Chapter 6: Frequency selective surfaces

Introduction

At the end of 18th century, American physicist D. Rittenhouse found out that some colors of a light spectrum are suppressed when a street lamp is observed through a silk handkerchief. This was the first proof of the fact that non-continuous surfaces can exhibit different transmission properties for different frequencies of incident wave. Hence, the surfaces are called frequency-selective surfaces.

Later, frequency selective surfaces appeared even in the range of radio frequencies. In 1919, G. Marconi and B. Franklin used a reflector built form horizontal conductors, which formed a non-continuous parabolic surface together. That way, a continuous reflective surface was imitated for a given frequency.

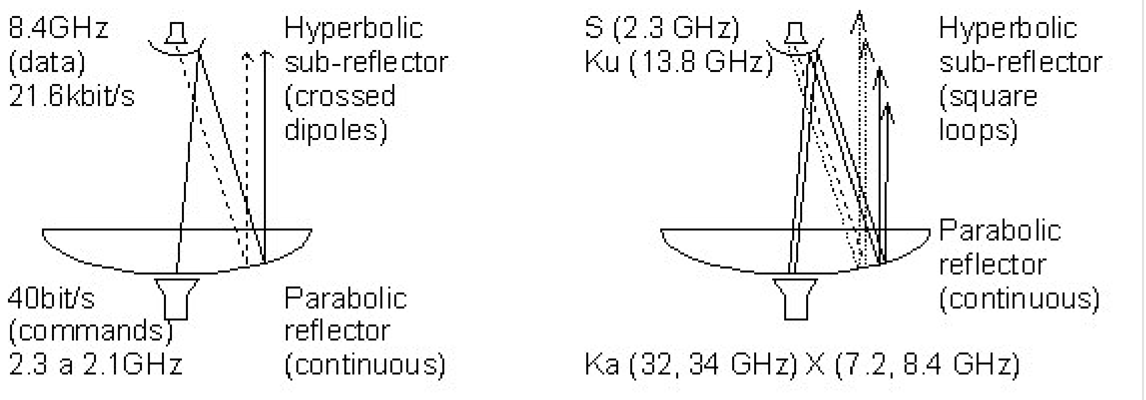

Fig. 6.1 *Antenna of satellite Voyager 77 (left) and Cassini 96 (right)*

Of course, frequency selective surfaces were further investigated and exploited. During the last 40 years especially, an intensive attention was turned to them. The satellite Voyager 77 exploited a frequency selective surface for implementing a double-frequency reflector (the parabolic antenna on the satellite could operate in two frequency bands and could be fed from two spatially separated sources). In the case of the satellite Cassini in 1996, the described principle was extended to four frequency bands. A schematic picture of both the antennas is depicted in fig. **6.1**, their photograph is shown in fig. **6.2**.

Selective surfaces are exploited even in military applications. As a typical example, a radome in the spike of a fighter can be given. A radome has to ensure a total reflection of all frequencies except of the operation frequency band of the radar. Next to the filtering, selective surfaces are also used as polarization filters.

In par. 6.1, numeric modeling of two selected types of frequency selective surfaces is described. Attention is turned to the surface, which consists of equidistantly distributed identical conductive rectangles, and to the surface, which is formed by rectangular slots in a metallic plane.

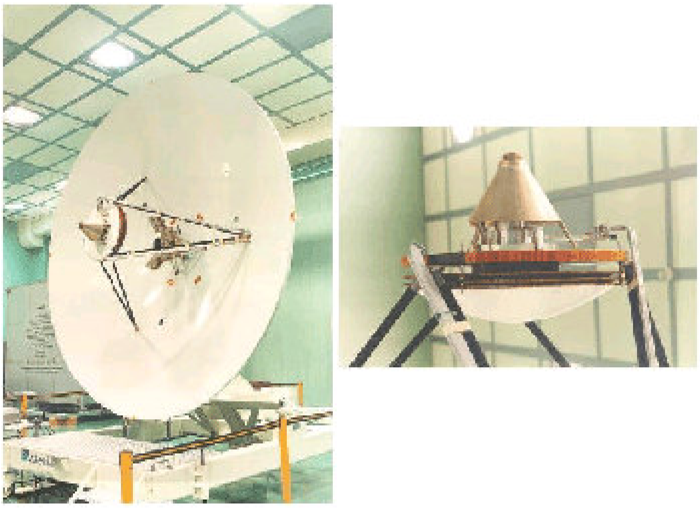

Fig. 6.2 *Antenna for the satellite Cassini 96 (left). A detailed view on hyperbolic sub-reflector of this antenna (right).*