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TUNICS



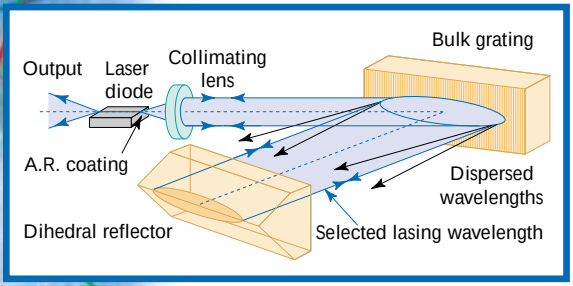
TUNABLE EXTERNAL CAVITY LASERS

The colors of WDM

photonetics

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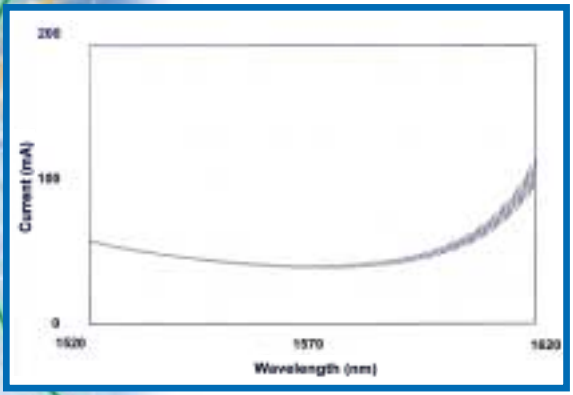
ULTIMATE DESIGN FEATURES FOR OUTSTANDING PERFORMANCE



Self-aligned external laser cavity

ULTRA-STABLE SELF-ALIGNED LASER CAVITY

TUNICS external laser cavity design guarantees long-term top performance because of its self-aligned configuration. In most laser cavities, minute changes in the position of the optical elements, caused by mechanical drifts over time, can rapidly degrade both the power and spectral purity. In contrast, the patented TUNICS cavity design uses a dihedral rear reflector made with a 180° folding prism that acts as a "1D corner cube," in order for the laser resonator to remain perfectly in tune, irrespective of small misalignments. Finally, the optical head is constructed entirely of invar, a zero-thermal-expansion metal, and therefore no temperature control of any kind is required to perform to full specifications. Benefits include instant start-up and low power dissipation.



Mode-hop-free characteristic

MODE-HOP-FREE OPERATION

Mode hops plague most tunable laser designs and are quite bothersome in many user applications. Their most conspicuous manifestation is in the power-vs-wavelength characteristic at a constant diode current, which exhibits significant stair-like glitches. Less obvious, but much more troublesome, are the sudden, unpredictable, and non-reproducible wavelength shifts, which make the sweep discontinuous. The scanning mechanism in TUNICS has a geometry that maintains at all times the cavity length at a fixed multiple of the wavelength. This guarantees a large range of smooth spectral sweep, free of any mode hops. For ultimate performance, we now offer TUNICS-Plus and TUNICS-Purity, which feature a new patended active control that ensures perfect mode-hop-free operation over their entire tuning range.

INTERNAL WAVELENGTH REFERENCING

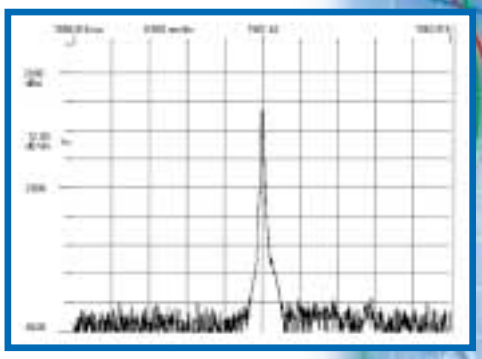
The wavelength accuracy of an external cavity laser depends on sub-micrometer variation of the cavity length. TUNICS-Plus and TUNICS-Purity incorporate an internal referencing system to precisely measure the emitted wavelength. This avoids the need of an additional wavelength-meter and speeds up the measurement sequence.

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TUNICS is a complete family of state-of-the-art tunable external-cavity lasers designed to meet the most demanding requirements in fiber-optic component and system testing, in particular for DWDM applications. Its novel, proprietary optical design features provide a unique range of user benefits.

