3G: An Innovation Wake-up Call

3G possibilities, and even its retraction, have sparked creativity, innovation, and much needed time at the drawing board.

A mere two years ago, the 3G estimations suggested there'd be tremendous demand for high volumes of wireless equipment. For a little refresher about our shared optimism at the time, check out these verbatim judgment calls from industry experts:

&#149 By the year 2010, there will be one billion wireless subscribers worldwide on 3G (third-generation) networks [stated in mid-2000]

&#149 3G Wireless Infrastructure Equipment Revenues to Surpass 2G by 2003 [press release headline from March, 2001]

&#149 Within the next three years, U.S. operators will be launching a critical mass of third generation (3G) services, creating a critical need for the allocation of additional spectrum [from April, 2001]

&#149 The worldwide number of 3G base stations to be deployed by the year 2004 will be 72.3 thousand [second quarter, 2000]

Yes, as quickly as the wireless market &#151 and hopes for a seamless and fast transition to 3G had grown to its heights in the late '90s &#151 it has since seen an equally dramatic downturn that has left wireless players both up- and downstream of major OEMs and service providers reassessing their position in the wireless market. If not stepping up production to keep pace with tremendous volume, what exactly are our marching orders?

Well, Newton had his collision with an apple. George de Mestral, inventor of Velcro(tm), had his astute observations about the way burdocks stick to our sweaters. And, we in the wireless industry, have the wanna-be 3G revolution to thank for some of the most important technology breakthroughs in recent years.

Get smart. Get small. Get &quotsmooshed.&quot

In the 1990s, the strategies and organizations of major wireless OEMs centered on meeting voracious market demand with ever-larger, 3G-style system deployments or, put another way, wider pipes. Attuned to their customers' needs, key component and subsystem manufacturers in the wireless space then followed suit &#151 focusing the bulk of their attention on investments in, and processes to support, volume manufacturing.

As demand for wireless services peaked around 2000, though, full-scale 3G-type deployments came into question and the name of the game dramatically shifted to handling still healthy, but clearly diminished demand with smarter, more integrated systems &#151 where what counts is value per installation, &quotsmooshing&quot functionalities together, and the elimination of residual costs from the 90s' volume-only mindset. In other words, the name of the game has changed to doing more with less &#151 and, of course, responsive players in the sector are once again

reorienting their organizations, technology strategies, and tactical directions from a volume-based thrust to one in which the goal is order-of-magnitude jumps in integration, miniaturization, performance, and lower cost. Along the way, GSM and CDMA markets, if not 3G, are the beneficiaries of many of these technological gains and cost reductions.

Some examples?

a.) Companies in the integrated circuit market are focused on the integration of functionality in smaller and smaller outline packages, leveraging relationships with partners to offer packaging technologies for functionalities not available today at the die level (such as LTCC and softboard solutions), and on reduced chip counts overall. As a result, the foundation built for triple-band, three- and four-device GSM telephones is becoming the starting point for WCDMA and UMTS chipsets. Good stuff.

b.) Then, there are ever-increasing demands of the infrastructure community leading to LDMOS power semiconductors &#151 that stretch to the limit the amount of power being generated from the IC cascade, while still appeasing the all-important thermal-management gods, in an effort to reach newer $/Watt and linearity schematics demanded from the 3G community.

c.) When 3G was in its network planning stages, it was obvious that the quantity of equipment needed per square mile would need to be significantly higher than previous systems, such as GSM. This lead to a focus on the expensive items inside the 3G base station - and it became the goal of the major OEM's to reduce their BOM's by targeting inherently expensive items. To this end some companies have introduced OCXO's as a direct replacement to expensive Rb atomic clocks. This solution offers Rb performance at significantly reduced cost.

d.) Newly developed Film Bulk Acoustic Resonators (FBAR) are also technology aimed at CDMA and WCDMA (3G); here, the major applications are for duplexers used in cellular phones, making the FBAR a much-needed, cost-competitive solution to historical ceramic and SAW-based product offerings.

e.) Finally, consider how micro-miniature circulators &#151 culminating in 4mm &#215 4 mm &#215 1 mm solutions &#151 have found their niche in the 3G handset development world, as early models of single-band 3G handsets feature these miniature, Ferrite elements in the design of 2.1 GHz based terminals.

What about technologies even further up the supply chain?

Component suppliers too have reaped some positive benefits from the seemingly negative of having no gaping 3G maw to feed. One such company is Anaren Microwave Inc. Once connectorized component supplier, Anaren stepped up to '90s volume demand with significant investments in automation and sea-change products like its Xinger&reg couplers.

Figure 1. While gearing up for 3G volume and &quotno touch&quot assembly, Anaren transformed hand-cut coaxial cable delay lines to SM components.

As the game has changed, however, it seems Anaren volume-minded innovations are nonetheless serving well in new, the &quotsmarter-is-better&quot era: Originally inspired by quantities and "no-touch" manufacturing goals associated with 3G deployments, the company is having good success with new products that pack multiple functions into single, surface-mountable packages &#151 typically in categories historically dominated by non-volume-friendly connectorization.

Figure 2. The company likewise has introduced a leadless SM circulator in contrast to traditional, solder-intensive pill circulators.

Three noteworthy examples:

1. SM-style delay line: Anaren's Xinger&#153 delay replaces a coil of semi-rigid cable (often connectorized) mounted in the cavity of an amplifier casting. The unit was inspired by the pursuit of volume savvy designs free of extra milling and finishing steps, hand-mounting, and cropping for feed-forward and pre-distortion power amplifiers.
2. SM-style circulator: Again, focused on volume-based manufacturing, Anaren this time wedded its tape-and-reel packaging with traditional Ferrite technology. The resulting part is the acquiescent, aqua's washable, and repeatable component that volume-focused OEMs were demanding at the height of 3G optimism &#151 yet the new package also resulted in significant return loss/isolation improvements.
3. SM vector modulator: The company also developed a vector modulator in the Xinger&#153 format, this time embedding multiple functions in a single, highly manufacturable part. Traditionally represented on a PCB by as many as 17 discrete components, the volume-inspired component simplifies customer BOMs, compresses the supply chain, and speeds time-to-market schedules.

In short, the 3G-minded thinking about manufacturability led the way to solutions also well-suited to today's smarts-focused sector requirements.

Sometimes, a bump on the head is a good thing.

All in all, though 3G has yet to be rolled out &#151 some think it may never be rolled out at all &#151 there is no doubt that its possibility and even its retraction has sparked tremendous amounts of creativity, innovation, and much needed time at our drawing boards. There is also no doubt that 3G, alive or dead, has taught us that trend lines or not, we shouldn't be gun shy about innovation: As many questions and risks as there are about the future, that's where the niftiest ideas will come from.

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