbO<sub>3</sub> modulators so as to generate short optical pulses. The DR-PL Driver is optimized for short and long Pulses Width (PW) over a wide range of Frequency Repetition Rate (FRR) signals. This amplifier module is ideally suited to drive high extinction ratio intensity modulators for pulse applications.

### Key Features

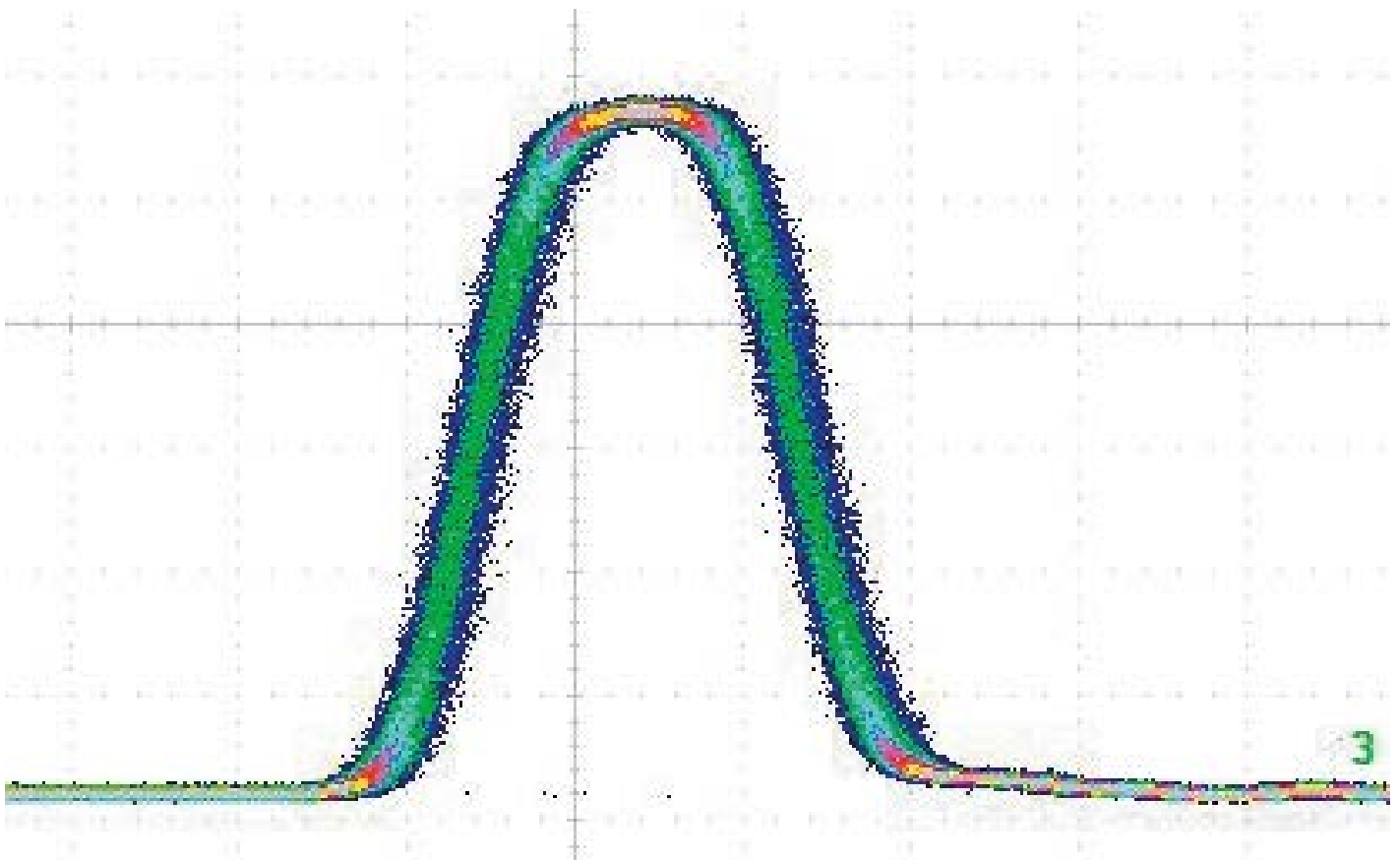
- Medium output voltage
- Short to long pulse widths
- Single shot to high frequency repetition rate

### Applications

- LiNbO<sub>3</sub>/InP/GaAs optical modulators
- Pulse generation
- Pulse picking
- Pulse shaping
- Spectroscopy
- Lidar

### Related Products

- High extinction ratio amplitude modulators
- Matched Heat-Sink





## Electronic | Digital Modulator Bias Controller

### Modulator Bias Controller

The Modulator Bias Controllers (MBC) are designed to compensate the inherent drift of Mach-Zehnder modulators due to aging and environmental variations. The MBC-DG is an automatic bias controller specially designed to lock the operating point of LiNbO<sub>3</sub> Mach-Zehnder modulators and ensure a stable operation over time and environmental conditions. The MBC-DG is ideally suited to drive optical modulators at any wavelength for Pulse and Telecom applications.

### Key Features

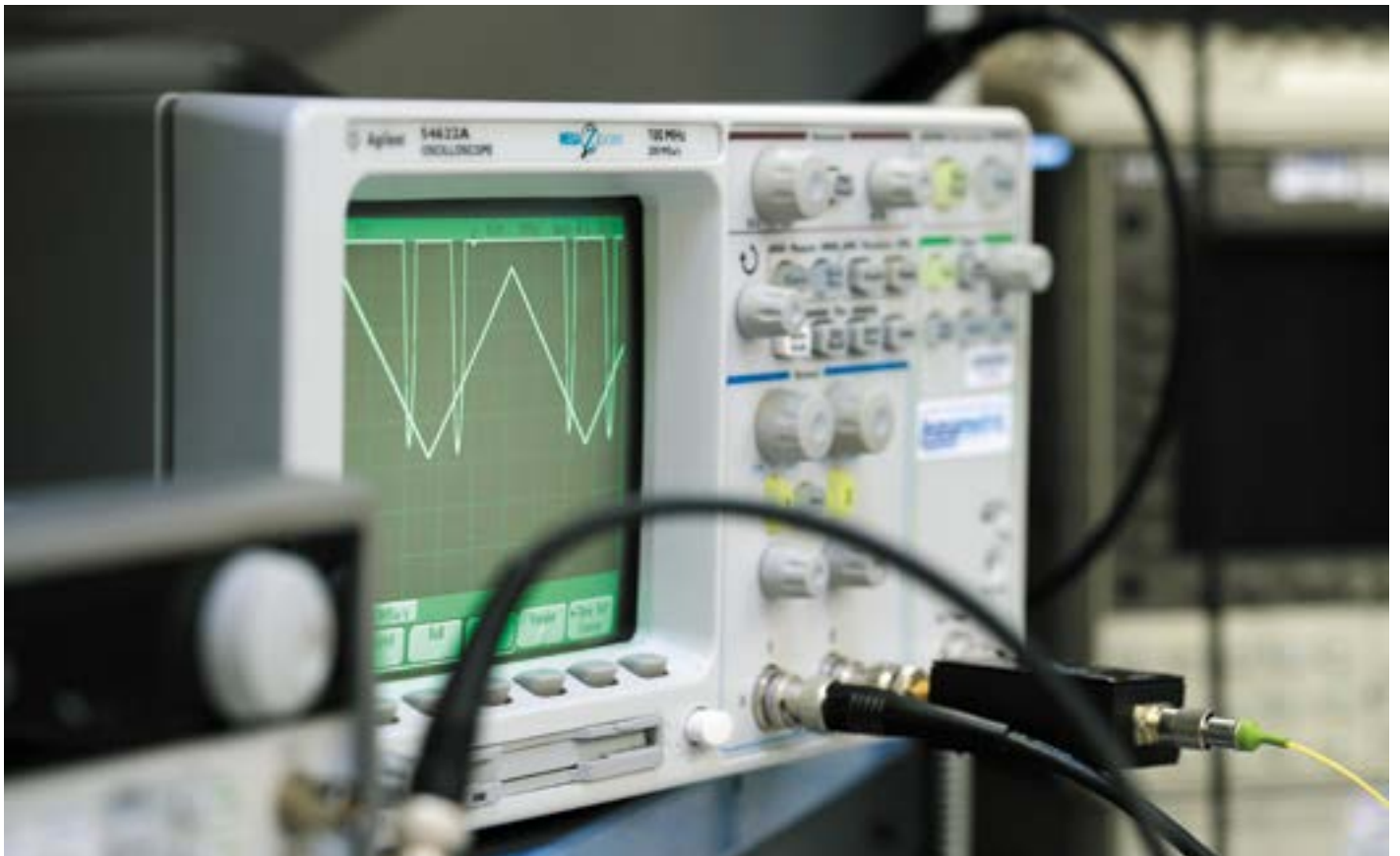
- MIN, MAX, QUAD+ & QUAD-
- Any other operating points
- Continuous tuning of the operating point
- USB remote control
- High sensitivity

### Applications

- Pulse applications
- Digital applications

### Related Products

- Benchtop and board versions
- MBC-IQ benchtop
- Intensity modulators
- Internal photodiodes and tap couplers







## Electronic | Analog Modulator Bias Controller

### Modulator Bias Controller

Unlike classical dither signal based bias controllers, MBC-AN do not superimpose any tone signal to the optical modulated signal. They are designed for application where such a tone signal is not desired and typically for analog applications where a high purity carrier is required. This MBC-AN is ideally suited to drive intensity modulators at any wavelength for analog applications.