FULL-POWER ASE-NOISE-FREE OPERATION

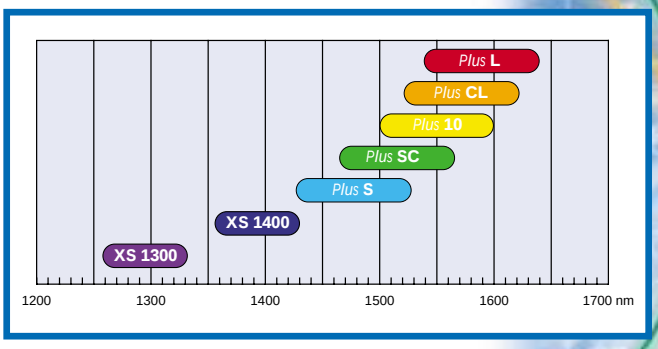
An external-cavity laser-diode emits a single line, but also some background broadband amplified spontaneous emission (ASE). This residual ASE noise must be filtered out to perform an accurate testing of components and amplifiers. TUNICS-Purity is the perfect solution because it emits a truly pure ASE-noise-free single-mode laser line while maintaining the full power and all features of state-of-the-art external cavity lasers. TUNICS-Purity features a new patended intra-cavity filtering design and avoids the need of an additional filter that often causes drift and loss.
This ASE-noise-free configuration is also available as an option for the well-known TUNICS-OM modular source. It brings a key improvement for testing very high bit rate multi-wavelength transmission systems.



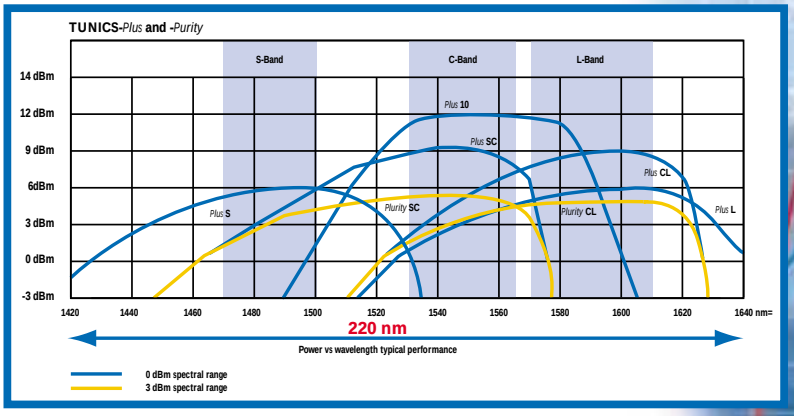
Tunics-Purity
ASE-noise-free spectrum

AMPLE OPTICAL POWER FROM 1260 TO 1640 nm

Fast, reliable, noise-free measurements of high-performance telecommunication components and systems often present challenging power-budget constraints, which only a high-power, yet low-noise source can resolve. The high-performance laser diodes used in TUNICS and the highly-efficient external cavity design lead to a high output power over a wide tuning range. Several milliwatts of optical power are routinely available at the optical connector of TUNICS in the central portion of their spectral range. A full suite of specifically designed laser diodes covers the complete 1260 nm to 1640 nm spectral range for the present and future needs for DWDM transmission systems. In all cases, the automatic power control holds power constant within ±0.01 dB over time.



Wide choice
of wavelength ranges



Output power of TUNICS-Plus
and TUNICS-Purity models

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THE TUNICS FAMILY

BENCHTOP INSTRUMENTS

Photonetics offers a complete line of benchtop instruments to fulfill the most demanding needs of optical communications. Instinctive, user-friendly keyboard and display are optimized for natural, easy, and flexible operation and the instruments are fully programmable through the universal IEEE-488 and RS-232 interfaces. External analog inputs and outputs are also provided for fine wavelength tuning, amplitude modulation, and instant recording of spectral sweeps.



TUNICS-*Plus*

TUNICS-Plus is the result of many years of Photonetics leadership in high-performance tunable external cavity lasers. Based on an ultra-stable self-aligned cavity, it now uses an active control to ensure a perfect mode-hop-free operation over its full wavelength tuning range. It also integrates an internal wavelength referencing system. TUNICS-Plus models comfortably cover the full DWDM range from 1430 nm to 1640 nm.



TUNICS-*Purity*

TUNICS-Purity provides the latest breakthrough in external cavity laser performance. It utilises a new proprietary intra-cavity filtering scheme to fully eliminate background ASE noise and emit a pure single-mode laser line without any compromise to output power or wavelength stability. TUNICS-Purity models cover the S-, C- and L-band from 1465 nm to 1625 nm.



TUNICS-XS

TUNICS-XS is optimized for the eXtended Short wavelength ranges around 1300 nm and 1400 nm. Its tuning mechanism enables extremely smooth scans over more than 70 nm.



TUNICS-BT

TUNICS-BT offers in a compact package all the basic features of Photonetics prime benchtop tunable lasers at a more affordable price. Its 80 nm wavelength range and 10 pm resolution (1 pm optional) make it the ideal tool for every optical bench. TUNICS-BT covers the complete C- and L-band and +10 dBm high output power is available as an option.

