

Trusted Resource for the Working RF Engineer



[Communications]

UWB Welcomes Flood Of Handset-Centric Applications

Although next-generation mobile applications will rely on a blend of standards and technologies, the recent advances of UWB will help it spearhead this evolution.

Nancy Friedrich | March 2007

Copyright © 2008 Penton Media, Inc., All rights reserved.

Printing of this document is for personal use only.



[Reprints](#)

Mobile handsets now provide Internet applications like e-mail, web browsing, and Instant Messaging. Going forward, even more performance, memory, and functionality will be integrated into handsets. Because so many consumers carry a mobile phone, it is clearly on the way to living up to one service provider's marketing slogan: "It's my life in there." To realize this potential, however, next-generation handsets will need to integrate short-range, high-speed wireless capabilities that can seamlessly connect with a variety of existing and emerging communications methods. The answer may lie in ultrawideband technology, which provides standards-based, high-bandwidth, multi-protocol capabilities. UWB also provides the flexibility for auto-discovery and connection with a variety of peer-to-peer and/or local server-based networks.

To help lower cost while increasing integration for UWB products, Staccato Communications (San Diego, CA) developed a single-chip, all-CMOS solution. That development was followed by the announcement of reference designs and a Mini Card combining Bluetooth and certified Wireless USB technologies. The Ripcord family is based on the WiMedia Alliance's UWB common radio platform and the Certified Wireless USB specification from the USB Implementers Forum (USB-IF). Ripcord is implemented in a complete system-in-package (SiP) using 110-nm digital CMOS process technology. At less than \$10 per node in volume, it was spawned to provide a complete, fully integrated solution for the first commercial applications of high-speed UWB at 480 Mb/s based on Certified Wireless USB.

The inspiration for a CMOS UWB solution came to Staccato early on. According to Mark Bowles, the company's co-founder and vice president of business development and corporate marketing, "From the beginning, Staccato's vision was to dominate the UWB silicon space by having a superior solution for our customers. We realized that this meant building a single-chip CMOS product because of the inherent benefits in cost, power consumption, and form factor. As we expected, this is an extremely difficult task in UWB because the radio has to operate at up to 10 GHz, each channel is more than 500 MHz wide, the ADC and DACs are extremely high-speed, and the transmit power is very low."

The Ripcord family includes devices that target the host wire adapter (HWA), device wire adapter (DWA), native Secure Digital I/O (SDIO), a physical-layer (PHY)-only solution, and three production-ready reference designs. The SC3501, for example, operates in the 3.1-to-4.8-GHz spectrum. By integrating the media access controller (MAC), baseband, and RF, it provides a complete single-chip solution for Wireless USB HWA designs or embedded designs requiring a Universal Serial Bus (USB) 2.0 device interface. The SC3501 supports all mandatory and optional Wireless USB data-rate modes from 53.3 to 480 Mb/s. In addition, it supports all data communication over a secure wireless link using 128-bit Advanced Encryption Standard (AES) hardware encryption. The device features a 32-bit RISC processor core, internal SRAM, and external Flash or EEPROM support. Aside from USB HWA designs, it can support Certified Wireless USB modes like embedded host, embedded device, and dual-role device. Through device firmware upgrades and the Protocol Independent Kernel (PIK) design, it also can simultaneously support additional protocols including Bluetooth 3.0 and WiMedia's WiNET IP.

Although the SC3502 has much of the same features and occupies the same spectrum, this solution targets Certified Wireless USB DWA designs. A DWA promises to transform any existing USB peripheral into a Certified Wireless USB product with no or very few design modifications. Developers may either implement an external DWA or embed it within an existing design. Wireless USB promises to provide secure wireless communications, the same speed as wired USB (480 Mb/s), low cost, low power, and backward compatibility with wired USB products. It targets the applications that currently rely on USB to transmit data, such as digital still cameras and camcorders. A Ripcord DWA design kit also is available. The SC3223R single-port DWA daughter-card is intended for integration in peripherals that already support the wired USB 2.0 device interface.

In terms of features, the SC3503 differs very little from its siblings. It provides a solution for embedded Certified Wireless USB designs that require an SDIO 1.1 device interface. The SC3503 enables personal-computer, Windows CE, and mobile-product designers to embed Certified Wireless USB functionality into their designs. Because the SC3503 also comes with the PIK, it can support Wireless USB as well as Bluetooth 3.0 and WiMedia's WiNET IP. The company offers development and reference-design kits in support of the SC3503. In addition, a fully abstracted software library, dubbed the Ripcord Control Library, is available to simplify the integration and porting effort to multiple embedded platforms.

The Ripcord family was behind SK Telecom's decision to partner with Staccato in order to deliver the first worldwide mobile deployment of UWB wireless-personal-area-networking (WPAN) mobile-phone services. After the initial launch in Korea, the services that will be developed and launched by SK Telecom and Staccato will be standardized and offered worldwide. With this introduction of UWB WPAN mobile-phone services, customers will have expanded options and bandwidth for entertainment-content delivery to their mobile devices. They will be able to connect mobile phones to larger displays (PC, TV, auto) as well as to the PC ecosystem ([see figure](#)). Through personal-area social networking (PASN), they also will be able to share profiles and content from one user to another. Specifically, mobile social networking will allow users to communicate directly with other mobile users or from kiosks at 480 Mb/s. As a result, individuals will be able to connect based on one another's proximity.

