IEEE 802.11
Wireless Access Method and Physical Specification

Title: **Constant Envelope Modulation**

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Synopsis

Constant envelope schemes offer major advantages in WLAN type applications. Foremost amongst these is the lower power consumption of a Class C amplifiers and of limiting IF amplifiers is the receiver. The use of Continuous Phase FSK further assists in reducing the occupied bandwidth of the transmitted signal.

Non-Constant Envelope Scheme

Many of these exist: most PSK, m-ary QAM and OFDM systems are of this form. These require linear amplification, by either conventional analog means, pre distortion, feed forward compensation, or polar or cartesian loop feedback approaches. However, none of these methods are capable of extremely high efficiency, especially when a design aim for portable equipment is to run from 5 volts, and, in the future, 3 volts.

One of the penalties involved is the necessarily low load impedance at low voltage e.g at 3 volts and 1 watt output.

$$R_L = \frac{V_{cc}^2}{2Po} = 4.5\Omega$$

This assumes a 3 volt peak voltage swing, which is unlikely, especially in a linear amplifier, where phase distortion products may be caused by the low reverse voltage or semiconductor junctions causing a change in junction

capacity and the phase shift through the device. This phase distortion reflects back into a non-linearity in the transfer characteristic, and thus the output envelope. Additionally, the large RF currents involved can lead to much higher losses than at higher impedances or in non linear stages.

Constant Envelope Schemes

This includes CPFSK and all its subsets such as TFM, GMSK etc. It has advantages in terms of transmitter efficiency and receiver simplicity, as well as minimising EMC problems caused by direct rectification of the signal. Of all the varieties of constant envelope schemes, the applicable ones for 2.4 GHz data transmission requirements appear to be some form of CPFSK: the lack of abrupt phase transmissions reduces the bandwidth, while the constant envelope provides far higher transmit efficiency. Because the receiver can use a limiting IF amplifier, not only is the maximum advantage taken of the AM suppression characteristics to minimise noise, but the capture effect allows greater frequency re-use.

The main argument is in the number of levels used. In 2 level CPFSK (of which GMSK is a particular subset) the spectral efficiency is lower than in 4 level. Above 4 levels, the number of levels requires the differentiation between relatively small levels, and when the effects of drift, phase noise etc, are taken into account, the benefits appear less attractive. From this, it would seen that the argument is between 2 and 4 level CPFSK.