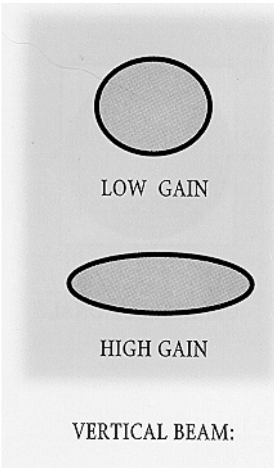

GAIN
Vertical gain in antennas is accomplished by compressing the vertical plane radiation pattern of the antenna into a narrower beamwidth. The net effect is to focus the antenna's energy toward the horizon at the expense of the upper and lower quadrants.

Selecting the right antenna gain for the application is the subject of much analysis and investigation. Gain in traditional designs is achieved at the expense of vertical beamwidth: high gain antennas feature narrow beamwidths while the opposite is also true. This fact is not generally well understood and leads to inappro-priate gain choices and results in poorly functioning systems. Vertical beamwidth is defined as the angle sub-tended by the two half-power (-3 dB) points on either side of the main lobe of radiation. The half-power points are generally symmetrical around the radius containing the peak of the main lobe.

How much gain is required? Specifying as much gain as the budget permits often results in a radio system that interferes with systems in the next county or state but does not service the intended users in the immediate vicinity of the site. Celwave Sales Engineers may assist your choice of antenna gain by using charts to determine RF horizon from your site and suggesting appropriate vertical beamwidth for it.

BANDWIDTH
The generally accepted definition of bandwidth in the land-mobile radio industry is the range of frequencies over which the VSWR is 1.5:1 or lower. Outside this range, the VSWR increases, with increasing frequency offset from the antenna's design center. Celwave offers a wide selection of broad, medium, and narrow antenna bandwidths.

Narrow bandwidth antennas offer the inherent advantage of filtering. Increasingly higher VSWR farther from the center frequency causes greater impedance mismatch between the antenna and feedline, and less efficient power transfer from source to load.

For receiving applications, this means greater rejection of unwanted signals away from the center frequency and greater receiver selectivity. For transmitters, rejection of unwanted-inbound signals means lower inter-modulation products generated in the transmitter's power output stage.

BANDWIDTH CHOICES
Factors influencing the bandwidth choice are inherent in the system design. Is it a one-way paging system or a two-way communications system? Simplex or duplex? Single or multiple channel?

Let's examine the implications of each question.

Single-channel paging systems require the least antenna bandwidth available. In multiple system sites, paging transmitters are often troublesome to the other tenants' systems owing to the wideband noise generated by paging's digital modulation techniques, and the sometimes higher power levels of paging transmitters. While these problems can be alleviated through the use of cavity resonators installed on the paging transmitter and/or in the nearby receivers, specifying a narrowband antenna at the outset is the first line of defense against the intermodulation and selectivity problems frequently present at paging sites.

Similarly, for single-channel simplex two-way systems, the narrowband antenna offers the same filtering advantages.

Duplex (separate transmit/receive frequencies). Two-way systems and multiple-channel combined transmit and multiplex receive systems require broader bandwidth antennas to accommodate the band of frequencies in use. In conventional UHF repeaters where the transmit-receive offset is 5 MHz, a single-antenna system design incorporating a duplexer necessitates an antenna bandwidth of 5 MHz. Multiple-channel duplexes systems require even greater bandwidth.

The filtering advantage is lost with greater bandwidth antennas and cavity resonators may be required in addition to the filter action supplied by the duplexer(s) in order to minimize intermodulation and selectivity problems.