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SERIES J: CABLE NETWORKS AND TRANSMISSION
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MULTIMEDIA SIGNALS

Miscellaneous

Parameter sets for analogue interface specifications for the interconnection of set-top boxes and presentation devices in the home

ITU-T Recommendation J.182

(Formerly CCITT Recommendation)

ITU-T J-SERIES RECOMMENDATIONS

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MULTIMEDIA SIGNALS**

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ITU-T Recommendation J.182

Parameter sets for analogue interface specifications for the interconnection of set-top boxes and presentation devices in the home

Summary

This Recommendation defines the parameter sets for analogue interface specifications for video signals between television set-top boxes and television presentation devices in the home, when such signals are provided in analogue component video form carried on three parallel channels.

This Recommendation has three appendices (I, II, and III), that provide specifications for: 525-line (total scan lines) TV devices (i.e. with 480 active lines), and 750-line TV devices (720 active lines), and 1125-line TV devices (1080 active lines). This reflects the fact that a number of TV systems are in use on a worldwide basis and it is necessary to define parameter sets for the associated devices.

Appendix IV describes the interface between digital tuner and television receiver using D-connector selected from EIAJ CP-4120.

Source

ITU-T Recommendation J.182 was prepared by ITU-T Study Group 9 (2001-2004) and approved under the WTSA Resolution 1 procedure on 9 March 2001.

Figures I.2 to I.4, II.3, II.4, III.1 to III.6 of ITU-T Recommendation J.182 are extracted from SMPTE standards with the kind permission of the Society of Motion Picture and Television Engineers.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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ITU-T Recommendation J.182

Parameter sets for analogue interface specifications for the interconnection of set-top boxes and presentation devices in the home

1 Scope

This Recommendation defines the characteristics of the interface between television set-top boxes and television presentation devices in the home, when such signals are provided in analogue component video form carried on three parallel channels for 60 Hz display.

This Recommendation recognizes that television users in the home are likely to access television programmes, sound-broadcast programmes and other additional services from a variety of service providers that use a variety of delivery systems.

For instance, a television user may access television programmes and sound programmes from a cable television network to which he is connected, from terrestrial broadcasting, from satellite broadcasting, from recorded material such as videocassettes, DVDs and CDs, or even from the Internet.

Such programmes may be received in digital form or in analogue form, and they may be open, or may be subject to conditional access.

Reception and presentation of this host of programmes in different formats require the use of a variety of demodulators and decoders. Such devices could be integrated into the home television receiver, but this condition is sometimes not viable due to constraints imposed by the marketplace. The present situation is that signals received on different delivery systems are often processed in different, dedicated "set-top boxes" which provide outputs to the television and sound displays in a form that a normal television or sound display can understand, e.g. as analogue component or analogue composite signals.

2 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- ITU-R BT.709-4 (2000), *Parameter values for the HDTV standards for production and international programme exchange*.

3 Informative references

- EIAJ CP-4120, *EIAJ Connector Type D*.

4 Bibliography

- ANSI/SMPTE 125M-1995, *Television – Component Video Signal 4:2:2 – Bit-Parallel Digital Interface*.
- ANSI/SMPTE 170M-1999, *Television – Composite Analog Video Signal – NTSC for Studio Applications*.

- ANSI/SMPTE 253M-1998, *Television – Three-Channel RGB Analog Video Interface*.
- ANSI/SMPTE 274M-1998, *Television – 1920 × 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple-Picture Rates*.
- ANSI/SMPTE 293M-1996, *Television – 720 × 483 Active Line at 59.94 Hz Progressive Scan Production – Digital Representation*.
- ANSI/SMPTE 296M-2001, *Television – 1280 × 720 Progressive Image Sample Structure – Analog and Digital Representation and Analog Interface*.
- ANSI/SMPTE RP 177-1993, *Derivation of Basic Television Colour Equations*.
- CIE Publication 15.2 (1986), *Colorimetry*, Second Edition.

5 Recommendation

It is recommended that the parameter sets defined in Table 1 should be used when interface signals are delivered from the output of the set-top box to the input of the home presentation device in analogue component video form on three parallel channels.