### Key Features

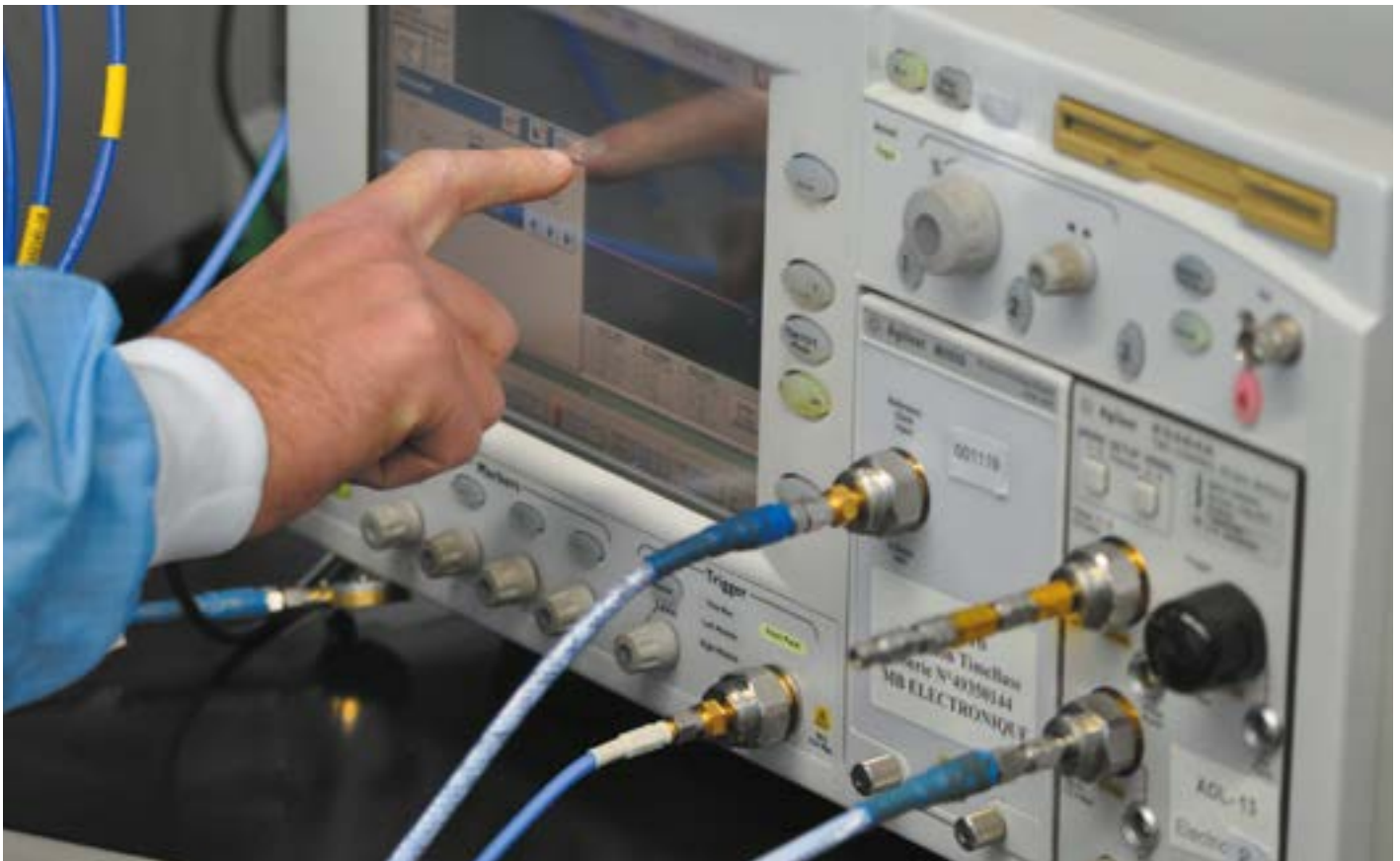
- Dither-less operation
- QUAD+ & QUAD-
- Continuous tuning of the operating point
- USB remote control
- High sensitivity

### Applications

- RoF links
- Electronic warfare
- Analog communications

### Related Products

- Benchtop and board versions
- MXAN-LN Analog intensity modulators
- Internal photodiodes and tap couplers





# MODBOX





## ModBox | Reference Transmitter - NRZ

### The ModBox-NRZ & ModBox-NRZ-SE: Clean and Stress NRZ Eye Diagram Reference Transmitters

The ModBox-NRZ is a family of Reference Transmitters that generates excellent quality NRZ optical data streams. These Reference Transmitters produce clean eye diagrams with high SNR and short rise and fall times. They can provide the flexibility of adjusting the extinction ratio for vertical eye closure.

In addition, the ModBox-NRZ-SE family offers the possibility to add an independent solution for tunable stress magnitudes in both horizontal (time) and vertical (optical power) eye axis (Stressed Eye).

### Key Features

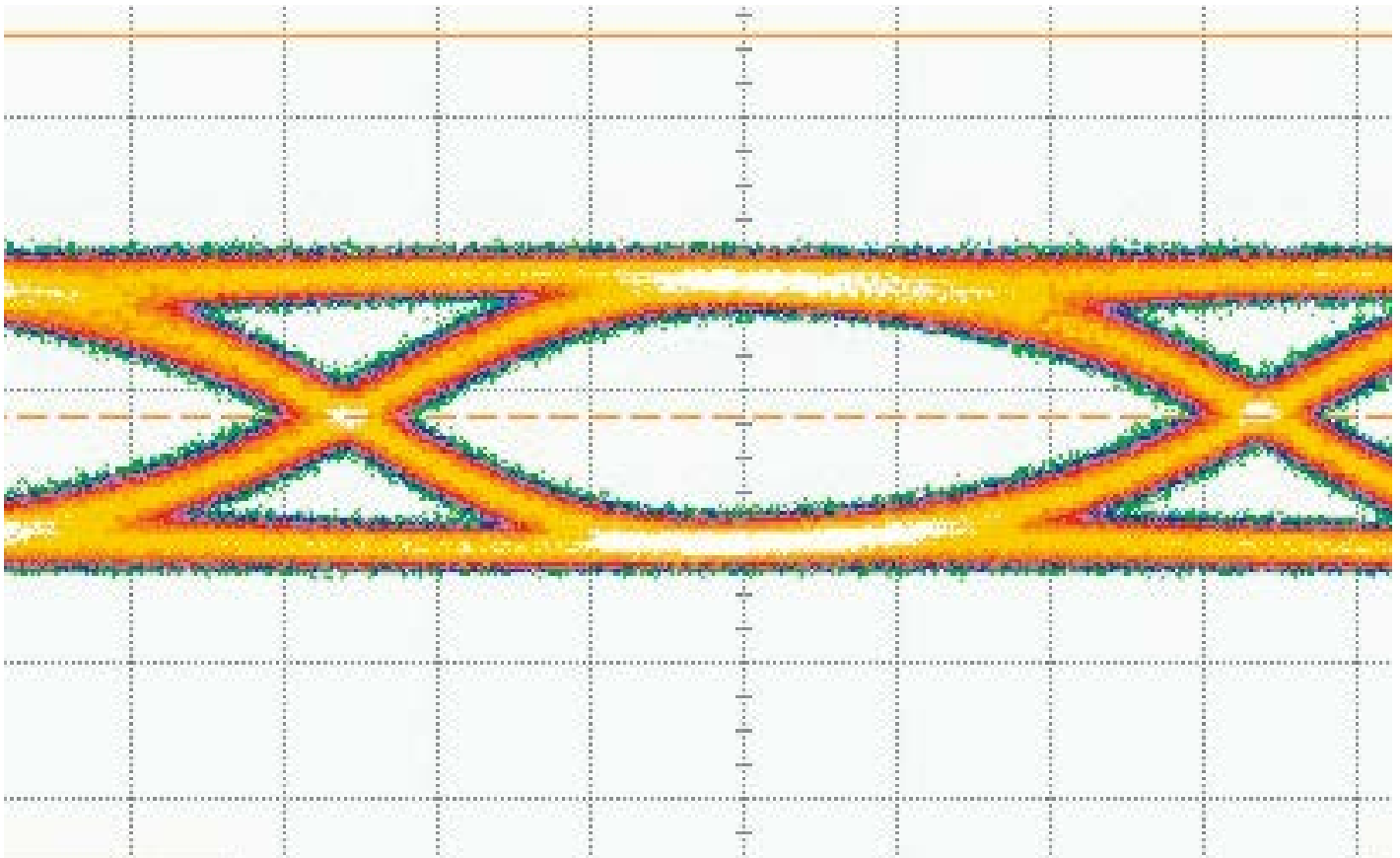
- Up to 56 Gb/s NRZ
- Up to 28 Gb/s NRZ Stress-Eye
- 850 nm Multi-mode output fiber
- O-Band CWDM & LAN-WDM lane grid
- Full C-Band

