In the rapidly growing world of wireless telecommunications, numerous trends are gaining widespread popularity. Most dominant are wide band cellular radio transceivers that can support multiple carriers and multiple standards while preserving high signal quality required by bandwidth efficient complex modulation schemes. Design engineers envision a common hardware platform capable of processing a wide range of carriers, while supporting dynamic switching between transmission standards.

A PLL+VCO source which can be tuned over a wide frequency range is a critical circuit for the wideband transceiver. Generating local oscillator (LO) signals for the up and down-conversion of RF signals is its application. The challenge for a wideband PLL+VCO is to cover a broad frequency range while maintaining excellent noise and low spurious performance at each frequency.

Hittite Microwave exceeded this challenge with the introduction of the HMC830LP6GE, an industry leading, low noise, wide band, Fractional-N Phase-Locked-Loop (PLL) with integrated Voltage Controlled Oscillator (VCO). The HMC830LP6GE generates continuous frequencies from 25 MHz to 3000 MHz, and represents a truly unique product which delivers unsurpassed performance.

The Importance of Low Phase Noise and Low Spurious Products in a Transceiver Design

In addition to frequency coverage, key performance parameters to be considered when selecting a PLL+VCO are phase noise, spurious products and lock time.

Low phase noise is important in transmitter design as the local oscillator noise is amplified by the subsequent amplifier stages and eventually fed to the antenna together with the desired signal. The desired signal is accompanied by broadband noise originating from local oscillator phase noise. Noise generated can mask nearby lower power stations or affect the receiver in a Frequency Division Duplexing (FDD) system. Conversely, a low-phase noise Local Oscillator (LO) will give the designer greater margin for non-linearity and any other RF impairments in the transmitted signal. In general, low phase noise helps preserve transmitted signal quality.

Spurious products on the transmitted signal must also be kept at a low level so that they do not interfere with other users in the same system, or nearby systems. On the receive side, low phase noise is crucial to obtaining good receiver signal-to-noise-ratio (SNR), especially at high signal levels when phase noise exceeds the thermal noise floor of the receiver.

Sometimes, the desired received signal will be accompanied by a large interferer in an adjacent channel. When the two signals are mixed with LO output, the down converted band consists of two overlapping spectra, with the desired signal suffering from significant noise due to the tail of the interferer. This effect is known as reciprocal mixing. A spurious product at the channel spacing needs to be low because it will mix with the strong interferer and fold onto the desired signal. A high level of spurs can also affect lock time by forcing the design engineer to choose a narrower PLL loop bandwidth in order to provide sufficient attenuation of these spurs, but a narrower loop bandwidth has the effect of slowing down the PLL response.

Hittite Microwave's HMC830LP6GE: A Truly Unique Product

Hittite's HMC830LP6GE features...
industry leading phase noise and spurious performance across all frequencies, which make it the best choice for applications that require excellent signal quality performance and high SNR. The HMC830LP6GE also features an integrated Phase Detector (PD) and delta-sigma modulator which are capable of operating up to 100 MHz in fractional mode to permit wider loop-bandwidths with excellent spectral performance.

In addition to high integration and excellent performance, the HMC830LP6GE offers a number of other features including: exact frequency mode. This enables users to generate frequencies with 0 Hz frequency error with minimal spurious emissions at multiples of channel spacing; CSP (cycle slip protection) technology that allows faster frequency convergence; and Auto-Calibration of the VCO subsystem, which ensures single point calibration for optimal operation over the device’s full temperature range.

With its superior performance, the HMC830LP6GE is ideal for wideband multi-carrier, multi-standard cellular base stations as it can be used not only in up or down conversion, but also as a low jitter clock LO generator, or even as a tuneable reference source for spurious free performance. It is also ideal for high QAM microwave point-to-point links, and communications test equipment.

Hittite’s HMC830LP6GE Figure of Merit is -230/-227 dBc/Hz in integer and fractional modes respectively. Double sideband RMS jitter is less than 180 fs and noise floor is -171 dBc/Hz in fundamental mode at 2 GHz. The worst integer boundary spurious product is around -55 dBc when falling in-band. These specifications make the HMC830LP6GE the ultimate choice for designers looking for a single, superior performance, multi-purpose, multi-application device to cover a wide frequency range. The HMC830LP6GE is housed in a 6 x 6 mm plastic leadless surface mount package and provides excellent temperature stability over the -40 °C to +85 °C temperature range.

Hittite Microwave continues to lead the way with state-of-the-art innovations in low phase noise microwave components. In addition to this new Fractional-N PLL+VCO product, Hittite is well known for providing high performance frequency generation and distribution products, including dividers, multipliers, dynamic and static prescalers, VCOs, phase locked oscillators (PLOs) and complete synthesizers. More than 100 standard LO/Clock Generation products are available from Hittite which can be utilized in signal generation loops and system clock applications from DC to 80 GHz. Hittite has developed hundreds of custom VCOs to meet demanding application specific requirements.

Designers can choose from more than 925 products over 31 product lines offered by Hittite, including modulators, phase shifters, attenuators, amplifiers and switches. Data sheets and supporting informa-
tion for all of Hittite's products are available online at www.hittite.com.

Figure 3: The right hand side plot shows the HMC830LP6GE's exceptional jitter performance in fractional mode maintained over a wide frequency range. The left hand side plot shows the Figure of Merit (FOM) in fractional mode.