HIGH FREQUENCY
ELECTRONICS

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Also Published Online at
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High Frequency Electronics, Vol. 4 No. 12, December 2005. Published monthly by Summit Technical Media, LLC, 7 Colby Court, Suite 7-436, Bedford, NH 03110. Subscriptions are free to qualified technical and management personnel involved in the design, manufacture and distribution of electronic equipment and systems at high frequencies. Send information requests by mail to the above address, by telephone to 603-472-8261, by fax to 603-471-0716, or by e-mail to: editor@highfrequency-electronics.com.

What to do When There is no Chip Set or Reference Design

Gary Breed
Editorial Director

Most electronic products that are manufactured in volume are developed using a design that was done by someone else—a chip set or reference design using a pre-determined layout and materials list. This is a valuable method for supporting low cost, large market development of useful (or fun!) technologies. Such standardized designs leverage the classic "economy of scale" concept, giving us such things as free wireless phones with a service agreement and cheap, powerful personal computers.

There are many excellent engineers developing these high-volume devices and the components that go into them. The product designers understand the required system-level performance that must be achieved after a chip set is interfaced with its supporting circuitry and any additional functionality. The developers of chip sets combine circuit design knowledge with integrated circuit design. Ultimately, high-volume product design is a joint effort of the finished product manufacturers and the component suppliers who are addressing these large, well-focused markets.

But the design of chip sets and the products they go into are just two of the many areas of high frequency design engineering. Applications that are smaller in volume, or require unique performance features, need a different design approach. They need reliable sources for components that offer state-of-the-art performance, but can be purchased in modest quantities. Designers of these products also need EDA design tools that are comprehensive, yet flexible enough to handle any type of circuit.

On this latter point, this issue includes a tutorial-level article on the proper setup of EDA simulations. While high-volume applications usually have built-in standards-compliant setups—e.g. just push the "IEEE 802.11g" button on the SETUP menu—a more individualized design requires that the engineer establish each parameter for the simulation. Do you want linear or nonlinear simulation? Which models will be used? What is the frequency range, frequency step and scaling of the axis for the output data plots? Are you just measuring gain and VSWR, or is this a system simulation with digital signals in and BER or eye diagram data out?

With today's powerful EDA tools, the learning curve can be steep, but it is necessary to put those tools to their best use. Of course, an engineer should also know these things for a pre-selected setup, but there is no need to repeat work that has been competently done by others.

In the component realm, there are some interesting approaches taken by the supplier companies. Some have chosen to serve only high-volume markets with application- or standard-specific products. This requires an investment in manufacturing equipment, design methodology and customer support that is suited to these markets.

Another approach is to emphasize building-block components that provide a range of typical functions and performance levels that can be combined in various ways to accomplish a wide range of tasks. Some products may even approach small-scale chip sets by combining a number of common functions into a single device.

Some types of components allow relatively economical customization at modest production quantities. Application-specific ICs, filter modules, couplers and combiners, and many other products are broad enough in their usage that variations in their basic design can be implemented quickly, at a reasonable cost.

How Big are Niche Markets?

These "non-mass-market" applications represent a large portion of the high frequency marketplace. I cannot find definitive research on this matter, but analyzing data on various large markets versus the total marketplace suggests that 1/3 to 1/2 the dollar volume may be represented, perhaps more, depending on how you define certain military products. And there is a lot more than military business.

A few of the markets that are sizeable, but not really mass-markets include: medical, security, sensors, test and measurement, telemetry, avionics, industrial systems and radar. Then we must add the limited-quantity base station equipment for services such as satellite systems, CATV head-end and distribution, terrestrial broadcast, microwave backhaul and many others.

Economic success (and high levels of employment) in high frequency electronic technology requires both large and small markets. After all, some of those small markets can become quite large (WLAN and RFID are probably the best recent examples).

From December 2005 *High Frequency Electronics*