

## SPECTRAL SHAPING OF DIGITAL SIGNALS

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In digital systems, whether it is transmission or storage, the spectrum of the signal is tailored to satisfy constraints imposed by the channel transfer characteristics or other system requirements. Spectral modification with special features such as spectral nulls and spectral lines [1] is also required in a number of other applications - pilot insertion, timing extraction etc [2].

The simplest method of shaping a frequency spectrum uses conventional filter networks. This approach, which is mainly used in analogue systems, provides only a limited flexibility in controlling the spectrum. The other means of controlling or changing the frequency spectrum can be explored using;

- (a) waveform shaping
- (b) modification of message sequence.

When we deal with digital information a variety of spectral characteristics can be obtained for a given data sequence by a proper selection of waveform shapes (not necessarily digital) for the message symbols. These waveform patterns can be stored in a memory at the transceivers. Depending on the type of pattern required, this might slightly increase the complexity of the terminal equipment.

In the other approach, modification of message sequence, we examine the ways in which a binary signal can be modified to accommodate more redundant information and still preserving the category of digital signals. That is, even after the modification the waveform should remain digital. This may be achieved by modifying the original message sequence so that it would introduce the desired features into the frequency spectrum of the signal.

This technique has a number of advantages:

- The spectrum is controlled by introducing redundancy in the time domain
- the modified time domain signal remains digital.
- The modification process can easily incorporate other facilities such as error corrections/detection.

In this paper, we propose a novel technique in which frequency spectrum is controlled by digitally modifying or recoding the original data sequence. Theoretical analysis and the detailed results of these studies will be reported in the full paper.

- References: [1] Siegel et al. "Fixed rate constrained channel code generating and recovery method and means having spectral nulls for pilot signal insertion", US patent no. 4567464, Jan. 1986.
- [2] Bylanski P, Ingram DGW, "Digital transmission systems", IEE telecommunication series 4, P. Perdrinus Ltd. 1980.