ModBox-CBand-CS-RC-SSB

ModBox CBand with Residual and Carrier Suppression modes

ModBox

The ModBox-CBand-CS-RC-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 C Bands up to 18 GHz.

The ModBox-CBand-CS-RC-SSB is a versatile SSB transmitter allowing the control of the carrier level by an original mean, and achieving coherent modulation schemes such as SC-SSB, RC-SSB, FC-SSB. Each of these modulation schemes are set for a 5 GHz operation, and are automatically generated from preregistered modes available from the ModBox interface.
The ModBox operation such as the modulation schemes, the laser and RF amplifiers parameters, are controllable from the touch screen front panel interface, as well as an Ethernet remote link.

The ModBox-CBand-CS-RC-SSB is a fully optimized SSB optical transmitter based on the use of the $LiNbO_3$ IQ modulator and its automatized bias controller.

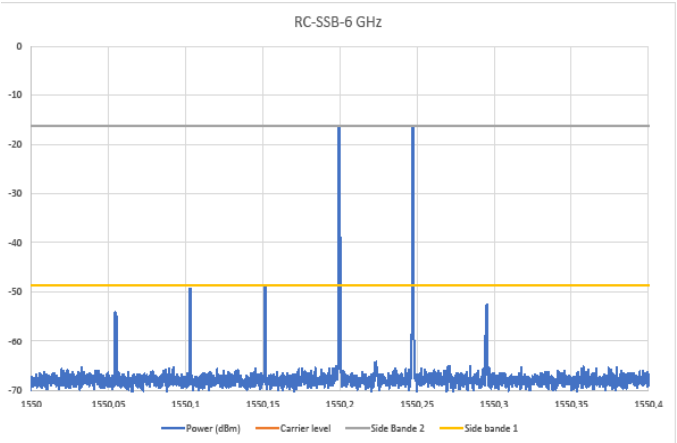
FEATURES

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

Performance Highlights

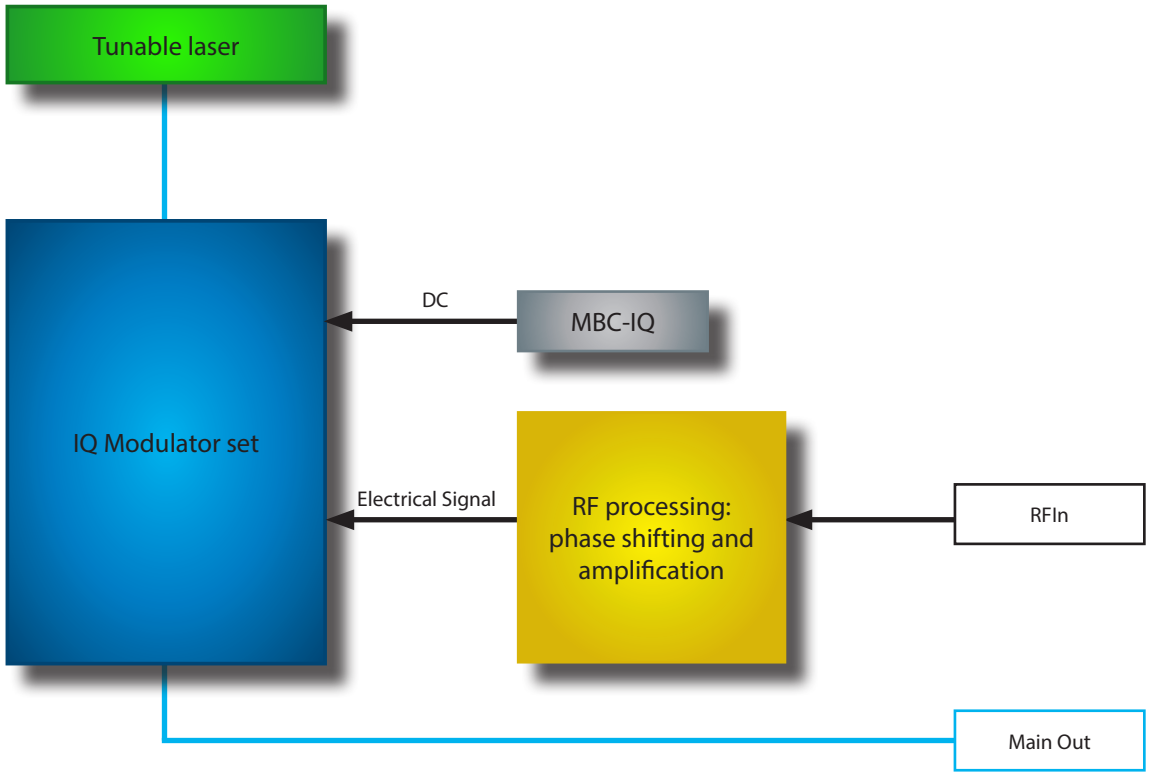
Parameter	Min	Typ	Max
Operating wavelength		C-Band	
Modulation Formats		CS-SSB, RC-SSB, FC-SSB	
Offset SSB Modulation Frequency		Up to 18 GHz	
Optical Carrier Attenuation		> 30 dB	
Side Band Attenuation		> 30 dB	