### Applications

- Data-Com
- 100GBASE-LR4, 100GBASE-ER4, 100GBASE-SR4
- Receiver test

### Options

- Variable Extinction Ratio
- Dual wavelength 1310 nm & 1550 nm version
- Stressed eye generation
- 4 Channels version
- Internal Receiver





## ModBox | Reference Transmitter - PAM4

### The ModBox-PAM4: Pam-4 Reference Transmitters

The ModBox-PAM4 is a family of Linear Reference Transmitters that generates excellent quality multi-level PAM-4 optical data streams. These Reference Transmitters produce very clean eye diagrams with low jitter and short rise and fall times.

### Key Features

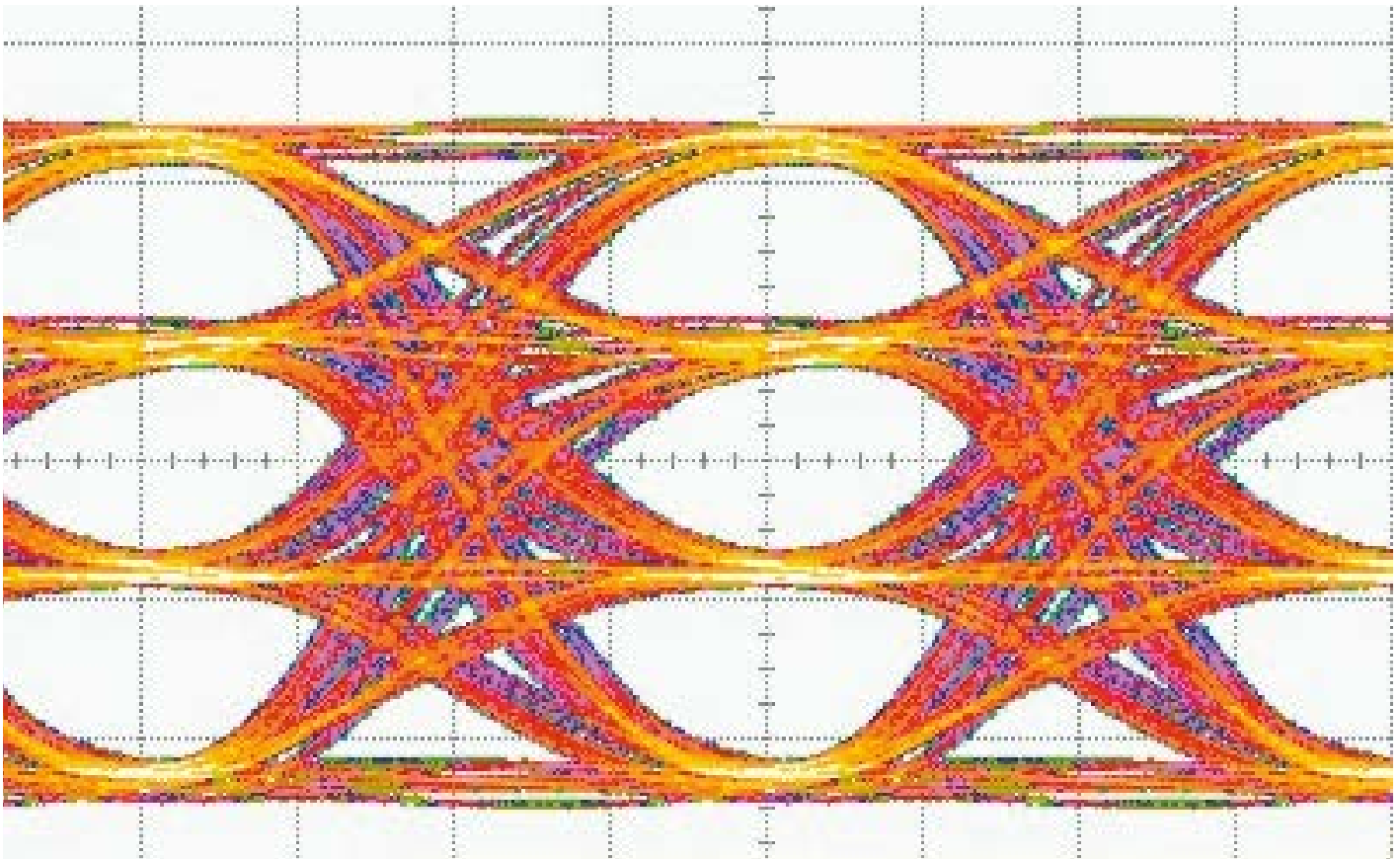
- Up to 64 Gbaud
- 850 nm Multi-mode output fiber
- O-Band CWDM & LAN-WDM lane grid
- Full C-Band

### Applications

- Data-Com
- 100 GE and 400 GE in data centers
- Receiver test

### Options

- Dual wavelength 1310 nm & 1550 nm version
- 4 Channels version





## ModBox | Reference Transmitter - VNA

### The ModBox-VNA: Optical VNA extension Reference Transmitters

The ModBox-VNA is a wide bandwidth Optical Transmitter designed to extend Vectorial Network Analyzers into the optical domain. When associated with a Vectorial Network Analyzer, they make up a high performance and easy to use test equipment for the characterization of photoreceivers or any high speed optoelectronic device.

### Key Features

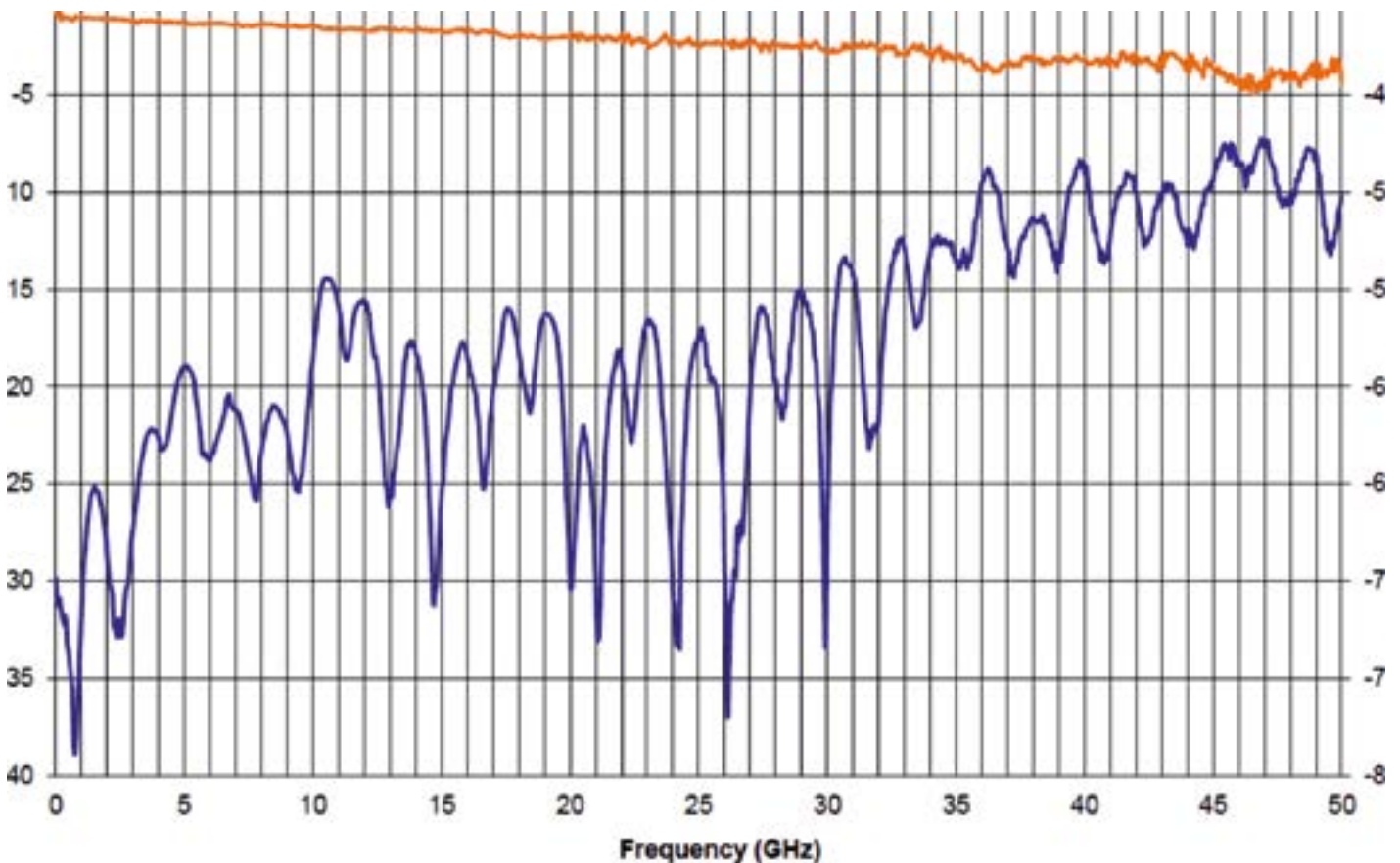
- Up to 70 GHz
- 850 nm Multi-mode output fiber
- O-Band CWDM & LAN-WDM lane grid
- Full C-Band
- Low insertion-loss

