SpaceComb

Space Optical Frequency Comb

MenloSystems



KEY SPECIFICATIONS

- All-in-one Space-qualified Frequency Comb
- Compact Solution (7 l, 8 kg)
- Up to 2 CW Laser Input for Beat Generation
- Ultrastable and Accurate Optical-to-RF Conversion

APPLICATIONS

- Space Optical Clocks
- Space Optical Link Stabilization
- LIDAR Laser Calibration
- Space Observatory Spectrometer Calibration
- Support for Gravimetry in Space
- Space Time and Frequency Distribution

OPTIONS

- 10 MHz RF Clock Output
- PLL for External Laser Stabilization
- Custom Application Slide-in Modules

Frequency combs are at the heart of quantum sensors and optical clocks, enabling reference and control of continuous-wave (CW) laser systems, and facilitating the transfer of optical frequencies within the optical domain or to the RF domain with accuracy and stability beyond 10^{-16}.
Our advanced internal architecture allows the comb to achieve its outstanding performance under vacuum and zero-gravity conditions on free-flying or space station platforms.
All optical and EEE (Electrical, Electronic, and Electromechanical) components have been selected and/or qualified for space radiation environments. Flight systems are qualified to meet mission environment requirements, encompassing shock, vibration, thermal cycling, thermal vacuum, and electromagnetic compatibility (EMC) testing. The design standard mandates comprehensive finite element method (FEM) analyses for both mechanical and thermal aspects prior to manufacturing, ensuring rigorous validation and reliability.

SPECIFICATIONS

Phase Noise and Stability (10 MHz Carrier)	
Offset Frequency (Hz)	**Single Sideband Phase Noise (dBc/Hz)**
1	-100
10	-110
100	-120
1 K	-120
10 K	-140
100 K	-145

Phase noise of the 10 MHz clock output of the SpaceComb compared to a reference comb

Integration Time (τ)	**ADEV @ 10 MHz**	**ADEV @ CW Input (1064 nm)**
1 s	$<5 \times 10^{-13}$	$<5 \times 10^{-16}$
10 s	$<1.6 \times 10^{-13}$	$<1.6 \times 10^{-16}$
100 s	$<5 \times 10^{-14}$	$<5 \times 10^{-17}$
1000 s	$<1.6 \times 10^{-14}$	$<1.6 \times 10^{-17}$
10 000 s	$< 5 \times 10^{-15}$	$< 5 \times 10^{-18}$

Stability of the 10 MHz clock output and CW input of the optically referenced SpaceComb compared to a reference comb

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SPECIFICATIONS

Quality Level	ESA Class 3
Radiation Tolerance	100 kRad
Operations	autonomous system operation, continuous 24/7 operation
Communication Protocol	ECSS-E-ST-70-41C compliant PUS-C (Packet Utilization Standard)
Communication Interface	RS422 & TCP/UDP over ethernet (hot redundant)
Qualification Operating Temperature	+ 5 °C to + 35 °C
Qualification Non-Op Temperature	-25 °C to + 70 °C
Operating Voltage	24 - 36 VDC, via SubD 15 connector
Power Consumption	38 - 43 W (depending on temperature at interface)
Dimensions	190 x 220 x 190 mm^3 (W x D x H), including mounting feet
Weight	7.7 kg
RF Clock Input	10 MHz
Optical Clock Output	10 MHz (other frequencies on request)
CW Laser Input	1550, 1064, 780, 689 nm, other wavelengths on request
Comb Light Output (Optional)	> 35 nm BW at 1560 nm, 10 mW

ORDERING INFORMATION

Product Code	SpaceComb LEO

Please call for pricing. Specifications are subject to change without notice. Custom modifications are available, please inquire.





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