December 1975

B75-10318

NASA TECH BRIEF

Lyndon B. Johnson Space Center

Power Spectrum Analysis of Staggered Quadriphase-Shift-Keyed Signals

One modulation technique used in a high-reliability communications system consists of staggering two pulsed signal trains through a quadriphase modulator. Staggered quadriphase shift keying (SQPSK) provides an efficient means of manipulating particular types of modulated signals. The spectrum and bandwidth of SQPSK-modulated signals (when amplitude limited) can be controlled solely by the electrical response characteristics of a pulse-shaping filter. This permits shaping the spectrum (for minimum bandwidth) by selecting a suitable filter function.

The exceptional bandwidth characteristics possible with SQPSK and also with quadriphase shift keying (QPSK), an earlier method, raises the problem of defining the theoretical bandwidth requirements of each system. A mathematical analysis of the power spectrum of the outputs of each system is used to determine system bandwidth. To simplify the analysis, a hard limiter characteristic is assumed.

Previous simulations of the SQPSK and QPSK systems did not lend themselves to determining the optimum pulse spectral characteristics which would conserve system bandwidth. This analysis provides the mathematical relationships of the signal power spectrum at the output of a hard limiter for any type of baseband pulse input subjected only to output parameter constraints.

Note:

Requests for further information may be directed to:

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Reference: TSP75-10318

Patent status:

NASA has decided not to apply for a patent.

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Category: 09 (Mathematics and Information Sciences)