### Applications

- Transmission system test
- Receiver frequency test
- Optical components frequency characterization

### Options

- Dual wavelength 1310 nm & 1550 nm version
- Multi-channels version





## ModBox | Reference Transmitter - QPSK-QAM-OFDM

### The ModBox-IQ: Optical QPSK-QAM-OFDM Transmitters

The ModBox-IQ is a high performance and versatile modulation unit that allows telecommunication engineers and research scientists to produce optical signals with complex modulation formats (QPSK, QAM, OFDM).

The ModBox-IQ is easy to use and finds its place in production test beds, development laboratories and scientific setups. The high bandwidth and low harmonic distortion of the ModBox-IQ allow to generate particularly clean QPSK, QAM and OFDM optical signals thanks to the high linearity of its internal components.

### Key Features

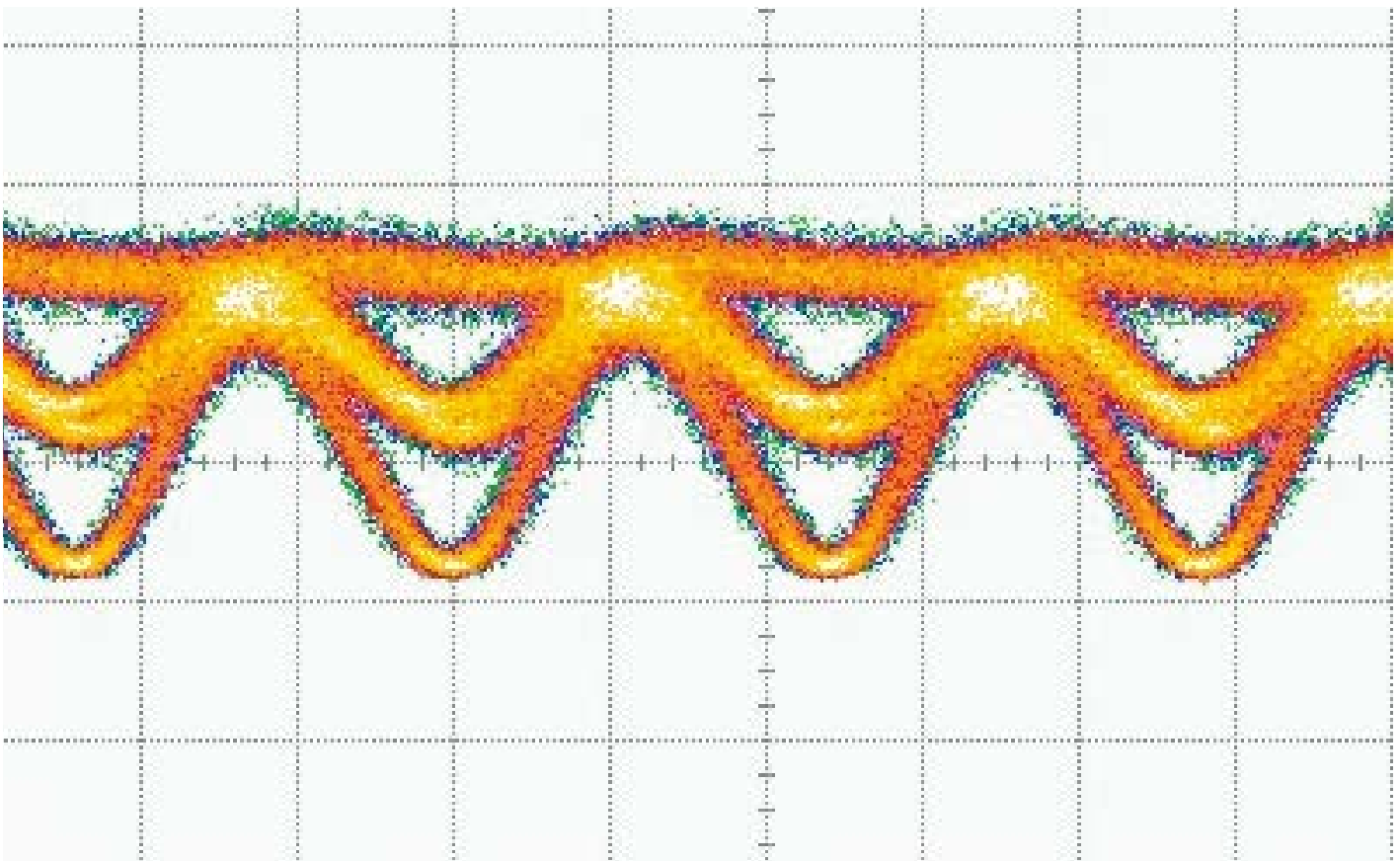
- Complex and multi-levels modulation
- Up to 32 Gbaud
- Low EVM
- High SNR

### Applications

- Transmission system test
- R&D Datacom/Telecom
- Components characterization
- Telecom laboratories

### Options

- Dual wavelength 1310 nm & 1550 nm version
- Multi-channels version
- Pol-Mux version
- Receiver ModBox





## ModBox | Analog Optical Transmitter

### The ModBox-AN: Analog Optical Transmitter

The ModBox-AN is an ANalog optical modulation unit specially designed for operations in an analog environment. They can be used for RF over fiber links, analog devices characterization, test and measurement.

