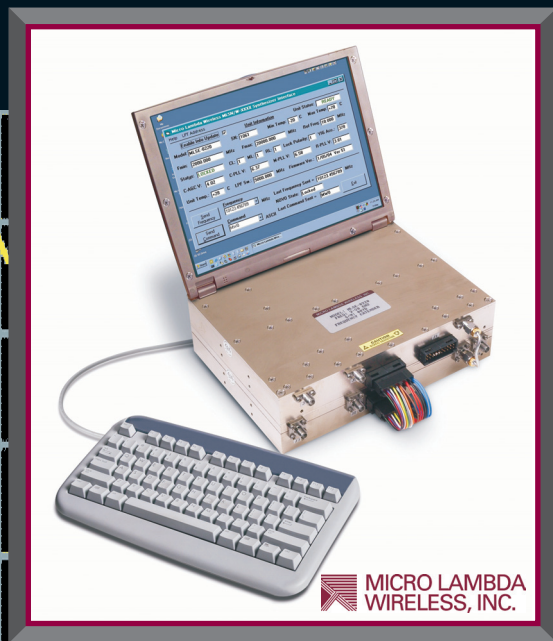


HIGH FREQUENCY

E L E C T R O N I C S

LOW NOISE SYNTHESIZERS COVER 1-22 GHz WITH 1 Hz RESOLUTION



MICRO LAMBDA
WIRELESS, INC.

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Estimating Antenna Tuning Unit Losses
Technology Report: Baseband DSP
Focus on Oscillators, Synthesizers
and Optical Products

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New Synthesizers Handle Wide Band, Low Noise Applications

This new line of wide band synthesizers offers low noise performance, fine tuning steps, programmability and a set of useful options for advanced wireless systems

A new series of wide band, low noise frequency synthesizers has been introduced by Micro Lambda Wireless, Inc. The MLSE Series uses advanced YIG technology, multi-loop

synthesis and frequency extender techniques to achieve 1 to 22 or 2 to 20 GHz coverage with 1 Hz resolution. Target applications include laboratory instrument signal sources, local oscillators (LOs) in receivers, transmitters and frequency converters.

The design of the new line is based on the successful wide band MLSW series synthesizer, feeding a channelized doubler/divider modules to obtain the final output spectrum.

Exceptional Noise Performance

The MLSE series provides noise performance that rivals the best test instruments (see Figure 1). This figure compares noise performance at various offset frequencies, while a comparison of cost is: ~\$15,000 for the MLSE-

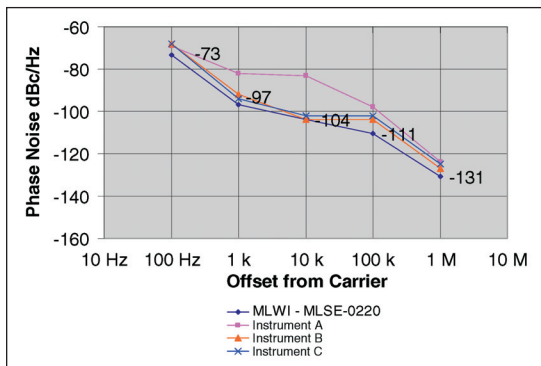


Figure 1 . Comparison of the MLSE with three laboratory test instruments.



0220 versus a range of \$23k to \$27.5k for the test instruments.

With its low noise, combined with the fine frequency resolution, the synthesizers are suitable for systems employing complex modulation. Figures 2-4 shows phase noise plots at three output frequencies across the unit's tuning range. At 20 GHz, the typical phase noise at 10 kHz offset is -104 dBc.

Power leveling achieves ± 1 dB flatness over the unit's entire frequency range (Figure 5). The output level is controllable over a range of ± 20 dB, centered at 0 dBm.

Options include a second LO output in the 500 MHz to 4 GHz range, tunable in 100 kHz steps. A second low noise RF output can also be provided, covering 4 to 11 GHz with a +10 dBm output level. An auxiliary input port can be specified, which allows an additional 2 to 20 GHz signal to be run through the unit and switched to the main output RF connector.

