

**Title:** Direct-conversion scheme points to software radio.(ParkerVision's Direct2Data direct-conversion architecture for RF receiver circuits eliminates almost all RF decoding and demodulation elements)(Product Announcement)

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Jacksonville, Fla. - The highly touted "software radio" may be one step closer to fruition if Jeff Parker's claims can be validated. Parker's company, ParkerVision Inc., an \$11 million design shop here, is beginning to demonstrate a direct-conversion architecture for RF receiver circuits that Parker says eliminates almost all RF decoding and demodulation elements. Called Direct2Data or D2D, the system captures RF signals and outputs digitized voice or data.

What's more, the circuit can capture any RF signal up to 3 GHz, Parker said. It can decipher a variety of digital cellular modulation schemes, including TDMA, CDMA and DECT. And it can be implemented in a variety of semiconductor technologies including CMOS, BiCMOS, bipolar and gallium arsenide.

The direct converter will require a 100-MHz clock, but in CMOS the device will consume less than 10 mA from a 1.8- to 5-V supply. "The antenna-matching components are the only change required to put out the data for all frequencies up to 3 GHz," said Parker. "That includes pagers, cell phones, PCS phones, GPS, wireless LANs, etc.-all from one small receiver IC."

Claiming a need to protect his patent applications and intellectual property, Parker refused last week to discuss the details of the architecture or to explain in detail how D2D actually works. He said he is willing to discuss licensing arrangements with interested parties.

The visionary software radio is most likely a portable device with relatively few ICs or hardware components. Rather than a battery of inductors, tuning capacitors and intermediate-frequency components, such a radio will likely utilize an integrated RF front end and a high-Mips DSP and microcontroller. The frequency at which the receiver operates, the modulation scheme it deciphers and other features are chosen and programmed in software.

The D2D demo board shows an I/Q (in-band and quadrature) output for a TDMA or a CDMA application. Digital oscilloscope measurements suggest a sensitivity of -120 dB ("a theoretical max," Parker said) with only 25 dB of gain in the circuit. "This is with a 10-dB low-noise amplifier on the front and 15 dB at the very low-frequency baseband, which costs literally pennies," he said. "A typical heterodyne TDMA or CDMA receiver requires approximately 110 to 120 dB of gain because it is so inefficient."

Additional demo boards in development will bypass the digital scopes, said Parker. One will utilize a general-purpose DSP and will show virtually all of the data processed into

its final result. Another will use application-specific components, but will show RF in and analog voice out. "There's very few parts," he said. "We will walk around and use it."

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