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MODULAR SOURCES

To complement its benchtop instrument series, Photonetics also offers modular TUNICS sources optimized for multi-wavelength transmission system testing. From affordable manually-tunable sources to fully-controlled platform modules, Photonetics products cover a wide range of applications from advanced laboratory experiments to automated factory test set-ups.

TUNICS-OM

TUNICS-OM is a modular 8-channel tunable source with manual adjustments for wavelength and power level. It is the popular multiple-wavelength solution when wavelengths are occasionally modified. TUNICS-OM is now available with an ASE-noise-free option which brings a key improvement in the testing of very high bit rate DWDM systems.



OSICS-ECL

OSICS is a new generation platform that builds on the backbone of TUNICS technology. Its sophisticated electronics, with its large display, controls and sets both the power and wavelength of up to 8 tunable external-cavity-laser modules. These OSICS-ECL modules can be mixed and matched with DFB laser modules to provide a truly convenient multi-wavelength test source.



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TUNICS BENCHTOP INSTRUMENTS



TUNICS-*Plus*

TUNICS-Plus is the result of many years of Photonetics leadership in tunable laser sources. It covers the various bands of optical DWDM. Its performance is unparalleled in the world of tunable laser-diode sources.

Active control of mode-hop-free operation

For ultimate performance, Tunics-Plus features a new proprietary active control that ensures perfect mode-hop-free operation and accurate wavelength sweep over its entire tuning range.

High output power

Up to +10 dBm for TUNICS-Plus 10 model out of the fiber pigtail eases the experiment power budget and provides low-noise measurements.

Wide, fast, truly continuous tunability

Extremely smooth scans over 100 nm, with an unsurpassed 1 pm resolution, allow a fine analysis over a wide spectral range.

Multiple modulation possibilities

A full range of amplitude modulation capabilities and mode-locked operation satisfy any specific modulation requirement.

Optical frequency fine tuning

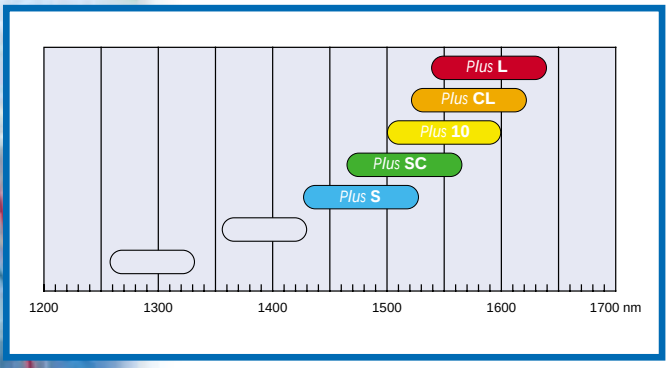
The external or internal wavelength fine tuning down to sub-MHz resolution and the coherence-control capability, are other useful features provided by TUNICS-Plus.

Internal wavelength referencing

±40 pm absolute wavelength accuracy with its internal referencing system.

Wide choice of wavelength ranges

Wide choice of tuning ranges which overlap to comfortably cover from the short band (S model) to the long band (L model). SC model covers S- and C-band. CL model covers C- and L-band. TUNICS-Plus 10 for +10 dBm high output power in the C-band.



Wavelength ranges of the various TUNICS-Plus models

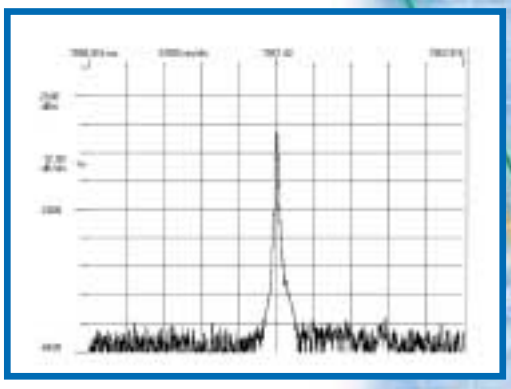
TUNICS-*Purity*

TUNICS-Purity provides the latest breakthrough in external-cavity laser-diode performance.
A new patented configuration yields an intra-cavity filtering of the background broadband ASE noise.
The equivalent full width at half maximum (FWHM) of this filtering is as narrow as 0.15 nm which makes the residual ASE almost unmeasurable.
TUNICS-Purity emits a pure high-power single-mode laser line, thus enabling direct spectral measurements of filters and multiplexers with an unsurpassed dynamic range.
This avoids complex set-ups requiring an additional tracking filter or an optical spectrum analyzer, which often cause loss.

