STUDY OF ANTENNAS IN C BAND FOR SATELLITE COMMUNICATION

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Abstract: -

The main focus of this paper on the various types of antennae used in C band for satellite communication. This paper gives information to reader about the antennas used for C band. It gives overview about the patch antenna and dish antenna and their individual losses and performance. In the end of paper, we discuss some of antennas that can be used for future aspects in satellite communication.

Keywords: C band, Antenna, microstrip patch

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INTRODUCTION:

C band for satellite communication is electromagnetic frequency band. C band is divided into two standards. One is IEEE C band and another one is NATO C band. IEEE C band includes frequency range from 4 to 8 GHz and NATO C band includes frequency range 500 to 1000 MHz. C band is less affected by adverse weather condition like rain attenuation and sky noise as compared to K band. C band are used for applications like weather radar system, voice and other data communication applications. There are various types of antennas used in C band for satellite communications for different application but mostly patch antenna is used.

1. Microstrip Patch Antenna

A microstrip patch antenna is very small antenna that have a conducting metal plate on one side of substrate and conducting ground plane on another side of substrate. It is constructed on a dielectric substrate using lithography process. Microstrip patch antenna is very small in size and installed in microstrip array form. Typically, these antennae have gain of 5 to 6 db. These shows a good performance and can be installed in nano satellites. There is various design of microstrip antennas like rectangular microstrip antenna, circular microstrip and in elliptical shape antenna, each have their own characteristics.

1.1 GAIN

Gain of antenna is represents the radiation efficiency. It is defined as the ratio of radiation produced by a far-field to the radiation produced by an isotropic source. Gain of this antenna is small typically 5 to 6 db. Gain can be increased by use of array of microstrip patch antennas. The rectangular patch antenna has maximum directivity in one direction to the direction of broadside. Gain of this antenna reduced due to the surface wave losses and losses due to the dielectric medium used.

1.2 IMPEDANCE

Input impedance of a patch antenna depends on quality factor, resonant frequency and the resonant resistance.

$$f_c \approx c / 2L \sqrt{\epsilon_r}$$

As the spacing between the patch and the ground plane decreases lesser energy is released and more energy is stored in patch capacitance and inductance

The width of microstrip antennas controls the input impedance. Larger the width larger will be the bandwidth. For square patch antenna the input impedance will be on the order of 300 Ohms. The impedance can be reduced by increasing the width, so to decrease the input impedance to 50 Ohms wide patch antennas are required, which takes up a lot of valuable space.

1.3 ADVANTAGES:

An array of patch antenna is used rather than a single antenna which provides more gain than a single patch antenna. It can be easily manufacture as it includes two-dimensional geometry. It supports both linear and circular polarization. These are efficient radiators. Due to small size these have less weight. Although these have low manufacturing cost. Some of disadvantages of patch antenna are:

Excitation of surface wave.

Low impedance bandwidth.

Extra radiation occurs from its feeds and junctions.

These antennas can be directly printed on the PCB.

2. Satellites Dish Antenna

A satellite dish antenna is a parabolic shape of dish that reflects signal to dish's focal point. It has a feed horn that is mounted on dish that is basically a waveguide that couple electromagnetic energy into the cable. This feed horn gathers the signal to a LNB. LNB is a low noise block down converter device that is a type of low noise amplifier. The distance between the feed antenna and the reflector is typically several wavelengths as well. This is in contrast to the corner reflector, where the antenna is roughly a half-wavelength from the reflector.

2.1 GAIN

Parabolic reflector or large dish have larger gain commonly from 30 to 40 db and also have low cross polarization. They have reasonable bandwidth approx. 5%. Unlike resonant antennas like the dipole antenna which are typically approximately a half-wavelength long at the frequency of operation, the reflecting dish must be much larger than a wavelength in size. The dish is at least several wavelengths in diameter, but the diameter can be on the order of 100 wavelengths for very high gain dishes (>50 dB gain).

2.2 ADVANTAGES

The Parabolic antennas has high directivity. Parabolic antennas possess some of top gains, that is they can develop narrowest bandwidths, connected with almost any feeder type. Parabolic antennas are used in high frequency part of radio spectrum, at uhf and microwave frequencies. It can be used as a high gain antenna for applications like microwave links that carry telephone and television signals.

3. Future antennas:

With the advancement in technology and the trend of ever increasing capacity availability of services leads to more flexible, lighter and even more stylish satellite antennas. Combining Tx and Rx into same antenna is a feature of new satellite antennas. The implementation of PIM-free multiband antennas will call for advanced low-loss multiplexer technologies such as the

triplexers and quadruplexers that have been required on some recent programs.

Reconfigurable antennas: In FSS/DSB communication need of reconfigurable antennas is increased in last few years. Reconfigurable antenna have the ability to reconfigure their shape by mechanical means or by electronic means. They provide flexibility to operator to change the shape of spacecraft in orbit in order to cope with change in traffic requirements.

Active Direct Radiating Array (**DRA**) is another future antenna that offer the potential for unequalled coverage flexibility from space, with significant commercial returns

Conclusion:

In this article we concluded satellite dish and microstrip antenna that is used in satellite band communication and their different parameters. Dish antennas have larger in dimension but they have larger gain than microstrip patch antenna. While microstrip patch antenna have small size and used in many application where small size antennas required like in nanosatellite and in small size satellites.

References:

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