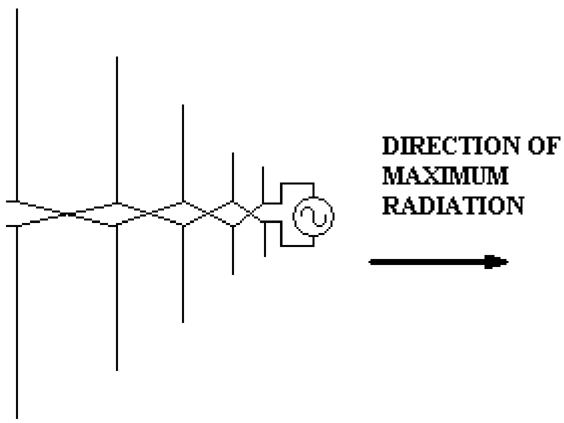
LPDA, LENS AND SLEEK ANTENNA

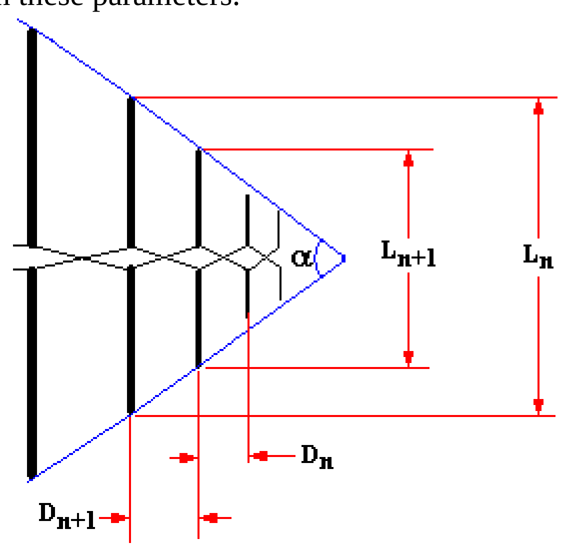
LOG PERIODIC DIPOLE ARRAY:

The log periodic dipole array (LPDA) is one antenna that almost everyone over 40 years old has seen. They were used for years as TV antennas. The chief advantage of an LPDA is that it is frequency-independent. Its input impedance and gain remain more or less constant over its operating bandwidth, which can be very large. Practical designs can have a bandwidth of an octave or more.

Although an LPDA contains a large number of dipole elements, only 2 or 3 are active at any given frequency in the operating range. The electromagnetic fields produced by these active elements add up to produce a unidirectional radiation pattern, in which maximum radiation is off the small end of the array. The radiation in the opposite direction is typically 15 - 20 dB below the maximum. The ratio of maximum forward to minimum rearward radiation is called the Front-to-Back (FB) ratio and is normally measured in dB.



The log periodic antenna is characterized by three interrelated parameters, α, σ and τ as well as the minimum and maximum operating frequencies, f_{MIN} and f_{MAX}. The diagram below shows the relationship between these parameters.



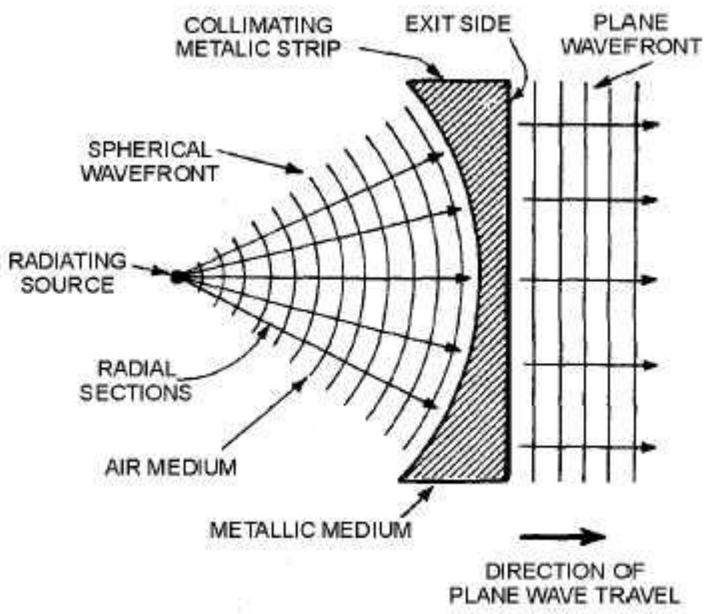
$$L_N = \frac{500}{f_{MIN}} \qquad L_1 = \frac{360}{f_{MAX}} \qquad \sigma = \frac{1-\tau}{4\tan(\alpha)} \qquad \tau = \frac{D_n}{D_{n+1}} = \frac{L_n}{L_{n+1}}$$

Unlike many antenna arrays, the design equations for the LPDA are relatively simple to work with. If you would like to experiment with LPDA designs, click on the link below. It will open an EXCEL spreadsheet that does LPDA design.