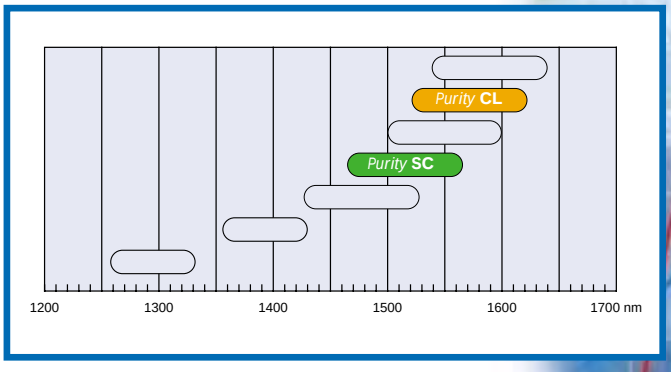
TUNICS-Purity design utilises all the features of TUNICS-Plus: ultra-stable self-aligned cavity, active control of mode-hop-free operation, high output power, wide continuous tunability, multiple modulation possibilities and internal wavelength referencing.

TUNICS-Purity is also the ideal instrument for an accurate testing of amplifier signal over noise ratio.
TUNICS-Purity provides a pure ASE-noise-free operation with no compromise to other key features of state-of-the art tunable external-cavity laser-diodes.





TUNICS-Purity spectrum



Wavelength ranges of the TUNICS-Purity models

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TUNICS BENCHTOP INSTRUMENTS



TUNICS-XS

TUNICS-XS is optimized for the eXtended Short ranges around 1300 nm and 1400 nm.

Mode hop free

Guaranteed 40 nm range, free of any mode hop, ensures smooth and accurate wavelength sweep.

Wide, fast, truly continuous tunability

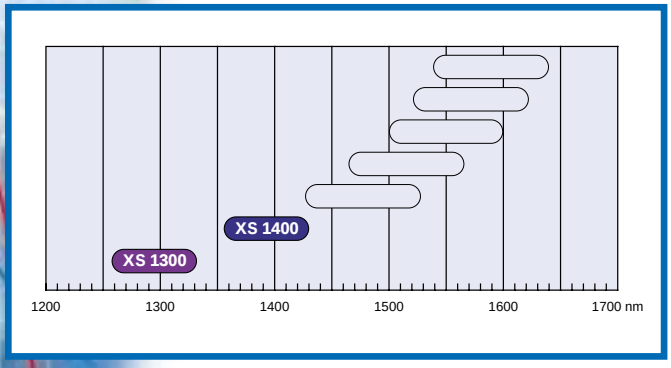
Extremely smooth scans over 70 nm, with an unsurpassed 1 pm resolution, allow a fine analysis on a wide spectral range.

Multiple modulation possibilities

A full range of amplitude modulation capabilities and mode-locked operation satisfy any specific modulation requirement.

Optical frequency fine tuning

The external or internal wavelength fine tuning down to sub-MHz resolution and the coherence-control capability, are other useful features provided by TUNICS-XS.

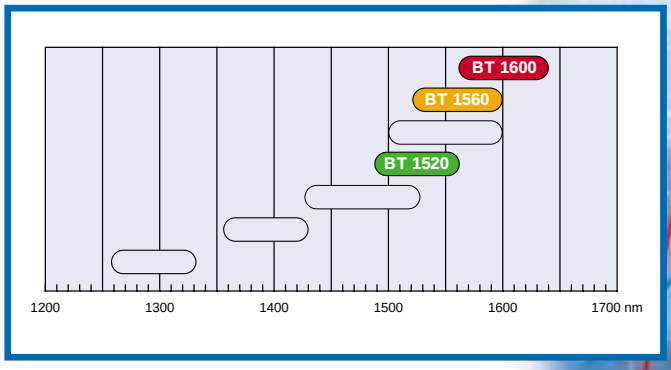


Wavelength ranges of TUNICS-XS models

TUNICS-BT



TUNICS-BT is a general-purpose bench-top "work-horse" tunable laser, offering the basic features of the TUNICS prime benchtop models in a more compact package. With its affordable price and state-of-the-art high-performance, TUNICS-BT should equip the bench of each and every contributor in the field of optical fiber communications. The standard configuration features a 10 pm resolution and a 0 dBm output power ranging from either 1480 to 1560 nm, 1520 to 1600 nm, or 1560 to 1640 nm. Options include a +6 dBm or +10 dBm output power and a 1 pm resolution over the entire spectral range. In addition, the fine scanning and coherence-control features can also be added, making TUNICS-BT a complete, full-featured instrument.



