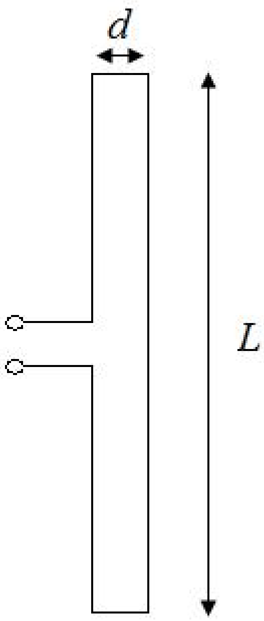
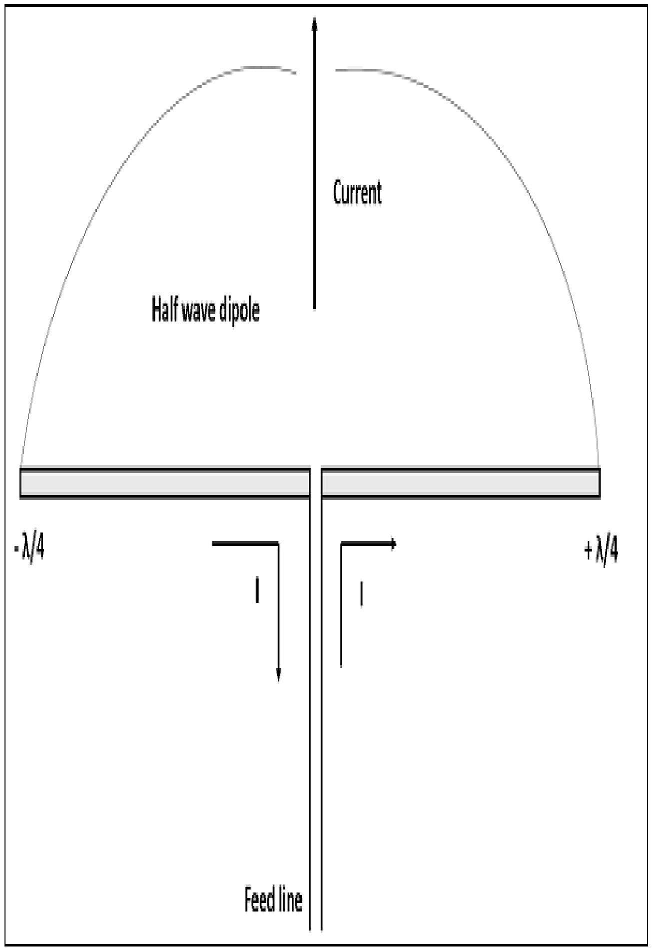
FOLDED DIPOLE ANTENNA

- Two conductors connected on both sides, and folded to form a cylindrical closed shape, to which feed is given at the center.
- dipole antenna with the ends folded back around and connected to each other, forming a loop.
- The length of the dipole is half of the wavelength. Hence, it is called as **half wave folded dipole antenna**.
- Frequency range-around 3KHz to 300GHz.
- This is mostly used in television receivers.

- Typically, the width d of the folded dipole antenna is much smaller than the length L.
- Because the folded dipole forms a closed loop, one might expect the input impedance to depend on the input impedance of a short-circuited transmission line of length L.
- However, you can imagine the folded dipole antenna as two parallel short-circuited transmission lines of length $L/2$.


d
L


Current
Half wave dipole
-λ/4
+λ/4
I
I
Feed line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- The input impedance ZA of the folded dipole is given by:

$$Z_A = \frac{4Z_t Z_d}{Z_t + 2Z_d}$$

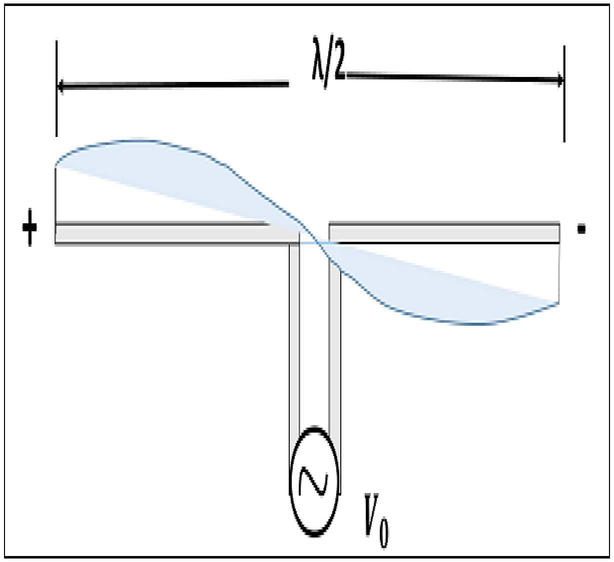
- Zd represent the impedance of a dipole antenna of length *L* and Zt represent the impedance of a transmission line impedance of length *L*/2, which is given by:

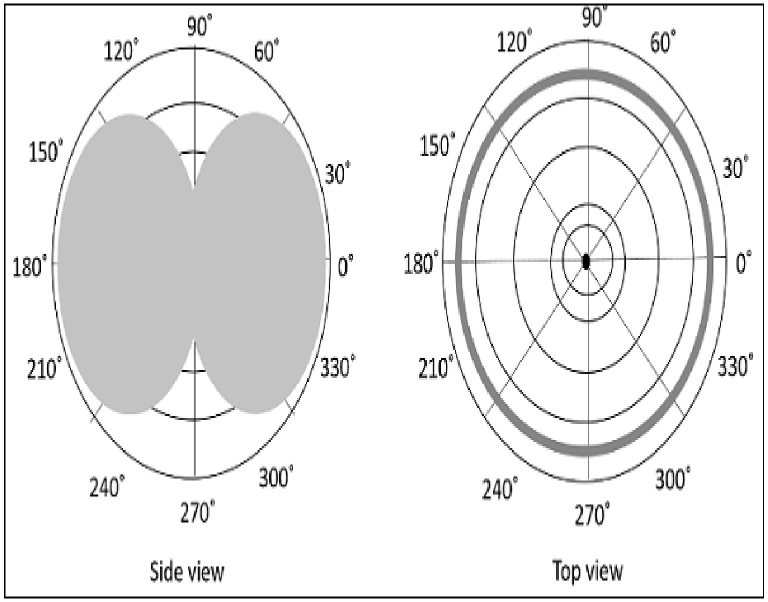
$$Z_t = jZ_0 \tan\frac{\beta L}{2}$$

Half-Wavelength Folded Dipole

- The antenna impedance for a half-wavelength folded dipole antenna ZA=4*Zd.
- At resonance, the impedance of a half-wave dipole antenna is approximately 70 Ohms, so that the input impedance for a half-wave folded dipole antenna is roughly 280 Ohms.
- Because the characteristic impedance of twin-lead transmission lines are roughly 300 Ohms.

- The radiation pattern of half-wavelength folded dipoles have the same form as that of half-wavelength dipoles.





- This folded dipole is the main element in **Yagi-Uda antenna**.
- Advantages
  - Reception of balanced signals.
  - Receives a particular signal from a band of frequencies without losing the quality.
  - A folded dipole maximizes the signal strength.
- Disadvantages
  - Displacement and adjustment of antenna is a hassle.
  - Outdoor management can be difficult when antenna size increases.
- Applications
  - Mainly used as a feeder element in Yagi antenna, Parabolic antenna, turnstile antenna, log periodic antenna, phased and reflector arrays, etc.
  - Generally used in radio receivers.
  - Most commonly used in TV receiver antennas.

Yagi-Uda antenna

- Most commonly used type of antenna for **TV reception** over the last few decades.
- It is the most popular and easy-to-use type of antenna with better performance, which is famous for its high gain and directivity.
- **Frequency range-**around **30 MHz to 3GHz** which belong to he **VHF** and **UHF** bands.