### Key Features

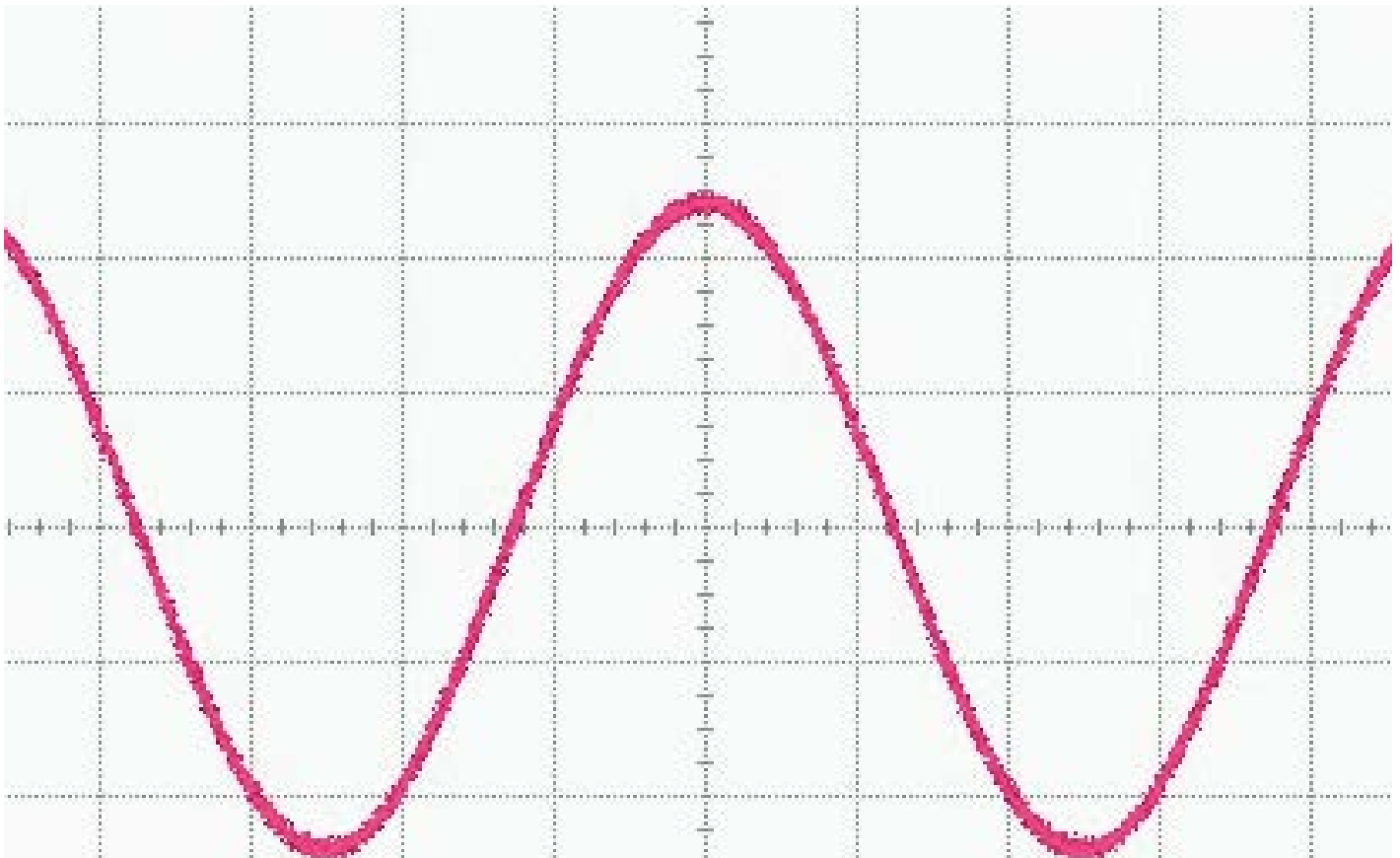
- ANalog transmission
- Up to 70 GHz
- From 780 nm up to 2000 nm
- Dither-less bias controller
- Low RIN
- High harmonics suppression

### Applications

- Transmission system test
- Receiver and components characterization
- Radio Over Fiber
- R&D laboratories

### Options

- Dual wavelength 1310 nm & 1550 nm version
- Multi-channel version
- Internal photodiode







## ModBox | Optical Pulse Generator

### The ModBox-PG: Optical Pulse Generator

The ModBox-PG is an optical modulation unit that generates high performance square shape optical pulses. The equipment incorporates a modulation stage based on a broadband and high extinction ratio LiNbO<sub>3</sub> Mach-Zehnder modulator, coupled with a high performance pulse microwave driver and an automatic bias control circuitry. It also integrates an optional laser source and a programmable pulse generator.

### Key Features

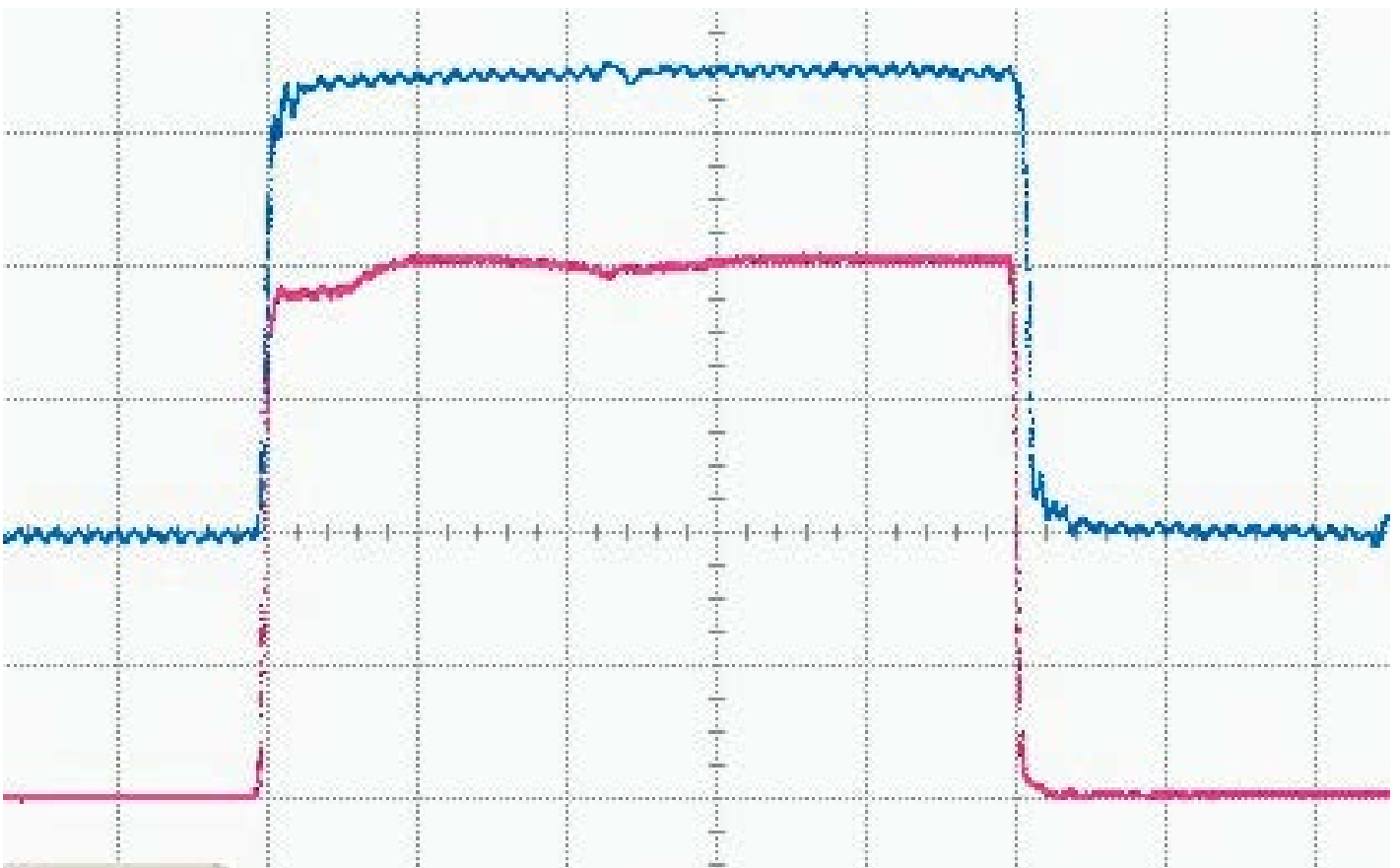
- Square shape optical Pulse Generation
- From 780 nm up to 2000 nm
- Optical Extinction Ratio up to 60 dB
- Pulse width from 30 ps to  $\mu$ s
- Frequency Repetition Rate up to the GHz

### Applications

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

### Options

- Build-in Electrical Pulse Generator
- Laser power and line-width
- Extinction Ratio value
- Pulse Width and Frequency Repetition Rate





## ModBox | Pulse Shaper & Front-End

### The ModBox-PS & ModBox-FE: Optical Pulse Shaper Generator and Front-End laser

The ModBox-PS & ModBox-FE are respectively an optical modulation unit & a laser Front-End unit. They generate short shaped pulses with high extinction ratio, with user adjustable pulse duration, repetition rate and temporal pulse shape. The optical pulse shaping functionality allows to pre-compensate the pulse distortion that occurs in the optical amplifier chains that operate in a highly saturated regime. In addition, the Laser Front-End ModBox-FE guarantees the peak-power and the energy levels.