Wavelength ranges of TUNICS-BT models

TUNICS MODULAR SOURCES



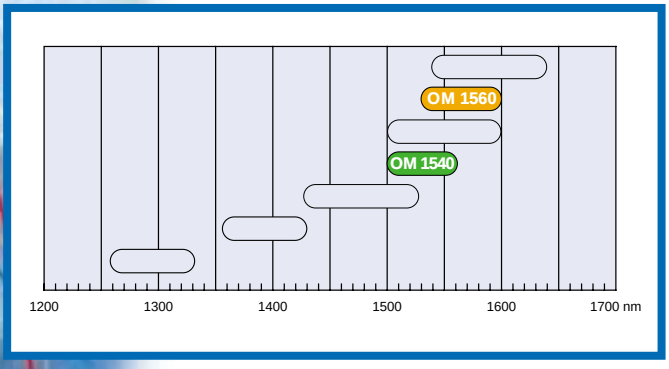
TUNICS-OM

TUNICS-OM is a compact and modular manually-tunable source for use in multi-wavelength test systems. Up to 8 TUNICS-OM modules can be assembled into an affordable single 19" instrument. A multi-turn knob allows the wavelength to be adjusted over 70 nm with a resolution of better than 10 pm.

Each module incorporates an adjustable automatic-power-control diode driver and provides more than 0 dBm of truly-single-mode optical power over the tuning range. Two wavelength ranges are available, 1500-1570 nm or 1530-1600 nm.

For more power-hungry applications, Photonetics offers +6 dBm and +10 dBm high-power options. An external input allows each unit to be intensity modulated from 10 kHz to 1 GHz.

After having been the pioneer of modular multi-wavelength tunable sources, TUNICS-OM now reaches a new frontier with an ASE-noise-free option, which avoids the trouble of additional filters and yields a key improvement for testing very high bit rate multi-wavelength transmission systems.



Wavelength ranges of TUNICS-OM models

OSICS-ECL



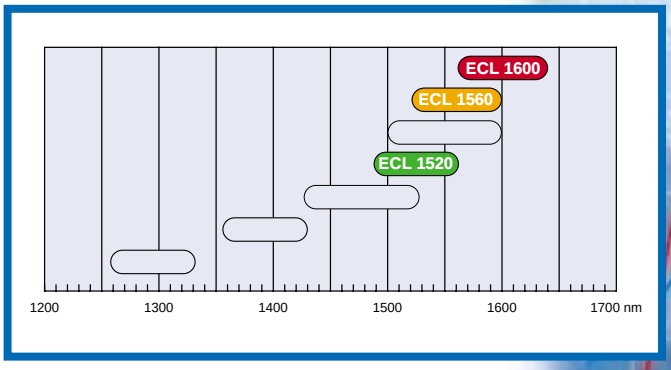
OSICS is a new generation platform with a sophisticated full-control electronics to set the parameters of up to 8 plug-in modules.

The OSICS-ECL module is an external cavity laser based on TUNICS technology. Both the wavelength and optical power can be selected and controlled from the front panel of the instrument, or through IEEE-488 and RS-232 interfaces.
In addition, the modules and the mainframe offer a full suite of internal and external modulation capabilities.

The standard configuration features a 10 pm resolution and a 0 dBm output power ranging from either 1480 to 1560 nm, 1520 to 1600 nm, or 1560 to 1640 nm. Options include a +6 dBm or +10 dBm output power and a 1 pm resolution over the entire spectral range.

OSICS-ECL modules can be mixed with DFB laser modules to provide a convenient and versatile multi-wavelength source.

OSICS can also host OSICS-ASE, amplified spontaneous emission fiber source modules and OSICS-EDFA, erbium-doped fiber amplifier modules, thus fulfilling all needs for applications requiring multi-wavelength sources and amplifiers.

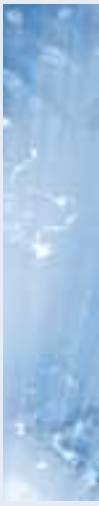


Wavelength ranges of OSICS-ECL models

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TUNICS BENCHTOP INSTRUMENTS
SPECIFICATIONS

	TUNICS-*Plus* S S-band	TUNICS-*Plus* SC S- and C-band	TUNICS-*Plus* CL C- and L-band	TUNICS-*Plus* L L-band	TUNICS-*Plus* 10 High power
Tuning characteristics					
Wavelength range (mode hop free)					
P = 0 dBm	1430-1530 nm	1465-1570 nm	1525-1625 nm	1530-1640 nm	1500-1600 nm
P = 6 dBm		1510-1570 nm	1560-1620 nm		
P = 10 dBm					1530-1580 nm
Absolute wavelength accuracy[1]	±0.04 nm	±0.04 nm	±0.04 nm	±0.04 nm	±0.04 nm
Tuning repeatability (typ.)	±0.005 nm	±0.005 nm	±0.005 nm	±0.005 nm	±0.005 nm
Wavelength setting resolution	0.001 nm	0.001 nm	0.001 nm	0.001 nm	0.001 nm
Optical frequency fine tuning	±2 GHz	±2 GHz	±2 GHz	±2 GHz	±2 GHz
Tuning speed	1 s (100 nm)	1 s (100 nm)	1 s (100 nm)	1 s (100 nm)	1 s (100 nm)
Laser output characteristics					
Power stability (1 hour)	±0.01 dB	±0.01 dB	±0.01 dB	±0.01 dB	±0.01 dB
Side mode suppression ratio[2]	>45 dB	>45 dB	>45 dB	>45 dB	>45 dB
RIN[2]	>145 dB/Hz	>145 dB/Hz	>145 dB/Hz	>145 dB/Hz	>145 dB/Hz



