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Broadcast Teletext Specification

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Contents

FOREWORD

This document describes the parameters of the Teletext signals transmitted in the United Kingdom by the BBC and the Independent Television networks. It supersedes earlier specifications. The BBC uses the name Ceefax and the Independent Television Companies the name Oracle for their public information services. The technical specifications of the Oracle and Ceefax signals are identical.

Based on experience gained in the initial years of the transmissions, changes have been made since the first specification published in October 1974. Additional Control Characters have been allocated to provide facilities which can be used to enhance the display of information. These changes have been made in such a way that future transmissions remain compatible with Teletext decoders based on the later specification dated January 13th 1976.

Distortions, noise and spurious signals inevitably degrade the signal to a greater or less extent. An important point to note is that an increase in magnitude of these effects will cause a gradual deterioration in analogue television while a digital signal, such as Teletext, can still be decoded until the disturbances exceed a critical level. Field studies have confirmed that in almost all cases this critical level for Teletext occurs when television reception is already poor.

INTRODUCTION

This document defines the Teletext broadcasting system. Much of the detailed information is carried by figures and tables. The description is in four sections.

The first section describes how binary code groups are formed into Data-Lines for inclusion in the television field-blanking interval.

The second section describes how the control and address information carried on each Data-Line, together with the special Page-Header Data-Lines and the sequence of transmission of the Data-Lines, allow the Data-Lines corresponding to the Rows of a selected Page to be identified.

The third section describes how the Character Codes received on the Data-Lines corresponding to the Rows of the selected Page are interpreted to give the Page display.

The fourth section defines Teletext terms.

1. TELEVISION DATA-LINES

The television signal includes unused lines in the field-blanking interval (see Figure 1) to allow time for field flyback in receivers before each active field begins. The duration of this interval is usually 25 lines, and some of the later lines are used by broadcasters for test and signalling purposes.

This system can use any of these unused lines as Data-Lines. Initially lines 17(330) and 18(331) are being used but other lines may be used.

A line in the field-blanking interval is identified as a Teletext Data-Line by the presence of the Clock Run-In (see 1.2.1) followed by the Framing Code (see 1.2.2) at an appropriate time.

1.1 Data-Line Waveform

Each Data-Line contains binary elements (bits) as a two-level NRZ (Non-Return-to-Zero) signal, suitably shaped by a filter.

1.1.1 Data Levels

The binary signalling levels are defined on a scale where television black level is 0% and white level 100% (see Figure 2). The binary '0' level is then 0(±2)% and the binary '1' level is 66(±6)%. The difference between these levels is the basic data amplitude. The data waveform will contain overshoots so the peak-to-peak data amplitude will exceed the basic data amplitude.

The basic data amplitude may vary from Data-Line to Data-Line.

1.1.2 Bit Rate

The binary element signalling rate is 6·9375 Mbit/s (±25 parts per million).

It is 444 times the nominal television line frequency.

1.1.3 Data Timing

The data timing reference point is the peak of the penultimate '1' of the Clock Run-In sequence (see Figure 3). This point has been selected to reduce the effect of any transient distortions at the start of the Data-Line.

The line time reference is the half-amplitude point of the leading edge of the line synchronising pulse.

The data timing reference in the signal as transmitted shall be 12·0 (+0·4/−1·0)μs after the line time reference.

The data timing may vary from Data-Line to Data-Line.

1.1.4 Data Pulse Shape

The spectrum of the generated data pulses, which is the product of the spectrum of the basic NRZ data waveform and that of a phase-corrected shaping filter, is indicated in Figure 4. To minimise intersymbol interference the spectrum is substantially skew-symmetrical about a frequency corresponding to one-half of the bit rate. There is minimal energy above 5·0 MHz.

The corresponding one-bit pulse is indicated in Figure 5.

1.2 Data-Line Structure

Each Data-Line comprises 360 bits which may be considered as 45 eight-bit Bytes.

