

NATIONAL RADIO ASTRONOMY OBSERVATORY
GREEN BANK, WEST VIRGINIA

ELECTRONICS DIVISION TECHNICAL NOTE NO. 128

Title: 300-1000 MHz RECEIVER FEEDS

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300-1000 MHz RECEIVER FEEDS

We have designed and constructed five cavity backed dipole feeds covering most of the spectrum from 300 to 1000 MHz. They were designed to work with our 300 foot and 140 foot antennas which have an F/D of 0.428. The feeds are designated 300-350, 350-410, 450-500, 500-700 and 700-1000 MHz. Feed pattern measurements in both the E and H planes were made. The edge illumination of 12 to 15 dB down was the design goal. The taper efficiency and spillover temperatures were calculated from the feed patterns using R. Fisher's program described in EDIR 174.

A summary of the feed characteristics follows:

300-350 MHz Feed-----

| | | | | | |
|-------------------|-------|-----|------|-------|-----|
| Frequency (MHz) | 280 | 300 | 320 | 340 | 360 |
| E-Plane Edge(dB) | -12.5 | -11 | -13 | -14.5 | -16 |
| H-Plane Edge(dB) | -14.5 | -12 | -12 | -13.5 | -13 |
| Return Loss (dB) | -24 | -22 | -24 | -21 | -16 |
| Taper Efficiency | .83 | .83 | .79 | .76 | .73 |
| Spillover Temp(K) | 21 | 24 | 14.7 | 11 | 7.2 |

350-410 MHz Feed-----

| | | | | | | |
|------------------------|-------|-------|-------|-------|-------|-----|
| Frequency (MHz) | 310 | 330 | 350 | 370 | 390 | 410 |
| E-Plane Edge(dB) | -9.5 | -11 | -12.3 | -13 | -14 | -16 |
| H-Plane Edge(dB) | -12.8 | -10.8 | -12.3 | -13.3 | -13.5 | -15 |
| Return Loss (dB) | -13 | -23 | -17 | -20 | -32 | -16 |
| Taper Efficiency | | | .79 | | | .74 |
| Spillover Temp(Kelvin) | | | 16 | | | 9 |

450-500 MHz Feed-----

| | | | | | |
|-------------------|-------|-------|-------|-------|-------|
| Frequency (Mhz) | 420 | 440 | 460 | 480 | 500 |
| E-Plane Edge(dB) | -9.9 | -11.5 | -11.7 | -12.9 | -14.7 |
| H-Plane Edge(dB) | -11.3 | -11.9 | -12.3 | -13.5 | -14.4 |
| Return Loss (dB) | -22 | -23 | -22 | -24 | -23 |
| Taper Efficiency | .82 | .80 | .79 | .77 | .74 |
| Spillover Temp(K) | 20.2 | 15.3 | 13.2 | 11.9 | 8.7 |

500-700 MHz Feed-----

| | | | |
|--------------------------|-------|-------|-------|
| Frequency (MHz) | 500 | 600 | 700 |
| E-Plane Edge(dB) | -15.5 | -16 | -18 |
| H-Plane Edge(db) | -13.8 | -16.3 | -19.5 |
| Return Loss (dB) | -15 | -21 | -12 |
| Taper Efficiency | .764 | .723 | .652 |
| Spillover Temperature(K) | 13.7 | 7.6 | 3.0 |

700 - 1000 MHz Feed-----

| | | | | | |
|-------------------|-------|-------|------|-------|-------|
| Frequency (Mhz) | 650 | 700 | 800 | 900 | 1000 |
| E-Plane Edge(dB) | -13.8 | -14 | -15 | -16.4 | -17.5 |
| H-Plane Edge(dB) | -14.3 | -15.4 | -16 | -16.5 | -18.5 |
| Return Loss (dB) | -10 | -16 | -17 | -16 | -10 |
| Taper Efficiency | .79 | .77 | .77 | .76 | .68 |
| Spillover Temp(K) | 17.2 | 13.9 | 10.5 | 9.2 | 4.9 |

