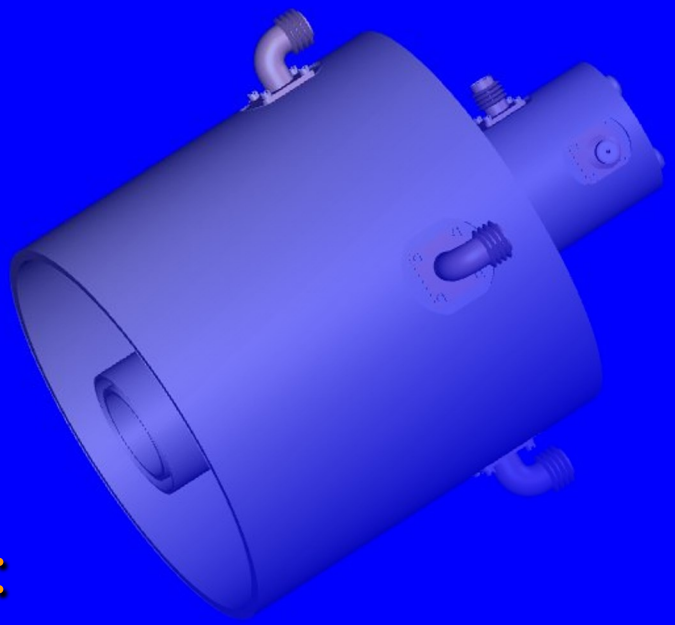
The Coaxial Waveguide Antenna – An Ideal Feed Configuration For the Amateur Band Satellite Communications Antenna



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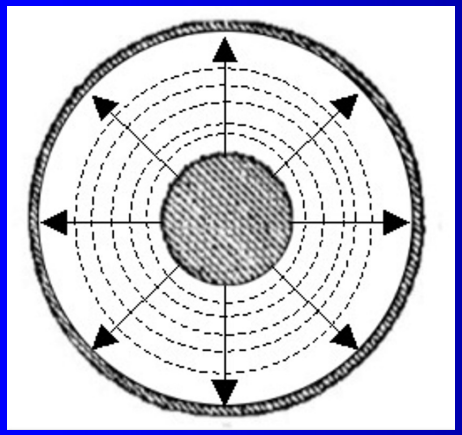
Allen, Texas

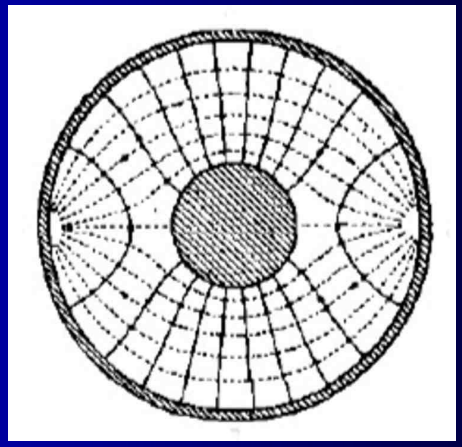
Coaxial Waveguide Principle of Operation

Electro-magnetic Fields in Coaxial Waveguide

TEM Mode



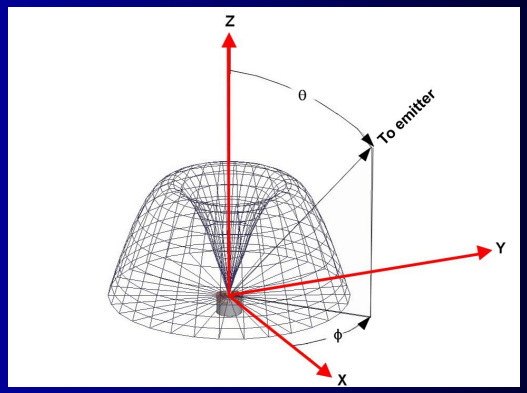
$TE_{1,1}$ Mode



Radiation Patterns From Coaxial Waveguide

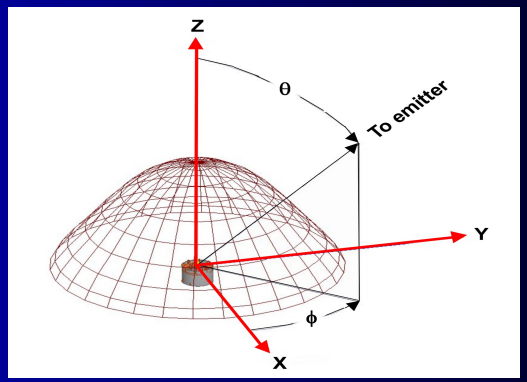
TEM mode

- Null on axis
- Everywhere *radially* polarized
- Unsuitable for any feed application