	TUNICS-*Purity* SC S- and C-band	TUNICS-*Purity* CL C- and L-band
Tuning characteristics		
Wavelength range (mode hop free)		
P = 0 dBm	1465-1570 nm	1525-1625 nm
P = 3 dBm	1510-1570 nm	1560-1620 nm
Absolute wavelength accuracy[1]	±0.04 nm	±0.04 nm
Tuning repeatability (typ.)	±0.005 nm	±0.005 nm
Wavelength setting resolution	0.001 nm	0.001 nm
Optical frequency fine tuning	±2 GHz	±2 GHz
Tuning speed	1 s (100 nm)	1 s (100 nm)
Laser output characteristics		
Power stability (1 hour)	±0.01 dB	±0.01 dB
Signal to source spontaneous-emission density ratio[3]	>90 dB	>90 dB
Signal to total source spontaneous-emission ratio[4]	>65 dB	>65 dB
RIN[2]	>145 dB/Hz	>145 dB/Hz



NOTES

(1) From 20 °C to 28 °C.
(2) Measured with 0 dBm output power.
(3) Measured with an optical spectrum analyzer at 0.1 nm resolution bandwidth.
(4) Measured with a fiber Bragg grating to suppress the signal.

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	TUNICS-XS 1300	TUNICS-XS 1400	TUNICS-BT 1520	TUNICS-BT 1560	TUNICS-BT 1600
Tuning characteristics					
Wavelength range					
P = 0 dBm	1260-1330 nm	1360-1430 nm	1480-1560 nm	1520-1600 nm	1560-1640 nm
P = 6 dBm (P6 option)			1510-1550 nm	1530-1580 nm	1570-1620 nm
P = 10 dBm (P10 option)				1540-1580 nm	
Mode hop spacing	>40 nm	>40 nm	>30 nm (typ).	>30 nm (typ.)	>30 nm (typ.)
Absolute wavelength accuracy	±0.2 nm	±0.2 nm	±0.2 nm	±0.2 nm	±0.2 nm
Tuning repeatability (typ.)	±0.005 nm	±0.005 nm	±0.01 nm	±0.01 nm	±0.01 nm
Wavelength setting resolution	0.001 nm	0.001 nm	0.01 nm	0.01 nm	0.01 nm
Optical frequency fine tuning	±2 GHz	±2 GHz	Option	Option	Option
Tuning speed	0.5 s (40 nm)	0.5 s (40 nm)	10 s (70 nm)	10 s (70 nm)	10 s (70 nm)
Laser output characteristics					
Power stability (1 hour)	±0.01 dB	±0.01 dB	±0.01 dB	±0.01 dB	±0.01 dB
Side mode suppression ratio[1]	>45 dB	>45 dB	>45 dB	>45 dB	>45 dB
RIN[1]	>145 dB/Hz	>145 dB/Hz	>145 dB/Hz	>145 dB/Hz	>145 dB/Hz

INTERFACE AND ENVIRONMENT

	TUNICS-*Plus* models	TUNICS-*Purity* models	TUNICS-XS models	TUNICS-BT models
Interface				
Optical connector	FC-APC	FC-APC	FC-APC	FC-APC
Output fiber	SMF-28™	SMF-28™	SMF-28™	SMF-28™
Output isolation	35 dB	35 dB	35 dB	35 dB
Return loss	60 dB	60 dB	60 dB	60 dB
Remote control IEEE-488.1	yes	yes	yes	yes
Remote control RS-232 C	yes	yes	yes	yes
Low frequency modulation	30 kHz to 8 MHz	30 kHz to 8 MHz	10 kHz to 8 MHz	no
High frequency modulation	30 kHz to 1 GHz	30 kHz to 1 GHz	30 kHz to 1 GHz	10 kHz to 1 GHz
Mode-lock frequency	5 GHz	5 GHz	no	no
Environment				
Operating temperature range	+15 to +30 °C +60 to +85 °F	+15 to +30 °C +60 to +85 °F	+15 to +30 °C +60 to +85 °F	+15 to +30 °C +60 to +85 °F
Power supply	100 to 240 V 50 to 60 Hz	100 to 240 V 50 to 60 Hz	100 to 240 V 50 to 60 Hz	100 to 240 V 50 to 60 Hz
Dimensions (W x H x D)	448 x 133 x 370 mm^3	448 x 133 x 370 mm^3	448 x 133 x 370 mm^3	340 x 133 x 308 mm^3
Weight	12.5 kg	12.5 kg	12.2 kg	7.5 kg