Table 1/J.182 – Parameter sets for analogue component video interface

Television system	525/59.94(60)/2:1	525/59.94(60)/1:1	750/59.94(60)/1:1	1125/59.94(60)/2:1
Black level and blanking	0 V			
Signals to be used	Y, P _B , and P _R			
Synchronization pulse on/off selection	Y with Sync Pulse, P _B /P _R without Sync Pulse			
Chromaticity coordinates (CIE, 1931) (See Note)	x y Red 0.630 0.340 Green 0.310 0.595 Blue 0.155 0.070		x y Red 0.640 0.330 Green 0.300 0.600 Blue 0.150 0.060	
Reference white	x y D65 0.3127 0.3290			
Opto-electronic transfer characteristics at source	V' = 4.5 L for 0.018 > L ≥ 0 V' = 1.099 L ^{0.45} – 0.099 for 1.00 ≥ L ≥ 0.018 where: L: luminance of the image 1 ≥ L ≥ 0 V': corresponding electrical signal			
Luminance and chrominance equations	Y' = 0.299R' + 0.587G' + 0.114B' PB' = (B' – Y')/1.772 PR'=(R' – Y')/1.402		Y' = 0.2126R' + 0.7152G' + 0.0722B' PB' = (B' – Y')/1.8556 PR' = (R' – Y')/1.5748	
Signal amplitude for 100/100 colour bar	Y: 0 to +714 mV Sync: 0 to –286 mV (Appendix I) Y: 0 to +700 mV Sync: 0 to –300 mV (Appendices II and IV) P _B /P _R : ± 350 mV	Y: 0 to +700 mV P _B /P _R : ±350 mV Sync: 0 to –300 mV (Appendix II)	Y: 0 to +700 mV P _B /P _R : ±350 mV Sync: 0 to ±300 mV (Appendix III)	
Connector	RCA phono connector with 75 Ω (nominal) or EIAJ-D Connector (Appendix IV)			
Cable impedance	75 Ω ± 5 %			
NOTE – Use of the unified colourimetry should be studied (see ITU-R BT.1361).				

APPENDIX I

Analogue component parallel video interfaces for 525-line interlaced and progressive scanning structures

I.1 Introduction

This appendix describes the main characteristics of home interconnection interfaces for two scanning structures, both capable of either 4:3 or 16:9 aspect ratios for:

- a scanning structure having 525 lines, 59.94 fields/s, 2:1 interlaced, and a horizontal scanning rate of 15.734 kHz (1H);
- a scanning structure having 525 lines, 59.94 frames per second, progressively scanned, and having a horizontal scanning rate of 31.47 kHz (2H).

Both scanning structures are currently used in standard-definition television home displays.

Signal characteristics are defined by a gamma-corrected component set: a luminance video and two accompanying colour-difference signals.

I.2 Copy protection

Users of this Recommendation should note that, at some future point, copy protection parameters, methods and/or standards are expected to be established with which copy-protected content traversing the component video interface should be required to comply.

I.3 Video components

I.3.1 Blanking level

Blanking level is defined as the level during the clamp period shown in Figures I.1 and I.4.

I.3.2 Signals

The three channels of the interface are designated to carry specific signals as shown in Table I.1.

Table I.1/J.182 – Channel specification

	Y, P_B, P_R component set	
Channel 1	Luminance	Y
Channel 2	Scaled B – Y	P _B
Channel 3	Scaled R – Y	P _R

I.3.3 Y, P_B, P_R component set

The component set (Y, P_B, P_R) is derived from positive-going primary colour signals (R,G,B).¹

The luminance (Y) and colour difference (B – Y, R – Y) signals are first formulated according to the basic equations:

¹ The RGB signals in 3.3 are gamma-corrected, and therefore, the prime convention is not included within this Recommendation.

$$Y = 0.299R + 0.587G + 0.114B$$

$$B - Y = -0.299R - 0.587G + 0.886B$$

$$R - Y = 0.701R - 0.587G - 0.114B$$

These resulting three component video signals are additionally specified in I.3.3.1, I.3.3.2 and I.3.3.3.

I.3.3.1 Luminance Y

The luminance (Y) signal, as derived in I.3.3, has a peak video amplitude of 714 mV (100 IRE) from blanking level. A negative-going sync pulse of 286 mV (−40 IRE), conforming to the timing requirements of I.7 and Figure I.4, is added to the luminance signal as the only timing reference for the Y, P_B, P_R component set.

Black level setup should be either none or 7.5 IRE ± 2 IRE from blanking level to the reference white level.

I.3.3.2 Colour difference signal P_B

P_B should be amplitude scaled B − Y according to:

$$P_B = (B - Y)/1.772$$

After such scaling, the P_B signal should have a maximum peak amplitude of ±350 mV (±49 IRE) over or under blanking level.

The P_B signal should be a bipolar video signal and should conform to the timing requirements of Figure I.1. The dc level of P_B during the clamp period shown in Figure I.1 should be at blanking level.

I.3.3.3 Colour difference signal P_R

P_R should be amplitude scaled R − Y according to:

$$P_R = (R - Y)/1.402$$

After such scaling, the P_R signal should have a maximum peak amplitude of ±350 mV (±49 IRE) over or under blanking level.

The P_R should be a bipolar video signal that conforms to the timing requirements of Figure I.1. The dc level of P_R during the clamp period shown in Figure I.1 should be at blanking level.

I.4 Impedance

Equipment using this interface should have 75 ohms ± 5% input and output impedance.

I.5 Clamping and signal dc content

The clamp period shown in Figures I.1 and I.4 may be used as a dc level clamp reference.