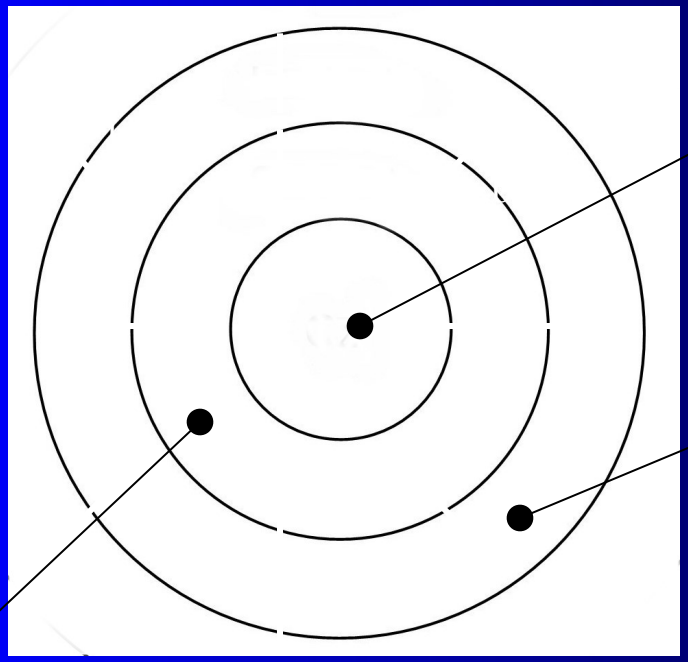


$TE_{1,1}$ mode

- Peak on axis
- Ideal feed pattern for parabolic reflector
- Can be either linearly or circularly polarized



Coaxial Waveguide Cavity Configuration for Multi-band Operation

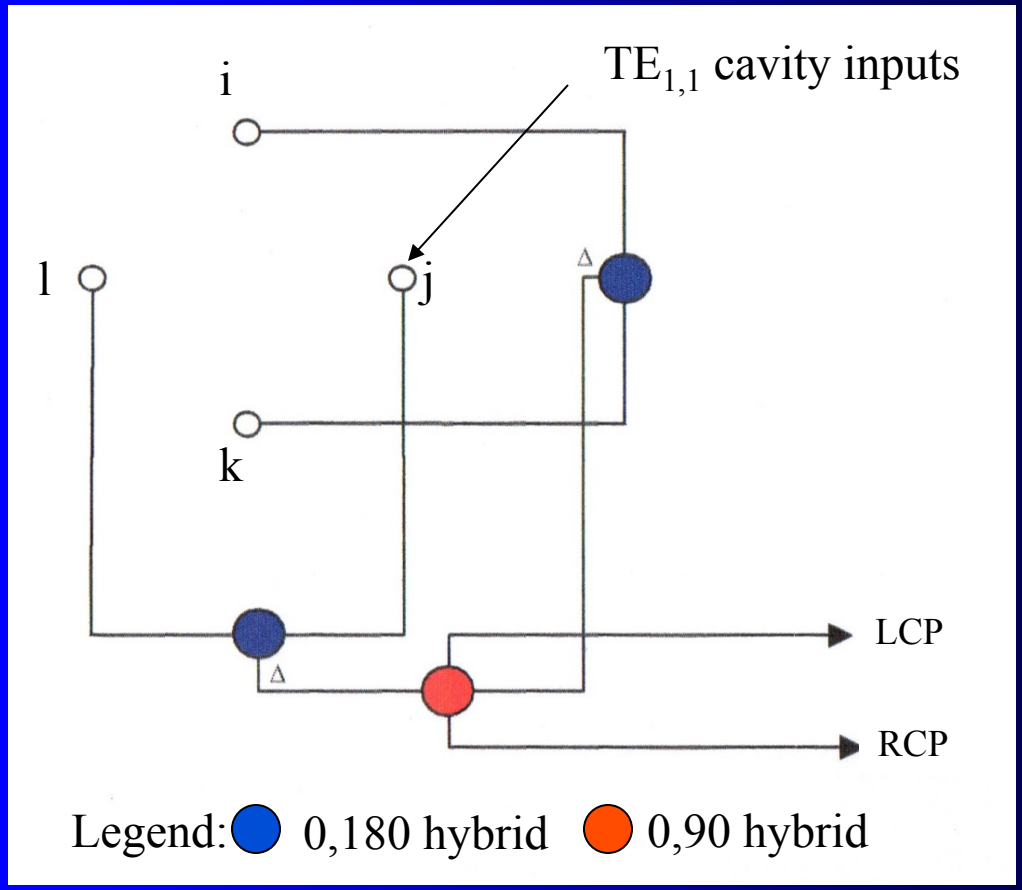


Highest frequency cavity (circular waveguide)

Lowest frequency cavity (coaxial waveguide)

Intermediate frequency cavity(ies) (coaxial waveguide)