The standard external frequency reference is 10 MHz, but the the unit may optionally be programmed for reference frequencies from 5 to 100 MHz.

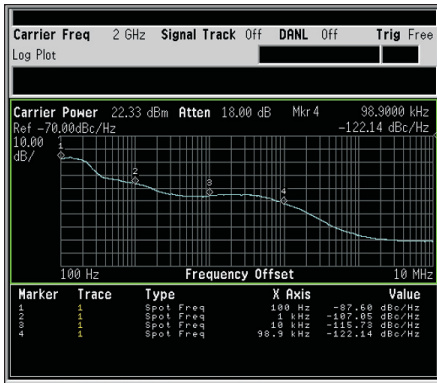


Figure 2 · MLSE-0220 phase noise measurement at 2 GHz.

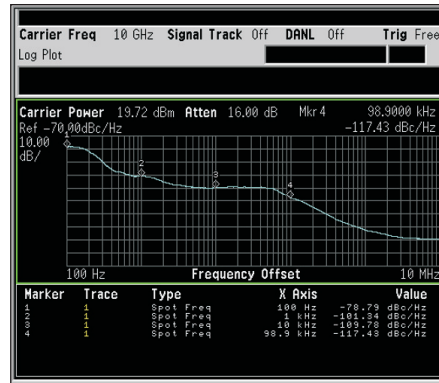


Figure 3 · MLSE-0220 phase noise measurement at 10 GHz.

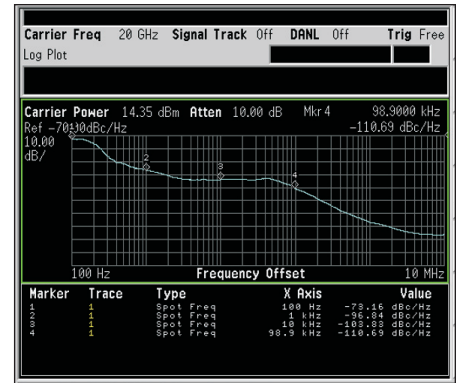


Figure 4 · MLSE-0220 phase noise measurement at 20 GHz.

Programmability and PC Control

The MLSE units are easily controlled by a standard PC or laptop computer, through the parallel port using a 5-wire serial command structure. The frequency step size is 1 Hz, with user control over step size as needed for a particular system's architecture.

The units are operated by an internal microcontroller with non-volatile memory. In addition to user-input frequency and setup data, the unit will deliver data on its operation back to the user to confirm operating status, including its internal temperature. The unit can store up to 1,000 preset frequencies in internal memory.

Performance Specifications

Key specifications of the MLSE-0220 are summarized in the list below:

- Power output: +20 dBm typical (2 to 20 GHz)
+17 dBm typical (1 to 22 GHz)
- Power level vs. frequency: ± 1 dB
- Power control: 0 dBm ± 20 dB with 0.1 dB resolution

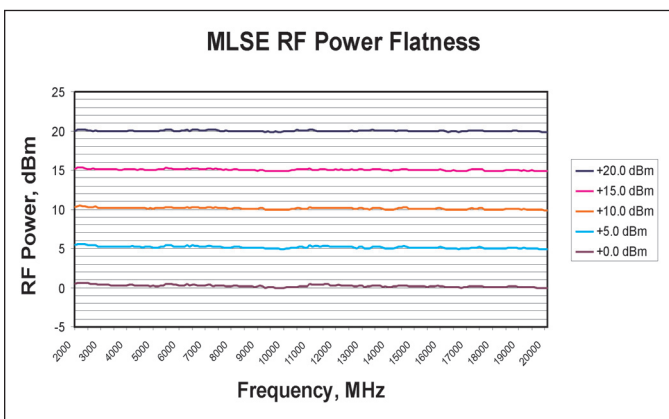


Figure 5 · Power output of the MLSE series is controlled to within ± 1 dB over the entire frequency range.

