

## **Phase Noise Origins and Measurements**

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### **Abstract**

The need to quantify the frequency stability of crystal oscillators emerged during WWII with military radar and communications systems. By the early 1970s, IEEE established the basis for the initial 1139 standard. At that point, the then slow, complex measurement was primarily used by defense systems providers and a handful of supporting component manufacturers. With modern defense and commercial communications systems, phase noise is being rapidly adopted as the standard for verification of signal stability.

A basic oscillator circuit is presented to demonstrate where phase noise originates, along with some design considerations for improving performance. Measurement types will be further expanded to cover residual/additive as well as relating phase noise to jitter. Finally, the benefits of making phase noise measurements using a modern real time, cross correlation phase noise analyzer will be presented to demonstrate how verification of this valuable parameter has become straight forward, fast and highly accurate.