Ideally, all current entering the second ring network at terminal B flows out at terminals 3 and C. Terminal 4 is inherently isolated from terminal B and therefore from terminal 1 because no current enters the second ring network at terminal C. The isolation between terminals 1 and 4 can be no better than the intrinsic isolation between alternate terminals of either ring network.

The circuit of Fig. 1 is printed on $\frac{1}{16}$-inch teflon fiberglass with a copper backing. No effort is made to conserve space. The characteristic impedance of the printed lines used for the terminals 1-2-3-4 and coupling arms is 50 ohms, while the characteristic impedance of printed lines in the rings is approximately 70 ohms.

Characteristics for a single filter section designed for 1 Gc are shown in Fig. 2. These include VSWR of the input to arm 1 and isolation (or insertion loss) of the filter between terminal 1 and each of the other three terminals with unused terminals terminated in 50 ohms. Fig. 3(a) shows the isolation for two units cascaded into a band-pass filter, while Fig. 3(b) shows isolation for the same two units cascaded into a rejection filter. The two peaks in the rejection curve of Fig. 3(b) are due to a 10-Mc separation of the peak rejection frequencies of the individual sections.

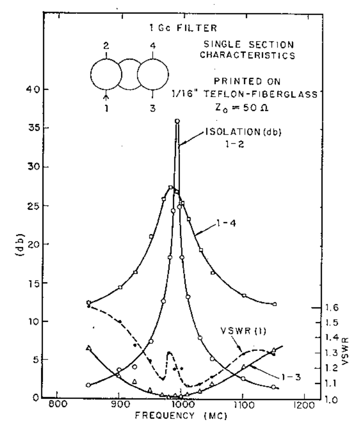

Fig. 2.

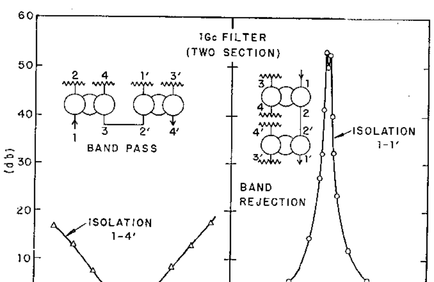

Fig. 3.

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A Technique for Obtaining DC Isolation in Coaxial Cable RF Transmission Lines*

Introduction

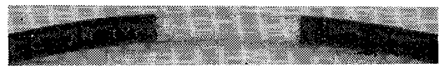
In many applications involving microwave tubes it is desirable to monitor the voltages and currents of the various tube elements. This is particularly true of experimental tubes. The situation may be illustrated by a high voltage pulsed traveling-wave tube in which the collector and body are operated at or near ground level with the cathode at a negative potential. In order to observe current pulses at collector and body it is necessary to ground these points through a series resistor. Since the RF terminals of the device are generally fixed to the body, some form of dc isolation is required on the input and output transmission lines. If the ports are of waveguide construction, one method commonly employed is to place a thin teflon or polyethylene window between two cover flanges which are held together with nylon insulating screws. Tubes with coaxial connectors are usually adapted to waveguide and the above procedure is followed. The technique described below has been developed for obtaining dc isolation quite simply in coaxial cable.

The basic idea is to sever the outer conductor or shielding braid of the coaxial line, in this case a cable of the RG-9B/U type. A sever presents an open circuit to the DC path but permits transmission of the RF. It is noted that a capacitive coupling on the center conductor would not be satisfactory for this application. Most attempts to cut the braid with a sharp knife or other instrument will result in some damage to the dielectric underneath. An alternate approach might be to lift each strand individually and snip with electricians scissors, but this is a rather lengthy procedure. However, a very satisfactory method is described in the section below.

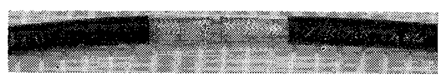
Description of Technique

The cable is first cut to the desired length and the outer protective covering removed for a distance of two or three inches near the middle. A strip of electrical tape about one-sixteenth of an inch wide is then wrapped circumferentially about the exposed braid at the position selected for the sever. It is necessary to keep the sever small with respect to cable wavelength in order to prevent excessive radiation. A narrow opening also minimizes the effect of the discontinuity presented to the TEM traveling-wave. The remaining braid is then completely covered with a layer of melted paraffin. After the wax has hardened a wedge-shaped cut is made at the severing point and the wax removed until the band of tape is uncovered. The tape is then peeled off leaving a narrow strip of exposed braid [Fig. 1(a)]. The careful application of concentrated nitric acid by means of a cotton swab rapidly etches away the silvered-copper braid. This operation should be performed under a hood. The paraffin protects the remaining braid [Fig. 1(b)] and the polyethylene dielectric does not react with nitric acid. The acid residue can be rinsed away with water and the paraffin removed by gentle heating or scraping. A very thin coating of paraffin left on the braid will prevent the loose strands from fraying throughout the rest of the procedure. It is important that all the frayed ends lie flat so that they do not puncture the insulating sleeve that follows.

The braid is then wrapped with thin teflon, polyethylene or electrical tape. An outer sleeve of braid is placed over this wrapping in contact with just one end of the outer conductor. The open end should overlap the sever by about a quarter wavelength in order to reduce radiation losses. A final covering with electrical tape keeps the outer sleeve snugly in place and presents a neat finished appearance. The desired cable connectors are then placed on the ends.



(a)



(b)

Fig. 1—(a) Before etching. (b) After etching.

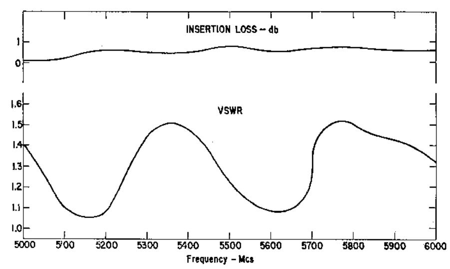


Fig. 2.

Results

An experimental cable was obtained and the technique described above was carried out. A continuity check of the assembled cable indicated an open circuit between the ends of the outer conductor. A further confirmation was obtained by applying a potential of five hundred volts with no arcing or current reading. To prevent possible contact at the sever, the gap may be wrapped with electrical tape during the procedure. Measurement of the RF characteristics showed that a VSWR of 1.5 or less and an insertion loss of about 0.5 db could be expected over the band from 5000 to 6000 Mc (Fig. 2). Considering the load and connector characteristics, these results are comparable to an unsevered cable.

The experimental data indicate that this technique provides the dc isolation and RF transmission required for this type of application.

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