



- ▲ **UHF, VHF, L-Band, and S-Band coverage**
- ▲ **10 MHz to 4 GHz operating frequency**
- ▲ **125 MHz to 4 GHz modulated output**
- ▲ **10 MHz to 125 MHz direct output**
- ▲ **>250 MHz bandwidth on each (I&Q) input**
- ▲ **1 MHz synthesizer tuning step size**
- ▲ **Minimum +7 dbm output power (4 GHz)**
- ▲ **31.5 dB amplitude range, 0.5 dB step size**
- ▲ **TCXO, OCXO, or external 10 MHz reference**
- ▲ **PCIe x4 half length physical x1 electrical**
- ▲ **Windows™ and Linux API/drivers**

Wideband RF Up Converter

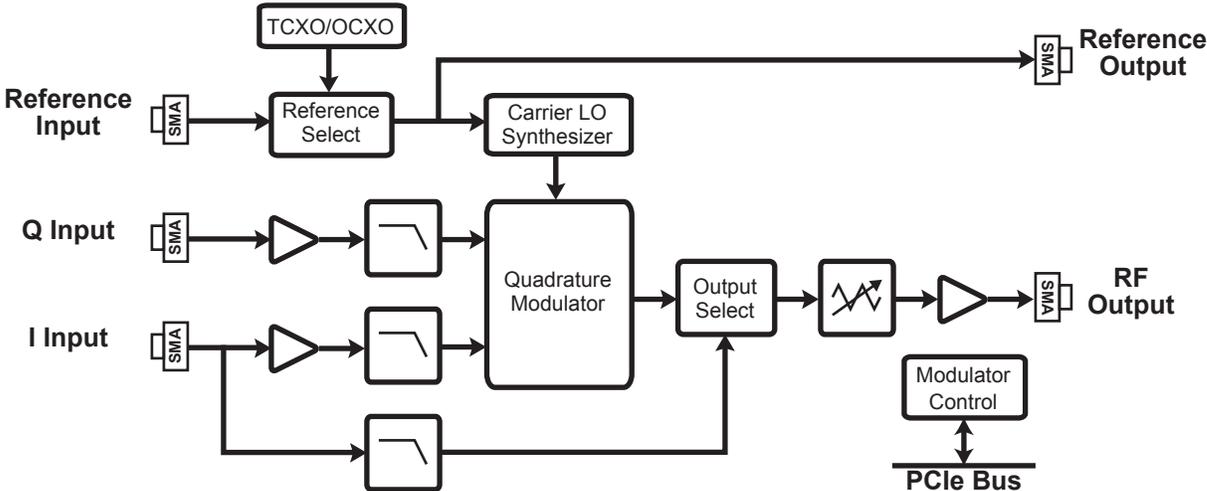
The *Wavefront Quadrature Modulator* product family supports direct RF modulation from any computer equipped with a PCI Express expansion socket. The product family includes frequency coverage and operating mode variants tailored to meet a variety of applications and budgets. A single unit is capable of supporting a frequency range from 10 MHz to 4 GHz. Lower cost options are available to cover specific bands of interest (UHF, VHF, L-Band, or S-Band).

The *Wavefront* family is built around a wideband quadrature modulator and broadband frequency synthesizer. The quadrature modulator features an extremely wide modulation bandwidth and operates over a very wide carrier frequency range. The on-board synthesizer features low phase noise and software controlled tuning across the full frequency range.

The precision of the frequency synthesizer is controlled through a 10 MHz reference clock. The reference can be supplied by an on-board temperature compensated crystal oscillator (TCXO) or oven controlled crystal oscillator (OCXO). An external source can also be supplied to achieve system-wide phase coherence.

The *Wavefront* features an RF amplifier chain consisting of a step attenuator followed by a broadband RF amplifier. The amplifier serves to boost the modulator output to a level sufficient to operate in low power wireless environments or to drive a power amplifier in high power applications. The attenuator provides coarse level control to compensate for gain variation over frequency.

