Abstracts

A Frequency Modulator with Gain for a Space Array

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An active microwave frequency modulator is described which has been devised for a retrodirective space array. In this modulator one tunnel diode simultaneously functions as amplifier, frequency translator, and frequency modulator. The modulator is an image frequency converter with a local oscillator signal injected into the modulator circuit. The frequency of the image signal is modulated by varying the frequency of the local oscillator. The image frequency is the difference between the second harmonic of the local oscillator and the signal frequency. The frequency deviation of the image frequency signal is twice the frequency deviation of the local oscillator signal. Since the image frequency signal is the lower modulation side-band, its phase is inverted in reference to the phase of the incoming signal. The retrodirective characteristic of the modulated space antenna is realized by the phase inversion property of the modulator. Each array element is terminated with one modulator, and the local oscillator signals that are directed to the modulators must be of equal phase. No nonreciprocal device is required to separate incoming and reradiated signals in the antenna array. In order to determine the optimum operating conditions the analysis of the image frequency converter was derived and an experimental model was tested at 2 Gc. Amplification of the image frequency signal over the incoming signal of 27 db was obtained. The local oscillator power required by one modulator is 10 μw; the dc bias power is less than 100 μw.

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