The WiMedia Common Radio Platform is the foundation for the project. Yet SK Telecom and Staccato are developing applications using several protocols. This benefit is enabled by Staccato's PIK MAC technology, which enables the simultaneous operation of Certified Wireless USB, WiNet, Bluetooth 3.0, and other potential protocols at speeds up to 480 Mb/s. Initially, products will launch with WiMedia radios using spectrum below 6 GHz (band group 1, band 3). Above-6-GHz operation will be added when the WiMedia Alliance completes the certification process for these bands.

In January, Staccato enhanced the Ripcord family by announcing a wafer chip-scale package (WCSP) for the solutions. The package boasts a footprint of only 7.5 X 7.5 mm. With WCSP, packaging occurs at the wafer level. This approach allows a low-cost and efficient manufacturing flow. The Ripcord WCSP provides flexibility in system designs by enabling low-cost, small-form-factor modules of various materials from low-temperature co-fired ceramic (LTCC) to organic substrates and simple FR4-based printed-circuit-board designs.

Of course, one of the most interesting things about Staccato's solutions is its provisions for Bluetooth integration. Dr. Roberto Aiello, co-founder and CTO of Staccato Communications, states, "Both Wireless USB and Bluetooth 3.0 have huge potential and will dominate our focus and growth for the next few years with a variety of derivative products optimized specifically for target applications in mobile, PC/peripheral, and consumer electronics. Optimizations in power management and video streaming will become particularly important. However, as evidenced this past month with Broadcom, TI, and CSR all announcing integrated Bluetooth/WiFi/FM radio solutions, continued integration of other functions will be required to stay competitive."

Last March, Staccato announced an official Bluetooth Convergence Roadmap. In September, the company announced the delivery of the SC3224R combo Bluetooth Mini Card reference-design kit. The SC3224R was the first solution to combine both Bluetooth technology and Certified Wireless USB onto a single PCI Express Mini Card form-factor design. The SC3224R design proved that Bluetooth and Certified Wireless USB can simultaneously function in close proximity on a single Mini Card design. The initial version of the SC3224R reference-design kit supports current-generation Bluetooth and Certified Wireless USB for dual-mode wireless-PAN applications. Future generations will support tri-mode functionality by adding Bluetooth 3.0 capabilities.

Impressively, the SC3224R design enables the use of a single antenna. This antenna is shared simultaneously by both radios through a diplexer without any significant degradation in performance to either radio. In notebook PCs, antenna placement is a growing problem because of the increasing number of radios that are included. By sharing a single antenna and a single Mini Card slot, this reference design eliminates the need for additional antennas or Mini Card slots. By combining both wireless-PAN technologies onto a single Mini Card, it also allows OEMs to use only a single Mini Card slot on a notebook PC.

At the same time that the SC3224R was released, the company announced a single-chip, all-CMOS Half Mini Card based on Certified Wireless USB. It also began offering an SDIO-card reference design based on its Ripcord family. The SC3225R Wireless USB HWA Half Mini Card is half the size of a standard PCI Express Mini Card. As a result, the design leaves room for another Half Mini Card, such as Bluetooth. Notebook designs can have one Mini Card slot dedicated to WPAN and to support Wireless USB and Bluetooth simultaneously.

The SC3226R is a reference design, which is based on Certified Wireless USB, in an SDIO-card form factor. It supports native-host, native-device, or dual-role-device modes through an SDIO 1.1 device interface. In doing so, it targets laptops, PDAs, mobile handsets, and other devices that support SDIO cards. The reference design kits include a working hardware sample, schematics, PCB Gerber layout files, bill-of-materials, design guide, production test guide, HWA and DWA Windows XP drivers and utilities, and a sample end-user manual.

The Ripcord family, reference designs, and other products from Staccato are clearly designed at solidifying and growing the market for UWB. Dr. Roberto Aiello states, "For a UWB market to exist, it required Staccato to be innovative in creating an industry—not just the technology or a chip. We had help from several other start-ups and large companies. But since the early '90s, we have been at the forefront of fighting for worldwide spectrum regulations and worldwide standardization of UWB."

Our biggest innovation, however, has been the fact that while all of our competition considered it impossible to build UWB in single-chip CMOS, we took the risk and found a way to make it work and work well. This is the innovation that will truly allow UWB to become ubiquitous by reaching the price points required for mass adoption."

Like many of today's wireless-communications technologies, UWB had its origins in the military. After some initial hype, many naysayers loudly doubted both its viability and the possibility of a market for UWB. Thanks to the inspired efforts of companies like Staccato, however, UWB will be at the root of solutions that welcome the next wave of wireless applications. Consumers will be transmitting high-bandwidth content, networking with others based on their location, and enjoying other conveniences that could only become possible by enabling UWB and blending it with other standards and technologies.





[Planet EE Network Home](#) | [Contact Us](#) | [Editorial Calendar](#) | [Media Kit](#) | [Headlines](#) | [Site Feedback & Bugs](#)
Copyright © 2008 Penton Media, Inc., All rights reserved. Privacy