

Design of a New Dichroic Plate and Feed for a BWG Antenna

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A BWG feed system is composed of one or more feed horns with a series of flat and curved mirrors arranged so that power can be propagated from the horn through the mirrors with minimum losses. Horns and equipment can be located in a large stable enclosure at an accessible location. The current NASA large ground station BWG antennas use conventional corrugated horns for feeds and thick dichroic plates with rectangular holes to separate multiple frequency bands. The dichroic plates are designed so that the lower frequencies are reflected and the upper frequencies are passed.

A new all metal dichroic plate was designed that is transparent at the lower frequencies and reflective at the upper frequencies. The basic concept of the new design is to use slots in a moderately thick metallic plate for the transmit band and to use chokes in the slots to reflect the upper frequency bands. Thus the dichroic plate is transparent at the lower frequency band and reflective at the upper frequency bands without using a dielectric. Two designs are under consideration for Deep Space Network (DSN) applications; 1) reflect Ka-band transmit and receive frequencies and pass X-band receive frequencies and 2) reflect Ka-band frequencies and X-band transmit frequencies, and pass X-band receive frequencies. Examples of both designs are given that have insertion losses as low as 0.04 dB at the narrow pass band as well as the ability to handle up to 20 KW of power.

Also, a new feed horn design is shown that produces a very gaussian type radiation pattern with very low sidelobes. This type of feed is ideally suited for illuminating BWG systems.