

# Pocket-Size Signal Source

Employing a compact, low-phase noise, high-frequency source in your design will combine the best attributes of high frequency signal source with compact portability.

## SPECIFYING CRYSTAL OSCILLATORS

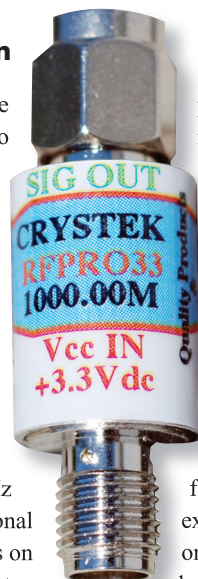
Specifying a crystal oscillator properly should start with a thorough understanding of the performance specifications that are required by a given application. Frequency, accuracy and stability may be given by a government standard. Power consumption may be dictated by battery longevity. So an overall review of the entire system will dictate some or most of the oscillator parameters.

## By Ramon Cerda, Crystek Corporation

In the not too distant past, procuring a low phase noise 1 GHz source was very expensive, limiting it to only very high-end applications that could support the cost of incorporating this technology in the design. Responding to this need, oscillator manufacturers developed surface-mount SAW-based 1 GHz clocks and voltage controlled SAW oscillators (VCOSOs) as a solution. However, these surface-mount oscillators are meant to be integrated into a final product and, therefore, lack the flexibility that would have made the technology useful in wider range of applications.

To meet the needs of these additional applications, the goal was to develop a sort of “connectorized” 1 GHz RF source. The initial solution was to house the traditional 1 GHz source in a big enough package, stick some SMAs on it and call it “connectorized.” While this was a solid first step in the product’s development, the real challenge was to design an oscillator small enough to fit into the internal space of an attenuator housing while at the same time maintaining the low phase noise performance of the 1 GHz RF source.

Achieving this size and performance benchmark would



allow many applications to realize the benefits of low phase-noise signal control. This performance achievement is significant in wireless designs as low phase noise performance can directly translate to greater communications distances.

## Applications for an In-line 1 GHz RF Source

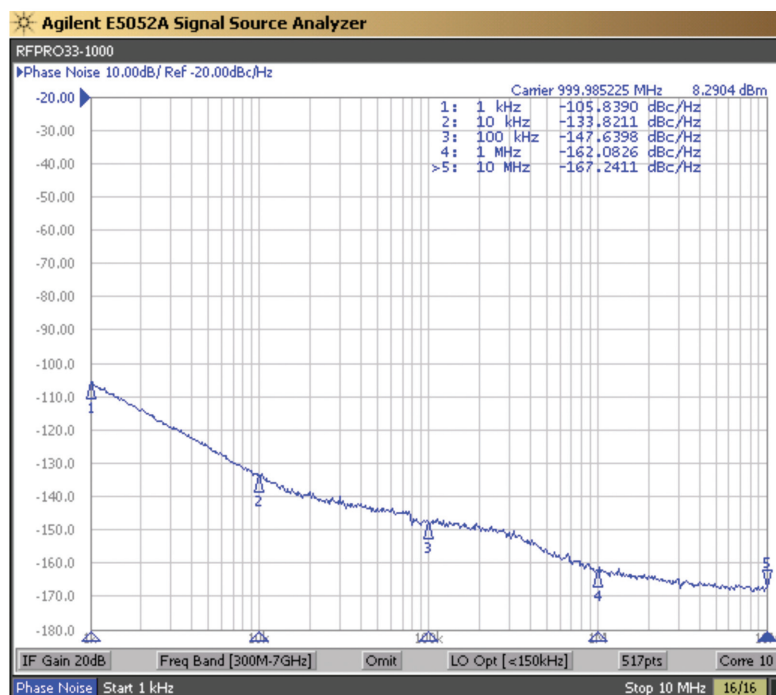
The product is perfect for many applications, including the following:

**Evaluation Boards** — Some semiconductor manufacturers now offer Direct Digital Synthesis (DDS) chips, requiring a low phase noise 1 GHz clocking source. If you order an evaluation board for these DDS chips, it will come with an option for an external 1 GHz source. With this set-up, simply connect one end of your 1 GHz source directly to the evaluation board and the other to a clean +3.3 V power supply. This

in-line source will allow the user to bypass the internal phase-locked loop (PLL) of the DDS which is not as “clean,” hence the output of the DDS spurious free dynamic range (SPDR) and phase noise performance can be quickly tested. By using a compact, connectorized 1 GHz clocking source, you can also perform long term tests without tying up an expensive RF generator.

