

KNW-161
ANTENNA POLARIZATION

Modified and added to by Earl Pack
Based on an article by Steve Decho – NE6FX

This is a short refresher course on antenna polarization. A transmitted radio wave consists of an electric field and a magnetic field, which are 90 degrees apart, or “orthogonal”, radiating outward from the antenna. Polarization refers to the alignment of the electric field relative to the earth’s horizon. An antenna has “horizontal” polarization if the E-field is parallel to the horizon, and “vertical” polarization if the E-field is perpendicular to the horizon. It is critical to match the polarization of the transmitting and receiving antennas, since a 45 degree mismatch causes a 3 dB loss, and a 90 degree mismatch can result in losses exceeding 20 dB.

You are probably most familiar with vertical polarization, since this is the natural orientation of vehicle-mounted antennas, and hand-helds properly positioned with the whip straight up. Most base station antennas for VHF and UHF, from the simple quarter-wave whip to the high-gain omni-directional antennas used at the repeaters, are vertically polarized. So are AM and FM broadcast stations (FM changing from horizontal to vertical after AM/FM Band auto radios became widespread).

Horizontal polarization is used for over-the-air TV signals. Some of us remember and may still use, the multi-element Yagi TV antennas that we would point at the broadcast site, before homeowner’s associations and cable and satellite TV became ubiquitous. In ham use, a wire dipole suspended between uprights, or a multi-band HF beam antenna, are horizontally polarized. Here, the antenna elements are parallel to, and suspended above, the ground.

Most of the multi-element beam antennas for VHF and UHF can be oriented on the support mast for either vertical or horizontal polarization. Vertical is the choice if you are trying to reach distant repeaters. Since atmospheric and background noise tends to be vertically polarized, horizontal is often chosen for weak-signal DX’ing.

The polarization of a radio signal keeps its orientation in free space, but will become distorted by obstructions such as buildings, mountains, vehicles, etc. There’s no guarantee what will happen to a handy-talkie signal from inside a metal car, even when properly held! In the case of ham HF operation, both vertical omni-directional, and horizontal beam antennas are used. When HF signals are reflected by the ionosphere back to earth (and often several times over great distances) the original polarization becomes hopelessly distorted. Therefore, the choice of antenna type is more an issue of cost and esthetics. Verticals are cheaper, self-supporting, and radiate omni-directionally (some say equally poor in all directions). Horizontal dipoles are also cheaper, but require vertical supports at the ends, and have a fixed directionality perpendicular to the wires. The best, and of course most expensive DX choice is a tower mounted, multi-element single or multi-band horizontal Yagi beam antenna with rotator, at least 50’ high. Not only will you make the most DX radio contacts, but you’ll give the neighborhood birds an interesting place to rest.

Adding to this original article. It is important to be aware that signal jamming equipment is also polarized, most often in the vertical plane for UHF and VHF. So if you suspect jamming may be

occurring, try turning your antenna orientation at both the transmitting and receiving stations by 90 deg to a horizontal orientation. You may find that your signal is no longer jammed.