Sometimes it is not difficult for new high technology companies whose “latest thing” product is narrowly focused on a growing market to make a splash for a few years. It is much harder, though, for a new company to follow up on that success and to survive over the long term, because survival inevitably means not only the development of new products, but the right new products at the right time.

All of which makes the history of Anadigics (Warren, New Jersey, USA) stand out from the crowd a bit. Anadigics is well known for its GaAs power amplifiers, and has long had its own GaAs fab. With a few twists and turns, and several ups and downs, the firm has flourished since it was founded two decades ago, in the technologically simpler world of 1985.

In 1985 Anadigics was producing 3” GaAs wafers in its fab. The initial products were RFICs for direct satellite broadcast, later for cable markets, fiber optics markets, and early wireless power amplifiers. In 1985 mobile phones were scarce and expensive, but today Anadigics produces power amplifiers - largely using Indium Gallium Phosphe (InGaP) heterojunction bipolar transistor (HBT) chips - for cell phones and other wireless appliances. A few years ago the firm built the world’s first commercial 6” InGaP HBT fab for analog devices. In April 2005 Anadigics shipped its 25 millionth InGaP HBT power amplifier for wireless LAN applications.

Anadigics moved into GSM power amplifiers back in the 1990s. The GSM standards have their own evolutionary path. In the 1980s, various European countries were each establishing their own standards for mobile phone transmission - a situation that was rapidly creating a lack of interoperability between the various systems. In 1982, an international committee, known as Groupe Speciale Mobile, or GSM, began setting standards for a pan-European public land mobile system. What started out as a European system gradually became a global system, still called GSM, except that today the acronym GSM stands for Global System for Mobile communications. And today Anadigics has acquired a strong reputation for its broadband and wireless power amplifiers.

Explains Dave Osika, VP, Wireless Development: “As we gained traction in the CDMA linear power amplifier market, we developed a new line of rugged GSM power amplifiers. Back in the 1990s we were shipping quite a few power amplifiers to major phone manufacturers, using our GaAs MESFET technology.”

“In the last five years we not only converted our fab to larger wafer sizes, but also to InGaP HBT, and subsequently have ramped those products into production, first for CDMA, and now for GSM.”

Anadigics has followed the evolution of GSM, and today makes advanced GSM power amplifiers, and is seeing the technology migrate from AlGaAs-based chips to InGaP-based chips.

“If you look historically at GSM amplifiers, the evolution has been toward higher levels of integration,” Osika explains. “Years ago GSM started out with single-band phones, but has subsequently moved to dual-band, tri-band, and most recently quad-band implementations. Our power amplifiers are addressing the trend toward higher levels of integration by absorbing the power control function into the module to simplify handset designs.

“A part of its evolution, Anadigics in late 2003 acquired Tavanza, a firm that also made power amplifiers on InGaP HBT technology.”

Anadigics’ AWT6202 is the company’s third generation PowerPlexer transmit module, which integrates the power amplifier, antenna switch, power control circuitry, and harmonic filters to dramatically simplify handset design.
amplifiers,” Osika says. “They had some unique assembly and design capabilities for passive-free assembly, so the acquisition augmented some of our portfolio with designs that did not rely completely on conventional surface-mount laminate technology. Instead these designs employed a passive-free assembly, where we have only one die in each module.”

By eliminating separate surface-mount components, Anadigics is able to reduce the overall size of the power amplifier. Putting the components onto the chip is something that silicon houses would like very much to be able to do — and have begun to do in a limited way — but is much simpler on GaAs, Osika notes. “Generally it is easier to execute these designs on GaAs because of the high Q factor of the chip components, which eliminates loss in the GaAs substrate and therefore reduces signal degradation.

InGaP HBT is at the heart of Anadigics’ newest and most exciting products, including its PowerPlexer for GSM systems. The PowerPlexer incorporates the power amplifier, the filter and the front-end switch. “Customers have the ability to buy our power amplifier independent of the front-end module and do their own board-level integration, or they can buy our PowerPlexer, which integrates the complete transmit RF chain from the transceiver to the antenna,” Osika says.

Recently the firm received the first production orders for its InGaP HBT 3.5GHz power amplifier for fixed point WiMAX (Worldwide Interoperability for Microwave Access) applications. Anadigics is also developing a full line of high linearity, high efficiency WiMAX amplifiers for 2.5 GHz and 3.5 GHz WiMAX applications. The WiMAX standard allows high throughput over long distances and connectivity at speeds up to 75 Mb/s, and is aimed at wireless metropolitan area network (WMAN) applications.

Anadigics also recently began shipping production volumes of its InGaP HBT power amplifiers to LG Electronics for use in LG’s VX8000 CDMA phone, which incorporates a 1.3 megapixel camera, digital zoom, dual colour screens, and an MP3 audio player.

Several other of Anadigics’ modules go into products using CDMA (Code-Division Multiple Access) and wideband CDMA (WCDMA), which is a 3G technology standard. “Our current market share in CDMA is 25%, which makes Anadigics the second largest supplier in the market,” Osika says.

“CDMA has historically involved much less integration than GSM,” he observes, “with very small blocks that have been reduced down to very small footprints. I believe that CDMA is at a crossroads, where many manufacturers are beginning to look at higher levels of integration and dual-band or multi-band products.”

What are the advantages of integration? “I anticipate that multi-mode phones will start to receive market acceptance, while the power amplifiers that enable these phones will provide higher levels of integration. These phones will have GSM plus wide-band CDMA - a blend so users have almost complete global roaming.”

One of the unique bits of architecture built into Anadigics’ CDMA and WCDMA power amplifiers is High Efficiency at Low Power, or HELP. “Basically HELP is to reduce quiescent current at the lower power levels, which is where CDMA and WCDMA handsets normally operate,” Osika says. “It’s rare that you’re all the way out at the edge of cells where you need to transmit at high power. With this technology, the average user’s talk time is improved dramatically.”