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YIG SOURCES & FILTERS REDUCE NOISE

These YIG components are no longer the conventional military designs of years past.

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YTTRIUM-IRON-GARNET (YIG)-based oscillators and filters may represent the archetypical dual-use components. Long associated with military designs, they are now being refined and mass produced for commercial systems. One of the suppliers making the refinements is Micro Lambda (Fremont, CA), with innovations and surface-mount adaptations that have brought this powerful magnetic technology to the modern military/commercial age.

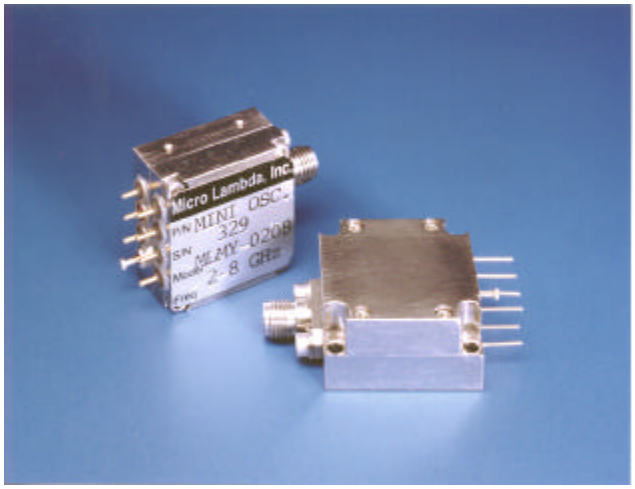
By miniaturizing the design of the MLMY series of YIG oscillators, the company has also succeeded in cutting power requirements and costs, making these oscillators attractive for use in VXI test instruments, satellite and line-of-sight communications systems, and portable microwave test equipment. The series, which features four models spanning 2 to 8 GHz, including the full band model MLMY-0208 (see figure), shares an output power rating of +15 dBm minimum with ±2 dB output power flatness across the frequency tuning range. The maximum pulling figure for the source series is 1 MHz (into a load with a 12 dB return loss), while the common operating temperature range is 0 to + 65°C. All four of the oscillators are supplied in a compact 1.0 X 1.0 X 0.5 in. (2.54 X 2.54 X 1.27 cm) metal enclosure with field-replaceable SMA connectors.

While the second and third harmonic performance levels for the MLMY series are not exceptional, at –12 and –20 dBc, respectively, the sources achieve solid spurious and phase noise performance marks. For all four oscillators, spurious content is –60 dBc or better. The phase noise for all models is better than –100 dBc/Hz offset 20 kHz from the carrier and better than -120 dBc/Hz offset 100 kHz from the carrier. All four sources have a typical 3 dB bandwidth of 5 kHz. The frequency tuning sensitivity is 10 MHz/mA (or 20 MHz/mA for custom applications) for the main port. In addition, a frequency-modulation (FM) tuning port is included for modulation and phase locking purposes; this port has sensitivity of 310 kHz/mA.

The miniature MLMY sources draw 100 mA from a +15 VDC supply and 50 mA from a –5 VDC supply. In addition, a +24 VDC supply is required to drive YIG heater circuitry (which controls frequency drift over the operating temperature range within 15 MHz or less). The heater circuitry draws only 25 mA current under steady-state conditions, with maximum surge levels reaching 250 mA.

In addition to small size, integration has been a key to enhancing the effectiveness of YIG designs. The MLOF series of 2 to 8 GHz YIG oscillators incorporates single- and two-stage filters for suppression of harmonic levels. The MLOF-0208 oscillator, for example, includes a single-stage filter, resulting in harmonic performance of -40 dBc while still achieving +14 dBm

Less than 1 in.^{3}, the tiny MLMY-0208 YIG Tuned oscillator provides at least +15 dBm output power from 2 to 8 GHz.



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output power from 2 to 8 GHz. With the same output power and frequency range, the MLOF-2208 uses an integral two-stage filter to reduce harmonic levels to –60 dBc. These integral filters can be set at the oscillator's fundamental frequency or offset by some intermediate frequency (IF) specified by a user.

Another example of integration leading to YIG performance enhancements is the MLOS line of switched dual YIG sources, in which two YIG circuits are contained within a common housing. For new designs, a single assembly provides broadband tuning in receivers and test signal generators. For existing designs, a single YIG oscillator can retrofit two older components.

Three models are available in the MLOS line for frequency coverage of 2.0 to 18 GHz, 2.0 to 20 GHz, and 2.0 to 26.5 GHz. Each of the housings contains a single broadband GaAs monolithic-microwave-integrated-circuit (MMIC) amplifier to boost output signals to +13, +12, and +8 dBm, respectively, over the three frequency ranges. Within each housing, a PIN-diode switch selects between each oscillator band. The switch point occurs at either 8 or 12 GHz, with a 400 MHz overlap to guarantee generation of all frequencies. TTL signals are used to switch between bands and an internal driver shuts off the unused oscillator to conserve power consumption.

The three MLOS switched oscillators share low frequency drift of 30 MHz over an operating temperature range of 0 to +65°C. Second and third harmonics for all three models are –12 dBc or less, while spurious content is –60 dBc. The minimum phase noise for the low-frequency model is –113 dBc/Hz offset 100 kHz from 2 to 8 GHz carriers. The minimum phase noise for the 20 GHz model is –103 dBc/Hz offset 100 kHz from 8 to 20 GHz carriers. The minimum phase noise for the high-frequency model is –97 dBc/Hz offset 100 kHz from 12.0 to 26.5 GHz carriers.

In addition to these sources, the company also offers a wide range of YIG-tuned filters, including the MLFR series of "ultra-notch" band-reject filters. Designed for commercial and military satellite-communications bands of 5.9 to 6.5 GHz, 7.9 to 8.4 GHz, and 8.9 to 9.6 GHz, these filters offer 70 dB rejection over a 70 MHz bandwidth with maximum 3 dB tuned bandwidths of 300 MHz. Insertion loss is only 1.5 dB.

The product lines continue to evolve, with the MLMY series of miniature YIG oscillators soon to be available in printed-circuit-mount configurations for use on single-space VXI cards. P&A: 30 days. **Micro Lambda, Inc. 48041 Fremont Blvd., Fremont, CA 95438, (510) 770-9221, FAX: (510)770-9213.**