The first three Bytes, which have even parity, serve to synchronise the bit and Byte recovery operation in the receiver. The remaining 42 Bytes have odd parity and carry address and control information, and the codes for a Character Row (see Figure 6).

The use of odd parity during the variable part of the Data-Line ensures that there are never more than 14 bit periods between the data level transitions in the waveform. This simplifies the recovery of the bit-rate clock directly from the data waveform.

All the address and Page control information is transmitted using Hamming Code Bytes to reduce the possibility of the wrong Character Rows being stored in the receiver.

1.2.1 Clock Run-In

The first two Bytes of every Data-Line comprise the Clock Run-In sequence of alternating bits, beginning 101010....., to indicate the presence of a Data-Line and to establish the timing of the bits on that line (see Figure 6).

In some circumstances the first one or two binary '1's may be absent.

1.2.2 Framing Code

The third Byte of every Data-Line comprises the Framing Code 11100100. This code has been selected to enable Byte synchronisation to be established even if one bit of the Framing Code has been wrongly received.

Figure 9 indicates how incoming data are compared with the Framing Code pattern. It shows that a test for any seven corresponding bits will give a correct indication of the Framing Code in the presence of a single error.

1.2.3 Hamming Codes

The fourth and fifth Byte of every Data-Line, and a further eight Bytes of the Page-Header Data-Lines, are Hamming Codes containing four 'message' bits interleaved with four 'protection' bits dependent on the message bits as listed in Table 1a. The bits are transmitted in numerical order from b_1 to b_8.

Table 1b details four parity tests that can be made on the received Byte. Table 1c shows how the results of these tests can be used to correct single errors in the received Byte and detect multiple errors (when 2, 4 or 6 bits are in error). When there are 3, 5, 7 or 8 errors in the Byte this procedure results in a false message being decoded.

Figure 6 shows the locations and lists the functions of all the Hamming 'message' bits. When error correction is used the decoded message bit may differ from the corresponding bit in the Data-Line as the bits of the Hamming Code Byte are interdependent.

1.2.4 Character Bytes

The remaining Bytes of each Data-Line are seven-bit Character Codes (see Table 3) with an added odd-parity bit b_8. The bits are transmitted in numerical order from b_1 to b_8.

2. ORGANISATION OF PAGES AND ROWS

2.1 Addresses

2.1.1 Magazine and Row Address Group

Every Data-Line contains two Hamming Codes signifying a three-bit Magazine number and a five-bit Row address (see Figure 6).

The Magazine number is in the range 1-8, Magazine 8 corresponding to the bits 000 and the others being directly the number obtained with the bit weights given in Figure 6.

The Row address is normally in the range 0-23 and it is directly the number obtained with the bit weights as given in Figure 6. Row addresses in the range 24-31 may be transmitted but such Data-Lines must be ignored.

2.1.2 Page-Header

Data-Lines with Row address 0 are Page-Headers, which contain eight additional Hamming Code Bytes with message bits relating to that Page, including the two digits of the Page number and the four-digit Time Code (see Figure 6). The display and control functions of the other message bits are detailed in 2.3 below.

2.1.3 Page Identification and Time Code

Each Page is identified by its single digit Magazine number (1-8) and its two-digit Page number (00-99).

Different Pages with the same Magazine and Page numbers may be identified by invoking a four-digit Time Code whereby up to 3200 versions of that Page may be individually selected and held.

The 'Hours' and 'Minutes' of the Time Code are not necessarily related to clock-time. The 'Hours Tens' may take any value 0-3 and the 'Minutes Tens' may take any value 0-7.

2.1.4 Page Selection

A Page may be selected by its Magazine number and Page number, or by its Magazine number, Page number and Time Code.

Neither type of Page selection should respond to Page number 'Units' or 'Tens' in the range 10-15, and selection by Time Code should not respond to 'Minutes Units' or 'Hours Units' in that range, which may be used for other purposes.

2.2 Transmission Sequence

2.2.1 Pages

The transmission of a selected Page begins with, and includes, its Page-Header and ends with, and excludes, the

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