ModBox

ModBox-CBand-CS-SSB

ModBox CBand and Carrier Suppression modes

The ModBox-CBand-CS-SSB is an Optical Transmitter Frequency shifter based on high order optical Carrier Suppressed and Residual Carrier Single Side Band modulation. The ModBox operates in the full C band and up to 18 GHz.

The ModBox-CBand-CS-SSB is dedicated to applications that require a coarse tuning and very fine tuning frequency shift. Tunablility and accurate control of your wavelength can be useful for precision laser spectroscopy, quantum optics, cold-atom inertial sensors and atomic clocks, optical measurements, and optical fiber sensors.

The ModBox-CBand-CS-SSB is a fully optimized CS-SSB optical transmitter based on one $LiNbO_3$ IQ modulator and its automatized bias controller. It generates one (CS-SSB, Carrier Suppressed Single Side Band) or two RF sidebands (Carrier Suppressed Dual Side Band) that can be independently controlled in frequency and power.



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FEATURES

- Versatile Optical Transmitter
- High side band & carrier suppressions
- Preregistered mode: CS-SSB
- Proven solution
- Carrier power level controllable

Option

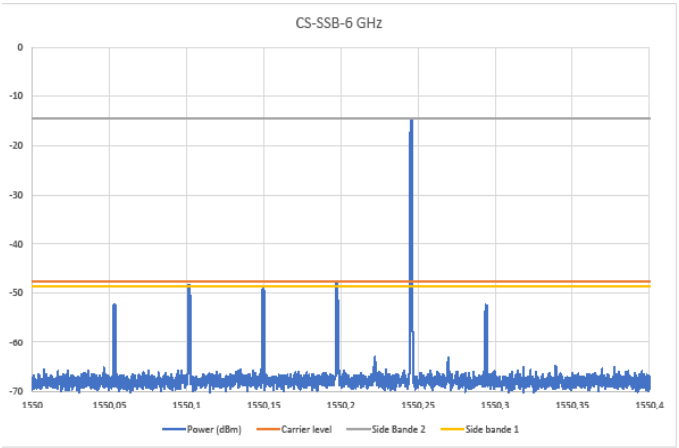
- Offset SSB modulation frequency: from 1 GHz to 18 GHz

PERFORMANCE HIGHLIGHTS

Parameter	Nominal
Operating wavelengh	C-Band
Modulation formats	CS-SSB, CS-DSB
Offset SSB modulation frequency	Up to 18 GHz [1]
Optical carrier attenuation	> 30 dB
Side band attenuation	> 30 dB

[1] Other «Offset SSB modulation frequency» bandwidth is available on request.

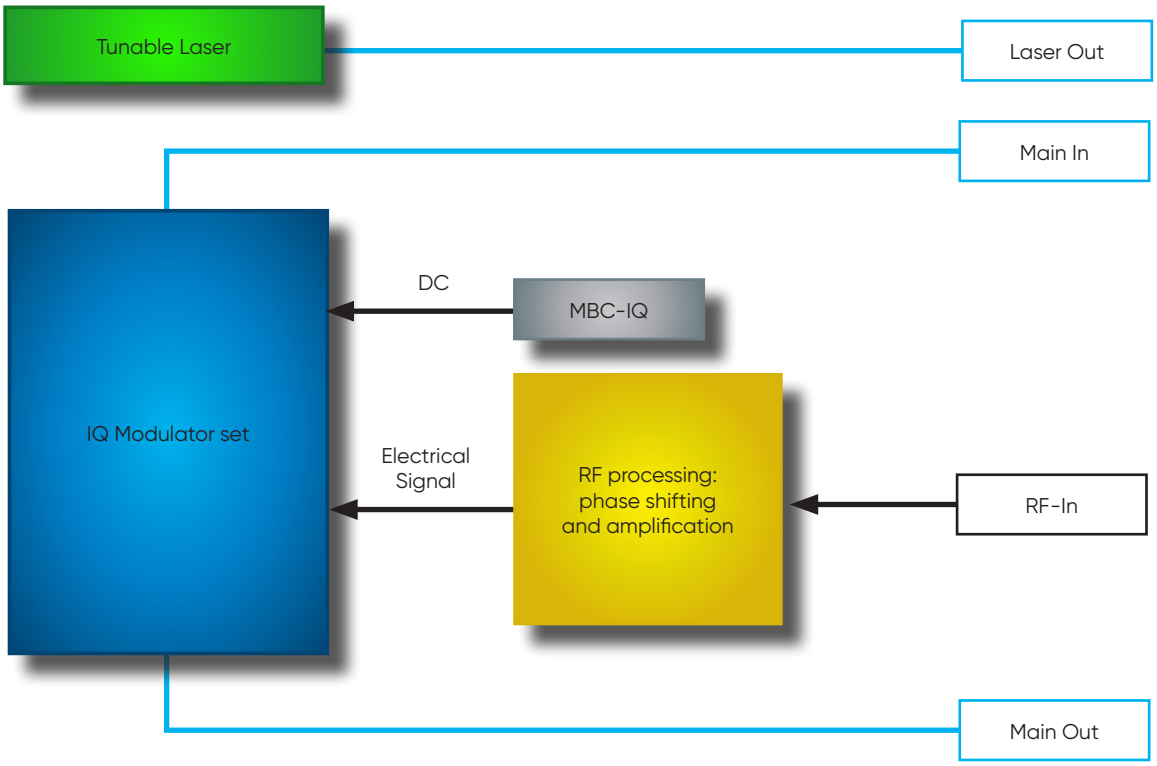
Optical CS-SSB ModBox Response



Example of Carrier Suppressed Single Side Band signal

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FUNCTIONAL BLOCK DIAGRAM



The ModBox-CBand-CS-SSB is designed around a set of Dual Parallel Mach-Zehnder Modulators, an automatic bias control circuitry and RF signal processing. The equipment operates with a user supplied RF signal. The ModBox embeds a high purity C-band tunable laser source.