NOTE *(1) Measured with 0 dBm output power.*

OPTIONS

P6	*High output power*	*(TUNICS-BT)*	*+6 dBm output power*
P10	*High output power*	*(TUNICS-BT)*	*+10 dBm output power*
M	*Polarization maintaining output*	*(all models)*	
L	*LabView driver*	*(all models)*	
R	*High resolution*	*(TUNICS-BT)*	*1 pm resolution*
C	*Coherence control and fine tuning*	*(TUNICS-BT)*	

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MODULAR SOURCES SPECIFICATIONS

	TUNICS-OM 1540	TUNICS-OM 1560	OSICS-ECL 1520	OSICS-ECL 1560	OSICS-ECL 1600
Tuning characteristics					
Wavelength range					
P = 0 dBm	1500-1570 nm	1530-1600 nm	1480-1560 nm	1520-1600 nm	1560-1640 nm
P = 6 dBm (P6 option)	1520-1570 nm	1540-1590 nm	1510-1550 nm	1530-1580 nm	1570-1620 nm
P = 10 dBm (P10 option)	1530-1570 nm	1540-1580 nm		1540-1580 nm	
Absolute wavelength accuracy	±0.2 nm				
Wavelength stability[1][2]	0.1 nm		±0.01 nm / h; ±0.01 nm / 24 h (typ.)		
Wavelength setting resolution	0.01 nm (typ.)		0.01 nm		
Tuming repeatability			±0.01 nm (typ.)		
Wavelength setting	multi-turn knob (16 nm/turn)		front panel or remote control		
Laser output characteristics					
Power setting	single-turn knob		front panel or remote control		
Power stability[1][2]	±0.01 dB		±0.01 dB / h; ±0.01 dB / 24 h (typ.)		
Side mode suppression ratio (typ.)[3]	>45 dB		>45 dB		
RIN (typ.)[3]	>145 dB/Hz		>145 dB/Hz (typ.)		
Interfaces					
Output connector	FC-APC		FC-APC		
Output isolation	35 dB		35 dB		
Return loss	60 dB		60 dB		
Remote control	no		RS-232 C and IEEE-488.2		
Modulation bandwidth	10 kHz to 1 GHz		100 Hz to 1 GHz (external)		
TTL modulation			100 Hz to 500 kHz (internal or external)		
Environment					
Number of modules per rack	up to 8		up to 8		
Operating temperature range	+15 to +30 °C		+15 to +35 °C		
	+60 to +85 °F		+60 to +95 °F		
Power supply (autoselect)	100 to 240 V		100 to 240 V		
	50 to 60 Hz		50 to 60 Hz		
Module dimensions (W x H x D)	50 x 128 x 167 mm³		35 x 130 x 250 mm³		
Mainframe dimensions (W x H x D)	448 x 133 x 370 mm³		448 x 133 x 370 mm³		
Weight	15.1 kg (for 8-module unit)		16.1 kg (for 8-module platform)		

NOTES

(1) After warm-up, for 0 dBm output power.
(2) At a constant temperature.
(3) Measured with 0 dBm output power.

