

## Ultra-Low Phase Noise, Low Cost Timing Solutions

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[www.abracon.com](http://www.abracon.com)

Current state-of-the art communication circuitry, such as:

- $\mu$ Wave Frequency-Up-Converters
- Point-to-Point  $\mu$ Wave Backhaul
- Satellite Modem
- High-End Networking
- Test & Measurement Equipment
- .....etc.

all have one thing in common; an exceptionally low phase noise frequency reference. Historically, to achieve this level of phase noise, oscillator manufacturers have relied on either SC-Cut crystals or, 5<sup>th</sup> or 7<sup>th</sup> overtone AT-Cut crystals for their reference oscillator solutions.

The former yields an OCXO which is bulky, consumes excessive power and is fairly expensive. The latter is complicated to implement, limited in frequency-offering and, inhibits system's ability to self-correct for Aging and temperature drift.

To address the composite challenge of cost, size, power, frequency stability & long-term aging correction; Abracon has developed the [ABLNO](#) series of VCXO's with exceptional phase noise characteristics, housed in a [9x14mm](#) package.

Offered in fifteen standard frequencies between 50.0MHz & 156.25MHz; these devices offer designers a comprehensive selection for reference timing. Additionally, the ABLNO series is available in fixed clock configuration, if system requirements cannot use a Voltage Controllable oscillator.

Figure (1) illustrates the typical phase noise at 50MHz carrier, whereas, figures (2) & (3) represent typical phase noise at 100MHz and 156.25MHz carriers, respectively. Table (1) summaries the typical Phase Noise performance for ABLNO series configured as VCXO's, at these carriers, while Table (2) represents the absolute worst case Phase Noise characteristics.