Optical RC-SSB ModBox Response



Example of Carrier Residual Carrier Single Side Band signal

Functional Block Diagram



The ModBox-CBand-CS-RC-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 DC_3 voltage).

The ModBox will be fully preset with fine adjustments of the RF driver gain, delay line and DC_3 bias voltage in order to obtain the maximum extinction of the carrier and the side band at 1550 nm and 5 GHz.
The carrier power and the carrier attenuation levels can be adjusted indepedently by a VOA mean.
The ModBox-CBand-CS-RC-SSB is coming with 3 preset modes, for each of these modes, the remaining side band is frequency adjustable from the RF generator:

- CS-SSB: Carrier Suppression Single Side band. This mode generates only one side band.
- FC-SSB: Full Carrier Single Side band. This mode generates one side band and the carrier.
- RC-SSB: Residual Carrier Single Side band. This mode generates one side band and the carrier with equal amplitude.

The user has access to these operating modes from the front panel using the embedded computer software and / or remotely from a Graphical User Interface (GUI) that is provided.

Electrical Input Specifications - User supplied, not a ModBox specification

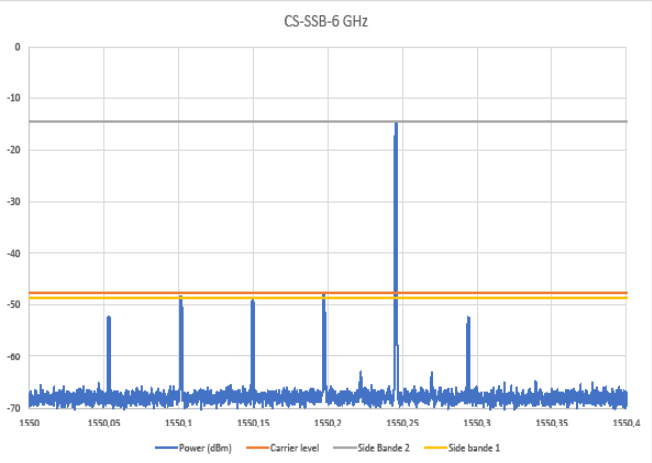
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Signal type	RF_{IN}	-	Sine			
Level	V_{RFIN}	50 Ω – Single ended	200	600	1 000	mVpp
Impedance Matching	Z_{RFIN}	-	-	50	-	Ω
Frequency	F_{RFIN}	-	1	-	18	GHz

