# FPGAs become rad-tolerant, rad-hard

Actel recently unveiled the latest device in its radiation-tolerant FPGA family and also announced that it is working on its first fully radiation-hardened FPGAs. The new RTAX4000S radiation-tolerant FPGA has twice the gate count of the company's last rad-tolerant FPGA, the RTAX-S, according to Ken O'Neill, director of military- and aerospace-product marketing. The new device, which has 500,000 ASIC gates, 840 I/Os, and 540 kbits of embedded memory, suits space applications, such as satellite-payload systems and scientific satellites.

Actel has built the device to the same radiation-tolerance standards as its other RTAX-S devices, O'Neill says. The FPGA includes embedded RAM with EDAC (error detection and correction), flip-flops that are practically immune to SEUs (single-event upsets), and memory-upset levels of less than $1^{-10}$ errors/bit/day.

The devices are immune to configuration upsets and have a TID (total-ionizing-dose) resistance as high as 300k rads (functional), which exceeds the requirement for most space applications and is more than ample for most space programs, according to O'Neill. Functional prototypes of the device, which aren't rad-tolerant, will be available in the first quarter of 2006, and radiation-tolerant versions will become available at the end of 2006.

In addition to the RTAX-4000S, Actel also announced that it is making progress in the development of its first radiation-hardened FPGAs, which take reliability one step beyond the radiation tolerance of its RTAX4000S. The upcoming RHAX-S family increases the reliability of the device to QML (qualified materials list) Class V. The projected device family will feature a TID resistance of 1M rad and logic and memory SEU resistance of less than $1^{-10}$ upset errors/bit/day.

The first device in the RHAX family will be a 250,000-system-gate (30,000-ASIC-gate) FPGA. Actel expects to deliver the prototype by the end of 2006 or early 2007 and production parts in 2008.

**—by Michael Santarini**
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# Multimode RF transceiver targets WEDGE mobile handsets

As cellular standards evolve toward 3G and beyond, the range of frequency bands and modulation schemes continues to broaden. Handset designers want to support legacy networks and strive to integrate support for next-generation networks. In the GSM (global-system-for-mobile-communications) space, the current state-of-the-art target is WEDGE, which combines WCDMA (wideband CDMA) and EDGE (enhanced data rate for global evolution). The emerging WEDGE phones, however, often use a combination of RF front ends that are glued together to support the new WCDMA standard that will extend data rates to 2 Mbps, whereas EDGE supports 385-kbps rates.

Start-up Sequoia Communications claims to have a SiGe (silicon-germanium)-based transceiver design that can support the full range of GSM-centric standards, including GPRS (General Packet Radio Service), EDGE, and WCDMA.

Sequoia is entering a crowded field seeking a share in the transceiver market. Vice President of Marketing and Business Development Charlie Wilcoxson points out that, although the market is crowded, no player has a dominant share. Wilcoxson shows a pie chart in which no provider of transceivers in the GSM market has a 20% share. And Wilcoxson claims that Sequoia has a technology that the other competitors lack in the new SEQ-5400 chip.

Sequoia is demonstrating first silicon in the lab transmitting and receiving the full slate of cellular signals in frequency bands of 800 to 2100 MHz. The fully analog implementation also integrates a SAW (surface-acoustic-wave)-receiver filter that other dedicated WCDMA transceivers lack. The company claims that the design will take the RF footprint in a WEDGE phone from 15.2 $cm^2$ to less than 7 $cm^2$. Sequoia also claims to be the first company to use polar modulation in a WCDMA transceiver. Wilcoxson believes that most competitors realize the benefits in power efficiency of polar modulation but haven't figured out how to apply the technique in WCDMA designs and are therefore using less-efficient linear modulation.

Sequoia claims that its chip will reduce the BOM (bill-of-materials) cost of the RF components in a WEDGE handset by 40 to 60%. The RF BOM cost in such a phone is now probably approximately $20. Samples are available now with volume slated for the first half of 2006. You could argue that the product is ahead of the market, and WCDMA hasn't taken off in North America. But Wilcoxson claims shipments are ramping in Europe and Asia. The company will also face a challenge with its first product targeting such a cut-throat market. Moreover, the DSP-based software-defined radios are waiting in the wings to support multiple cellular standards and even WiFi (Wireless Fidelity) technology.

**—by Maury Wright**
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