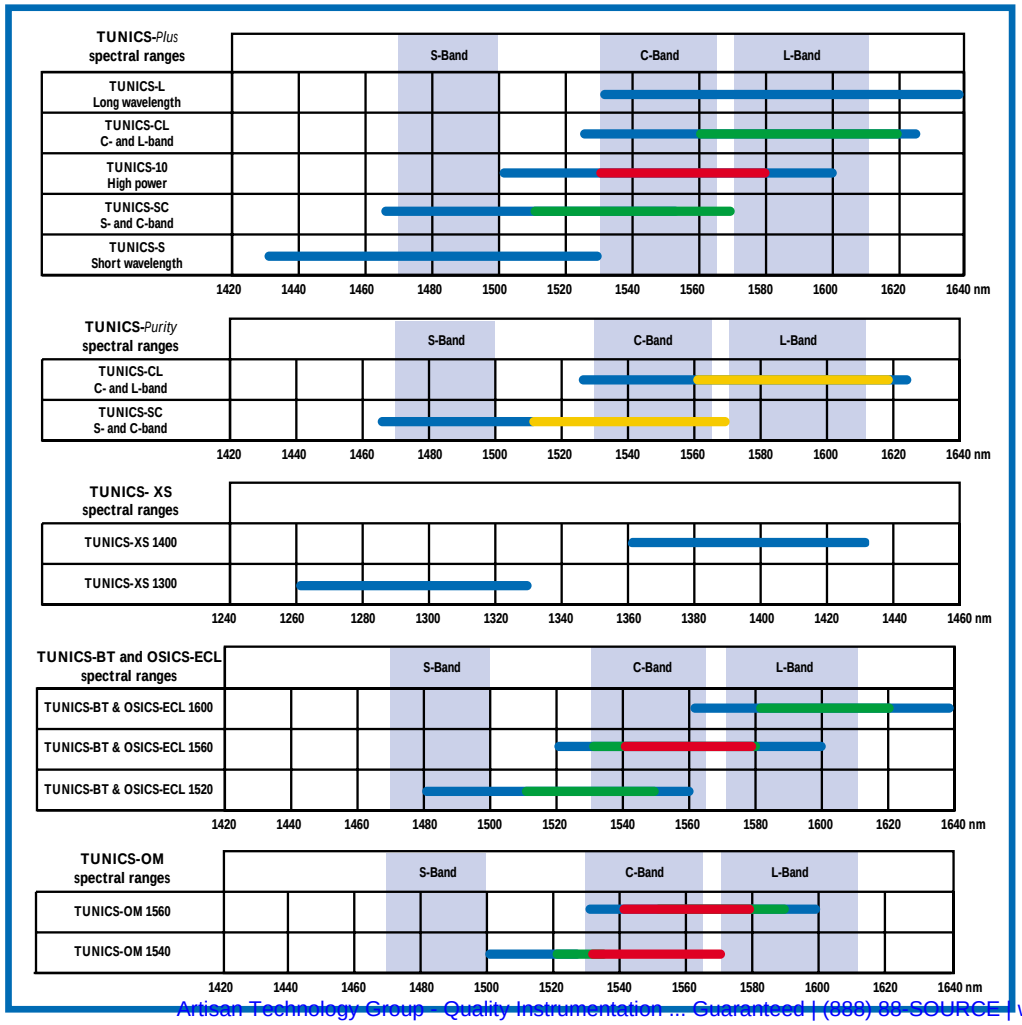
OPTIONS

P6	*High output power*	*(TUNICS-OM, OSICS-ECL)*	*+6 dBm output power*
P10	*High output power*	*(TUNICS-OM, OSICS-ECL)*	*+10 dBm output power*
M	*Polarization maintaining output*	*(TUNICS-OM, OSICS-ECL)*	
R	*High resolution*	*(OSICS-ECL)*	*1 pm resolution*
L	*LabView driver*	*(OSICS-ECL)*	
AF	*ASE-free operation*	*(TUNICS-OM)*	

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THE TUNICS FAMILY AT A GLANCE

	Plus	*Purity*	**XS**	**BT**	**OM**	**OSICS-ECL**
Benchtop instruments	X	X	X	X		
Modular sources					X	X
Number of channels	1	1	1	1	up to 8	up to 8
Full internal control	yes	yes	yes	yes		yes
Manual adjustment					yes	
ASE-noise-free operation		yes			option	
Mode-hop-free operation	active control	active control	yes	yes		
High resolution (1 pm)	yes	yes	yes	option		option
Pigtailed output	yes	yes	yes	yes	yes	yes
Polarization maintaining output	option	option	option	option	option	option
Remote control	yes	yes	yes	yes		yes
Power modulation capability	yes	yes	yes	yes	yes	yes
Mode-lock capability	yes	yes				
Optical frequency fine tuning	yes	yes	yes	option		
Coherence control capability	yes	yes	yes	option		yes



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A COMPLETE LINE



• **TUNICS**	**Tunable External Cavity Lasers**
• *WALICS*	*DWDM Optical Spectrum Analyzer*
• *OSICS*	*8-Channel Modular Platform*
• *UBICS*	*Modular Portable Instrument*
• *MICS*	*Multiplexers & Demultiplexers for DWDM Applications*
• *FIBERAMP*	*Fiber Amplifiers*
• *FIBERWHITE*	*Broadband Erbium-Doped Fiber Source*
• *LEFEVRE'S LOOPS*	*Polarization-State Controllers*
• *WIN-PMD*	*PMD Analyzer*
• *WIN-R*	*Optical Coherence Domain Reflectometer*
• *WIN-P*	*Optical Coherence Domain Polarimeter*

All TUNICS models comply with IEC 60825-1 and FDA (21CFR Subchapter J) laser safety standards.

The proprietary design features of TUNICS are patented.





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March 2000

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