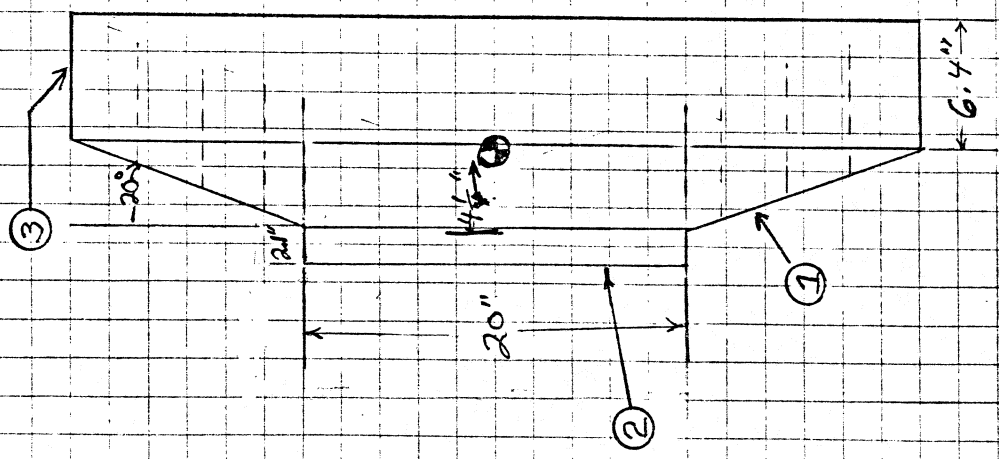
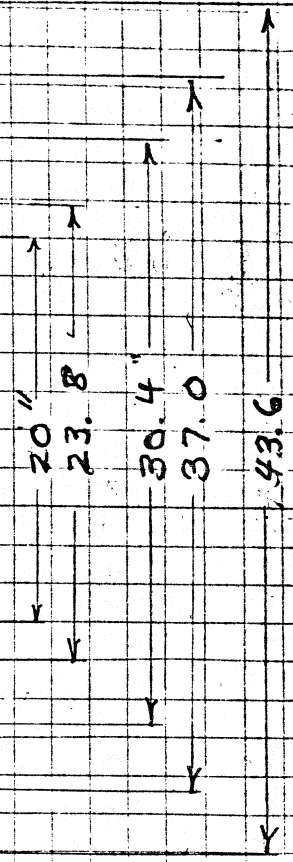
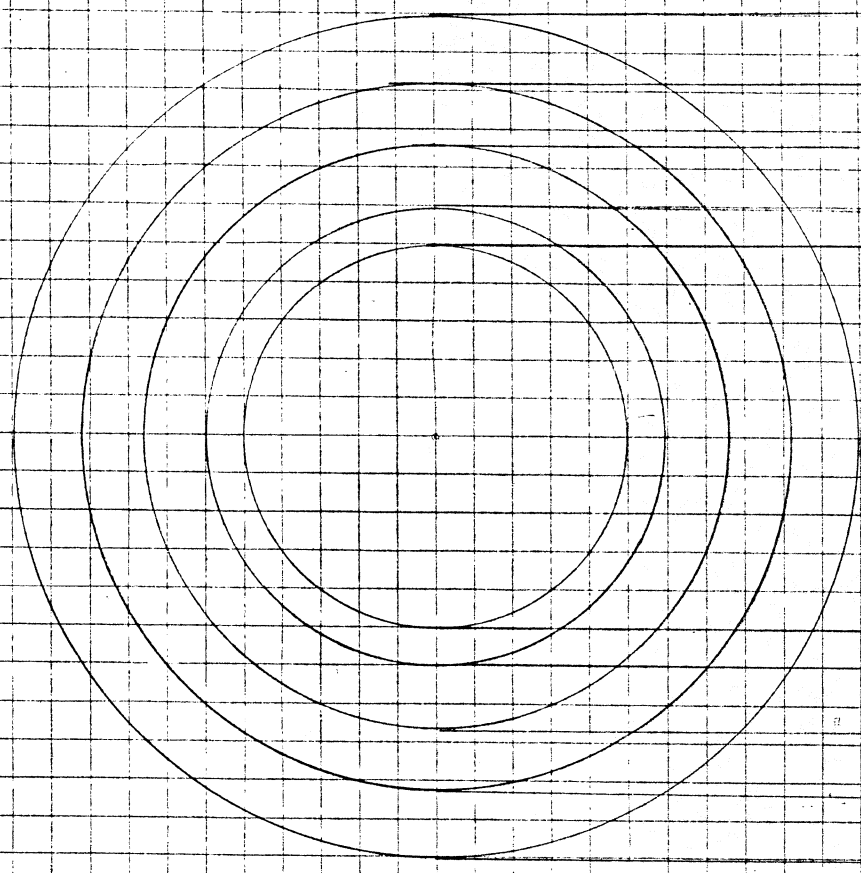
The 300-350, 350-410 and 450-500 MHz feeds are cavity backed dipole feeds. The physical dimensions are tabulated below:

| | | | |
|--------------------------------|-----------------|----------------|-----------------|
| Feed | 300-350 MHz | 350-410 MHz | 450-500 MHz |
| Dipole Length | 21.6 inches | 18.7 inches | 14.0 inches |
| Dipole Height from Cavity Back | 4.9 inches | 4.3 inches | 3.7 inches |
| Top Matching Element | 13.25 inch disc | 11.5 inch disc | 8.5 inch disc |
| Bottom Matching Element | 10.4 inch cross | 9 inch cross | 6.75 inch cross |
| Diameter of Cavity | 38.5 inches | 33.4 inches | 28.5 inches |
| Depth of Cavity | 14.7 inches | 12.75 inches | 10.9 inches |

