Wideband Antenna Feed Study
April 29, 2002

Background - JPL is interested in wideband antenna feeds for ground-based antenna arrays under construction or planned in the future. TRW has performed development work on wideband antenna feeds and has designs which may be applicable to these needs. A study is suggested in which TRW will manufacture a feed to the goals stated below, test the feed, and loan the feed to JPL for a period of 4 months for further tests. Test data will be delivered to JPL but the antenna will remain property of TRW.

Frequency Range - All goals stated below are desired over the 0.5 to 11 GHz frequency range.

Polarization – The antenna shall provide dual linear polarization.

Terminals – The antenna shall have two terminals, balanced with respect to ground, for each polarization. The terminals shall accessible through two .047" diameter 50 ohms coaxial lines with type SMA connectors. The length of these lines shall be no greater than 3" and shall be measured so the effect of the lines can be removed from VSWR and noise data. All test data will be measured with respect to the SMA connectors and the effect of external transmission lines and baluns will be de-embedded from the data.

VSWR – A VSWR < 2:1 with respect to a normalizing impedance which may be in the range of 70 to 150 ohms is desired measured at each terminal with the other terminal terminated.

Directivity Patterns – The antenna will be used to illuminate subreflectors with of the order of 114 degrees full subtended angle and the pattern should provide high efficiency (taper times spillover efficiency) for the 57 degree edge angle.

Resistive Loss – The antenna is intended for use with a cryogenic low noise amplifier having of the order of 15K noise temperature (0.2 dB noise figure) and resistive loss in the antenna is critical to the system performance. A goal is < 3% loss (0.15 dB) is suggested.

Physical Layout – The desired maximum size of the antenna and location of terminals is shown in Figure 1.

Test Data – The following test data is desired:

1) Complex patterns in the normal difference mode from 0.5 to 11 GHz in steps of 10 or 20 MHz over all angles within +/- 140 degrees of boresight.
2) Amplitude patterns in principle planes, -180 to +180 degrees, at frequencies of 0.5, 1, 2, 4, 8, and 11 GHz for both the normal difference mode and the sum mode as measured with an external 180 degree hybrid junction.
3) Phase patterns of the antenna in the normal difference mode at 0.5, 4, and 11 GHz.
4) Swept frequency gain with respect to a standard gain horn from 0.5 to 11 GHz.
5) Input impedance at each terminal (with other terminals terminated) swept from 0.1 to 18 GHz.
6) Transmission from one terminal to each of the other three, 0.1 to 18 GHz
7) Noise temperature of the antenna pointed at cold (no sun) sky. (To be performed by Caltech).

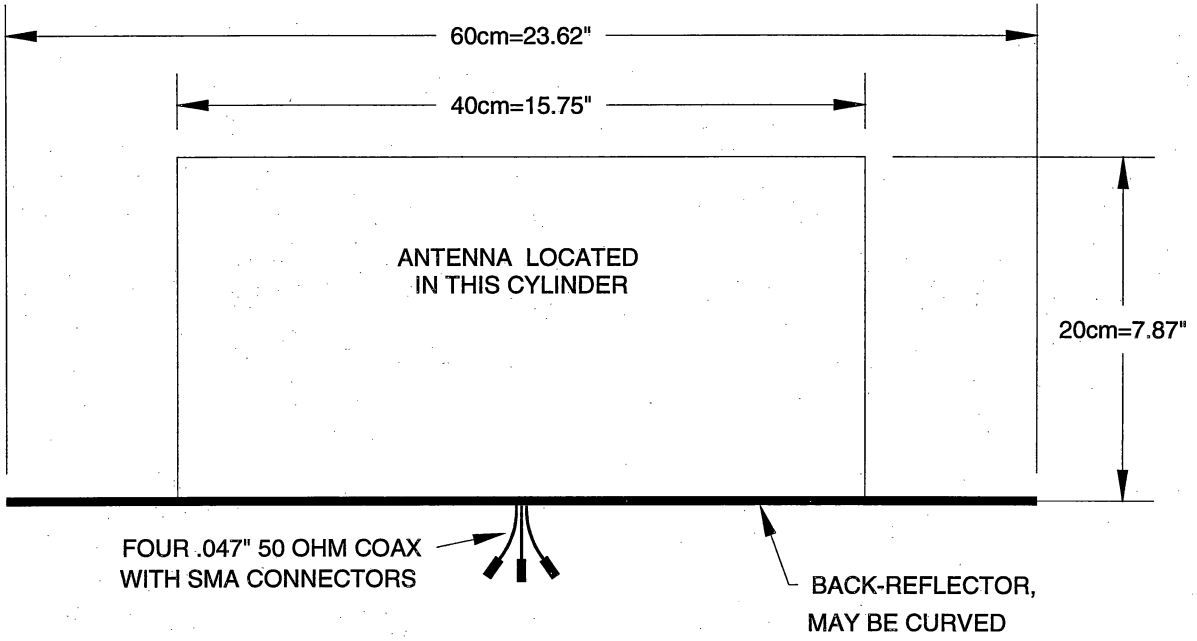

Figure 1 – Antenna outline maximum dimensions.