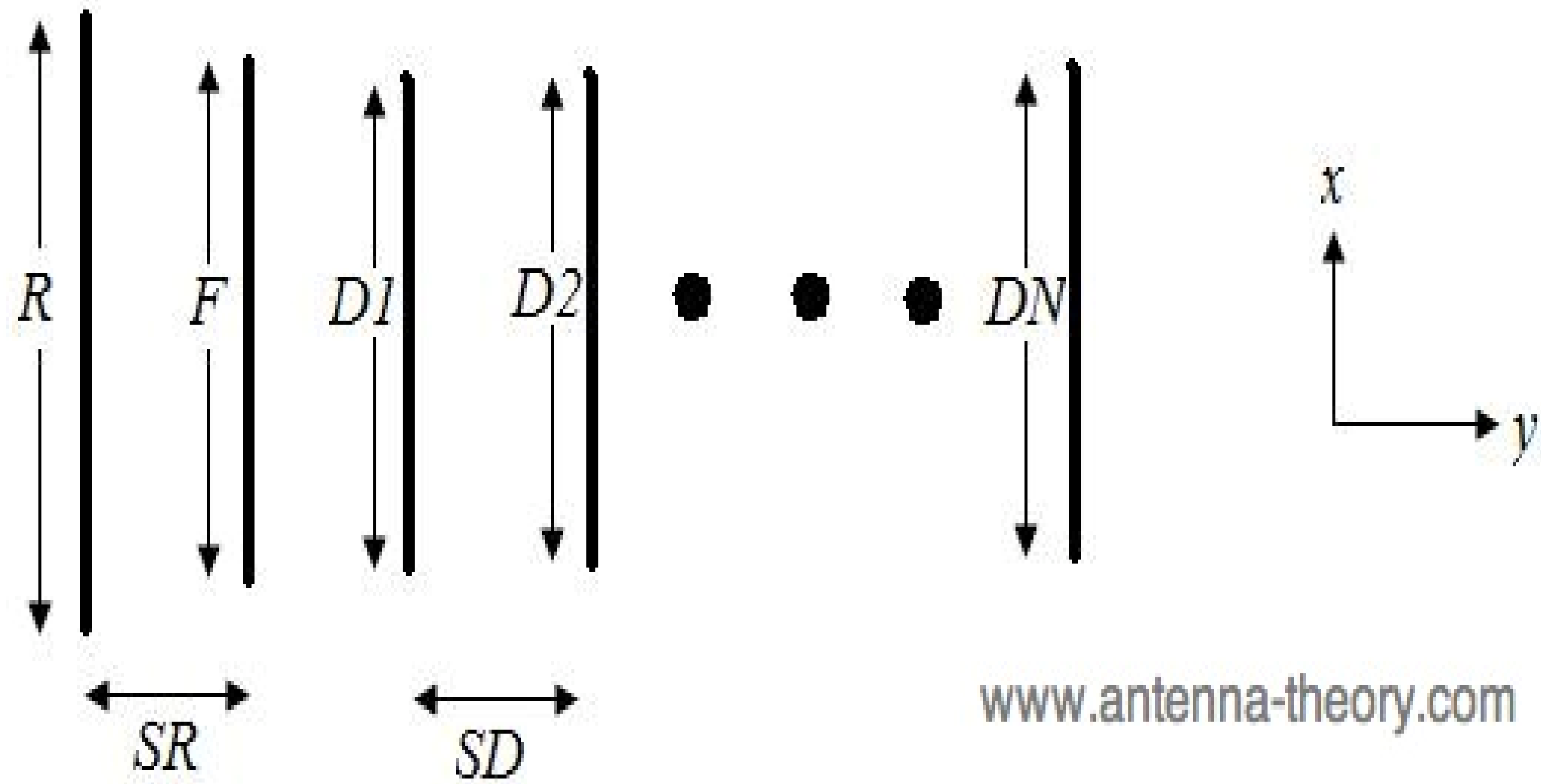
- The Yagi antenna was invented in Japan, with results first published in 1926. The work was originally done by Shintaro Uda, but published in Japanese. The work was presented for the first time in English by Yagi.
- It is seen that there are many directors placed to increase the directivity of the antenna.
- The feeder is the folded dipole.
- The reflector is the lengthy element.

Geometry of Yagi Antennas

- The Yagi antenna consists of a single 'feed' or 'driven' element, typically a dipole or a folded dipole antenna. This is the only member of the above structure that is actually excited.
- The rest of the elements are parasitic – they reflect or help to transmit the energy in a particular direction.
- This feed antenna is often altered in size to make it resonant in the presence of the parasitic elements.

  (typically, 0.45-0.48 wavelengths long for a dipole antenna).

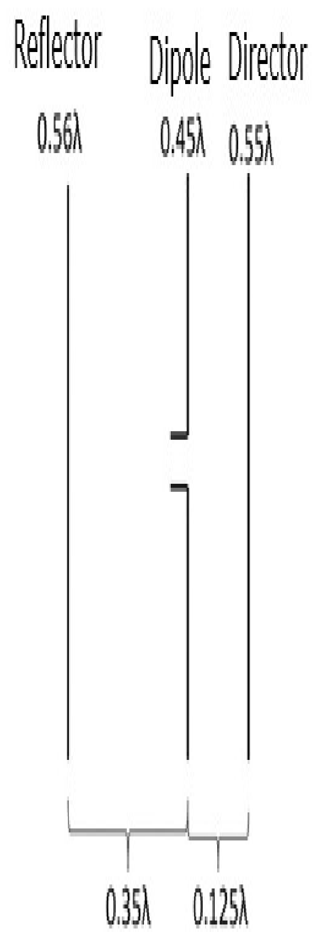
Geometry of Yagi Antennas



- The element to the left of the feed is the reflector.
- The length of this element is given as *R* and the distance between the feed and the reflector is *SR*.
- The reflector element is typically slightly longer than the feed element.
- There is typically only one reflector; adding more reflectors improves performance very slightly.
- This element is important in determining the front-to-back ratio of the antenna.