The 500-700 MHz and 700-1000 MHz feeds have the quarter wavelength deep concentric rings mounted on a cone around the main cavity. As shown above these two feeds have a narrower pattern than the lower frequency units which does reduce the spillover. This feed design provides acceptable illumination of the reflector over a wider frequency band than the single cavity backed dipole feed. The dimensions are:

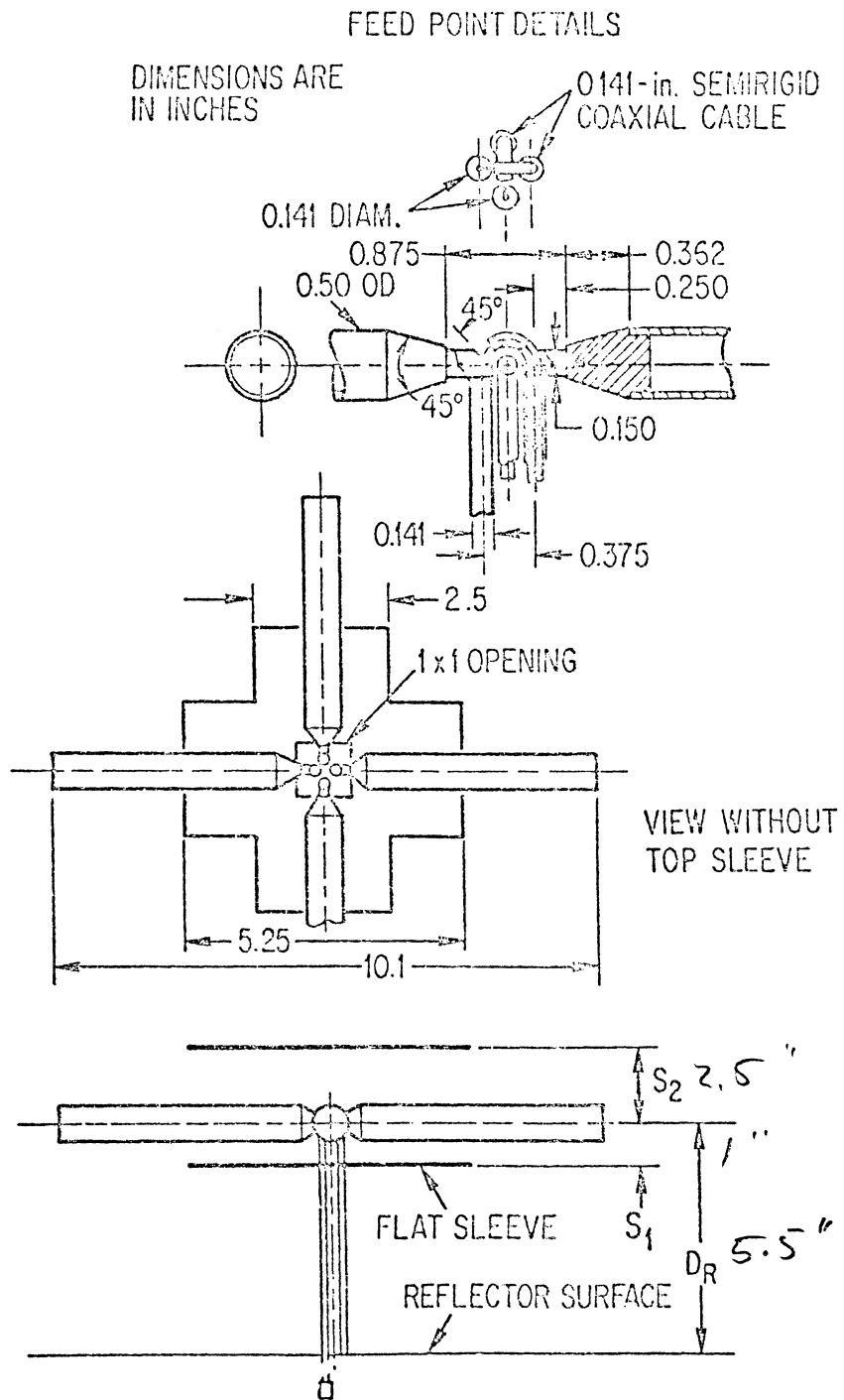
| Feed | 500-700 MHz | 700-1000 MHz |
|-----------------------------------|--------------|--------------|
| Dipole Length | 10.1 inches | 7.2 inches |
| Dipole Height from Cavity Back | 5.5 inches | 3.0 inches |
| Diameter of Cavity | 20 inches | 14 inches |
| Depth of Cavity | 8.6 inches | 6 inches |
| Outside Ring Diameter | 43.6 inches | 40 inches |
| Number of Rings/Spacing | 3/3.3 inches | 5/2.3 inches |
| Ring Depth | 6.4 inches | 4.5 inches |
| Cone Angle | 70 degrees | 70 degrees |

The attached sketches show construction details for the 500 to 700 MHz feed.



500-700 MHz FEED ASSEMBLY

4/23/79 P. Cal



Dual Flat-Sleeve Dipole Model

500-700 MHz Feed