## 5.2: A NOVEL HIGH POWER HARMONIC SUPPRESSOR

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The use of high power harmonic suppressors, or low-pass filters, is becoming an accepted technique in the microwave state-of-the-art. Such filters are required to absorb spurious frequencies generated by high power microwave sources. Radiation of such frequencies may cause serious interference problems with neighboring radar equipment. It is further desired that these harmonic frequencies not only be prevented from reaching the antenna, but should also be terminated resistively to prevent multiple reflections between the rejection filter and the microwave source.

Previously designed versions of this leaky-wall filter utilized slot-coupled waveguides beyond cut-off for the fundamental, which were resistively terminated. This approach yielded rather low coupling per element. Consequently, a large number of coupling elements were needed to achieve the overall desired harmonic attenuation. This design also presented a difficult fabrication problem for such higher frequency models as those with an X-band fundamental frequency.

The scheme used by the authors involves the use of dielectric loaded circular waveguides as branch lines. The diameter of these waveguides is adjusted to below cut-off for the fundamental frequency range. These branch lines are terminated in a loaded epoxy resin load common to all branches. This load is cast in place and is common to all branches as indicated in Figure 1.

Since high average power has to be handled in the fundamental frequency range, a low loss dielectric must be used as the medium filling the branch lines. The material chosen was quartz which has a dielectric constant of 4, and an extremely low loss tangent for X-band frequencies. It is also readily available and can be machined to accurate dimensions.

Impedance matching between the branch lines and the common microwave termination is accomplished by letting the dielectric extend beyond the metal wall of the branch lines into the load material. Such a filter containing approximately 500 branch lines, each .281" in diameter, has been constructed. Choice of these dimensions places the filter cut-off frequency at approximately 13 kMc/s. In the 10 kMc range this filter exhibited an insertion loss of less than 1/4 db with an input VSWR of less than 1.1. At the second harmonic frequency range this filter exhibited an insertion loss of greater than 70 db with a stop band VSWR of less than 2.1. Harmonic attenuation was verified using $TE_{10}$, $TE_{01}$, and $TE_{20}$ mode launchers. It can be argued, qualitatively that this selection of modes should be representative of all possible modes and high attenuation

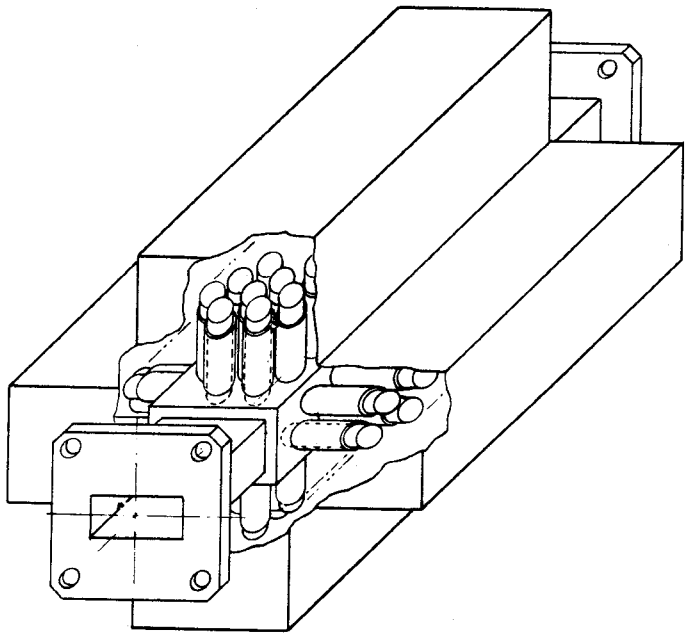

Fig. 1. Harmonic suppressor.

is therefore assured, irrespective of the mode configuration at the harmonic frequency ranges. Overall mechanical dimensions were 24" by 4" by 4".