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Widescreen Signaling (WSS)

Introduction [1]

To facilitate the handling of various aspect ratios of program material received by TVs, a widescreen signalling (WSS) system has been developed. This standard allows a WSS-enhanced 16:9 TV to display programs in their correct aspect ratio.

The Copy Generation Management System (CGMS-A) for analog PAL video signals will use some of the reserved bits. For analog NTSC video signals, EIA-744 adds CGMS capability to EIA-608. The PALplus system, which allows the transmission of 16:9 programs over normal PAL systems, requires the presence of the WSS signal.

625-line PAL and SECAM systems are based on ITU-R BT.1119 [2]; 525-line NTSC systems are based on EIAJ CPX-1204. [3] For analog YUV video signals, WSS information should be present on the Y signal. For analog RGB video signals, WSS information should be present on all three signals.

625-Line PAL and SECAM Systems

DATA TIMING

The first part of line 23 is used to transmit the WSS information, as shown in Figure 1.

The clock frequency is 5MHz (±100Hz). The signal waveform should be a sine-squared pulse, with a half-amplitude duration of 200 ±10ns. The signal amplitude is 500mV ±5%.

The NRZ (non-return to zero) data bits are processed by a bi-phase code modulator, such that one data period equals 6 elements at 5MHz.

DATA CONTENT

The WSS consists of a run-in code, a start code, and 14 bits of data, as shown in Table 1.

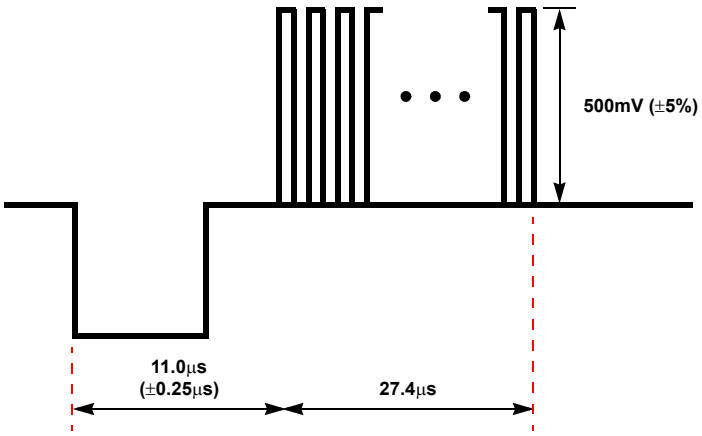

FIGURE 1. 625-LINE WSS LINE 23 TIMING

TABLE 1. PAL WSS INFORMATION

Run-In	29 Elements at 5MHz	1 1111 0001 1100 0111 0001 1100 0111 ($1F1C\ 71C7_H$)
Start Code	24 Elements at 5MHz	0001 1110 0011 1100 0001 1111 ($1E\ 3C1F_H$)
Group 1 (Aspect Ratio)	24 Elements at 5MHz “0” = 000 111 “1” = 111 000	b3, b2, b1, b0
Group 2 (Enhanced Services)	24 Elements at 5MHz “0” = 000 111 “1” = 111 000	b7, b6, b5, b4 (b5, b6, b7 = “0” since they are reserved)
Group 3 (Subtitles)	18 Elements at 5MHz “0” = 000 111 “1” = 111 000	b10, b9, b8
Group 4 (Reserved)	18 Elements at 5MHz “0” = 000 111 “1” = 111 000	b13, b12, b11 (b11, b12, b13 = “0” since they are reserved)

RUN-IN

The run-in consists of 29 elements at 5MHz of a specific sequence, shown in Table 1.

START CODE

The start code consists of 24 elements at 5MHz of a specific sequence, shown in Table 1.

GROUP 1 DATA

The group 1 data consists of 4 data bits that specify the aspect ratio. Each data bit generates 6 elements at 5MHz. Data bit b0 is the LSB.

Table 2 lists the data bit assignments and usage. The number of active lines listed in Table 2 are for the exact aspect ratio (a = 1.33, 1.56, or 1.78).

The aspect ratio label indicates a range of possible aspect ratios (a):

4:3$a \leq 1.46$

$14{:}91.46 < a \leq 1.66$

$16{:}91.66 < a \leq 1.90$

>16:9$a > 1.90$

To allow automatic selection of the display mode, a 16:9 receiver should support the following minimum requirements:

Case 1: The 4:3 aspect ratio picture should be centered on the display, with black bars on the left and right sides.

Case 2: The 14:9 aspect ratio picture should be centered on the display, with black bars on the left and right sides. Alternately, the picture may be displayed using the full display width by using a small (typically 8%) horizontal geometrical error.

Case 3: The 16:9 aspect ratio picture should be displayed using the full width of the display.

Case 4: The >16:9 aspect ratio picture should be displayed as in Case 3 or use the full height of the display by zooming in.