$TE_{1,1}$ Mode Excitation Network



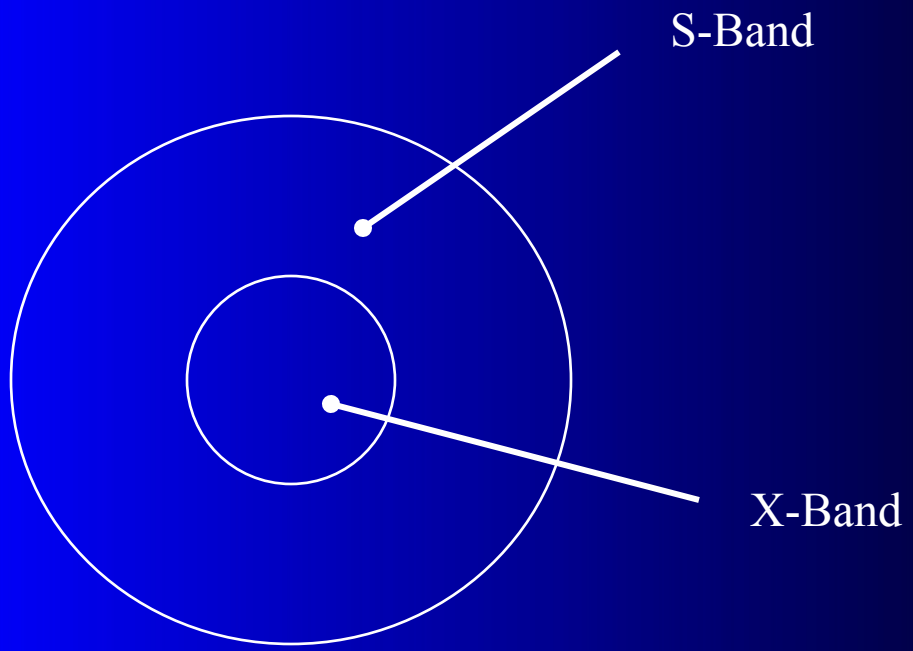
A Dual-band Feed Design Example

The following charts describe the design of a dual band coaxial waveguide feed which operates over the following amateur radio band frequencies:

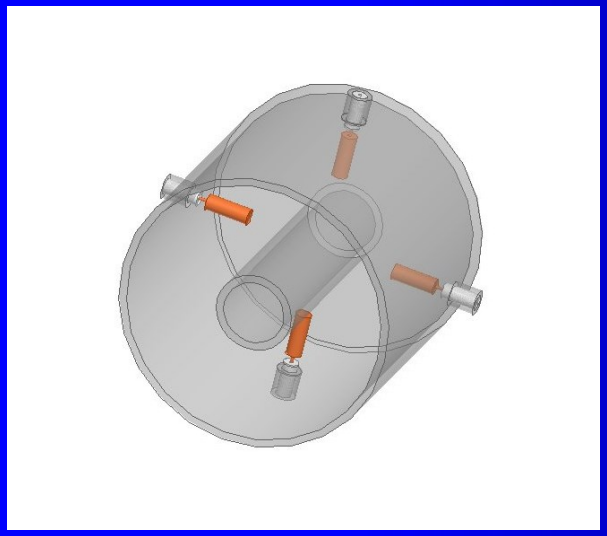
S-Band: 2404.775 ± 4.725 MHz

X-Band: 10,494.275 ± 4.725 MHz

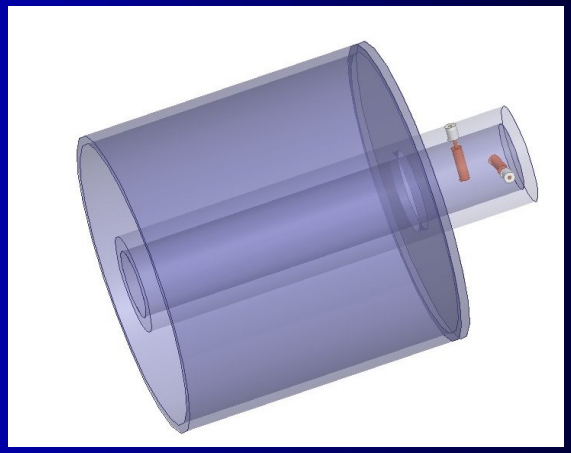
Waveguide Layout



Waveguide to Coaxial Output Transitions

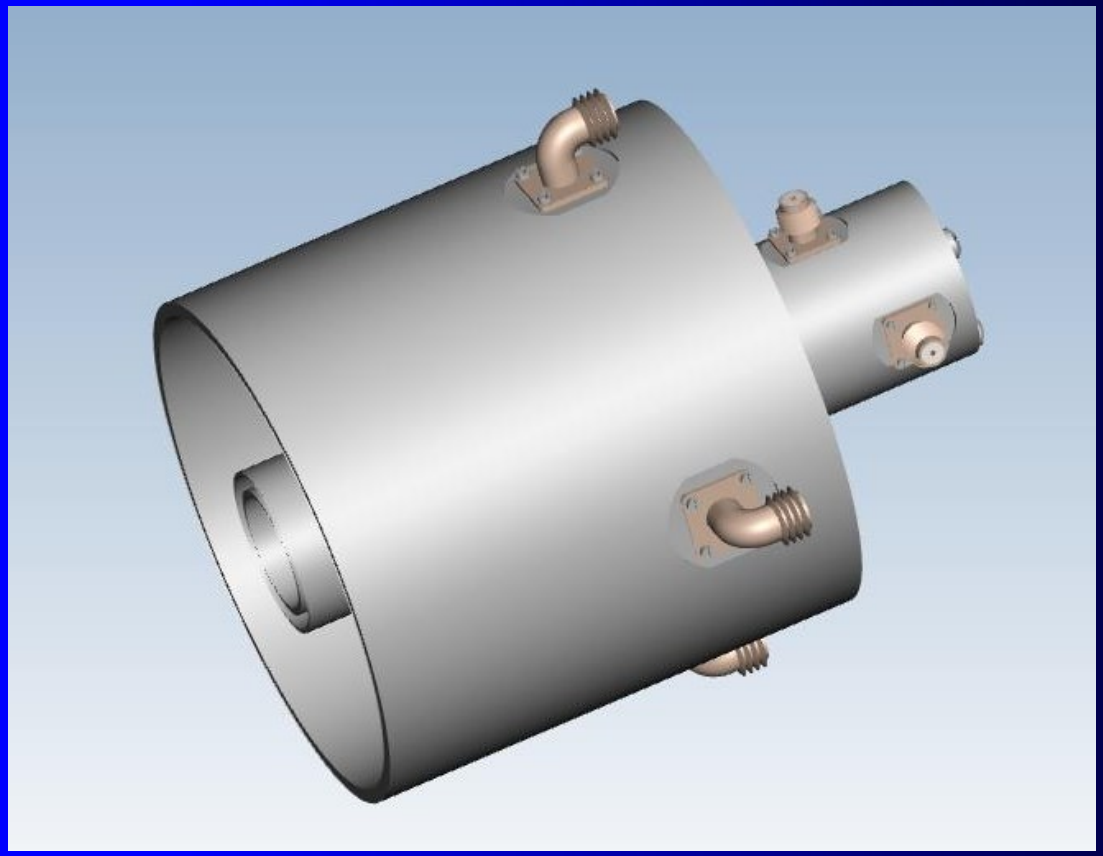


S-Band

