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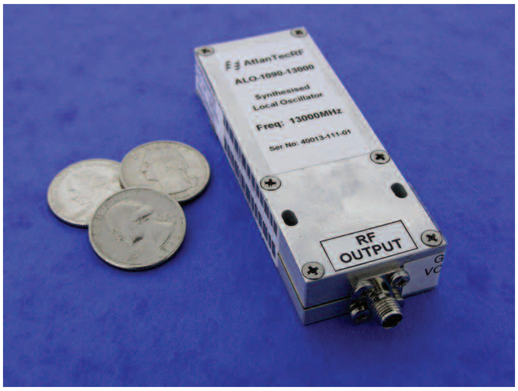

Synthesized Local Oscillators Offer Wide Choice of Output Frequency

In many commercial applications, particularly in the military and aerospace sphere, space is at a premium and component weight is a key consideration. In such situations, light weight and the flexibility afforded by modularity are key considerations, as is having a range of products to meet all requirements.

To meet these criteria, AtlanTecRF has developed the new ALO series of synthesized local oscillator modules that combine small size (33 × 88 × 16 mm) and light weight with a large range of output frequency. The modules are offered in frequency ranges with total coverage from 5 to 14.55 GHz.

These new devices complement the company's phase-locked oscillators in the APL series that utilize coaxial resonators up to 3 GHz and dielectric resonators (DRO) up to 14 GHz. These require a crystal-controlled reference oscillator in the 25 to 300 MHz range to be provided, either internally or externally, and as a result achieve very good phase noise. DRO-based oscillators are relatively narrow band in frequency due to the high Q of the DRO puck that has to be mechanically factory tuned and therefore has to be selected at the time of ordering, potentially lengthening the turnaround time.

Programmed to Serve

The required output frequency of the new ALO series is factory programmed to customer order with steps available in 500 kHz increments within the frequency range of each module. This is achieved via a group of pins in the power and alarm connector and can therefore be set to the required frequency very conveniently and quickly, thus shortening turnaround time. All models in the series share a common reference oscillator circuit based around a 20 MHz temperature-controlled crystal oscillator (TCXO).

The new reference oscillator design provides a benefit in terms of temperature stability that is improved by a factor of more than two times and allows a greater operating temperature range over the older designs. Also, the frequency stability of the oscillators is very good as a result of the internal TCXO with a setting error of less than ±0.5 ppm and tem-

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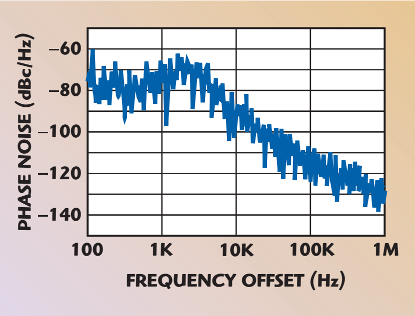
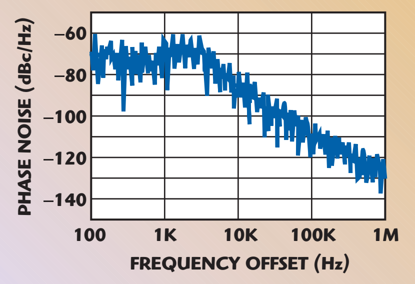
perature stability of less than ±2.5 ppm for the entire specified operating temperature range of –30° to +70°C.

PHASE NOISE

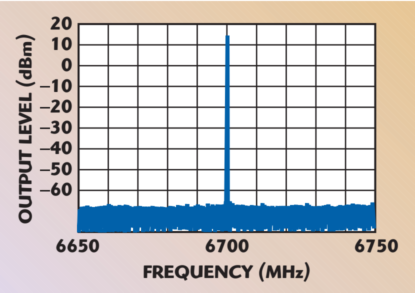
The synthesized oscillators have low phase noise at 100 kHz offset from the carrier of typically less than –105 dBc/Hz and are phase locked to the internal 20 MHz TCXO. The plots in ***Figures 1*** and ***2*** show the measured phase noise of sample oscillators at 6.7 and 13 GHz, respectively, at offsets from the carrier between 100 Hz and 1 MHz.



