The Non Importance of Antenna Patterns for Devices with Small Antennas

[#] Mats Andersson, Charlie Orlenius, Magnus Franzén

Bluetest AB, Götaverksgatan 1, SE-417 55 Gothenburg, Sweden
mats.andersson@bluetest.se

Abstract

The number of wireless products using small antennas is expanding very quickly. Besides the numerous existing products using small antennas, e.g. mobile phones, WLAN equipment, PDAs, Bluetooth devices etc., a large number of new types of wireless products are being introduced every year and also expected to experience rapid growth, RFID tags, TV game controllers like the Wii remote (Bluetooth), and home 3G base stations just to give a few examples. For small antennas the most important parameter to optimize is its antenna efficiency, i.e. the parameter that directly influences how much of the transmitter power is radiated into space, or how much of the radiation incident on the antenna reach the receiver. The Total Radiated Power (TRP) and Total Isotropic Sensitivity (TIS) are directed related to the antenna efficiency and have a direct influence on such important parameters as coverage, battery life time and bit rate in the up and down link. The TRP and TIS performance is very hard to estimate accurately with software but can be accurately measured. The antenna efficiency is also the most important parameter for diversity and MIMO antennas, much more important than antenna correlation. The traditional antenna metric for large antennas, i.e. the antenna pattern, is however for small antennas of no or little importance during design and/or evaluation. The requirement of measuring antenna patterns in a standard like CTIA is just a traditon and cause unnecessary delays for market introduction of products with small antennas. This is because for small antennas 1) the patterns are more or less omnidirectional, 2) most devices are used in a multipath environment and in random positions and 3) the antenna pattern is just a (unnecessary) step on the way to calculate antenna efficiency and hence TRP, TIS, diversity gain and MIMO capacity, but of no or little use in itself. The traditional way of measuring antennas in anechoic chambers, i.e. without any reflections, is very good and necessary for large antennas that normally are used in a Line-Of-Sight (LOS) environment, but is a slow and unsuitable way to measure devices with small antennas that normally are used in an environment with a lot of reflections, i.e. indoors or in an urban environment. Such an environment is much easier to simulate in a reverberation chamber. Bluetest has since 9 years been the Pioneer in the use of reverberation chambers for directs tests of antenna efficiency, TRP, TIS, antenna diversity gain, MIMO capacity without measuring antenna patterns. The reverberation chamber also have the advantage that it can be made much smaller and that the measurements are performed much faster than in an anechoic chamber. This paper will describe TRP and TIS measurements in Bluetest's High Performance (HP) reverberation chamber and compare the results to that of the same wireless devices tested in large anechoic chambers. It will be shown that the accuracy of the Bluetest chamber is similar or better to large CTIA approved anechoic chambers and that the measurement times for TRP and TIS are between 3 - 20 times faster depending on type of test and communication protocol when antenna patterns are bypassed. The non-importance of antenna patterns of devices with small antennas and several advantages of using reverberation chambers instead of anechoic chambers for devices with small antennas will be discussed in detail.