Calvin Passmore

DVB-T300.744

The DVB-T300.744 standard is used for sending and receiving television signals. The standard is designed to be directly compatible with the MPEG-2 format to facilitate easy coding and decoding. The standard consists of the following functional groups: transport multiplexing, outer coding, outer interleaving, inner coding, inner interleaving, mapping and modulation, and Orthogonal Frequency Division Multiplexing (OFDM) transmission. The system allows for different levels of QAM modulation and different inner code rates to help accommodate areas with a higher noise and interference level while allowing for good channels to perform better.

Since this is a broadcast standard, there is no need to support reception at the broadcast location, and the receiving locations don't need to transmit anything. This means the receiver only needs the inverse of the above elements: inner de-interleaver, inner decoder, outer de-interleaver, outer decoder and multiplex adaption. In this summary, however, only the transmit encoding will be covered, and we will assume the input signal/bits are already in the MPEG-2 format.

The outer coding will first apply to the input packet. The Reed-Solomon code will be used with a code length of 204 bytes, and with a dimension of 188 bytes. This means that up to 8 bits can be received incorrectly and it can still be recovered. This also adds some synchronization bytes into the data to help data interpretation and recovery. The outer interleaver will then scramble the bytes.

Interleaving is a process where individual bytes are reordered in a packet upon transport and will be un-reordered upon reception. The purpose of interleaving is to separate burst errors into single bytes errors that are then easier to correct. The outer interleaver interleaves the Reed-Solomon coded input data into 11 columns. This sequence of bytes is then sent to the inner coder and inner interleaver.

The inner coding uses a range of convolutional coding with rates 1/2, 2/3, 3/4, 5/6, and 7/8. These fractions refer to how many bits are getting input and how many are getting output from the convolutional coding. A code rate of 1/2 means that for every one bit put in, 2 bits are being generated. This is done by setting up a series of flip-flops or other similar delay structures, feeding the bits in then reading out specific delayed bits and Modulo-2 adding them to form the output bits. This can then be undone at the receiver to ensure that all the bits received were the bits sent, potentially correcting any mistakes.

The convolutionally encoded data is then sent to the inner interleaver where multiple layers of interleaving happen. First, there is bitwise interleaving and then symbol level interleaving. The bits are parallelized before bit interleaving, and then given to the symbol interleaver.

The interleaved symbols are then mapped onto the constellation. The available constellations are QPSK, 16-QAM (non-uniform, alpha={2,4}; hierarchical and non-hierarchical, alpha=1), 64-QAM (non-uniform, alpha={2,4}; hierarchical and non-hierarchical, alpha=1). This is then put into the OFDM frame structure, each frame consisting of 68 OFDM symbols.

The OFDM then transmits the data, with a number of sub-carriers dependent on the operation mode, 6817 for 8K mode and 1705 for 2K mode. There are also pilot tones in the OFDM signal that help with tracking and synchronization. Some of the sub-carriers occasionally won’t send data, but instead become a pilot tone for that symbol, which helps synchronization and tracking even more. These boosted-pilot tones reset their pattern in every frame.