### Key Features

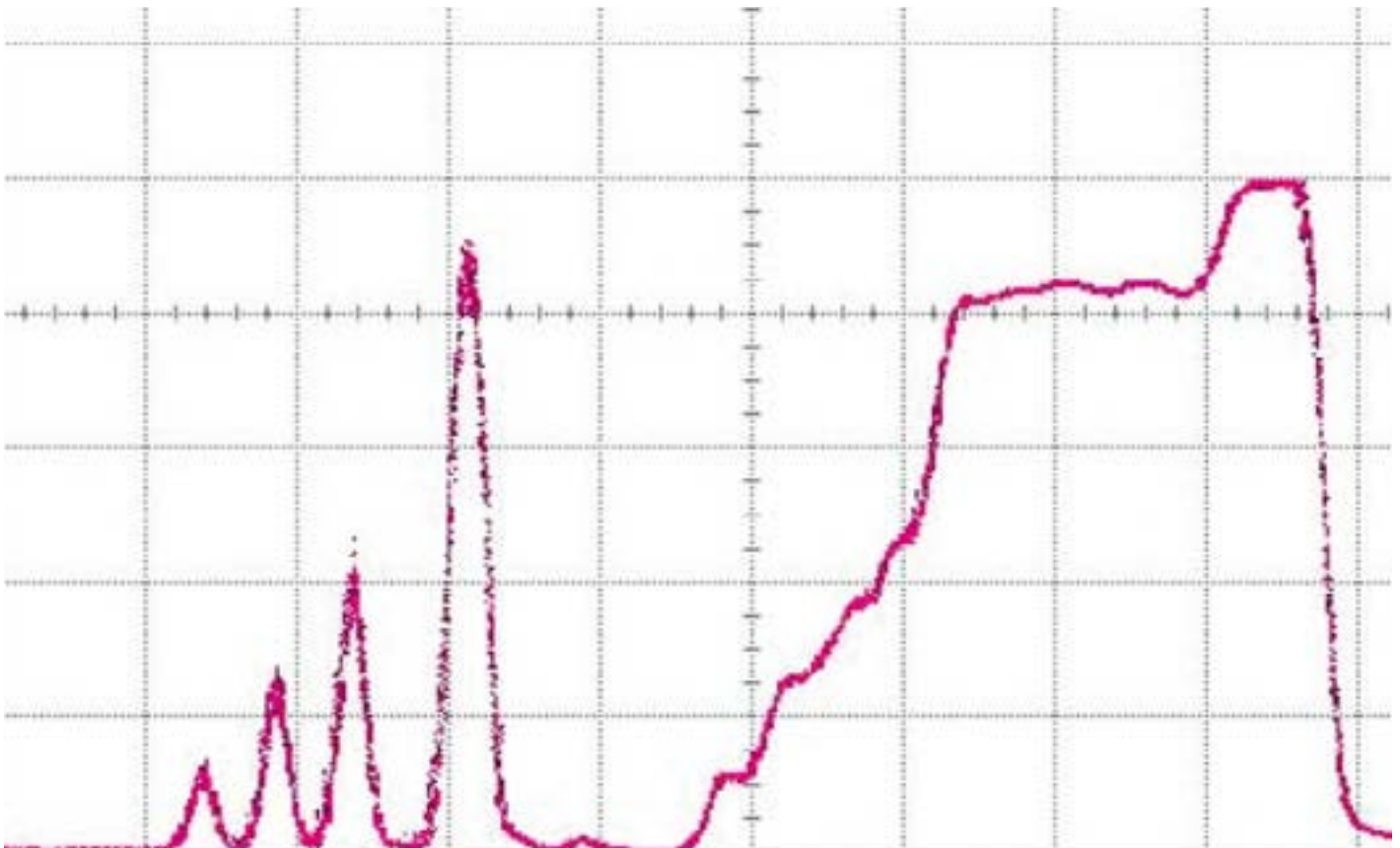
- C-Band, and NIR window
- Low jitter
- Low rise & fall times down to 30 ps
- Pulse width from 125 ps
- Energy of 800 pJ @ 1ns
- Frequency Repetition Rate up to the MHz

### Applications

- Inertial confinement fusion
- Interaction of intense light with matter
- Laser Plasma interaction
- OPCPA

### Options

- Build-in Arbitrary Waveform Generator
- Laser power and line-width
- Extinction Ratio value
- Pulse energy
- Pulse Width and Frequency Repetition Rate





## ModBox | Optical Pulse-Picker

### The ModBox-PP: Optical Pulse Picker Modulation Unit

The ModBox-PP allows to pick and optionally pulse shape any pulse or pulse sequence in an incoming burst train. It acts as a fast gate with low insertion loss and high extinction, and is available in a wide range of wavelengths.

### Key Features

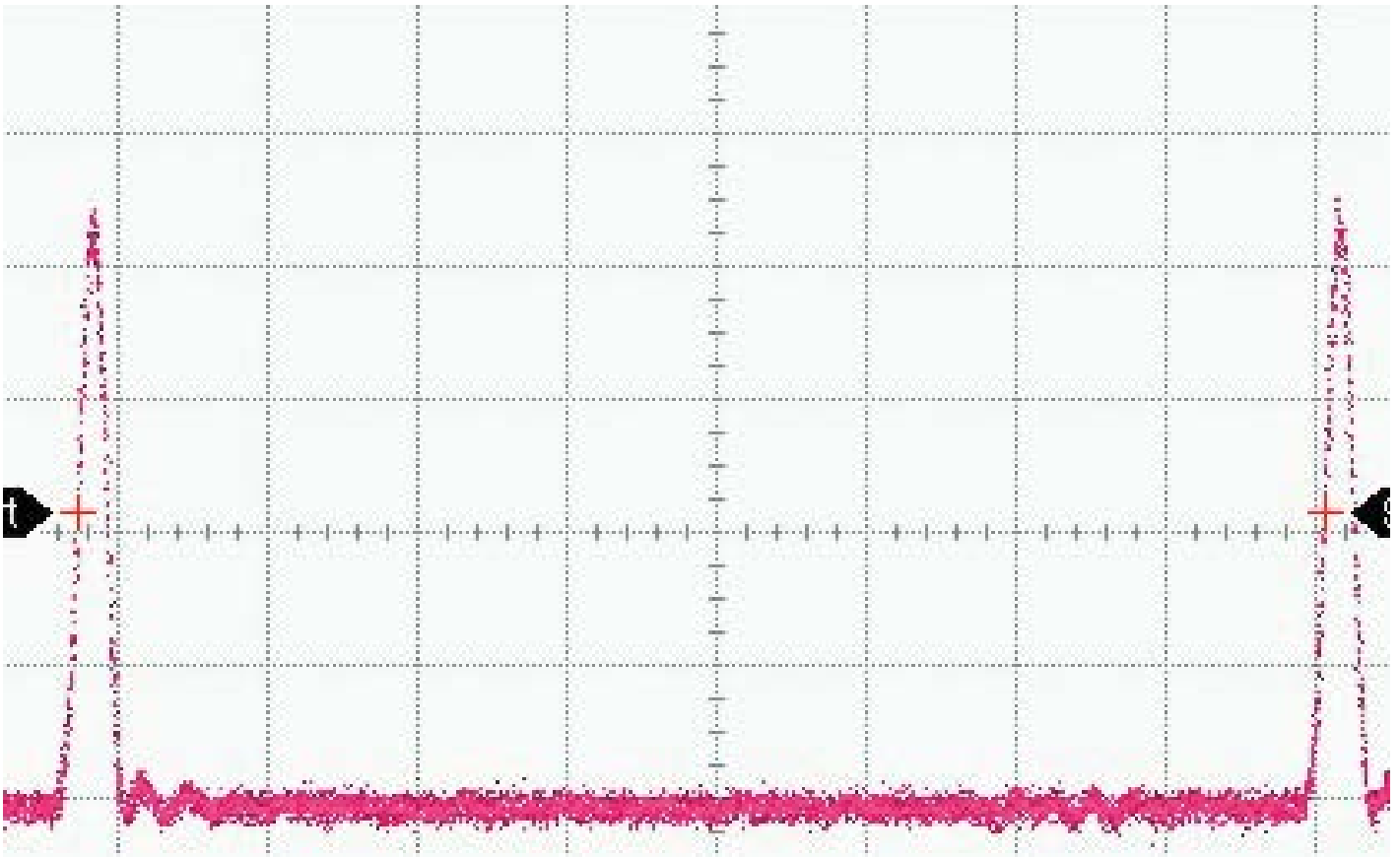
- Square shape optical Pulse Generation
- From 780 nm up to 2000 nm
- Optical Extinction Ratio up to 60 dB
- Pulse width from 30 ps to  $\mu$ s
- Frequency Repetition Rate up to the GHz

### Applications

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

### Options

- Build-in Electrical Pulse Generator
- Laser power and line-width
- Extinction Ratio value
- Pulse Width and Frequency Repetition Rate





## ModBox | Spectrum Broadening

### The ModBox-SB: Spectrum Broadening Modulation Unit

The ModBox-SB is a modulation unit dedicated to spectrum broadening of a highly coherent laser source to suppress the stimulated Brillouin scattering (SBS) in optical fibers caused by high fluxes. The ModBox-SB achieves the broadening of an optical signal by modulating its phase through a LiNbO<sub>3</sub> phase modulator. A number of side bands are created over a spectral width that can reach several nanometers.

