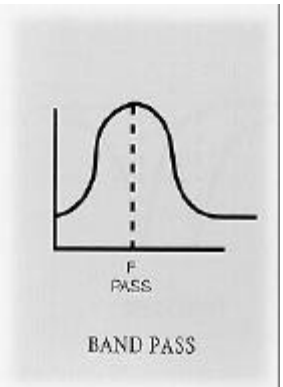
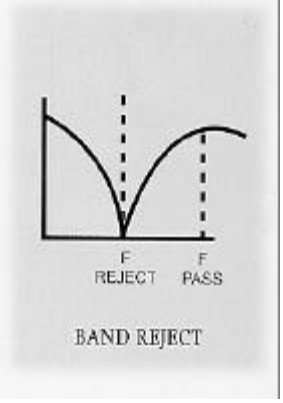
TYPES OF FILTERS

Types of filters available to the designer include low pass, high pass, band pass, and band reject filters. Low pass filters attenuate radio frequency energy above a certain cutoff point. In other words, they pass low. A typical use of a low pass filter involves suppressing the unwanted second harmonic and others above it from a transmitter. For example, a transmitter designed for 27 MHz service will generate a second harmonic at 54 MHz and, to a lesser extent, higher multiples. A good low pass filter will only permit the 27 MHz energy to reach the antenna, thus preventing interference with other radio services.



High pass filters attenuate radio frequency energy below a certain cutoff point. These filters pass high. They are the electrical mirror image of low pass filters.

Band pass filters pass a band of frequencies between specified low and high frequency cutoff points. RF energy above and below these cutoff frequencies is attenuated. Bandpass filters find wide application in land-mobile communications work. A typical application involves high power paging transmitters, where digital modulation tends to create adjacent channel interference with nearby simplex or repeater receivers. Use of a band pass-style filtering device (usually a cavity resonator) will "sharpen" the paging transmitter's RF output spectrum, permitting only the energy in the immediate vicinity of the carrier to be radiated from the antenna.



Band reject filters block, or "notch out" a band of frequencies between specified low and high frequency cutoff points. These devices are the electrical mirror image of band pass filters. RF energy below and above the cutoff points is passed to the filter output. Band reject filters also find wide application in the land mobile industry. As in the paging transmitter example, receivers with insufficient inherent selectivity that experience such interference can be outfitted with a notch filter adjusted to the offending transmitter's frequency, which effectively eliminates the interfering signal. Sometimes filters are required on both radios to completely solve interference problems at a site.

RESONANT CAVITIES

Successful commercial products are usually based on one of three basic designs: helical, transverse electro-magnetic (TEM), and waveguide. In most common use at this time are the helical and TEM styles.

TEM CAVITIES

TEM cavities are usually built as quarter- or three-quarter-wavelength resonators, with the long design used for low loss, high selectivity applications. The Q or quality factor of a TEM cavity increases as the diameter is increased to a limit point, depending upon the conductivity of the materials used in its construction. Silver plating can be applied to improve the cavity's Q

Frequency stability of a TEM cavity can be precisely controlled by incorporating an invar rod for tuning the inner conductor. Invar, with its low coefficient of expansion vs. temperature, allows the cavity to be tuned over a wide range of frequencies while the length of the tuning rod remains nearly constant over an extended range of ambient temperatures. Celwave product designers take full advantage of all of these techniques to offer superior frequency stability performance.

HELICAL CAVITIES

Helical cavities have generally been designed for low power, low Q applications such as receiver front-ends and mobile duplexers. As with the TEM style, the Q of the helical type is proportionate to the cavity diameter. Temperature compensation in helical cavities is more difficult to control than with TEM cavities, so helical designs are not specified for narrow bandwidth requirements.

DUPLEXERS

These products are an integration of filter sections, generally cavity resonators, and are used predominantly to facilitate duplex repeater operation utilizing a single antenna and feedline. Duplexers range in size and power handling capability from small mobile types to high-power base station units. They provide the critical isolation between receiver and transmitter that allows both to be connected to the antenna simultaneously without the need for a transmit-receive relay