

8th April 1957
G.P.O., Hobart
Tasmania, Australia

Dear Dr. Southworth:

Thank you for your letter of 1st January and the reprints which arrived here some time ago.

Now it is certain that cosmic static at 520kc arrives regularly thru the ionosphere here at Hobart. The situation is somewhat like in a waveguide where a variety of modes may exist simultaneously. If the electric fields of two modes are coincident over a significant volume of space, then energy may transfer from one mode to the other. The two modes in question are the ordinary transverse and the extraordinary longitudinal. The coupling regions are where the critical frequency equals the observing frequency. The lower coupling region is fixed at about 80 miles up in the E layer. The upper coupling region may vary from 500 miles to more than 1500 miles up, depending upon solar activity and the density of the solar corona near the earth. When the upper coupling region exceeds 1500 miles it falls outside the 520kc gyrofrequency height. At this height there is an infinity in the index of refraction of the longitudinal wave propagation path. This infinity causes the wave to be entirely absorbed. Thus a shutter exists at 1500 miles up.

Also it develops that auroral particles can make Cherenkov radiation at 520kc which at times overpowers the cosmic static. With the present rapid rise in solar activity, the shutter is staying closed an increasing amount of time. Also the Cherenkov radiation is becoming more and more objectionable. Consequently I intend to fold up in a few months and return to Hawaii. Presently, I am writing up my results and I will send you a copy when some reprints are available.

As you know Mills in Sydney invented a cross type antenna for making surveys of cosmic static at meter waves. This is quite an important contribution and is being copied several places elsewhere.

However, I have a long memory, and it seems to me that a cross type antenna was described as an exercise in antenna theory many years ago by R. M. Foster in the Bell Technical Journal about April 1926. He gave fotos of a model of the computed pattern. This model had a sharp center lobe and numerous side lobes. By switching the arms of the cross in the Mills fashion, the center lobe may be made to appear and disappear as if by magic while all the side lobe structure remains fixed. I'm wondering if you could find a couple of