Assignment - 03

1) What is a frequency independent Antenna ? Explain the structure and operating regions of a log periodic Antenna with a neat diagram.

Ans

frequency independent Antenna.

→ It is an antenna for which the impedance and radiation characteristics remains constant as a function of frequency.

→ The frequency independent can be achieved by following ways.

→ The antenna should expand (or) contract in proportion to the wavelength (λ).

(or)

→ If the antenna structure is not mechanically adjustable, the size of the radiating region should be made proportional to the wavelength.

Log periodic Antenna

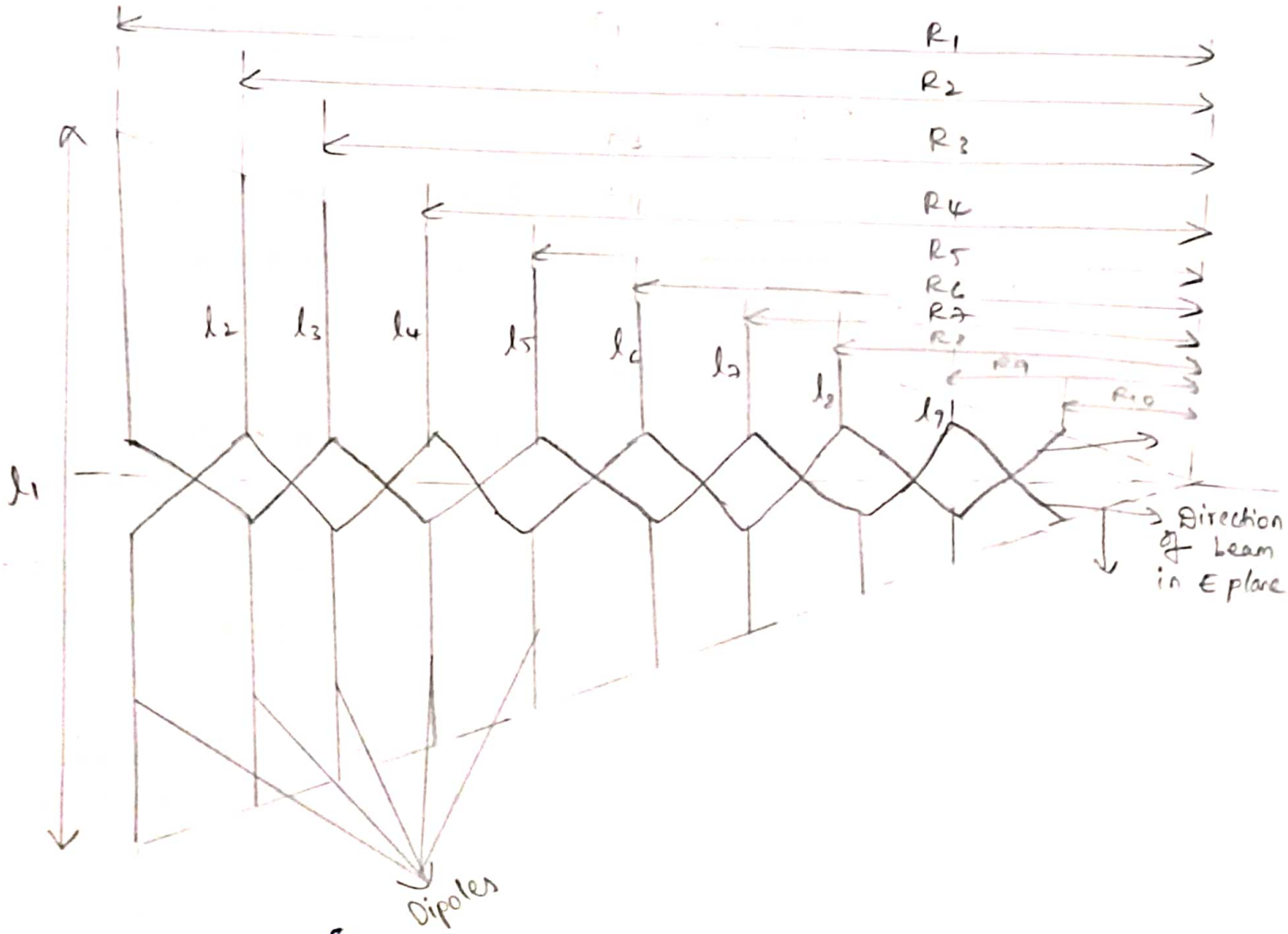
→ A log-periodic antenna is a broadband, multi-element, directional, narrow beam antenna.

→ It is an antenna in which the electrical properties repeat periodically with the logarithm of the frequency.

→ The individual components are given dipoles.

· Key points :

1) High bandwidth
2) moderate directivity.



Structure.

→ The dipole lengths and the spacing between two adjacent dipoles are related through a parameter called as design ratio (or) scale factor (τ).

→ Thus the relationship b/n R_n and and R_{n+1} and I_n & I_{n+1} is given by

$$R_{n+1}/R_n = I_{n+1}/I_n = 1/\tau$$

→ τ is also called as periodicity factor which is always less than 1.

→ The lengths are given as:

- $I_4 = I_5 + 25\%\ (I_5)$
- $I_3 = I_4 + 25\%\ (I_4)$.

Regions of Operations

→ The three regions of operations are:

i) Inactive (transmission line) region.

ii) Active region.

iii) Reflective region.

i) Inactive region

1) $L < \lambda/2$

2) Also spacing between the elements is small.

3) Elements offers high capacitance impedance (i.e, highly capacitive region).

4) Elements current is of small magnitude and leads the supplied voltage by 90°.

5) Thus, the small current through the element results in small radiation in the backward direction.

ii) Active region.

1) $L = \lambda/2$

2) Spacing is large.

3) In this region, dipoles acts like radiating regions.

4) Impedance offered by the dipoles are resistive.

5) Elements currents are large and in phase with the supplied voltage.

iii) Reflective region

→ $L > \lambda/2$

→ That dipole lengths are larger than resonant length.

→ Impedance becomes inductive as $L > \lambda/2$ causes the current in the elements to lag the base voltage.

→ Whatever a material is acting as inductive regions it starts reflecting the radiation.

→ Hence, a maximum radiation will be there in backward direction

→ Also the inactive region.

Advantages

→ It offers a compact structure.

→ It offers negligible loss of power when terminated.

disadvantages.

→ It is quite expensive than other antennas.

→ The mounting platform must be of sufficient strength to hold the elements.

Applications

→ UHF terrestial TV.

→ HF communication.

→ EMC (electromagnetic compatibility) measurement.

2) Explain briefly about the smart Antenna.

Ans Smart antennas (also known as adaptive array antennas, digital antenna arrays, multiple antennas and, recently, MIMO) are antenna arrays, with smart signal processing algorithms used to identify

Spatial signal signatures such as direction of arrival (DOA) of the signal, and use them to calculate beamforming vectors which are used to track and locate the antenna beam on the mobile / target. Smart antennas should not be confused with reconfigurable antennas, which have similar capabilities but are single element antennas are not antenna arrays.

Smart antenna techniques are used notably in acoustic signal processing, track and scan radar, radio astronomy and radio telescopes, and mostly in cellular systems like W-CDMA UMTS and LTE.

Smart antennas have many functions: DOA estimation, beamforming, interference nulling, and constant modulus preservation.