LENS ANTENNAS

With a LENS ANTENNA you can convert spherically radiated microwave energy into a plane wave (in a given direction) by using a point source (open end of the waveguide) with a COLLIMATING LENS. A collimating lens forces all radial segments of the spherical wavefront into parallel paths. The point source can be regarded as a gun which shoots the microwave energy toward the lens. The point source is often a horn radiator or a simple dipole antenna.

Waveguide Type The WAVEGUIDE-TYPE LENS is sometimes referred to as a conducting-type. It consists of several parallel concave metallic strips which are placed parallel to the electric field of the radiated energy fed to the lens, as shown in figure 3-10A and 3-10B. These strips act as waveguides in parallel for the incident (radiated) wave. The strips are placed slightly more than a half wavelength apart.



(A)

Advantages of Lens Antenna

Can be used as Wide band Antenna since its shape is independent of frequency.

Provides good collimation.

Internal dissipation losses are low, with dielectric materials having low loss tangent.

Easily accommodate large band width required by high data rate systems.

Quite in-expensive and have good fabrication tolerance

Disadvantages of Lens Antenna

Bulky and Heavy

Complicated Design

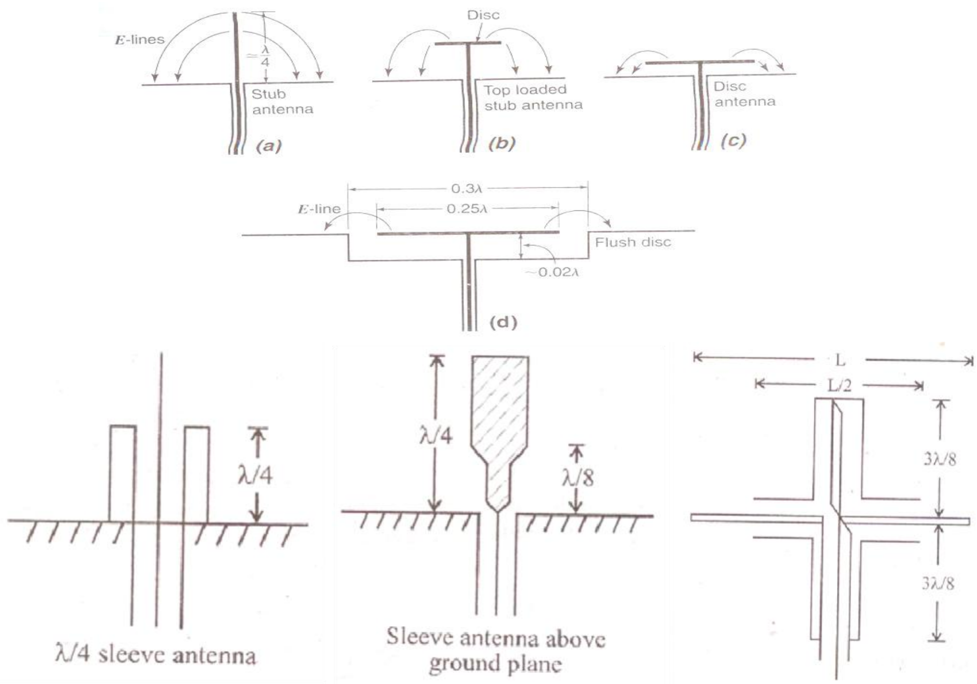
Refraction at the boundaries of the lens

Sleeve antenna

Ground plane or sleeve type λ/4 long cylindrical system is called a sleeve antenna. The radiation is in a plane normal to the axis of this antenna.

The second variety of sleeve is similar to stub with ground plane having the feed point at the centre of the stub. The lower end of the stub is a cylindrical sleeve of length λ/8.

A balanced-sleeve dipole antenna corresponding to the sleeve stub is shown in fig. This is fed with a coaxial cable and balance to unbalance transformer or balun. For L ranging between λ/2 to λ, the operating frequency ranges through 2 to 1.



Evolution of flush-disk antenna from vertical λ/4 stub antenna

It is the modified ground plane antenna.

Here the ground plane has de-generated into a sleeve or cylinder λ/4 long.

Maximum radiation is normal to the axis.

Source : http://elearningatria.files.wordpress.com/2013/10/ece-vi-antennas-and-propagation-10ec64-notes.pdf