# Differential modulation and demodulation of multi-frequency digital communications signals



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**Abstract:**
Multiple-frequency modulation (MFM) is a bandwidth-efficient digital communication signaling technique that may be used effectively in mobile satellite communications links. Algorithms for generating and demodulating differentially encoded multifrequency quadrature phase shift keyed (MFQPSK) signals using discrete Fourier transform (DFT) techniques are discussed. The theory and a prototype system for differentially encoding and decoding MFQPSK in the frequency domain are developed. By using long baud intervals and corresponding small spacing of the carrier tones, problems associated with channel fading are greatly relieved with respect to the previous method of differentially encoding the multiple carrier tones from baud to baud. An MFM system has been configured to transmit MFQPSK over a 4-kHz bandpass channel. Tone spacings, or baud rates, of 15, 30, 60, 120, and 240 Hz were tested. Output signal-to-noise ratios were estimated by computing sample means and variances of the real and imaginary parts of X/sub a/. Experimental results are presented showing good agreement with the theory.

**Published in:** Military Communications Conference, 1990. MILCOM '90, Conference Record, A New Era. 1990 IEEE

**Date of Conference:** 30 Sept.-3 Oct. 1990

**Date Added to IEEE *Xplore*:** 06 August 2002

**INSPEC Accession Number:** 3916303

**DOI:** 10.1109/MILCOM.1990.117428

**Publisher:** IEEE

**Conference Location:** Monterey, CA, USA, USA



## Keywords

**IEEE Keywords**
Digital modulation, Demodulation, Magnetic force microscopy, Discrete Fourier transforms, Digital communication, Satellite communication, Signal generators, Prototypes, Decoding, Frequency domain analysis

**INSPEC: Controlled Indexing**
satellite relay systems, decoding, demodulation, digital radio systems, digital signals, encoding, mobile radio systems, phase shift keying

**INSPEC: Non-Controlled Indexing**
4 kHz, multifrequency signals, differentially encoded MFQPSK, output SNR, tone spacings

Alerts

Fourier transform, encoding, decoding, frequency domain, carrier tones, channel fading, bandpass channel, baud rates, 15 Hz, 30 Hz, 60 Hz, 120 Hz, 240 Hz

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