



WIDEBAND VECTOR MODULATOR

ABSTRACT

A vector modulator that sums outputs of a plurality of quadrature-phase-shift-key (QPSK) modulator elements, each controlled by two digital input signals and a single local oscillator. The local oscillator provides a periodic sinusoidal output signal, and the modulator elements process the periodic sinusoidal output signal and the digital input signals. The state of the respective digital input signals determines which of four phase states are present at the output of the QPSK modulator. A plurality of summing devices are coupled to outputs of the modulator elements, and one summing device provides an analog constellation output signal of the vector modulator. A plurality of attenuators are provided for amplitude weighting output signals from the plurality of modulator elements. The outputs of the modulator elements are summed under control of their two respective digital input signals and the local oscillator to convert the digital input signals into phase and amplitude shifted, periodic, analog signals comprising the analog constellation output signal. In a second embodiment, a power divider is coupled between the local oscillator and the plurality of modulator elements and a power combiner is used to combine the summed output signals derived from the modulator elements. The modulator elements may each be a GaAs microwave monolithic integrated circuit that includes a 90° coupler followed by first and second input amplifiers for respectively receiving and amplifying the periodic sinusoidal signal derived from the local oscillator, and first and second data amplifiers for respectively receiving and amplifying I and Q data input signals to provide amplified I and Q data input signals. First and second mixers are respectively coupled to outputs of the respective input and data amplifiers for multiplying the amplified local oscillator signals with the I and Q data input signals. A summing device is coupled to respective outputs of the mixers for generating a modulated output signal of the modulator element.