**Test Equipment Demos** — With this new low-phase noise, connectorized RF source technology available, a salesperson demonstrating scopes, spectrum analyzers, etc. can carry the 1 GHz source in his pocket instead of a heavy signal generator. Today’s models can achieve a noise floor of -167 dBc/Hz enabling the instrument to show its true dynamic range. Quite often, these salespeople are carrying some sort of signal board to demo their instruments, but the reality is that a better signal quality can be achieved with the compact 1 GHz source.

**General Lab Use** — Performing block up and down conversion is a good application for such units. To illustrate, the typically-achieved +7 dBm minimum output power means that it can directly drive a +7 dBm passive mixer. By mixing, for example, one can extend the frequency range of a signal source analyzer (SSA). In the same manner, one can decrease the fre-



Above, Figure 1. Crystek’s RFPRO33-1000 family of SAW oscillators. Right, Figure 2. Single side band phase noise plot of RFPRO33-1000.

quency range of a unit under test (UUT) so that it can be measured by the SSA. This is achieved by filtering either the appropriate sums or differences of the mixing signals.

Further, a low phase noise 1 GHz source is always useful in an RF lab environment. It can easily be multiplied by two or more to achieve an RF source of 2 GHz and beyond as need arises.

**Technology Solution** — Crystek Corporation has recently addressed this technology challenge with the development of a new line of SAW oscillators. The RFPRO33 family is packaged in a traditional attenuator SMA housing (see Figure 1.) But it is more than just a re-packaging. It is an economical product that offers phase noise performance of -133 dBc/Hz at 10 kHz offset (see Figure 2), a feat unmatched by bench top signal sources costing thousands of dollars. The user simply needs to connect +3.3 V to the female SMA, and it will output a 1 GHz (+7 dBm min. into 50Ω) signal on the male SMA. Figure 3 shows the mechanical dimensions of this family of products.

Internally, the device uses a high performance SAW-stabilized oscillator directly at 1 GHz. Its frequency stability is typically +/-150 ppm over

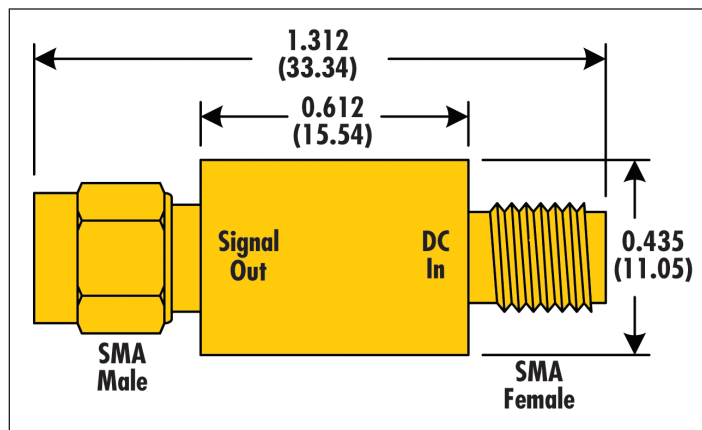


Figure 3. Mechanical dimensions of the RFPRO33 family.

-20°C to +70°C. There is no multiplication taking place and, hence, no sub-harmonics. Typical power output is +8 dBm with a current consumption of only 20 mA.

The RFPRO33 has been initially released at 500 MHz and 1 GHz. With the development of additional frequencies, more flexibility as to the use of a compact, low-phase noise 1 GHz unit will make it more important as a signal source. The engineer-

ing community will be able to roll out this technology in many more unforeseen applications.

### Conclusion

Employing a compact, low-phase noise, high-frequency source in your projects will bring together the best attributes of high frequency signal source with compact portability. This combination allows wireless design engineers many new options in high-performance frequency test and measurement

which otherwise would have been possible only with cumbersome and expensive equipment.

### WDD

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