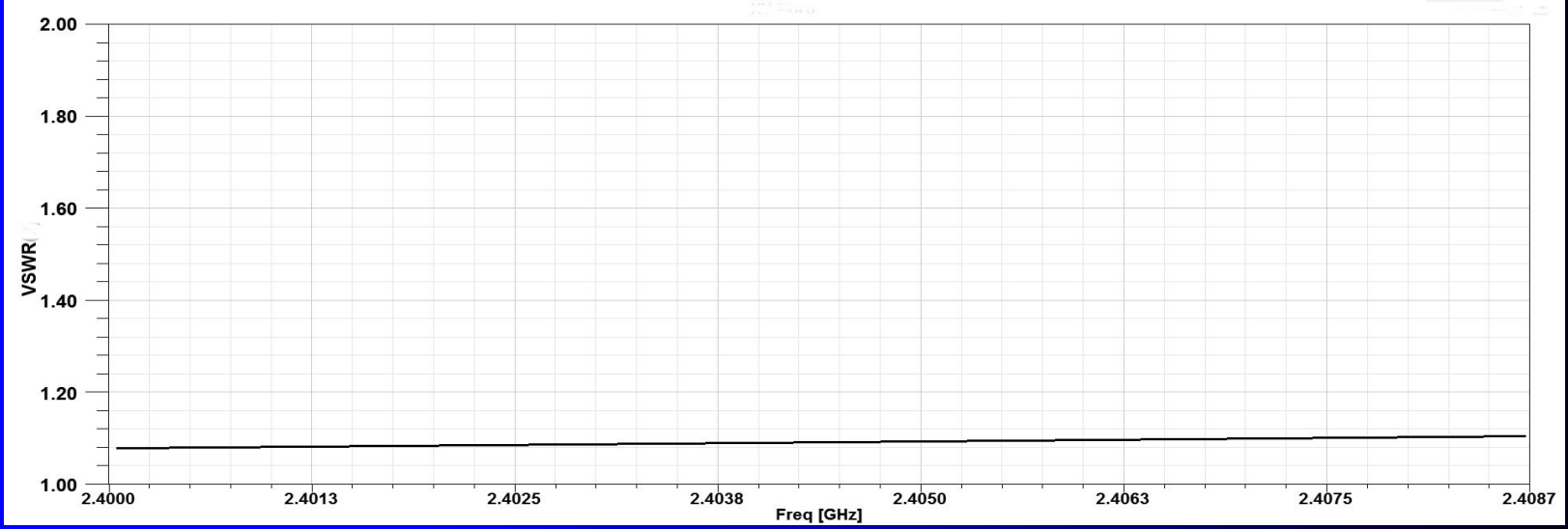


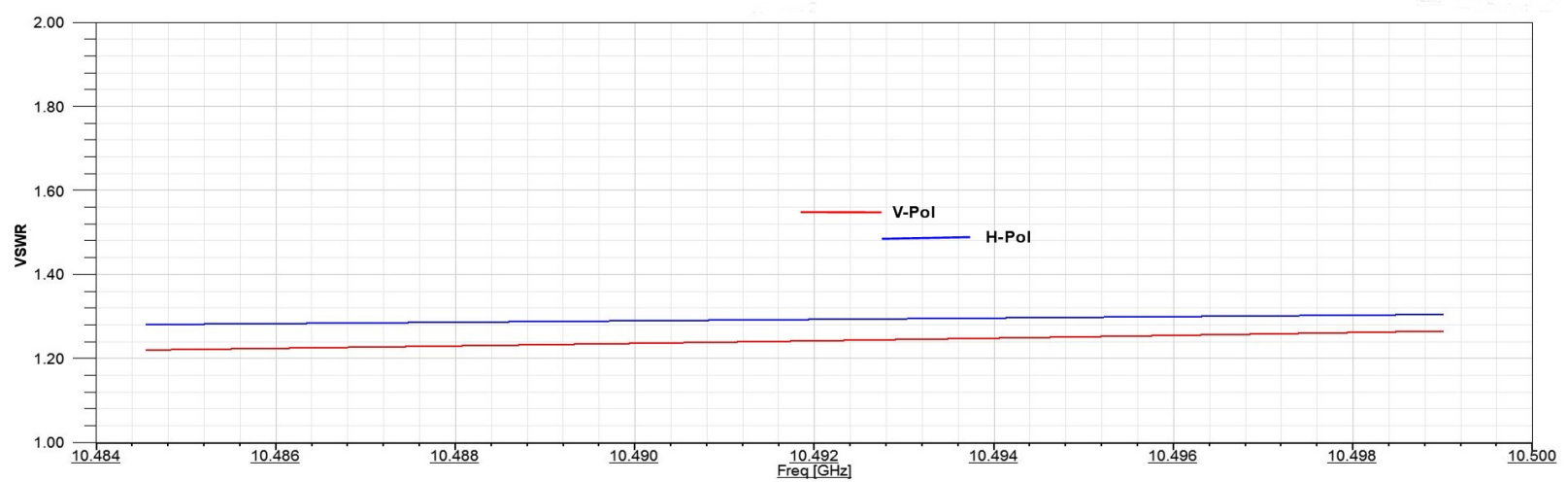
X-Band

Final Feed Design



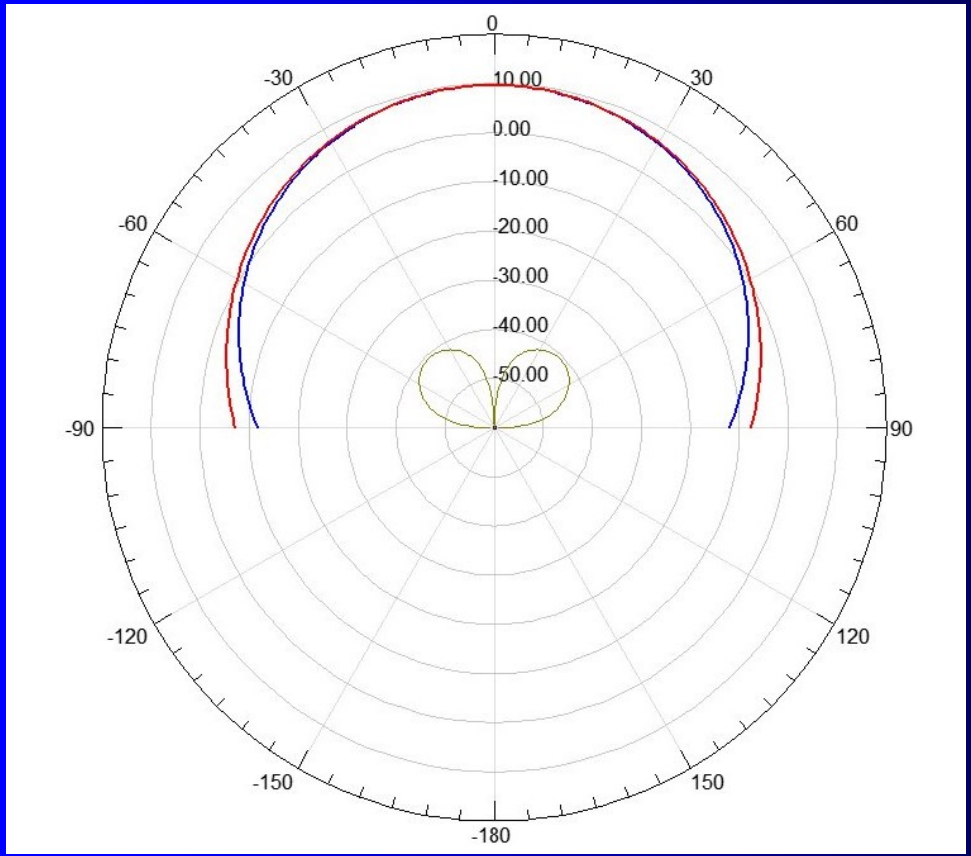
Performance*





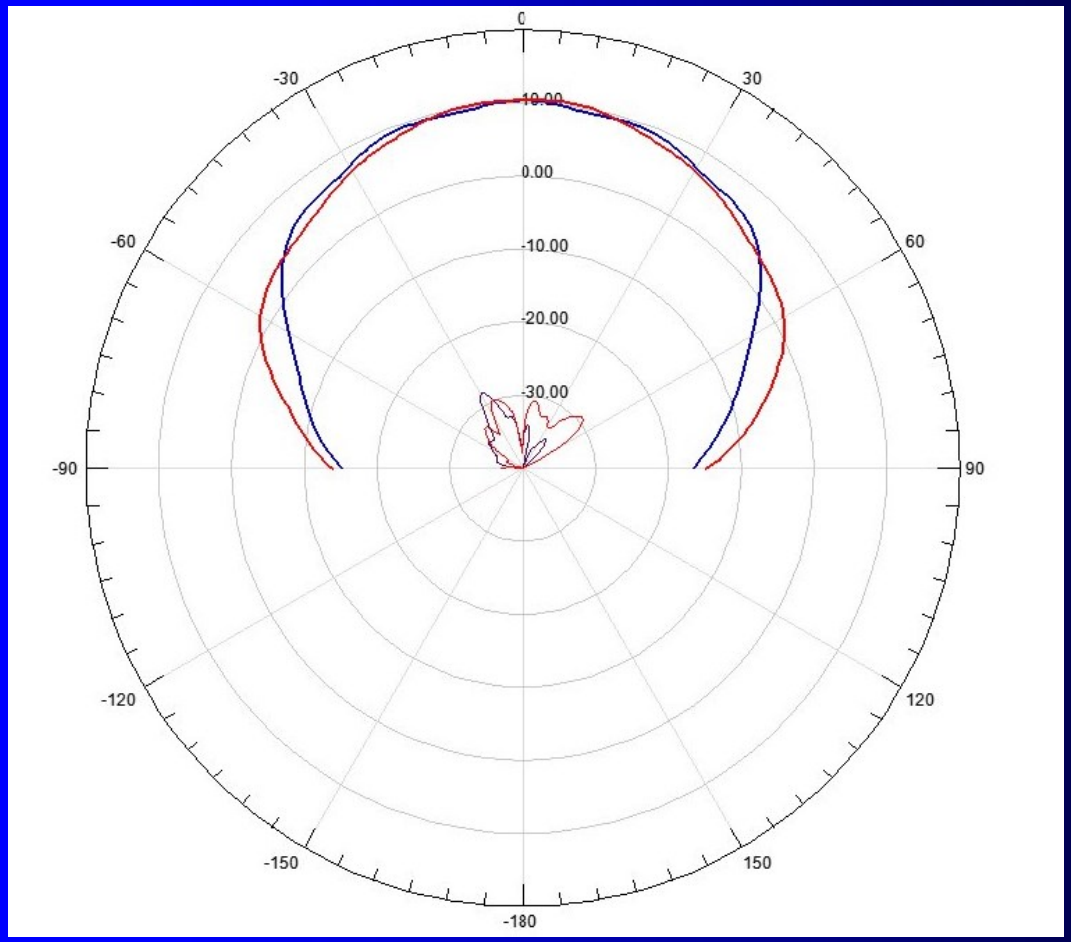
*** Data acquired using HFSS (High Frequency Structure Simulator) software**