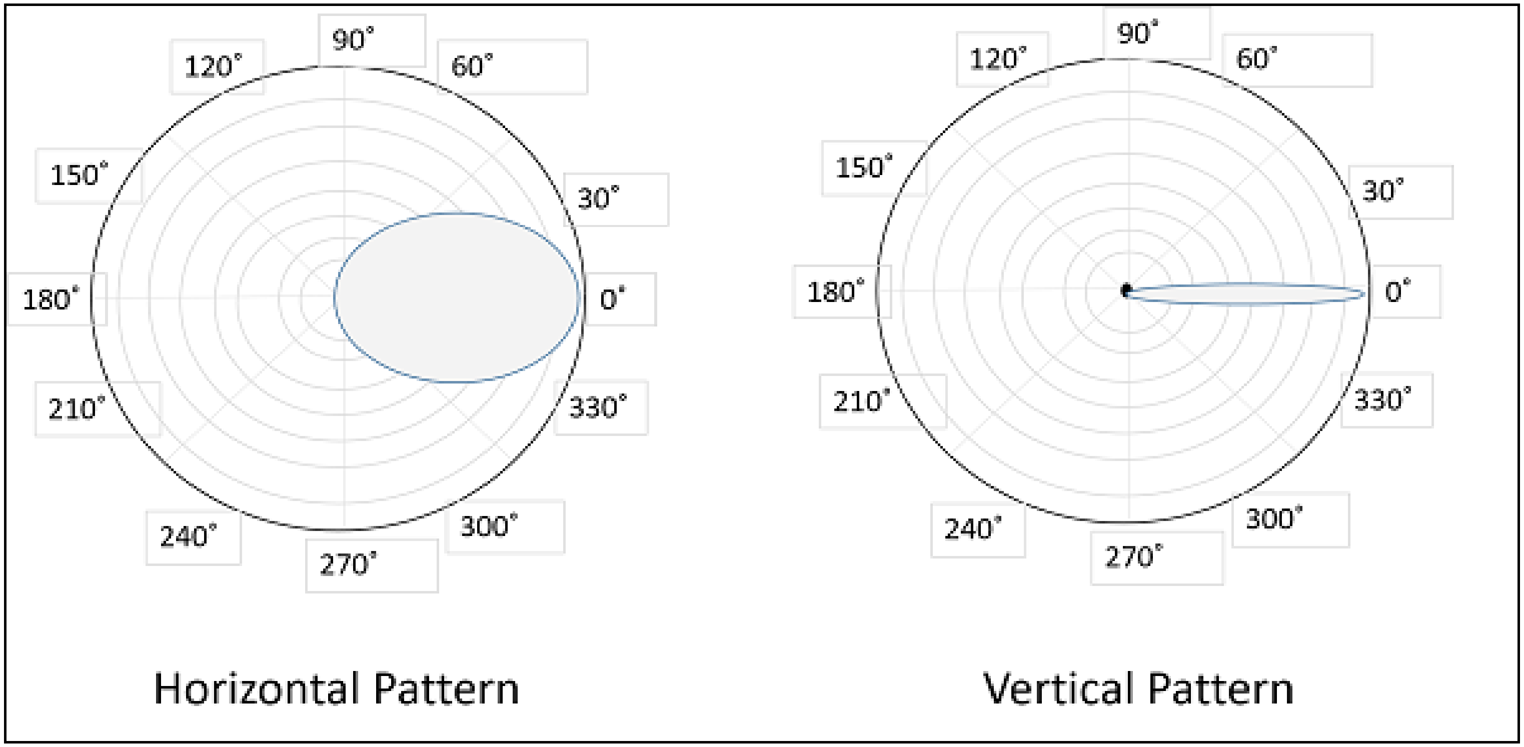
Design of a Yagi-Uda antenna

- quite simple.
- Because Yagi antennas have been extensively analyzed and experimentally tested.



ELEMENT	SPECIFICATION
Length of the Driven Element	0.458λ to 0.5λ
Length of the Reflector	0.55λ to 0.58λ
Length of the Director 1	0.45λ
Length of the Director 2	0.40λ
Length of the Director 3	0.35λ
Spacing between Directors	0.2λ
Reflector to dipole spacing	0.35λ
Dipole to Director spacing	0.125λ

Radiation Pattern



- Advantages
  - High gain is achieved.
  - High directivity is achieved.
  - Ease of handling and maintenance.
  - Less amount of power is wasted.
  - Broader coverage of frequencies.
- Disadvantages
  - Prone to noise.
  - Prone to atmospheric effects.
- Applications
  - Mostly used for TV reception.
  - Used where a single-frequency application is needed.