### Key Features

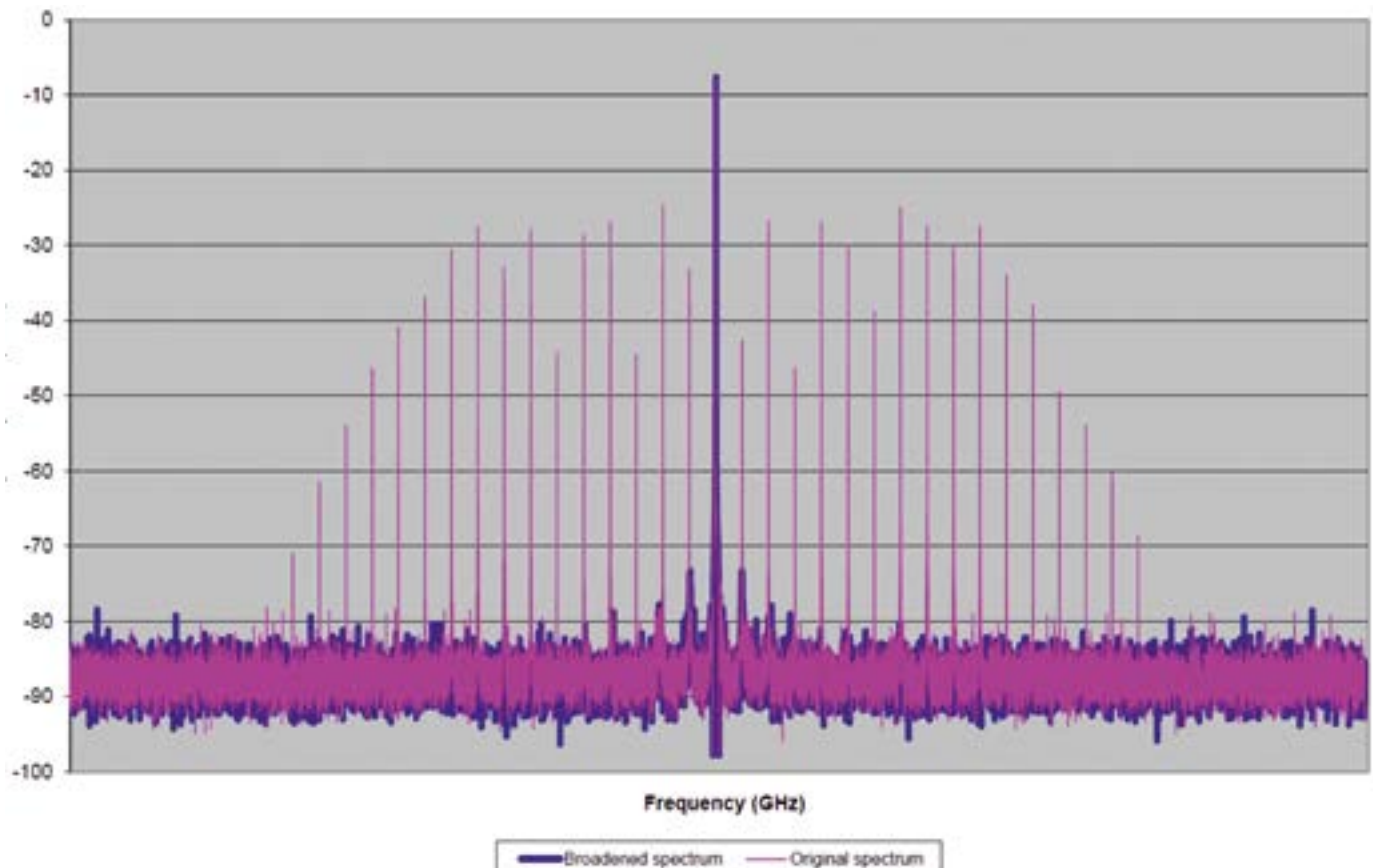
- C-Band, and NIR window
- Spectrum Broadening up to 1,5 nm
- Externally trigger
- Low insertion loss

### Applications

- SBS Suppression
- Fiber Laser
- Inertial confinement fusion
- Interaction of intense light with matter
- Laser Plasma interaction

### Options

- Alternative synthesizer frequencies





## ModBox | Dynamic Extinction Ratio Analyser

### The ModBox-DER: Dynamic Extinction Ratio (DER) Analyser

The ModBox-DER is a measurement equipment that analyses the Dynamic Extinction ratio of sub-ns optical pulses. The analysis of the high extinction ratios and the pedestal is done from a unique measurement. The ModBox-DER uses a license on the intellectual property from the French Nuclear Agency (CEA patent n° US9,335,221). It finds applications mostly in ultra-intense laser facilities.

### Key Features

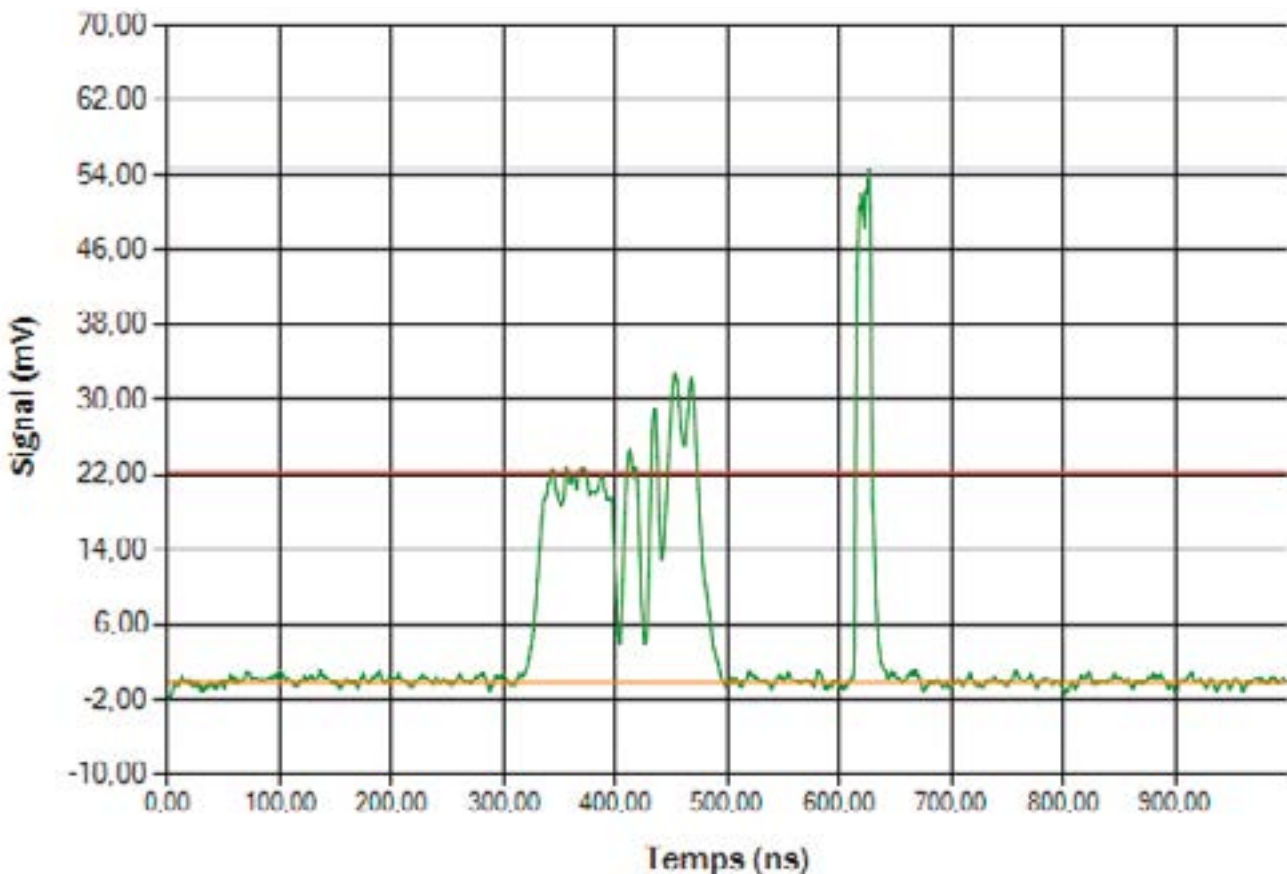
- 1030 nm, 1053 nm, 1054 nm, 1064 nm
- Extinction Ratio up to 60 dB
- Single shot to 10 kHz
- From 5 ns to 25 ns

### Applications

- Inertial confinement fusion
- Interaction of intense light with matter
- Laser Plasma interaction
- Laser implosion

### Options

- Build-in scope
- Wavelength
- Extinction Ratio





# ModBox | Customized Turn-Key Optical Transmitter

## The miscellaneous ModBox

The ModBox systems are a family of turnkey optical transmitters and external modulation units for digital and analog transmission, pulsed and other specific applications. The ModBoxes can be tailored to specific needs in order to provide systems engineers with reliable performance and high speed modulation capabilities together with the peace of mind of a ready-to-plug equipment.

