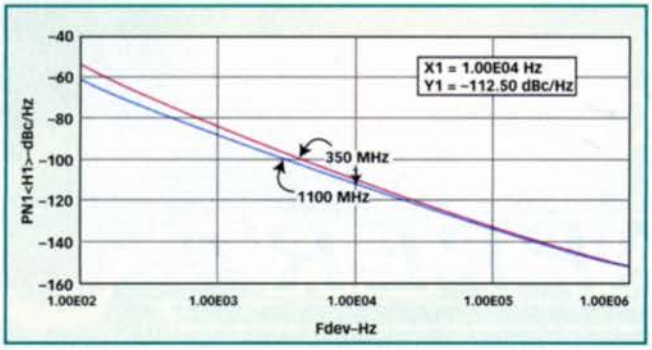
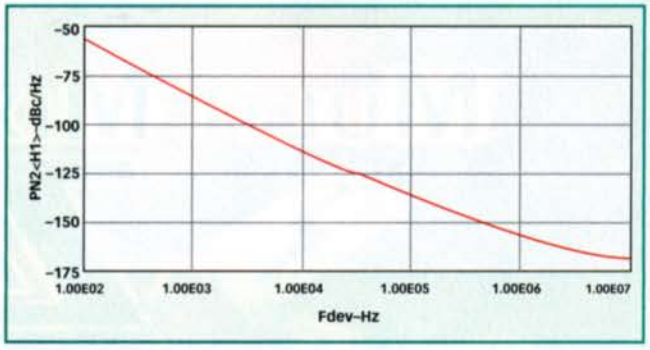


2. This phase-noise plot shows the performance of a DCFO oscillator for two carrier frequencies at the edges of the full bandwidth with bias of 28 mA at +5 VDC.

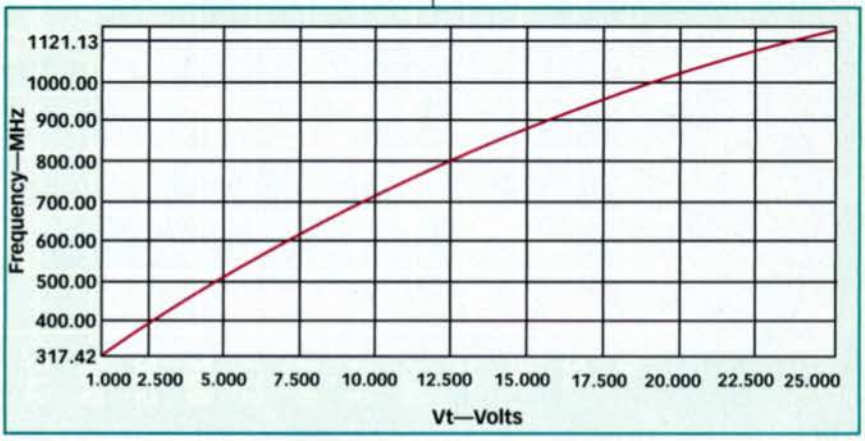


3. This phase-noise plot shows how the performance of a DCFO oscillator improves with a +12-VDC (28-mA) supply.

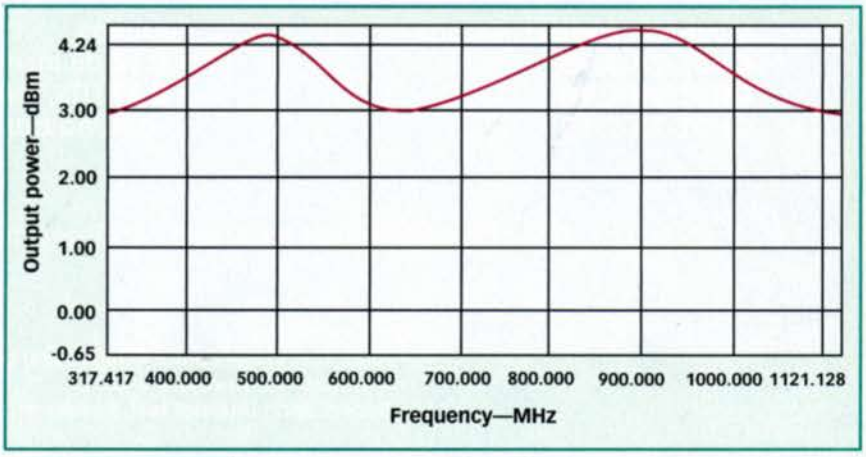
The new VCOs are particularly well suited for the new families of cellular handsets and base stations with Universal Mobile Telephone Systems (UMTS) requirements. Increased-bandwidth coverage is needed in support of combined voice, data, and wireless Internet services, yet the frequency source must also deliver very low levels of single-sideband (SSB) phase noise in order to reliably handle the complex digital modulation employed in these systems while also stably operating within tightly spaced communications channels. In a digital wireless-communications system, excessive phase noise can cause degradation in the effective system bit-error rate (BER), resulting in a loss of transmitted/received data and a loss of voice and data performance as perceived by the wireless customer.

Wideband tuning and low phase noise have long been assumed as opposing design targets. A decrease in VCO phase noise generally meant a decrease in tuning bandwidth, due to the problem of simultaneously controlling the loop parameters and optimizing the time average loaded quality factor (Q) of the VCO resonator over the tuning range. The tuning range of the oscillator generally influences the phase noise and typically there is a trade-off between the continuous tuning range of VCOs and the amount of phase noise generated by the varactor capacitance modulation.[1] On the other hand, the requirements for low-noise performance over a broad (more than an octave) frequency range are typically demanding. Thus, there exists a need for method and circuitry for improving the phase-noise performance over a wide tuning frequency range, typically more than an octave-band tuning range.

Although a great deal of progress has been made in recent years in monolithic, integrated-circuit (IC) VCOs, with a desire to fabricate completely integrated radio front-end circuitry for large-volume communications applications (such as cellular handsets), the best performance levels are still the domain of discrete-device VCOs. In



4. This plot shows the extremely linear tuning response of a DCFO oscillator with tuning voltages from 1 to 25 V.



5. Although specified for +1 dBm and ±3.5 dB flatness, the output power of a typical DCFO oscillator is much higher and flatter over frequency.