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### TECH RECON

#### XMC Board Uses FPGA and ADCs for Comprehensive GSM Monitoring

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The digital conversation requires the marriage of two key technologies: analog-to-digital converters (ADCs) and FPGAs. The trend has been to do that digital conversion as soon along the signal chain as possible. High-bandwidth A/D converters with high sampling rates must connect to extremely fast data transfer paths to store and process data with triggering or gating circuitry to digitize pulse waveforms at precisely the right time. To feed those needs, board vendors continue to push the barriers with solutions with ever faster ADCs and more sophisticated FPGAs. A number of digital receiver products combine ADCs and FPGAs on one VME, VPX, or PCI Express board, while others partition the integrate an FPGA processing engine with mezzanine-based ADCs using form-factors like FMC or XMC.

For this month's Editor's Pick section *COTS Journal* evaluated several FPGA-based digital conversion products based on three aspects: technology leadership, design innovation and market relevance. The winning product is the 71663 GSM Channelizer XMC module from Pentek (Figure 1). The board uses a single high-density Virtex-6 FPGA to implement 1100 digital receivers capable of capturing every possible up-link and down-link channel for both low-band and high-band GSM mobile telephone traffic. It has an exceptional dynamic range of greater than 85 dB allowing it maintain operation for very weak signals. The 71663's re-sampling filter delivers an optimal 4x over-sampling output data rate to streamline symbol recovery by the system processor. The board also boasts an extremely efficient frequency-multiplexed super-channel output mode to reduce PCIe traffic by a factor of four.



**Figure 1**

Jeff's Pick this month is the 71663 GSM Channelizer XMC module from Pentek. It uses the Virtex-6 FPGA to implement 1100 digital receivers capable of capturing every possible up-link and down-link channel for both low-band and high-band GSM mobile telephone traffic.

### **Tricky Board Layout Challenges**

In terms of design innovation, the 71663's layout had to contend with packaging four high-performance A/D converters amidst a field of high-power digital logic required advanced techniques in printed circuit board layout, power supply regulation and filtering, shielding, and ground plane management. Numerous switching power supplies on board act as powerful transmitters of unwanted energy threatening sensitive analog signal paths through conducted and radiated emissions across distances measured in millimeters. Since any one of these factors can limit the dynamic range performance of the board, the design of the 71663 required many iterative steps to eliminate each of the worst offenders, one by one. Each step often required a critical modification of the printed circuit board, carefully guided through meticulous testing, analysis and experience.

Monitoring the overwhelming glut of radio signals to Capable of capturing all GSM traffic in any location, the Pentek 71663 is an ideal solution as the front end of monitoring systems. Such technology is key for gleaning actionable intelligence through monitoring GSM cell traffic. GSM accounts for the majority of worldwide mobile telephone networks-and is especially prevalent in regions currently under military and terrorist conflict. Meanwhile, the XMC form factor is rugged and small enough for portable or mobile platforms, especially important for battlefield monitoring, anti-IED systems, police and emergency responders.

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