How Can I Control Antenna Radiation?

I would like to place a 1900 MHz PCS sectoral antenna (65 degree) in an area where I want to reduce radiation from the back side of the antenna to an absolute minimum. I am wondering if there is a method to add an RF barrier shield or collector antenna some distance behind the antenna that effectively blocks the RF emanating from the rear of the antenna. The antenna is mounted close to the ground; perhaps this may make this concept feasible.

Grant Wheeler

An Answer and Background Information

When controlling antenna radiation, the place to start is with the antenna manufacturer, Examine the pattern plots of the standard antennas they offer—many companies include models with high rejection of off-axis radiation. These antennas are usually constructed in a couple different ways. One is to use a large-area reflecting surface behind the driven element to capture more energy and re-radiate it in the forward direction. Typically, these antennas use solid panels or screening with small openings, with a shape and distance from the driven element that maximizes the effectiveness of the reflecting surface.

The other method is to use multiple elements in either a Yagi-Uda type parasitic array or as an all-driven array (phased array). Yagi antennas are common at 900 MHz, but they are also available for 1900 MHz as well as the 2.4 GHz ISM band.

If the cost of a high-directivity antenna is too high, and the alternative antennas do not have the desired rearward rejection, then you can proceed in the manner Mr. Wheeler suggested. I should emphasize that this is generally a "last resort" method, due to wide variations in the local environment that may limit what you are able to do.

If the antenna is mounted against a flat wall, a layer of absorbing material may be applied, although 1900 MHz is toward the lower limit of usefulness for common absorbers. Simply having a lot of construction materials behind the antenna may provide enough absorption in the unwanted direction.

Some readers might be surprised to know that the "collector antenna" idea can be used, although it is rare. The most common use of such an "antenna" is in a type of transverse electromagnetic (TEM) test cell used for EMC (electromagnetic compatibility) testing. The GTEM, as this type of cell is called, uses a matrix of resistors as an absorbing structure to avoid reflections within the test cell, so the devices under test are subjected to a reasonably accurate plane wave. The combination of the resistor leads and the resistive composite (usually a ceramic instead of the old carbon material) provides both the antenna conductors and the energy dissipating medium.

I believe there are companies that make sheets or blocks of materials with carbon or nichrome filaments that accomplish a this kind of absorbing function at frequencies lower than the usual microwave absorbers. I did not look into this further because it is probably a much more expensive solution than buying a high-performance antenna.

Which brings us back to the first paragraph—a high performance antenna should be investigated before any of the more exotic solutions.

Gary Breed
Editorial Director

A Request for Digital PC Board Information

We have received several questions regarding issues with digital signal traces on printed circuit boards—how to model them accurately, what rules-of-thumb will help minimize crosstalk and reflections, and how the performance of common layout practices changes at higher frequencies. While we have some of our experts working on answers, they tell us that this is an area where there is little hard data available from public sources.

We would like our readers' help locating information or an expert who can provide in-depth information on this important topic. If you know someone, please send them our way! The best way to contact us is by e-mail: editor@highfrequencyelectronics.com

Thanks!

Our "Ask the Experts" column is published in each issue of High Frequency Electronics. *Send us your questions and we will do out best to find someone to provide an answer, find the answer in the literature, or collect data from several sources that sheds light on the topic.*

Questions and comments should be sent by e-mail to: editor@highfrequencyelectronics.com, by fax to 608-845-3976, or by mail to: Editor, High Frequency Electronics*, 6666 Odana Road – #508, Madison, WI 53719.*