

UMS-Mini

Ultrastable Microwave System



Photonic microwave technology represents a paradigm shift in microwave signal synthesis. Introducing Menlo Systems' Ultrastable Microwave Systems, we present a groundbreaking advancement in microwave technology, for the synthesis of microhertz-level linewidth signals. Currently, the most established technology for the synthesis of stable microwave signals is based on up-multiplication of RF signals from oven-controlled crystal oscillators (OCXOs). This method leads to unavoidable and detrimental quadratic upscaling of phase noise. Our systems are the first commercially available photonic microwave sources that utilize the phase-coherent division of high-fidelity optical signals into the microwave domain. By employing this innovative approach, we can drastically reduce optical phase noise to levels that were previously considered physically impossible with multiplied OCXOs or room-temperature Sapphire oscillators.

The UMS-Mini is the microwave frequency source with the lowest phase noise on the market. In a compact 200-liter volume, the rack mountable system can be configured to provide multiple output frequencies from the RF to up to 20 GHz (higher on custom request). It includes a fully autonomous ultra-stable laser and a frequency comb. The system is the result of years of fine engineering.^{1, 2, 3}



Measurement instrument-limited phase noise trace for a 10 GHz carrier signal.

1) Xie, X. et al. Photonic microwave signals with zeptosecond-level absolute timing noise. Nature Photonics 11, 44–47 (2016).

2) Giunta, M. et al. Compact and ultrastable photonic microwave oscillator. Optics Letters 45, 1140 (2020).

3) Zobel, J. W. et al. Comparison of Optical Frequency Comb and Sapphire Loaded Cavity Microwave Oscillators. IEEE Photonics Technology Letters 31, 1323–1326 (2019).

MenloSystems

APPLICATIONS

- Atomic Clocks / Time-scale realization
- RF over fiber
- Quantum Computing
- Radar Local Oscillator
- Test & Measurements
- OCXOs/Oscillators calibration/measurements
- Telecom 5G/6G

FEATURES

- Compact and complete solution comprising an ultrastable laser and an optical frequency comb
- Fully remotely controllable
- Lowest phase noise on the market in this form factor
- Optional 1 PPS, 10/100 MHz outputs

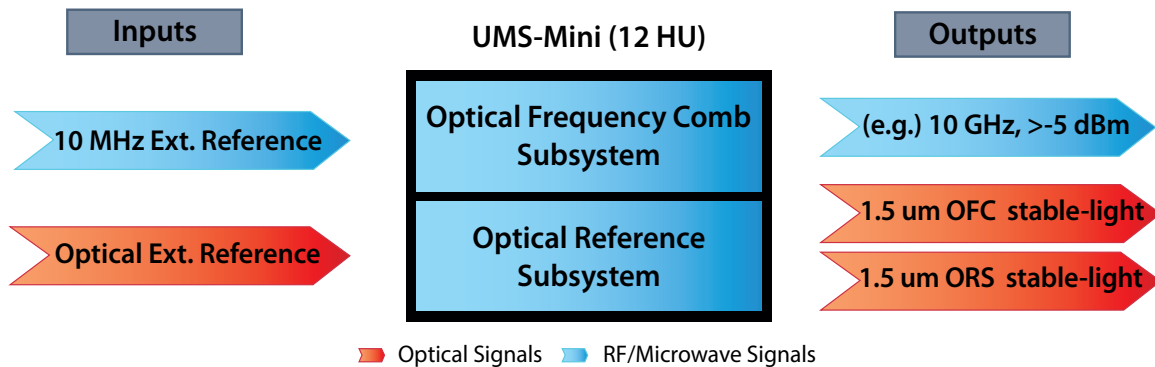
KEY SPECIFICATIONS

- Up to four phase-coherent RF and Microwave frequency outputs: 10/100 MHz, 1-20 GHz with guaranteed spectral purity
- Phase noise as low as < -80 dBc/Hz at 1 Hz, -160 dBc/Hz at ≥ 10 kHz from a 10 GHz carrier
- Frequency instability (for X-Band signals) as low as < $5E-15$ at 1 s, < $5E-11$ (50 ppt) at 1 day (without drift-removal)
- De-drift option available (to hand over GPS or other reference)
- Class 1 Laser System (depending on configuration)

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SPECIFICATIONS

Offset frequency (Hz)	Phase noise (absolute*, dBc Hz ⁻¹)			Averaging time (s)	Fractional frequency stability (absolute*)		
	10 MHz	100 MHz	10 GHz		10 MHz	100 MHz	10 GHz
1	-135	-125	-80	0.1	<5E-14	<5E-14	<5E-15
10	-145	-135	-100	1	<5E-14	<5E-14	<5E-15
100	-155	-145	-120	10	<1E-13	<1E-13	<2E-14
1k	-165	-150	-140	100	<5E-13	<5E-13	<2E-13
10k	-165	-155	-160	1000	<5E-12	<5E-12	<2E-12
100k	<-165	-155	<-160	>10000	<5E-11	<5E-11	<2E-11
1M	<-165	-155	<-160				

System can be equipped with GPS receiver for long-term steering. De-drift function can be configured for handover at the appropriate time to a more stable reference.

*Inquire for residual.

OUTPUTS

	1/100 MHz	Microwave
Level, 50 Ω	>7 dBm	>-5 dBm
Isolation	>70 dB	>80 dB
Spurious	<-90 dBc	<-70 dBc

POWER / ENVIRONMENTAL REQUIREMENTS

Operating Voltage	100/115/230 VAC
Line Frequency	50 to 60 Hz
Operating Temperature	22 ± 5 °C
Power Consumption	<200 W

ORDERING INFORMATION

Product Code | UMS-Mini

Please call for pricing. Specifications are subject to change without notice. Custom modifications are available, please inquire. The cubic cavity is an NPL patented design that is sold under a licensing agreement with the National Physical Laboratory (NPL). This configuration of the NPL cavity is intended for terrestrial use only. For further information on space-customised or space-qualified cavities, please contact NPL.



Laser Radiation
Class1 Laser Product
according to DIN EN 60825-1:2015-07

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