

NATIONAL RADIO ASTRONOMY OBSERVATORY  
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## Measurement of Microwave Absorbing Materials at Q and W bands

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### Introduction

This report documents reflection measurements made on various absorbing materials over the frequency ranges 40-50 GHz and 75-105 GHz. Six of the samples, consisting of various formulations of Stycast epoxy – carbon mixtures painted onto aluminum plates, were supplied to us by Simon Dicker of the University of Pennsylvania. These mixtures are representative of absorber mixtures used to paint cold surfaces in bolometer receivers at U. Penn.

### Materials tested:

Sample A: 10% by mass, carbon in Stycast 2852FT+23LV, thin layer smooth

Sample B: 10% by mass, carbon in Stycast 2852FT+23LV, typical layer smooth

Sample C: 10% by mass, carbon in Stycast 2852FT+23LV, rough finish, used in critical places

Sample D: 10% by mass, carbon in Stycast 2852FT+23LV, thick slab, smooth finish

Sample E: 7.5% by mass, carbon in Stycast 2852FT+23LV, thick slab, smooth finish

Sample F: 7.5% by mass, carbon in Stycast 2852FT+23LV, thick slab, with size 16 silicon carbide

Material: Cuming Microwave 0.080" thick FF2, high loss silicone rubber sheet absorber

Material: Cuming Microwave 1/8" thick GDSS, high loss silicone rubber sheet absorber

Material: Emerson & Cuming Eccosorb H10

Material: 1/4" thick flexible foam absorber – Unknown manufacturer and type.



Figure 1: Samples A-F shown on left; Material H10, round sample in center; FF and GDSS material on right;  $\frac{1}{4}$ " thick absorber, (white) shown on top

**Calibration and measurement:** For both Q and W band measurements, a waveguide calibration was done at the flange immediately in front of the feed horn. The feed was then installed and secured in the holding fixture. An aluminum shorting plate was then placed 1" from the feed aperture, and the response stored into memory. All data taken is in the form Data/Memory. All materials were measured with an aluminum plate immediately behind the sample.

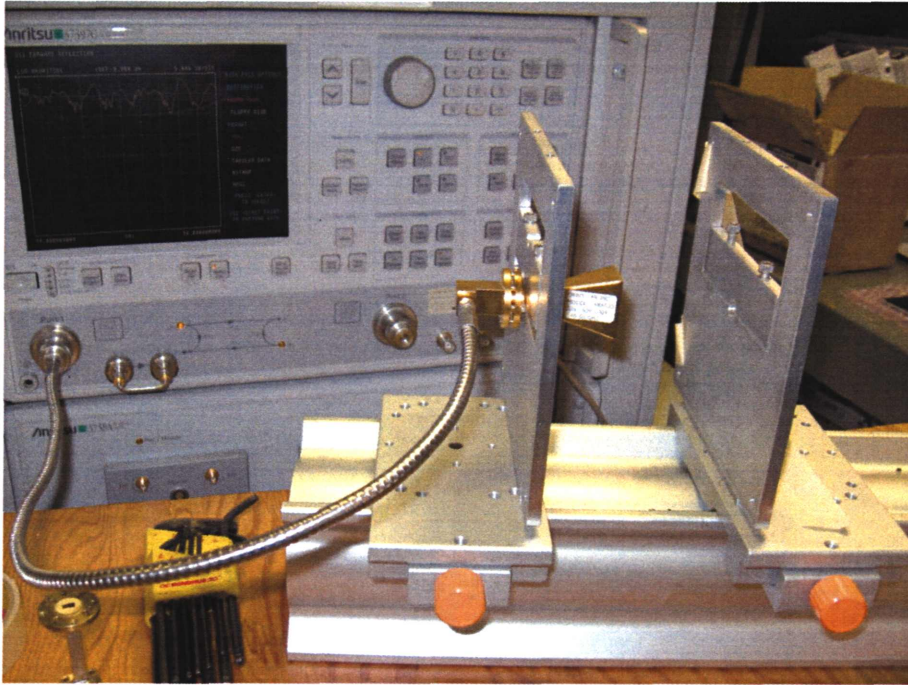


Figure 2: Q-band 40-50 Ghz measurement setup: Anritsu 37397C VNA in background; coax to waveguide transition; Orbit model FR6520, s/n 520-1004 horn in fixture holder.