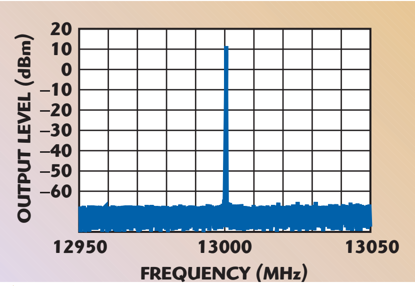
▲ *Fig. 1 Phase noise of a 6.7 GHz phase-locked oscillator.*



▲ *Fig. 2 Phase noise of a 13 GHz phase-locked oscillator.*



▲ *Fig. 3 Spur plot of a 6.7 GHz phase-locked oscillator.*



▲ *Fig. 4 Spur plot of a 13 GHz phase-locked oscillator.*

The modules are ideally suited for incorporation into modular designs for both commercial and military applications in the 5 to 14.55 GHz frequency range, particularly where size and space is at a premium. They are also suitable to be designed into special-to-type test fixtures, again where space is limited. Small, portable, battery-powered test sets can be constructed where a simple go, no-go test is required (on an aircraft radar system, for example).

The oscillator modules are fitted with a six-pin connector for providing DC power and lock alarm monitoring. They are supplied with a mating connector that allows them to be easily connected into existing or custom designs. In addition, +12 V DC operation at < 300 mA fits with the available power requirements of many OEMs.

APPLICATIONS

With a footprint of just 88 × 33 mm, the synthesized oscillators are small and versatile. They are suitable for applications such as the internal local oscillator for a block down-converter or up-converter for satellite monitoring or test systems where low phase noise and adequate mixer drive level are required. The synthesized oscillators can also be incorporated into existing receivers to act as independent frequency markers.

Very small size block converters can be constructed at an economic price by combining an ALO synthesized oscillator with a connectorised, double-balanced mixer and miniature filters. Their small size also makes the series ideal as the second, fixed local oscillator of an up/down conversion receiver design. Furthermore, the 5 to 6 GHz versions of the oscillators have sufficient output power at greater than +14 dBm to provide the common local oscillator for a pair of mixers in a direct conversion IQ receiver.

The oscillators can also form two-tone or multi-tone test sources that may be configured with combiners, filters and attenuators in suitable package formats for use in receiver or amplifier intermodulation distortion (IMD) test configurations. The good spectral purity, with regards to both spurs and harmonics, allow the modules to be configured without the need for external filters, although for some critical applications a low pass, harmonic filter may be desirable.

The plots shown in ***Figures 3*** and ***4*** are the measured spectra from two sample synthesized oscillators centered on 6.7 and 13 GHz, respectively. The span of ±50 MHz either side of the programmed centre frequency shows the absence of reference related spurs against a specification of < –60 dBc.

Inexpensive test sources for radar receiver or radar warning receiver (RWR) testing can be easily put together by selecting a suitable oscillator frequency and routing the output through a proprietary pulse modulator and step attenuator. In conjunction with a simple arbitrary waveform derived pulse generator, this would offer both minimum discernable sensitivity (MDS) and range tests in a single low cost test set. Similarly, stable, compact sources for TWT testing and aging can be constructed or provided as off-the-shelf bench test sets.

Additionally, more than one module combined with a multi-way switch would provide an easy-to-use test set for testing several sub-bands within a small volume package. For those applications requiring more output power, such as a short-range radiating test set, a range of amplifiers is available that can provide power levels of up to +30 dBm.

For higher frequency applications (above 14.5 GHz) the modules have sufficient output power to drive most frequency multipliers, which would allow operation up to at least 40 GHz or beyond, dependant upon connectors, and AtlanTecRF can supply a suitable range of amplifiers and frequency multipliers.

CONCLUSION

The new ALO series of synthesized local oscillator modules offers compact size and light weight, allied to modularity and a range of outputs that provide flexibility. These features make it a cost-effective and efficient option for many commercial and military applications, particularly where space is at a premium.

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