- Switching speed: 10 to 18 ms, depending on step size
- Harmonics: -12 dBc typical
- Non-harmonic spurious: -60 dBc typical
- Reference: 10 MHz standard, 5 to 100 MHz available
- Reference input level: 0 dBm ± 6 dB
- Digital control: 5-line serial
- DC power: 15 VDC @ 2100 mA; 5 VDC @ 1100 mA
- Operating temperature: 0 to $+70^\circ\text{C}$
- RF connectors: SMA-F
- Enclosure size: 7 \times 5 \times 2 inches, excluding connectors
(Note that the unit does not actually include a display and keyboard as depicted in the promotional photos!)
- Weight: 3.5 lbs.

Optional Frequency Outputs:

- 2nd LO frequency: 500 to 4000 MHz
- 2nd LO output power: +15 dBm minimum
- 2nd RF output frequency: 4 to 11 GHz
- 2nd RF output power: +10 dBm
- 2nd RF power level vs. frequency: ± 3 dBm
- 2nd RF harmonics and spurious: same as main output
- 2nd RF phase noise: same as main output

Summary

The MLSE series synthesizers provide designers with a new option for frequency control of high performance systems requiring a 1 to 22 GHz signal source, plus optional additional LO signals.

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HFELink 302

Test Equipment Performance at an Affordable Cost



FULL 2-20 GHZ AND 1-22 GHZ FREQUENCY COVERAGE IN SINGLE UNITS AND PORTABLE SIZE

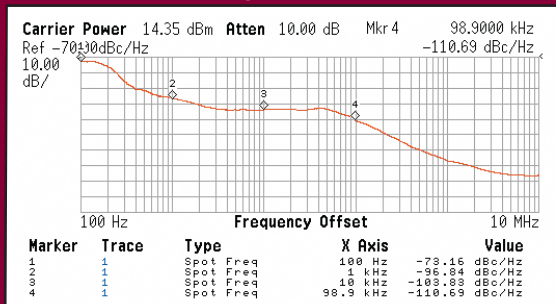
Micro Lambda Wireless, Inc. a leader in the development of next-generation YIG devices introduces a new line of high performance frequency synthesizers covering the 2-20 GHz and 1-22 GHz frequency range. Designed specifically for wide band and low noise applications, these new frequency synthesizer/extenders rival the best lab-grade test instruments on the market.

MLSE-SERIES WIDE BAND FREQUENCY SYNTHESIZERS.

This series of frequency synthesizers offer standard wideband tuning ranges covering 2-20 GHz and 1-22 GHz in standard models. RF Output power levels of +20 dBm and +17 dBm are offered respectively. Standard models provide output power leveling over the range of ± 20 dB with 0.1 dB resolution. Frequency step size of 1 Hz is standard, but is programmable with software for customer specific requirements. External reference frequency of 10 MHz is utilized, but 5 to 50 MHz are offered as options.

Options include second RF output covering 4-11 GHz which can be used for down conversion, a low noise 2nd L.O. output tunable over specified frequencies and an auxiliary input to add an additional frequency input within the units range – into the synthesizer switch matrix. All units measure 5"x7"x2" and weigh 57 oz.

Phase Noise
RF Frequency - 20 GHz



Excellent phase noise performance of -73 dBc/Hz at 100 Hz offset, -96 dBc/Hz at 1 kHz offset, -103 dBc/Hz at 10 kHz offset, -110 dBc/Hz at 100 kHz and -131 dBc/Hz at 1 MHz is provided at 20 GHz. The units operate from +15V and +5V supply lines and frequency control is via a 5-wire serial (SPI & busy) input protocol.

FEATURES

- 2.0- 20.0 GHz, 1.0 –22.0 GHz, Frequency Bands
- Excellent Phase Noise
- 1 Hz Step Size
- Output power Leveling / 0.1 dB resolution
- Fundamental RF Output available for downconverting

"Look to the leader in YIG-Technology"

**MICRO LAMBDA
WIRELESS, INC.**