Performance (cont’d)



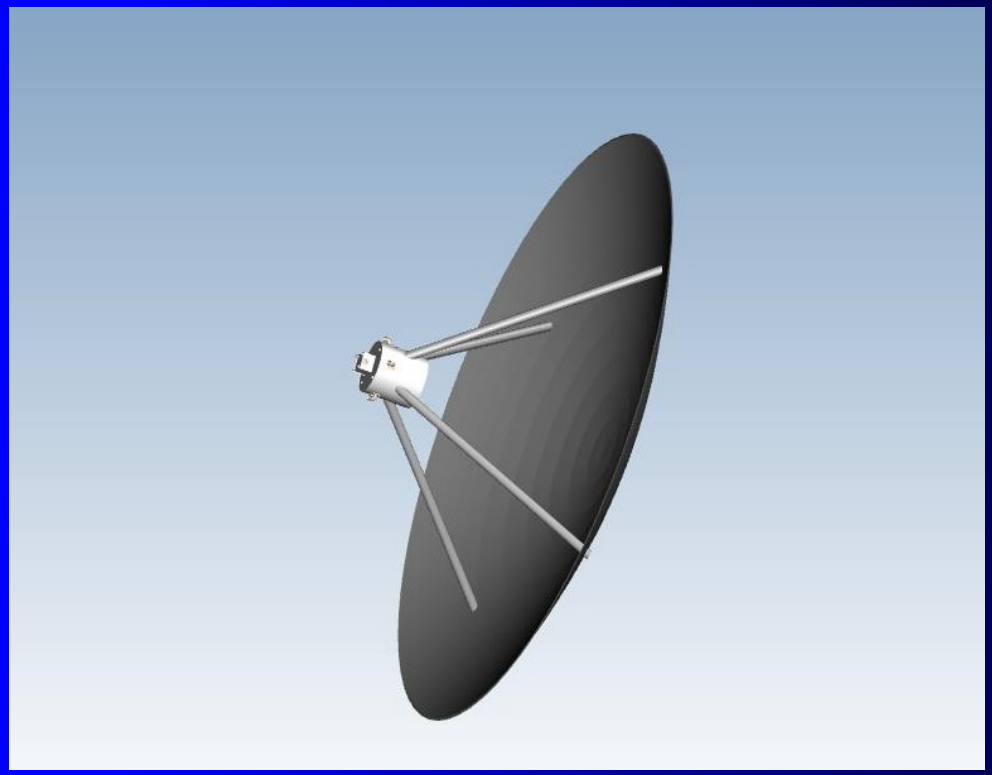
S-Band Feed Patterns

Performance (cont’d)



