How do Spread Spectrum Clocks Reduce Radiated Emissions?

I was wondering how spread spectrum clocks work. Intuitively, it seems that they would not reduce emissions, just move them around in frequency. How does this help meet EMI specs?

J. D. Roberts
Contract Engineer

The Answer is in Both the Frequency and Time Domains

You are correct that spread spectrum digital clock oscillators simply move the frequency around in a random manner. The reason that they reduce measured EMI is partly in the specification of the measurement, and partly in real-world behavior.

Although the spread spectrum clock has the same signal amplitude as an unmodulated clock, the frequency movement and the pseudo-random spreading sequence assure that the signal will not repeatedly occur on the same discrete frequency and increase the total energy at that point.

Spread spectrum modulation makes the clock signal more noise-like, not coherent. EMI measurement specifications are based on real-world behavior (and perception) of interference. They are peak measurements, but do not measure *instantaneous* peaks. Rather, they measure total energy using a specified time constant. The measurement method reflects the fact that coherent signals have a greater potential for interference than noise with the same peak amplitude, because the total energy (average amplitude) of a coherent signal is concentrated at one frequency.

Finally, if the clock signal is distributed across large p.c. boards (or multiple boards), spread spectrum may further reduce the total radiation by making radiation contributed by different parts of the system non-coherent. This, however, requires that time delays in clock distribution and circuit operation exceed the period of the spread spectrum modulation.

Editor's note—To learn more about electromagnetic compatibility issues, we recommend that you attend the IEEE EMC Symposium, which is August 18-22 in Boston. The symposium includes several workshops on basic EMC topics—fundamental principles, board design, lightning protection and others. This is an excellent event for networking, too. The IEEE EMC Society may be the most down-to-earth of all IEEE societies, which means that it is easy to find vendors, consultants, educators and other engineers who will gladly discuss whatever subject you think is important. Program and registration information is available at the event web site: www.emc2003.org

Follow up to 'Controlling Antenna Radiation'

In the May 2003 issue, Grant Wheeler asked, "I am wondering if there is a method to add an RF barrier shield ... some distance behind the antenna that effectively blocks the RF emanating from the rear of the antenna." He was referring to controlling the radiation from a PCS base station.

We advised Mr. Wheeler to first get as close as possible to the desired performance using the antenna itself, noting that absorber material may not be readily available or economical to use at lower microwave frequencies. We were not completely correct...

Since preparing the May issue, we were introduced to the "Curl Sorber" product made by Nippon Muki Co., Ltd. [1, 2]. Curl Sorber uses curled glass fiber (similar to fiberglass insulation batts) that holds a carbon electromagnetic wave loss material. With different depths of the fiber, density of the curled material and carbon loading, a broadband absorber is produced that works as low as 1 GHz (the company's 100 mm thick CS-100 material). These products are being promoted for applications like that proposed by Mr. Wheeler, reducing unwanted radiation in a localized area where reflections can be a problem.

For More Information...

1. In the U.S., Curl Sorber is available from Gilland Electronics Inc., tel: 408-358-5844, fax: 408-358-5804, e-mail: sales@gilland.com
2. The Nippon Muki web site also has product data: www.nipponmuki.co.jp

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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.*
