TECHNICAL NOTES ON ANTENNA SELECTION

How do you choose the right antenna? Evaluate the form, fit, function, and cost parameters of an antenna that will do the job, then order a product from the Celwave Product Selection Guide most closely matching that ideal. If the application advances the leading edge of communications technology, consultation with Celwave's design engineers may be required to create an antenna to suit your specific needs.

Successfully achieving system design objectives depends upon your understanding and manipulation of the physics of radio signal propagation, including wavelength employed, transmitter power, receiver sensitivity, antenna height and gain, and profile of the surrounding terrain.

All these factors interact to affect system performance, but not all may be within the designer's direct control. Aesthetic considerations, zoning restrictions, rugged terrain, and budget limitations are among many constraints facing the communications system designer. The challenge is to construct an optimum system in spite of the constraints, taking full advantage of the great variety of antenna solutions offered by Celwave.

FREQUENCY BAND
This factor presents the first opportunity to narrow the focus on the range of antenna choices available. Many but not all antenna styles are offered in all frequency bands. Panel antennas, for example, could become prohibitively large at VHF and below and are therefore not available in that region of the spectrum. Celwave manufactures antennas for low band, mid band, high band, UHF, the 800-960 region for all services, and above 1 GHz for PCS, most fixed base, mobile, and portable applications.

DIRECTIVITY
Is the system required to transmit and receive equally well in all directions from the antenna site, or should it be focused in one or more directions? In the land mobile communications industry, the term "directivity" refers to beamwidth in the horizontal plane of radiation. Omnidirectional antennas are designed to radiate and receive equally in all directions, whereas directional antennas focus their energy to an area less than 360'.

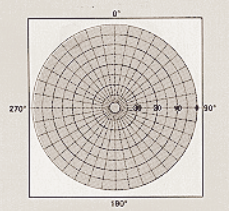
BEAMWIDTH
An antenna's beamwidth is defined as the angle subtended between the two half-power (-3 dB) points on either side of the main lobe of radiation. The half-power points are symmetrical around the radius containing the peak of the main lobe.

Generally, the vertical and horizontal radiation components are independent variables to the antenna designer, meaning the vertical pattern does not change shape (gain) as the horizontal beamwidth is narrowed.

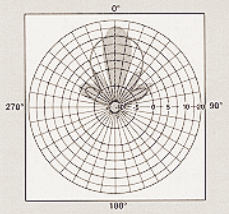
There may be legal as well as practical considerations involved in the choice of directivity. Certain cellular and paging applications require conformance to a licensed contour of operations, creating the need for directional antennas to remain within bounds. Land-based coastal applications may wish to limit the amount of radiation "wasted" over the water where there are no signal coverage requirements. Licensees not facing such restrictions may choose omnidirectional antennas for maximum signal distribution and system utility.

How much directivity to specify? Celwave antenna designs offer directional patterns ranging from low gain to high gain. For example, the addition of an external reflector rod to a fiberglass collinear antenna produces an eccentric offset pattern of about 5 dB, which retains the original antenna's broad horizontal circularity, while providing some gain increase in the favored direction and reduction in the opposite. This arrangement finds wide application in cases where some reduction in co-channel interference is required, or a slight boost in performance is needed in one general direction.

Other applications require greater focusing of the beam for a more specific, limited coverage area. The popular panel antenna in its many gain and beamwidth options has taken a predominant position as the antenna of choice over older styles such as the corner reflector, Yagi, and the attachment of multiple-rod reflectors to fiberglass antennas. These older designs are more susceptible to ice buildup and higher wind-loading than the smoother, lighter panels. Panel antennas offer a greater front-to-back ratio and fewer side lobes than their predecessors. This can be an important consideration in sectorized cellular applications where channel-to-channel isolation for handoff is critical.



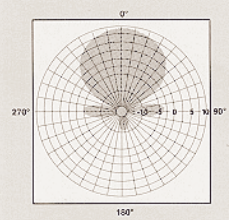
OMNIDIRECTIONAL



DIRECTIVITY

SHARP DIRECTIVITY

YAGI ANTENNA FOR HITTING A SPECIFIC TARGET



DIRECTIVITY

MILD DIRECTIVITY

POPULAR PANEL ANTENNA FOR COVERING A SECTOR