

ABSTRACT

**METHOD TO TRANSFER TRELLIS CODE MODULATED DIGITAL DATA
OVER A DIGITAL SUBSCRIBER LINE,
AND RELATED MODULATOR AND DEMODULATOR DEVICES.**

5 A method to transfer data from a digital data modulator device (MOD) to a digital data demodulator device (DMOD) over a digital subscriber line (TL) according to the ADSL [Asymmetric Digital Subscriber Line] or the VDSL [Very High Speed Digital Subscriber Line] technique. The digital data modulator device (MOD) comprises a detection circuit (MDET) for detecting
10 incoming idle ATM cells, and the cascade coupling of a null data cell generator (NUL), a trellis code modulator (TCM), a data encoder or mapper (MMAP), a constellation points rotation circuit (MRAN) for rotating constellation points and a constellation points shifting circuit (MTRN) for shifting constellation points to lower power points. The modulator further comprises a control circuit (MCTR)
15 for controlling the operation of the null data cell generator, of the rotation circuit and of the shifting circuit upon detection of idle data. The digital data demodulator device (DMOD) comprises a detection circuit (DDET) for detecting received null data, and the cascade coupling of a de-shifting circuit (DTRN) for shifting constellation points with the lowest power back to points corresponding
20 to null data cells, a de-rotation circuit (DRAN) for de-rotating the constellation points, a data decoder or de-mapper (DMAP) and a trellis code de-modulator (TCD). The demodulator further comprises a control circuit (DCTR) adapted to control the operation of the shifting circuit and of the rotation circuit upon detection of received null data. By associating with idle data constellation points
25 shifted to the low power condition, the transmission power is minimized for idle data. Furthermore, by randomly rotating the constellation points of lowest power around the origin of the constellation diagram, training and tracking of the frequency equalizer (FEQ) in the demodulator is simplified while not increasing the transmission power. It is also avoided that all idle data symbols are
30 represented by in-phase carriers which would otherwise result to a high crest factor in a multi-carrier systems. (Fig. 2)