## Key Features

- Turn-Key & plug-and-play
- Optimized based on customer requirements

## Applications

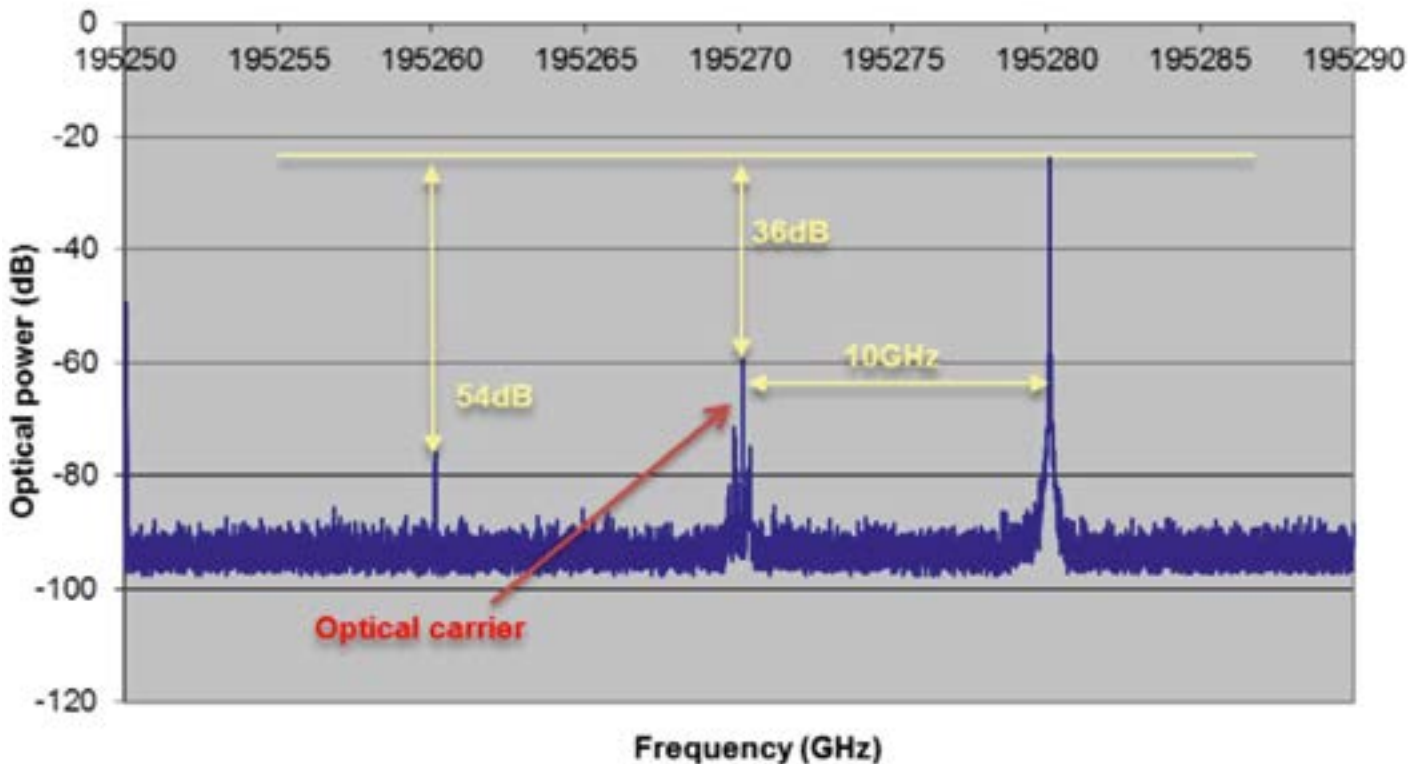
- R&D laboratories
- Fiber Laser
- Digital, linear modulation

## Options

- CS-SSB, CS-DSB
- Custom designs
- Multi-formats (RZ-DPSK, RZ,...)



10GHz SSB modulation







# APPLICATIONS







## Application | Space

### Space Qualified Optical Modulators

iXBlue carried out these passed year an evaluation program of optical lithium niobate modulators for applications in satellites. This program is the backbone of the modulator qualification process and is completed by numerous tests compliant to TELCORDIA requirements. Due to the extreme requirements of space applications, the results obtained demonstrate the high level of confidence reached for use in space applications and in particular in telecom applications at either 1550 nm, 1310 nm and 1060 nm wavelengths.

### Key Features

- Long term reliability
- Immunity to radiation
- Integration carried out with ESCC parts
- Screening steps
- Quality insurance based process
- Documented flow-charts

### Applications

- Laser Communication Terminals (LCT)
- Laser Stabilization
- Research & Science

### Space Evaluation and Qualification

- Gamma & Proton irradiations
- Random Vibrations and Mechanical Shocks
- Thermal Vacuum & Air cycling
- Accelerated aging tests
- Damp heat





## Application | Fiber Optic Gyroscope

### Space Qualified Optical Modulators

The Y-junction phase modulators are designed to be integrated in fiber optic gyroscope to build inertial navigation systems. The Y-junction phase modulators passed successfully the tests of reliability to be used in space (radiations, vibrations, mechanical shocks, thermal cycling and lifetests in vacuum,...)

### Key Features

- X-cut LiNbO<sub>3</sub>
- 1530 nm or 800 nm wavelengths
- Proton exchange waveguide
- Low Insertion loss
- High PER
- Compactness

### Applications

- Fiber Optic Gyroscope (FOG)
- Inertial Measurement Unit (IMU)
- Inertial Navigation Systems (INS)

### Options

- Chip on submount
- Pigtailed chip on submount
- Packaged devices

### Related Products

- IXF-PMG Gyroscope fibers
- Fiber optic coils





## Application | **BOTDA Distributed Fiber Sensor**

### **Distributed Fiber Sensor based on SBS**

BOTDA (Brillouin Optical Time Domain Analysis) is a class of industrial distributed fiber optic sensor. Stimulated Brillouin Scattering (SBS) is induced by a high power optical pulse in silica fiber. The amplification band depends on stress and temperature. iXblue developed a specific microwave optical modulator (MXER-LN) dedicated in particular to SBS probing and showing a high optical carrier suppression ratio. This extinction is a key parameter for high resolution (1 m) distributed fiber sensor.

### **Specific Optical Modulator**

- Dual side band modulation at 11.25 GHz
- High extinction ratio carrier suppression
- Low loss
- Harsh environmental conditions
- Low DC bias drift

### **BOTDA Applications & markets**

- Civil engineering (bridges, road, dam)
- Pipeline monitoring
- Cable monitoring

### **Optical modulation solutions for BOTDA systems integration**

- MXER-LN High Extinction Ratio modulator
- MBC-DG Modulator Bias controller
- DR-AN-HO High voltage driver amplifier
- IXC-FBG Fiber Bragg Grating optical filters





## Application | **FOCS**

### **Fiber Optic Current Sensor**

FOCS uses the Faraday effect in silica fiber. FOCS are based on non-reciprocal in-line polarimetric interferometer. iXBlue develops and produces  $\text{LiNbO}_3$  birefringent electro-optic phase modulators showing:

- High performances (Insertion loss, PDL, driving voltage, compactness) optimized for use in fiber optic current sensor.
- High reliability regarding qualification: vibration, ageing, thermal cycling.

### **Specific Optical Modulator**

- 1310 nm operation
- Outdoor operation: from  $-40^\circ\text{C}$  up to  $85^\circ\text{C}$
- High insertion loss stability
- High polarization extinction ratio stability
- Flat response from DC to 100 MHz

### **FOCS Applications & markets**

- Generation and supply of energy
- Metering, billing
- High DC current monitoring (metallurgy, chemistry)

### **Optical modulation solutions for FOCS system integration**

- MPX1300-LN-0.1 birefringent phase modulator
- PM fiber
- Spun fibers
- Polarizing Fibers





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