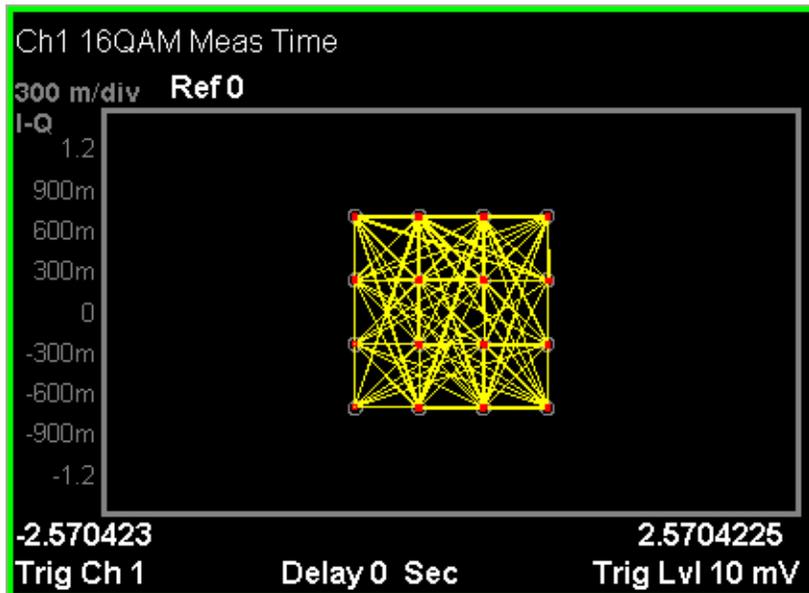
A unique feature of the *Wavefront* unit is the direct RF operating mode. This mode allows the user to bypass the quadrature modulator and directly map the I channel input to the RF output. This allows direct transmission of modulated signals through the same infrastructure as the quadrature modulator without changing cables.



Wavefront features ease of integration as an industry standard drop-in PCI Express card. Analog connections are made using SMA RF connectors. The presence of an external reference is automatically detected and used to lock the internal synthesizer. A convenient reference clock output is available to synchronize other systems to the Wavefront unit.

The hardware is controlled by a simple command set accessed through a Windows™ or Linux compatible driver. A simple API and sample code are provided to quickly get the unit operating.

The Wavefront product family can be directly connected to one of several baseband digital transceiver PCI cards offered by Red Rapids. The combined board set offers a complete bridge between the digital and RF domains in an open architecture solution.



Typical Output: 4 Msps 16-QAM Waveform at 1 GHz

Typical Applications

- ▲ GMSK, QPSK, QAM, or SSB Transmitter
- ▲ UMTS, GSM or CDMA Basestation
- ▲ Fixed Wireless or WLL
- ▲ ISM Transmitter
- ▲ Custom Wireless Waveforms
- ▲ Test and Measurement

Specification Summary

▲ RF Output Performance

Measured characteristics at 2 GHz*:

- Operating Frequency: 10 MHz to 4 GHz
- Max SSB output power: +16 dBm
- 1 dB Compression Point: +17 dBm
- Third Order Intercept: +29 dBm
- Noise Floor: -140 dBm/Hz
- Carrier Suppression: -60 dBc (calibrated)
- Sideband Suppression: -60 dBc (calibrated)

*Consult the Hardware Reference Manual for details.

▲ Carrier LO Performance

- Frequency Range: 125 Mhz to 4 GHz
- Step Size: 1 MHz
- Settle Time: 3 ms
- Phase Noise: -80 dBc/Hz (10 kHz offset)
- Harmonics: -15 dBc
- Spurious: -50 dBc
- TCXO Reference: 10 MHz +/- 1.5 ppm
- OCXO Reference: 10 MHz +/- 10 ppb

▲ Hardware

- Form factor: PCI Express half length
- Bus Protocol: PCI Express 2.0 (x1)
- Power dissipation: 10.6 Watts
- Airflow: 250 LFM at 35 degrees C

▲ Software

- Fedora Linux kernel 2.4 or 2.6
- Windows 2000, XP, Vista, or Server

▲ Build Options

- Operating Frequency:
 - Full: 10 MHz to 4 GHz
 - Partial: UHF/VHF, L-Band, S-Band
- Depopulate frequency synthesizer
- Baseband filter characteristics

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