GROUP 2 DATA

The group 2 data consists of four data bits that specify enhanced services. Each data bit generates six elements at 5MHz. Data bit b4 is the LSB.

b4:

0 camera mode

1 film mode

GROUP 3 DATA

The group 3 data consists of three data bits that specify subtitles. Each data bit generates six elements at 5MHz. Data bit b8 is the LSB.

b8:

0 no subtitles within teletext

1 subtitles within teletext

b10, b9:

00 no open subtitles

01 subtitles inside active image

10 subtitles outside active image

11 reserved

TABLE 2. PAL WSS GROUP 1 (ASPECT RATIO) DATA BIT ASSIGNMENTS AND USAGE

b3, b2, b1, b0	ASPECT RATIO LABEL	FORMAT	POSITION	ACTIVE LINES	MINIMUM REQUIREMENTS
1000	4:3	Full Format	-	576	Case 1
0001	14:9	Letterbox	Center	504	Case 2
0010	14:9	Letterbox	Top	504	Case 2
1011	16:9	Letterbox	Center	430	Case 3
0100	16:9	Letterbox	Top	430	Case 3
1101	> 16:9	Letterbox	Center	-	Case 4
1110	14:9	Full Format	Center	576	-
0111	16:9	Full Format (Anamorphic)	-	576	-

525-Line NTSC Systems

DATA TIMING

Lines 20 and 283 are used to transmit the WSS information, as shown in Figure 2.

The bit frequency is $F_{SC}/8$ or about 447.443kHz; F_{SC} is the color subcarrier frequency of 3.579545MHz. The signal waveform of a data bit should be a sine-squared pulse, with a half-amplitude duration of 2.235µs ±20ns. The signal amplitude is 70 ±10 IRE for a “1"; 0 ±5 IRE for a “0”.

DATA CONTENT

The WSS consists of 2 bits of start code, 14 bits of data, and 6 bits of CRC (cyclic redundancy check) as shown in Table 3. The CRC used is $X^6 + X + 1$, all preset to “1”.

START CODE

The start code consists of a “one” data bit followed by a “zero” data bit, shown in Table 3.

WORD 0 DATA

The word 0 data consists of 6 data bits:

b0:

0 = 4:3 aspect ratio

1 = 16:9 aspect ratio

b1:

0 = normal

1 = letterbox

b2-b5 = 0000

WORD 1 DATA

All bits are reserved, and have a value of “0”.

WORD 2 DATA

All bits are reserved, and have a value of “0”.

TABLE 3. NTSC WSS INFORMATION

Start Code	“1”
Start Code	“0”
Word 0	b5, b4, b3, b2, b1, b0
Word 1	b9, b8, b7, b6 (= “0000” since they are reserved)
Word 2	b13, b12, b11, b10 (= “0000” since they are reserved)
CRC	b19, b18, b17, b16, b15, b14

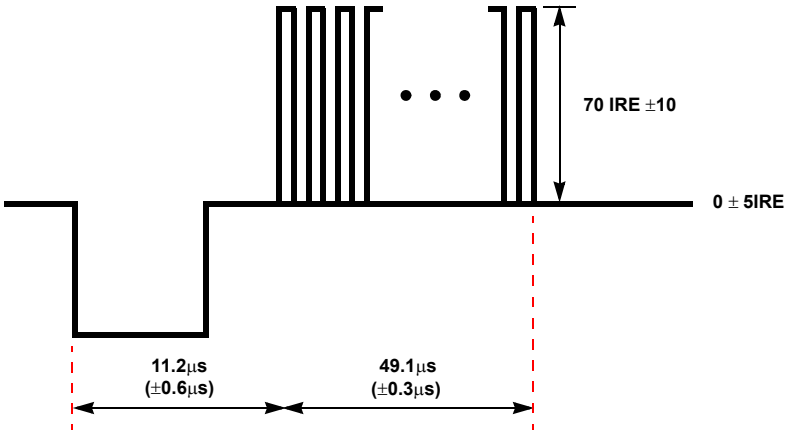

FIGURE 2. 525-LINE WSS LINE 20 AND LINE 283 TIMING

Summary

This Application Note presented some of the capabilities of the widescreen signalling (WSS) signal. With the number of widescreen TVs rapidly increasing, WSS allows the consumer to personally configure their TVs for greatest viewing enjoyment.

Using NTSC and PAL decoders that support WSS, such as the HMP8116, can bring new capabilities to multimedia PCs and 16:9 TVs. These capabilities include being able to handle 16:9 programs and supporting CGMS-A.

Using NTSC and PAL encoders that support WSS, such as the HMP8171 and HMP8173, allow the design of DVD players and settop boxes that support these emerging standards without becoming rapidly obsolete.

References

[1] Jack, Keith. *Video Demystified*. San Diego, CA: HighText Interactive, Inc., 1996.

[2] ITU-R BT.1119

[3] EIAJ CPX-1204

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