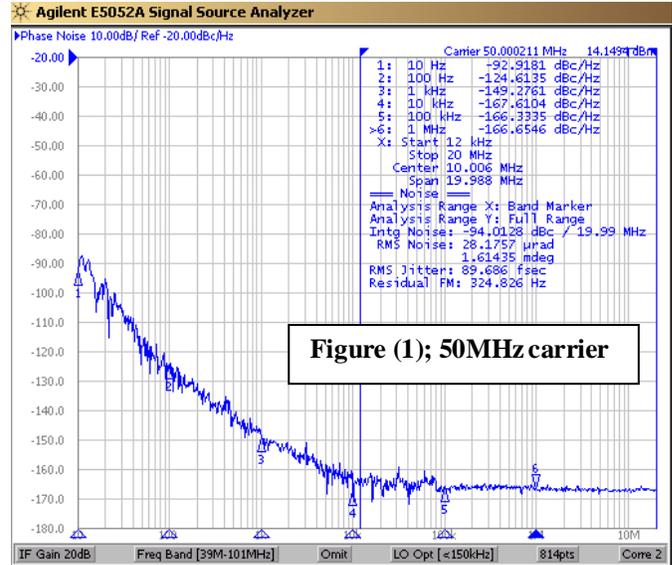


Figure (1); 50MHz carrier

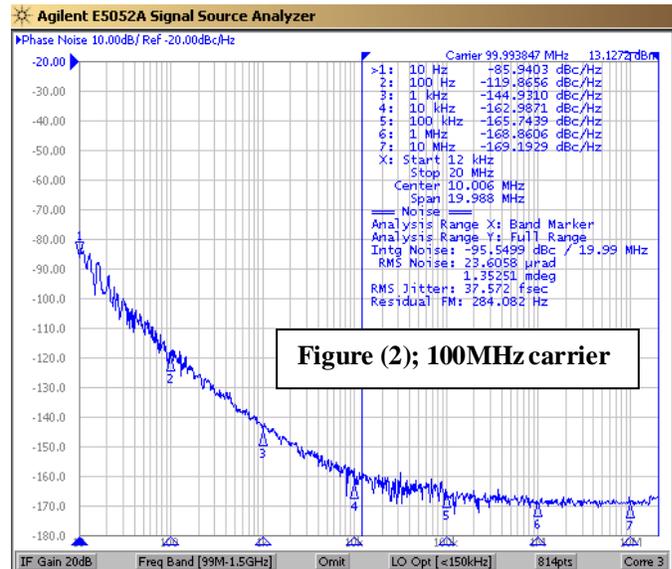


Figure (2); 100MHz carrier

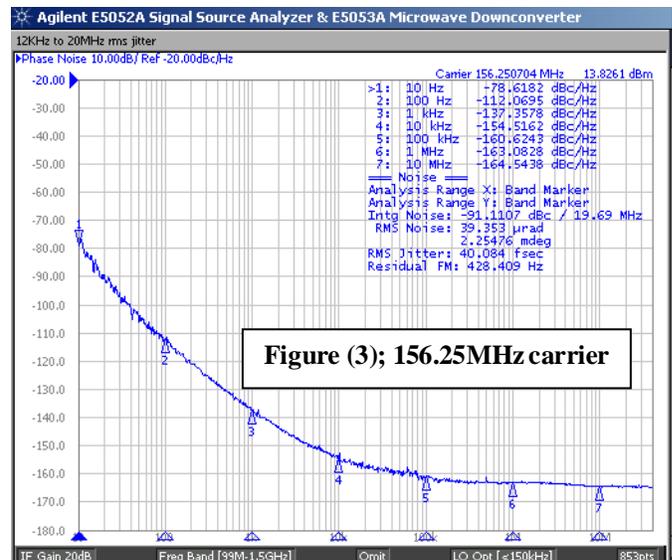


Figure (3); 156.25MHz carrier

**Table (1)**
**Typical Phase Noise Performance**

Offset from the carrier	F0= 50MHz (dBc/Hz)	F0=100MHz (dBc/Hz)	F0=156.25MHz (dBc/Hz)
10Hz	< -90	< -88	< -75
100Hz	< -120	< -118	< -110
1,000Hz	< -145	< -141	< -140
10,000Hz	< -165	< -160	< -155
100,000Hz	< -166	< -161	< -161
1,000,000Hz	< -166	< -165	< -165

**Table (2)**
**Worst Case Guaranteed Phase Noise Performance**

Offset from the carrier	F0= 50MHz (dBc/Hz)	F0=100MHz (dBc/Hz)	F0=156.25MHz (dBc/Hz)
10Hz	-82	-82	-70
100Hz	-155	-115	-105
1,000Hz	-140	-138	-135
10,000Hz	-160	-155	-150
100,000Hz	-165	-160	-160
1,000,000Hz	-165	-160	-160

ABLNO series is designed with specially processed, 3<sup>rd</sup> Overtone, AT-Strip Quartz Crystals which are optimized using various processing techniques to yield exceptionally high un-loaded “Q” and frequency stability over temperature. The combination of these crystals and the Oscillator Circuit designed with best-in-class phase noise as the primary objective; has yielded exceptionally low rms jitter over the most desired bandwidth of 12kHz to 20MHz from the carrier.

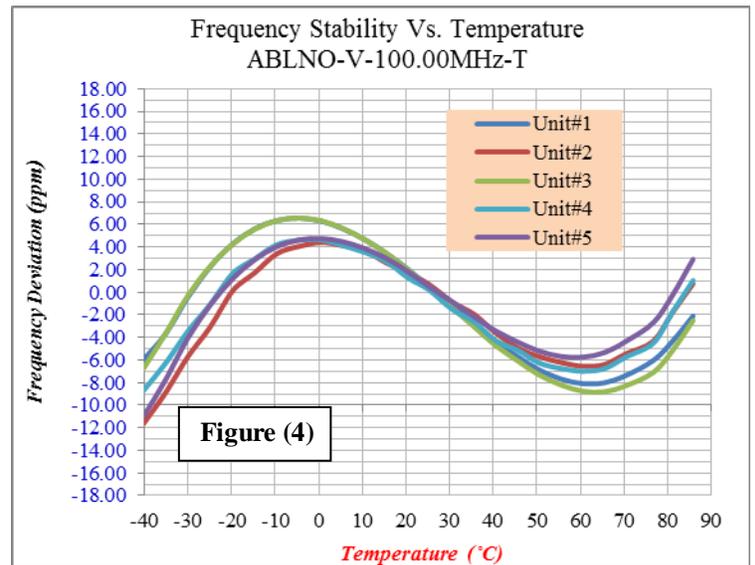
**Table (3)**
**ABLNO series rms jitter**

