IEEE P802.11
Wireless Access Methods and Physical Layer Specifications
TITLE: **Modulation Specification for HS 4FSK**

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ABSTRACT

This submission discusses a proposed modulation specification for the HSFH Phy. It specifies those areas where a product employing four-level FSK need to differ from those of a two-level FSK product.

1. INTRODUCTION

Products that support the High Speed Frequency Hopping (HSFH) option of the 802.11 standard require slightly different electrical performance specifications than have been proposed for the two-level standard rate. This paper attempts to specify the channel deviation for four levels of modulation and the modulation accuracy that is required for reasonable system reliability.

2. SYMBOL DEVIATION

Four separate frequency deviation levels are specified for each of the four possible symbols. These are referenced relative to the channel center frequency. These are chosen to utilise the maximum channel bandwidth while meeting the maximum channel bandwidth requirements agreed upon in May, 1993. The following levels are suggested, as measured from the mean carrier frequency.

Symbol Deviation for 4FSK

Symbol	Carrier Deviation
11	225kHz
10	75kHz
01	-75kHz
00	-225kHz

3. SYMBOL ACCURACY

A number of factors contribute to the accuracy of the modulation. Some of these contributors to inaccurate modulation are:

- The tolerance of the components used in the design.
- The linearity of the modulator over temperature, voltage, frequency, time, and data pattern.
- The accuracy of the symbol generation circuitry.
- The effects and repeatability of the modulated signal filtering.

It is desirable to have the modulation levels as accurate as possible, as this will reduce the system's susceptibility to noise (increased range and/or lower BER). Although perfect modulation is not possible, a certain level of accuracy is required to ensure compatibility between transmitting and receiving stations.

The accuracy requirements are more stringent in a four level system, where the actual amplitude of the modulation signal is used to encode the data, not just the polarity as in a two level system. Inaccuracies in modulation levels decrease the distance between symbols requiring higher larger Eb/No ratio for a given BER. A 20% reduction in distance between symbols requires about 2dB higher Eb/No to maintain constant BER. It is proposed that 20% be set as the symbol modulation accuracy limit for 4FSK.

Modulation Accuracy	+/- 15kHz from the specified deviation.

4.0 CARRIER FREQUENCY DRIFT

To ensure interoperability, a specification should be added to the standard, limiting the rate at which the mean carrier may change frequency. Ideally, the mean carrier frequency would not change during the transmission of a frame, but some implementations may have VCO load-pull, thermal drift, AC coupled modulation or other limitation that could cause the carrier to drift in frequency during a transmission. The maximum rate the carrier can drift should be much longer than the symbol rate to allow for reliable data slicing. It is proposed that the mean carrier frequency not change frequency at a rate faster than 10kHz per 100 symbols.

Maximum rate of frequency drift:	10kHz per 100uS

References:

[1]   IEEE P802.11-94/42 2 Mbit/sec M-FSK higher Speed PHY Proposal, Naftali Chayat, Lannair.