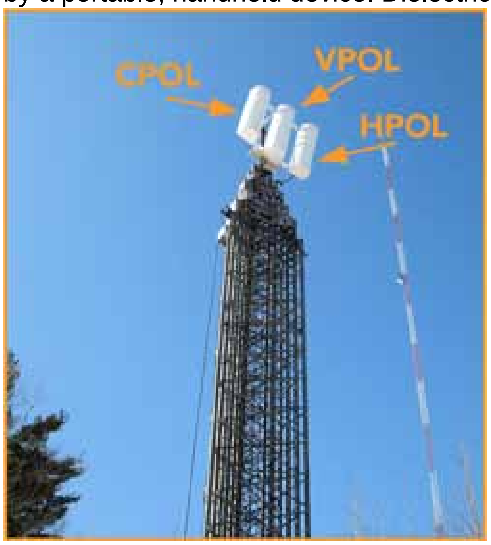
NAB NATIONAL ASSOCIATION OF BROADCASTERS TV TechCheck
The Weekly NAB Newsletter for Television Broadcast Engineers
July 13, 2009

Circular Polarization Shown to Improve Mobile Reception Performance

One of the challenges to be faced by TV broadcast engineers in the world of mobile DTV will be providing for reliable reception in a variety of new environments and for receivers that are constantly "on-the-go." In a presentation made at the 2009 NAB Show, John L. Schadler, Director, Advanced Antenna Systems Development and Kerry Cozad, Senior Vice President, Broadcast Engineering, both with Dielectric Communications (Raymond, ME, www.dielectric.com), suggested that use of circularly-polarized transmit antennas may offer performance advantages for mobile reception.

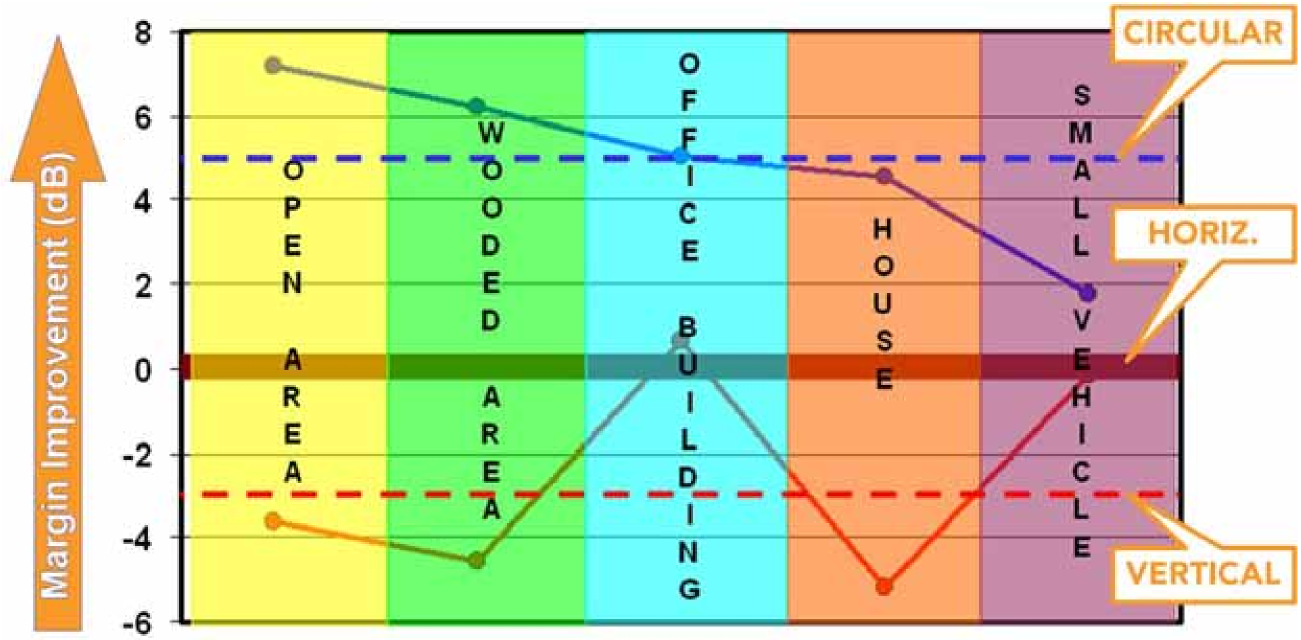
The information in their presentation was derived from a field study conducted by Dielectric into the impact of signal polarization on reception by a portable, handheld device. Dielectric identified two specific aspects of signal reception – polarization mismatch (between the transmit and receive antennas) and multipath fading – that produce variability as the receiver changes orientation and location, and conducted field experiments to evaluate the reliability of service of horizontal, vertical and circular transmit antenna polarization in depolarized fading environments.