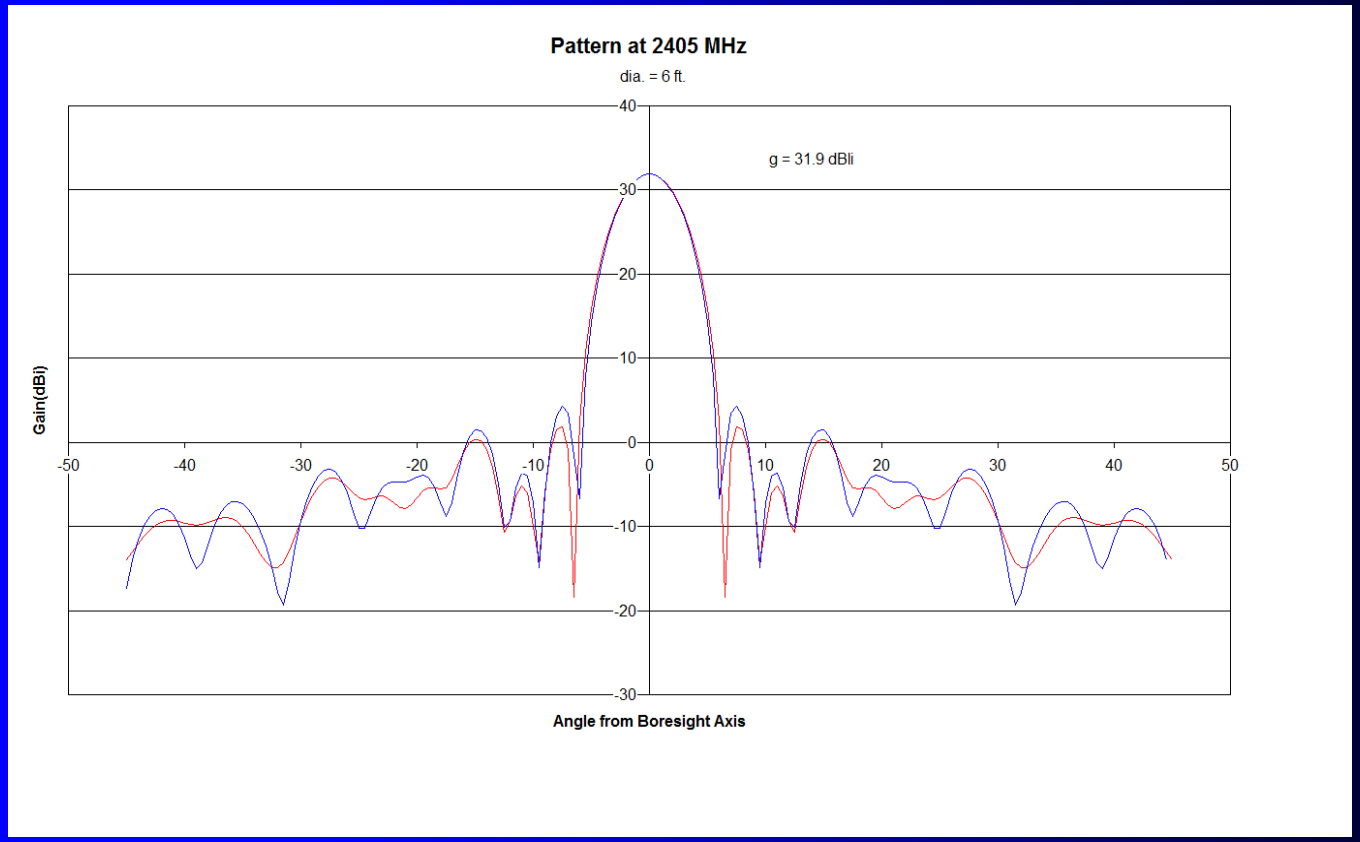
X-Band Feed Patterns

Antenna System for Amateur Band Satellite Communications



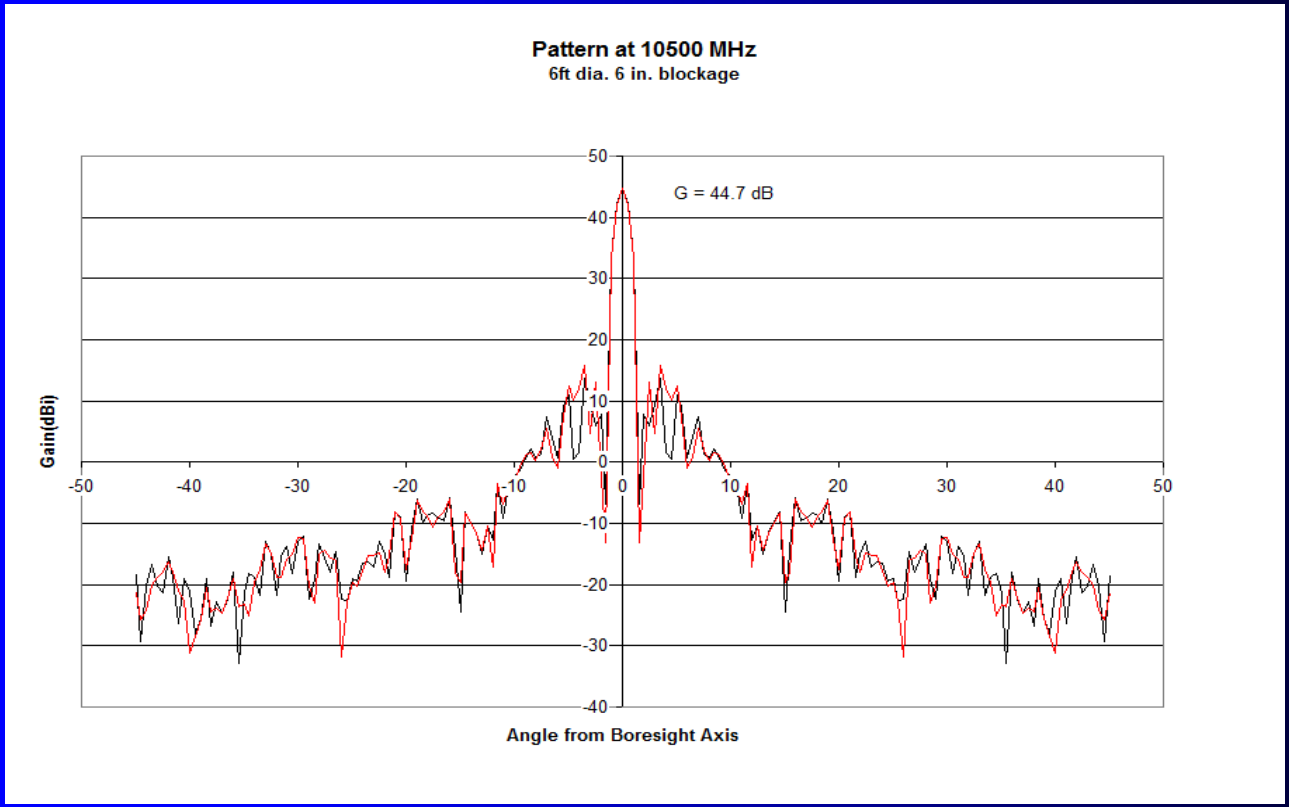
6 ft. diameter parabolic reflector with coaxial feed