Figure 3: Q-band cal kit: Short, termination, 4.9644mm offset short, 2.5438mm offset short

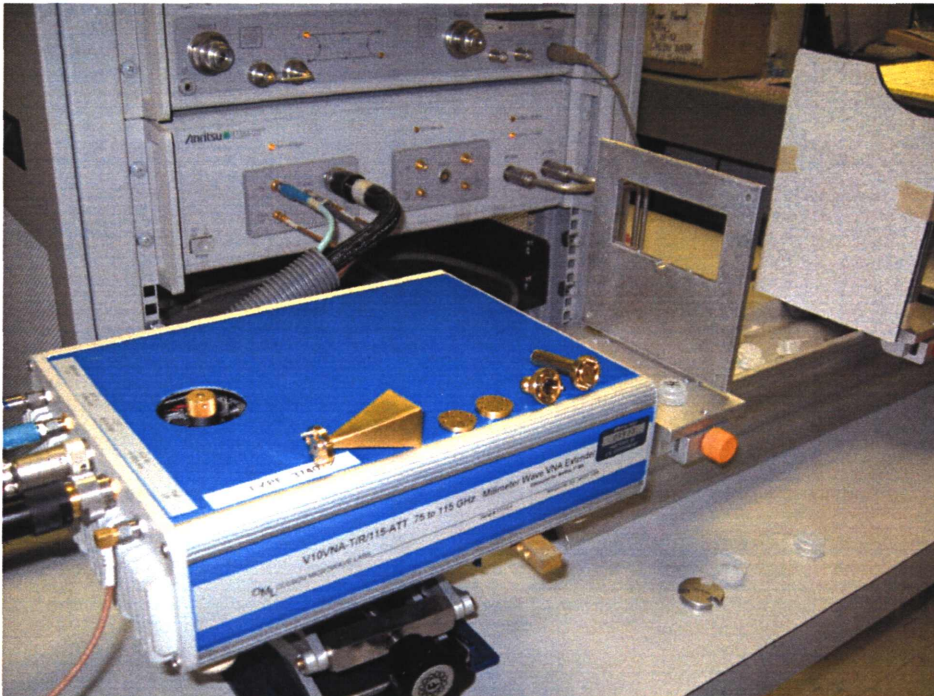


Figure 4: W-band measurement setup: Oleson model 3740, 75-105 GHz extender; Orbit FR6523, s/n 523-1006, WR10 horn; 75-110GHz Offsets, short, and termination for calibration.

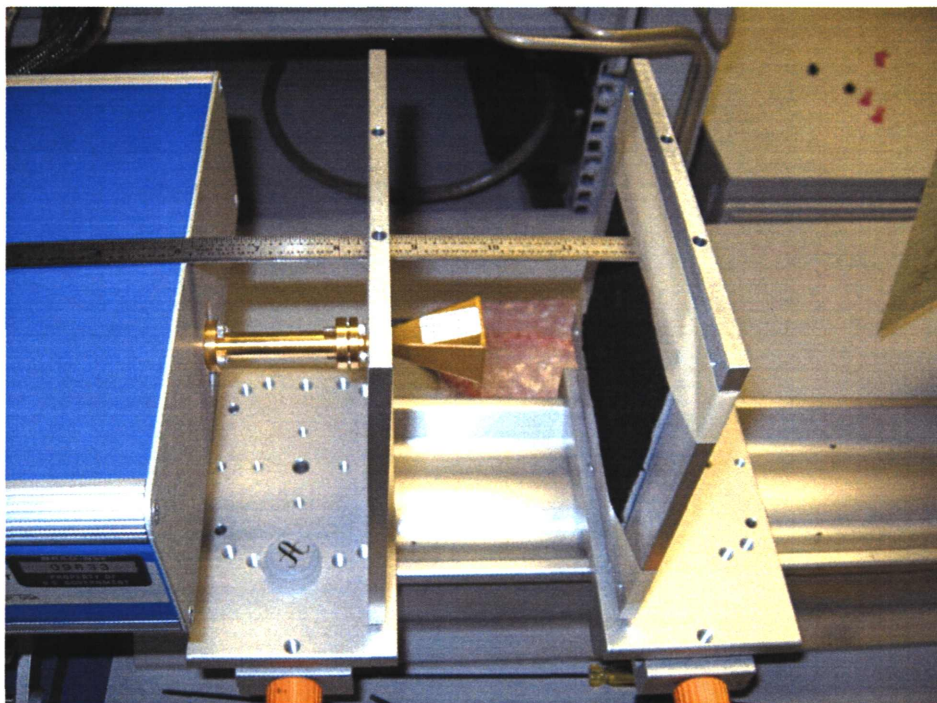


Figure 5: WR-10 feedhorn and test sample located 2" from feed aperture



## Measurement Results

The following plots show the return loss of each material, measured at 1" and 2" from the feed aperture.