The equipment incorporates an input RF coupler that splits the RF signal toward the I and Q sub-Mach-Zehnders RF input, tunable delay lines and RF driver. The carrier attenuation and the side band attenuation are depending on several factors including the RF power driven to the modulator, the RF power balance between the two sub-Mach-Zehnders, the wavelength of the optical signal, the frequency of the RF modulation signal and the I/Q phase shift (that one is set with the DC3 voltage).

The ModBox will be fully preset with fine adjustments of the RF driver gain, delay line and DC3 bias voltage in order to obtain the maximum extinction of the carrier and the side band at 1550 nm.

ModBox-CBand-CS-SSB

ELECTRICAL INPUT SPECIFICATIONS

User supplied, not a Modbox specification.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Signal type	RF_{IN}	-			sine	
Level	V_{RFIN}	50 Ω - Single ended	200	600	1000	mVpp
Impedance matching	Z_{RFIN}	-	-	50	-	Ω
Frequency [1]	F_{RFIN}	-	1 [2]	-	18 [3]	GHz

[1] Other «Offset SSB modulation frequency» bandwidth is available on request. [2] On request from 1 GHz. [3] On request up to 15 GHz.

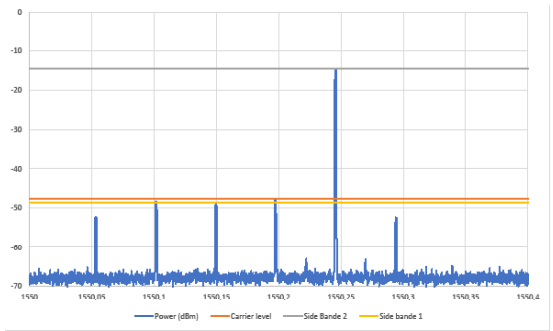
OPTICAL INPUT SPECIFICATIONS

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operation	λ	CW	1530	-	1675	nm
Polarisation	Pol	PM FIBER - FC / APC	Linear and controlled			-
Power	P_{IN}	-	10	-	20	dBm
Side mode suppression ratio	SMSR	Intrinsic laser value	30	-	-	dB
Spectrum linewidth	Δλ	Intrinsic laser value	-	1	20	MHz

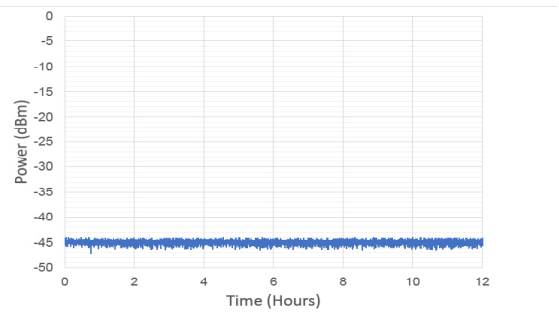
OPTICAL OUTPUT SPECIFICATIONS

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Test
Laser mode of operation	-	-		CW, tunable			
SSB mode control	-	-		Automatic bias control			
Modulation formats	MF	-		CS-SSB		-	OK
Operating wavelength	λ	-	1527.6	1550	1565.5	nm	OK
Linewidth	Δλ	-	-	-	100	kHz	-
Relative intensity noise	RIN	-	-	-	-145	dB/Hz	-
Side mode suppression ratio	SMSR	-	40	55	-	dB	-
SSB output power	SSB	-	-	-4	-3	dBm	OK
Output power	Main Out	Max mode	-	10	11	dBm	OK
Offset SSB frequency [1]	SSB	-	1 [2]	-	18 [3]	GHz	-
Optical carrier attenutation	CS	Test at 15 GHz, @1550 nm	30	35	-	dB	OK
CS stability	ΔCS	Over 8 hours	-	1	-	dBrms	OK
Side band attenuation	SSB	Test at 10 GHz, @1550 nm	30	35	-	dB	OK
SSB stability	ΔSSB	Over 8 hours	-	1	-	dBrms	OK
Polarisation extenction ratio	PER	-	20	23	-	dB	-
Optical return loss	ORL	-	40	-	-	dB	-

[1] Other «Offset SSB modulation frequency» bandwidth is available on request. [2] On request from 1 GHz. [3] On request up to 18 GHz.



1550 nm - 6 GHz - CS-SSB



Carrier suppression stability

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INTERFACES, DIMENSIONS AND COMPLIANCE

Interfaces	
Optical	Front panel: CBand range - FC/APC- Polarization maintaining fiber, Corning PM 15-U25D
RF	Front panel - SMA - Female
Control	Touch screen Smart Interface (front panel), GUI (Ethernet) - Windows 10
	Other control: MBC, RF driver gain, seed laser
Power supply	100 V - 120 V / 220 V - 240 V automatic switch 50 Hz - 60 Hz (Rear panel)
EMC and optional norms	EN61326-1 Ed. 2006 / NF EN 60825-1 & EN 60825-2 Ed.2014
Dimensions / Weight	Rack 19'' x 3U, Depth = 495 mm / 8 kg
Laser safety	Class 1M

ENVIRONMENT

Parameter	Min	Typ	Max	Unit
Operating temperature		22 ± 5		°C
Non-operating temperature		-10 to +30		°C
Operating humidity		30 to 60		%
Non-operating humidity		30 to 80		%



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