Performance



S-Band secondary patterns

Performance (cont’d)



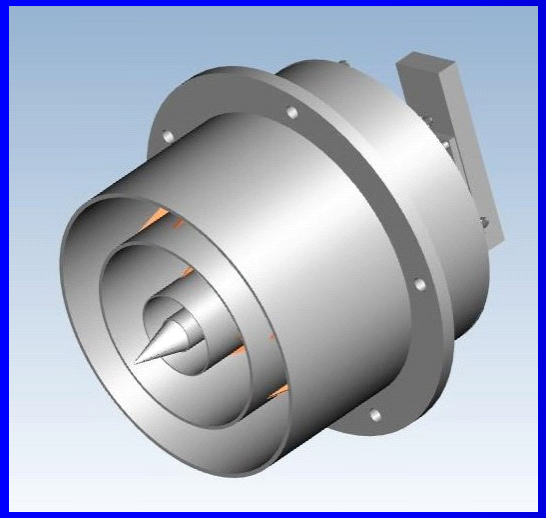
X-Band secondary patterns

Summary

The antenna described above meets the amateur band system requirements with near text book perfect performance.

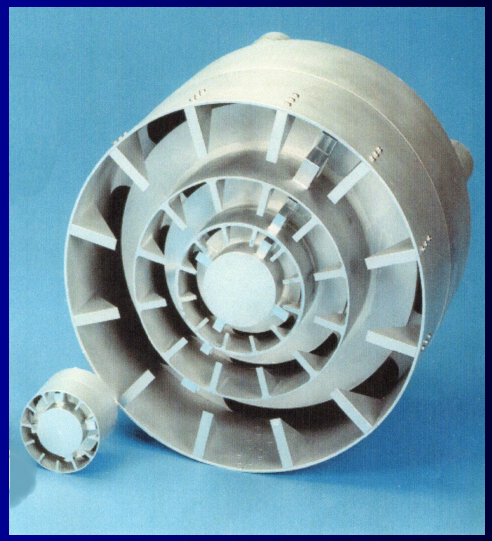
Several designs of this type have been fielded. Performance predicted by HFSS simulation has been repeatedly confirmed by testing.

Other Applications



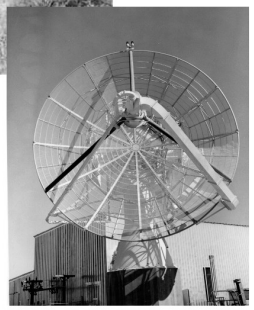
L/S/C-Band
auto-tracking
telemetry feed

Airborne
reconnaissance
antennas

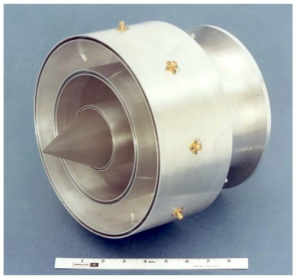


Design Examples

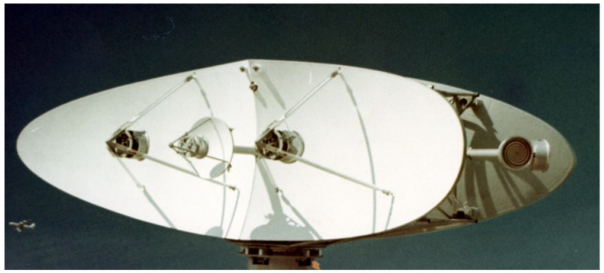
RAM VHF/UHF RADAR



STALLION VHF/UHF RADAR



L/S Band Tracking Feed



2-18 GHz Hign Gain Airborne Direction FInder

LS/X Band Downlink Antenna

C/X/Ku Band SatCom Antenna

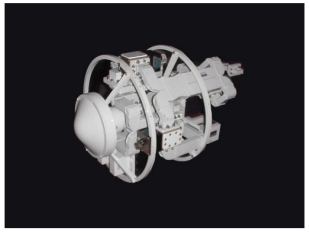
C/X/Ku Transportable SatCom Antenna

S/X Band Downlink Feed

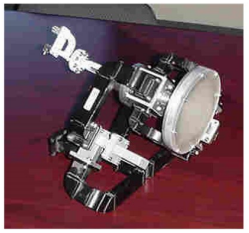
S/X Tracking Antenna

L/S Downlink Antenna

C/Ku SatCom Antenna



C/Ku Cassegrain Feed



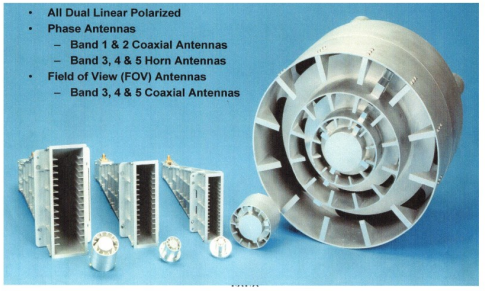
Ku/Ka Cassegrain Feed

L/S/C Band Telemetry Tracking Antenna

S/X Band Downlink Feed

S-Band RX/TX Feed

L/X Band Downlink Feed



Airborne Reconnaissance Antennas