Optical Output Specifications

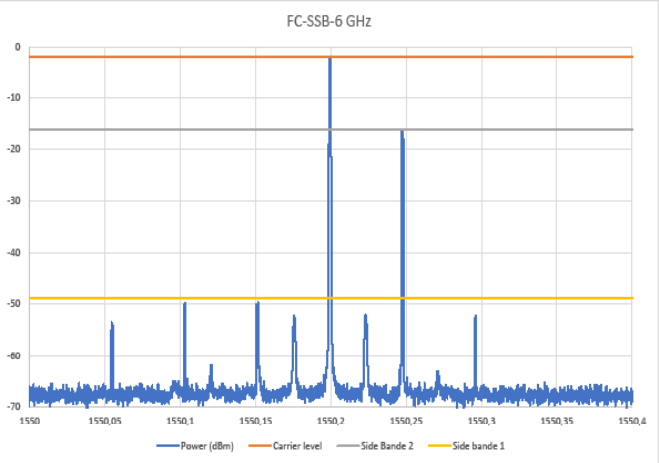
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Test
Laser Mode of Operation	-	-	CW, tunable			-	-
SSB mode control	-	-	Automatic bias control			-	-
Modulation formats	MF	-	CS-SSB, RC-SSB, FC-SSB			-	OK
Operating wavelength	λ	-	1527.6	-	1565.5	nm	OK
Linewidth	Δλ	-	-	-	100	kHz	-
Relative intensity noise	RIN	-	-	-	-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
Local oscillator output power	Main Out	-	-	2	3	dBm	OK
EO modulation bandwidth	EO-BW	-	22	25	-	GHz	OK
Offset SSB Frequency	SSB	-	1	5	18	GHz	-
Optical Carrier Attenuation	CS	Operation 5 GHz & 1550 nm	30	35	-	dB	OK
CS stability	ΔCS	Over 12 hours	-	1	-	dBrms	OK
Side Band Attenuation	SSB	Operation 5 GHz & 1550 nm	30	35	-	dB	OK
SSB stability	ΔSSB	Over 12 hours	-	1	-	dBrms	OK
Polarisation extinction ratio	PER	-	20	23	-	dB	-
Optical return loss	ORL	-	40	-	-	dB	-

ModBox Electrical and Optical Outputs

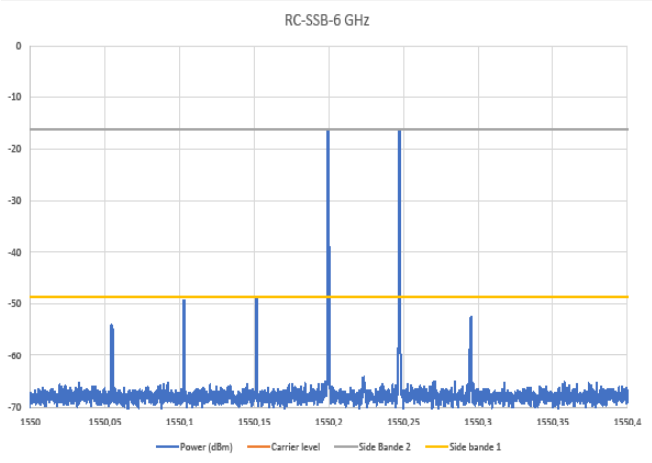
The following equipment was used to obtain below results :
- ModBox with built-in laser (not at full power)
- High resolution Apex model AP2081



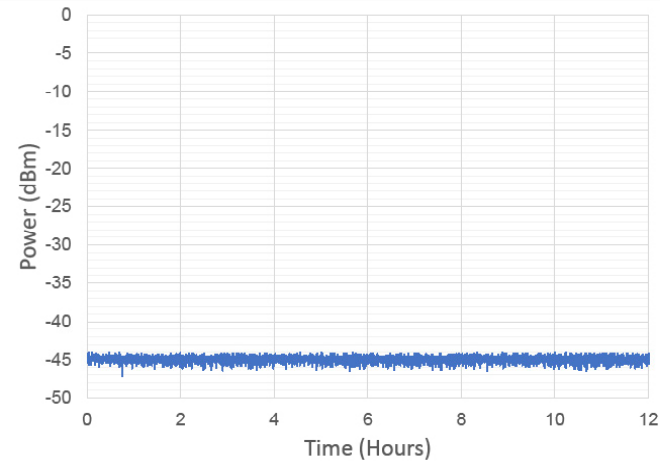
1550 nm - 6 GHz - CS-SSB



1550 nm - 6 GHz - FC-SSB



1550 nm - 6 GHz - RC-SSB



Carrier supression stability

Interfaces, Dimensions and Compliance

Interfaces	
Optical	Front-Panel - C Band 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
	User mode: CS-SSB, RC-SSB, FC-SSB
	Other control: VOA, MBC, delay line(manual), RF driver gain, seed laser, carrier level
Power supply	100 V - 120 V / 220 V - 240 V automatic switch 50-60 Hz (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 = 495 mm / 8 kg

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)1 30 08 87 43