Jitter Band Width (12kHz ~ 20MHz)	F0= 50MHz (dBc/Hz)	F0=100MHz (dBc/Hz)	F0=156.25MHz (dBc/Hz)
Typical	< 95 fs	< 40 fs	< 40 fs
Maximum	125 fs	75fs	75fs

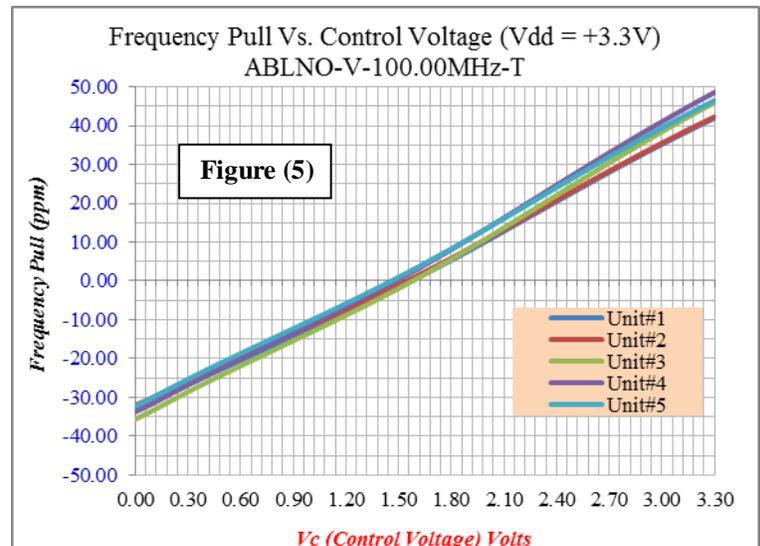
To ensure exceptional Phase Noise performance, ABLNO series not only meets the performance parameters outlined above as a function of design, but also, Abracon conducts room temperature testing

for Phase Noise and rms jitter compliance, on 100% of the product.

As mentioned earlier, Abracon has instituted proprietary Quartz-Blank processing techniques to significantly reduce the frequency vs. temperature error on these devices. Typically, ABLNO series of devices hold less than  $\pm 12$  ppm error ( $\pm 18$  ppm maximum), relative to the measured frequency at 25°C. This stability is guaranteed over the operating temperature range of -40°C to +85°C, as shown in figure (4) below.



In addition, these devices are guaranteed to hold better than  $\pm 7$  ppm Aging over a 10-year product life. To facilitate frequency correction capability over this period, a minimum frequency pull-ability of  $\pm 28$  ppm is guaranteed in VCXO configuration, see figure (5).



ABLNO series is designed with LVCMOS output, desired in most applications and draws 10mA typical @ 50MHz carrier and 17mA typical at 100MHz carrier.

This series is available through Abracon's Global Distribution Network, in the following standard frequencies:

50.00MHz, 80.00MHz, 81.92MHz, 92.16MHz, 96.00MHz, 98.304MHz, 100MHz, 104.00MHz, 106.25MHz, 120.00MHz, 122.88MHz, 125.00MHz, 150.00MHz, 155.52MHz & 156.250MHz

Most of the above specified frequencies will be in Distribution stock by October, 2013; both in fixed clock (XO), and Voltage Controllable (VCXO) configuration. Non-Standard frequencies can also be developed, please contact Abracon at:

[tech-support@abracon.com](mailto:tech-support@abracon.com)

#### *Stocking Distributors' Links:*



[Avnet Express](#)

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#### **About the Author:**



Syed Raza is the Director of Engineering at Abracon Corporation, and has been in the Frequency Control Industry since 1993. He holds a BSEE, a US Patent and has held senior technical positions at Motorola & Netcom, prior to joining Abracon in 2007.