



# Is There A Shortage Of Good RF Applications Engineers?

*By Rick Cory, Skyworks Solutions, Inc.*

In the past couple of decades, a not-so-subtle shift has taken place in how RF circuit design is done. The field has essentially divided into two subspecialties: system integrator and RF component designer. RF applications engineers are increasingly called to fill in the gap between these two camps.

The RF designer who toils to produce a working system or end product, such as the radio transceiver in a cellular telephone handset or WLAN access point router, has become a “black box” integrator who skillfully marries disparate integrated circuits and discrete components from various manufacturers into a smoothly functioning, cost-effective product. This skill, however, often comes at the expense of the opportunity to obtain design experience at the discrete component level.

The RF component designer’s skill set must include more than in-depth knowledge of circuit design and optimization. A working knowledge of material science and even chemical engineering has become required in order to understand the nuances of wafer processes (bipolar transistor, heterojunction bipolar transistor, RF diode, RF CMOS, RF BiCMOS, pHEMT, etc.), metal layers, passivation layers, transistor peripheries, and the like. This specialization also has the associated opportunity cost of becoming highly focused on the “nuts and bolts” of a device without thorough, intimate knowledge of the environment in which that product is expected to perform.

The reality of this situation is that, as good as the RF component designs are, it is often not a trivial activity to integrate them into a working system. The system designer and the RF component designer must each have at minimum a rudimentary knowledge of the other’s specialty to be successful, but the degree to which each must specialize makes adequate proficiency in the complementary specialty increasingly difficult to attain. Enter the RF applications engineer (RF AE), whose job is to keep a foot firmly planted in each of these domains in order to act as a translator, a mediator, a facilitator, a marketer, and more.

The RF AE assists the system integrator in understanding enough about the guts of an RF component to use it to the best advantage in a system design. This requires the RF AE to have a working knowledge of system design principals as well as RF component operation. This knowledge must also be applied in the opposite “direction”: knowledge of system requirements must be employed to define new RF



components, as well as to refine existing ones to keep product portfolios current and relevant. The importance of and need for good RF AEs are growing.

What makes an RF AE good? There are several required qualifications. A good RF AE must possess a thorough understanding of customer needs as well as the capabilities, specifications, and performance characteristics of his/her own products. The RF AE must be able to communicate effectively and diplomatically, both verbally and in writing. Most important is the ability to empathize and the strong desire to help solve other people's problems.

It is highly desirable for an RF AE to have direct personal experience performing the duties of one of his or her constituents. Who knows more about the inner workings of an RF integrated circuit (RFIC) than the engineer who designed and characterized it? This knowledge and experience can enable the RFIC designer to analyze other people's designs and recognize their strengths to be exploited, as well as any lurking idiosyncrasies that should be controlled or prevented from being exercised. Who knows more about the demands of bringing a complex, fully functioning system of components to market than a system integrator? Experience in one or both ends of the business can be put to good use by an RF AE.

The benefits of a good RF AE are easy to list but difficult to quantify. RF AEs facilitate the design-in of products into customers' systems. RF AEs can utilize their experience to define new products that meet the needs of their customers. RF AEs can defend existing business by comparing the relative merits of a competitor's product to his/her own product, thereby preventing the loss of business to competitors. RF AEs can translate system requirements to component specifications and vice versa. RF AEs can save system integrators time and trouble by guiding them through the component selection process to the optimal product solution.

It should be easy to ascertain the value of an RF AE's work. For example, when a design-in results in an order, that revenue can be identified and tracked — right? In today's market, it is not as easy as it sounds. Design activity often occurs in Location A, while assembly of the system is done by a contract manufacturer at Location B (and C, and D...). The contract manufacturer often consolidates orders for several designs to gain the advantage of volume pricing, which makes it difficult or impossible for a component manufacturer to identify what revenue is attributable to specific RF AE design-in activity. In some markets, such as the defense market, years may elapse between system design and the start of production. Who can keep track of such delayed gratification?

There are obvious rewards for being a good RF AE, not the least of which is being gainfully employed in the first place. A successful applications effort often results in repeat business from the customer who received the assistance. Indeed, it is not unheard of for a customer who is working on a tough problem to enlist the aid of a known, trusted RF AE, even though the product with which the difficulty is occurring is not supplied by the RF AE's organization. The RF AE's demonstrated knowledge and ability as a problem solver are not easily forgotten. A good RF AE can also gain recognition within the market, simply through day-to-day contact with many customers.

Consider the typical transaction between a customer and an RF AE. The busy customer contacts the RF AE for help — a component may not be functioning as the customer expects it should, the customer might not feel confident that he or she selected the best product for a specification application, or the customer may want advice about how to approach a design, etc. These factors all place pressure on the



RF AE to help resolve the situation quickly and effectively. The RF AE goes into “all hands on deck” mode, does what is required to address the customer’s situation, and then — more often than not — silence! The customer has more than one task to complete, so when the issue for which the RF AE’s help has been enlisted is resolved, the customer moves on to the next task. The RF AE who needs to hear “thanks” from the customer for a job well done is either going to be disappointed or will have to run the risk of annoying the busy customer by contacting him or her to seek feedback. While there is always something to be learned from customer feedback, the potential value of this new knowledge must be carefully weighed against the possibility that the act of seeking feedback may interfere with the customer and make him or her reluctant to make contact in the future. The experienced RF AE develops a “sixth sense” and knows when an issue has been satisfactorily resolved.

A significant challenge occurs when a customer is convinced, sometimes passionately so, that he or she is right about something but is actually wrong. The RF AE must be able to guide the customer to the right answer without engendering anger or embarrassment. People in the RF/microwave industry tend to have very good memories about those who they deem to have let them down. An approach to this situation that has produced success is to avoid confrontation with the customer but instead to ask him or her to explore an alternate possibility, explanation, solution, etc. It might take a bit longer to resolve the task at hand using this approach, but that is a small price to pay to keep a customer.

If RF AEs perform a necessary and important function, why is it so hard to find good candidates? The answer is simple: Many people who are eminently qualified to perform the function are not aware of their qualifications. Give it a try!

## About the Author

Rick Cory is an applications engineering manager for analog products at Skyworks Solutions, Inc. and has over 25 years of experience as an RF/microwave-semiconductor applications engineer. He holds a BSEET from the University of Lowell (now the University of Massachusetts Lowell) and an MBA from the University of Phoenix.