As a prelude to this study, Dielectric modeled a mobile handheld device ("phone") using high frequency simulation software (HFSS) to evaluate the device's radiation characteristic at VHF and UHF frequencies. Their conclusion was that the small antennas in a handheld device do nothing more than excite the long dimension of the phone or the circuit board. They found that the antenna's polarization is along the axis of the phone and that the phone itself acts like a dipole.

For these tests, Dielectric utilized three transmit antennas mounted side-by-side (as shown in the photograph above) operated at the same frequency (700 MHz) and ERP, and with the same azimuth and elevation pattern, so that the results obtained from each would be comparable. Signal reception into a linearly polarized receive antenna (with characteristics modeled on those found in the "phone" antenna) was evaluated for each of the three transmit antennas in five different reception environments: open areas, wooded areas, office building, house, and small vehicle.

In each case, received signal power versus receiver orientation and location were measured using a linearly polarized receive antenna installed in a test "jig" that Dielectric called "Ralph," for Rotating Advancing Linearly Polarized Handheld. "Ralph" would move the test receive antenna in both a linear and rotating fashion to simulate the movement an actual mobile DTV receiver would be subjected to. In this fashion, over 300,000 data points were collected, then analyzed to determine the mean value of signal strength and the variability spread between the mean and a desired probability of service value for each test environment and transmit antenna.



Using horizontal polarization as a baseline, Dielectric then determined, based on this data, the margin improvement of vertical and circular polarization relative to horizontal (see graph). On average, circular polarization offered 5 dB margin improvement over horizontal polarization and 7.5 dB margin improvement over vertical polarization. The dashed lines in the graph represent the average improvement margins for circular (blue) and vertical (red) polarizations, while the individual data points shown for each category represent the specific values for that category.

A video of an earlier version of the Dielectric presentation is available for download from the Dielectric Web page at www.dielectric.com/videos/polarization.wmv. Note that this earlier presentation (given to the Society of Broadcast Engineers in October, 2008) reports on antenna polarization studies performed in an anechoic chamber, which were a prelude to the field studies discussed at the 2009 NAB Show. These lab studies showed that an elliptically polarized signal with approximately 33% vertical component was the optimum arrangement for maximizing service to a linearly polarized receive antenna, outperforming circular polarization by about 1 dB. For additional information on this study, contact Kerry Cozad at Dielectric, at Kerry.Cozad@Dielectric.spx.com.

NAB Satellite Uplink Operators Training Seminar
October 5 - 8, 2009 • Washington, DC

This four-day course is designed to instruct about uplink operational practices, which minimize the risk of satellite transmission interference. This is an important course since the FCC rules require that a trained operator be present at all times during transmissions, either an earth station site or designated remote control point. Go to http://www.nab.org/satelliteSeminar/ or Contact NAB Science & Technology Department at (202) 429-5346 or ccolerid@nab.org for information about the NAB Satellite Uplink Operators Training Seminar. If you are interested in sponsorship opportunities for this event contact NAB Advertising at (800) 521-8624 or advertising@nab.org.