The dc offset, as defined by the blanking level of the signal, should be 0.0 V ± 1.0 V.

I.6 Component timing

The three component video signals Y, P_B, P_R should be coincident with respect to each other within ±5 ns.

I.7 Horizontal blanking and synchronization

Each line outside the vertical blanking interval is divided into an active line period and a horizontal blanking interval. The horizontal blanking interval for the Y signal contains the negative-going horizontal sync pulse. The remainder of the horizontal blanking interval is at blanking level and may be used for signal dc clamping. Horizontal timing for the 1H video format should be as given in Table I.2, and shown in Figure I.4.

Table I.2/J.182 – 1H (480i) video signal horizontal timing

	Measurement points	Value	Recommended tolerance	Units
Total line period (derived)		63.556	–	μs
Horizontal blanking rise time	10-90%	140	±20	ns
Sync rise time	10-90%	140	±20	ns
H-blanking start to H-reference	50%	1.5	±0.1	μs
Horizontal sync	50%	4.7	±0.1	μs
H-reference to clamp start	50%	5.7	±0.1	μs
Horizontal clamp period	50%	2.7	±0.1	μs
H-reference to H-blanking end	50%	9.2	+0.2, –0.1	μs
NOTE – It is recognized that horizontal blanking operating values may vary from the precise values given in order to meet operational requirements in practical systems.				

Horizontal timing for the 2H video format should be as given in Table I.3, and as represented in Figure I.4.

Table I.3/J.182 – 2H (480p) video signal horizontal timing

	Measurement points	Value	Recommended tolerance	Units
Total line period (derived)		31.776	–	μs
Horizontal blanking rise time	10-90%	70	±10	ns
Sync rise time	10-90%	70	±10	ns
H-blanking start to H-reference	50%	.59	±0.1	μs
Horizontal sync	50%	2.33	±0.1	μs
H-reference to clamp start	50%	2.85	±0.1	μs
Horizontal clamp period	50%	1.35	±0.1	μs
H-reference to H-blanking end	50%	4.52	+0.2, –0.1	μs
NOTE – It is recognized that horizontal blanking operating values may vary from the precise values given in order to meet operational requirements in practical systems.				

I.8 Vertical blanking and synchronization

I.8.1 1H video format

For the interlaced raster (1H), each television frame (one complete scanning of the picture) is divided into two fields. The fields carry every other scan line in succession with succeeding fields carrying the lines not scanned by the previous field. For the double scanned interface (2H), each field is identical and is progressively scanned.

Each field should be divided into an active picture area and a vertical blanking interval. The vertical blanking interval for the Y luminance signal should contain the vertical synchronizing information surrounded by blanking periods to properly position the vertical sync and by space allocated for special vertical interval signals (equalizing pulses), as specified in Table I.4 and shown in Figure I.2.

Table I.4/J.182 – 1H (480i) video signal vertical timing

	Measurement points	Value	Recommended tolerance	Units
Field period (derived)		16.6833		ms
Frame period (derived)		33.3667		ms
Vertical blanking start before first equalizing pulse	50%	1.5	± 0.1	μs
Vertical blanking ($63.556 \mu\text{s} \times 20 \text{ lines} + 1.5 \mu\text{s}$) (Approx. value: see notes)		20 lines plus $1.5 \mu\text{s}$	0 ± 0.1	lines μs
Pre-equalizing duration		3		lines
Pre-equalizing pulse width	50%	2.3	± 0.1	μs
Vertical sync duration		3		lines
Vertical serration pulse width	50%	4.7	± 0.1	μs
Post-equalizing duration		3		lines
Post-equalizing pulse width	50%	2.3	± 0.1	μs
NOTE 1 – Some component equipment does not blank lines 20 and 282, resulting in 19-line ($\pm 1.5 \mu\text{s}$) vertical blanking.				
NOTE 2 – All pulse rise and fall times, unless otherwise specified, are to be $140 \text{ ns} \pm 20 \text{ ns}$ measured from 10% to 90% amplitude points. All pulses are measured at 50% amplitude points.				
NOTE 3 – Line 21 is designated for other uses, including closed captioning.				

For 1H, the vertical synchronization signal should consist of a nine-line block divided into three, three-line-long segments. The first segment should contain six pre-equalizing pulses. The second segment should contain the vertical synchronizing pulse with six serrations provided to maintain horizontal synchronization. The third segment should contain six post-equalizing pulses.

The remainder of the vertical blanking interval not used for the nine-line vertical sync block should be available for special vertical interval signals². When such signals are carried on a particular line, the signals should conform to the period between horizontal blanking intervals. When such signals are not carried on a particular line, the line should be maintained at blanking level.

² Many television systems use line 10 for clamping levels or other information. Therefore, line 10 should not be used for data, since such use may interfere with system operation.