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SMPTE STANDARD

for Television — Three-Channel RGB Analog Video Interface



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1 Scope

This standard defines the component analog video interface for studio applications using three primary color signals carried on parallel channels for the interconnection of television equipment. The signals carried across the interface have a typical scanning structure of 525 lines, 59.94 fields/s, 2:1 interlace, and 4:3 or 16:9 aspect ratio. The signals have a vertical blanking interval that is divided into an active line period and a horizontal blanking interval. Signal characteristics are defined by a gamma-corrected set of red, green, and blue R'G'B' (hereafter defined as RGB) primary video signals.

In addition to general interconnection of television equipment at the RGB component analog level of operation, the signals defined by this standard are suitable as inputs to analog-to-digital conversion systems in compliance with ANSI/SMPTE 125M and ANSI/SMPTE 267M or as inputs to NTSC composite encoders in compliance with ANSI/SMPTE 170M.

The three-channel interface defined by this standard (sync on green) is the preferred implementation. Some applications may require a four-channel interface (with sync carried separately). Such an implementation is described in annex A.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility

of applying the most recent edition of the standard indicated below.

IEC 60169-8 (1978-01), Part 8: R.F. Coaxial Connectors with Inner Diameter of Outer Conductor 6.5 mm (0.256 in) with Bayonet Lock — Characteristic Impedance 50 Ohms (Type BNC); Appendix A (1993), Information for Interface Dimensions of 75-Ohm Characteristic Impedance Connectors with Unspecified Reflection Factors; and Amendment No. 1 (1996-03)

3 Scanning

3.1 The video signal shall correspond to scanning of the image at uniform velocities from left to right and from top to bottom. This will provide 525 nominally horizontal lines where alternate lines are scanned on each vertical pass for 2:1 interlace. As a result of vertical blanking, there are 483 active picture lines which are divided into an active picture period and a horizontal blanking period.

3.2 The aspect ratio of the active picture is entirely determined by the geometry of the pickup and display devices which should be appropriately matched. Parameters specified in this standard are not affected by the operational aspect ratio. Typical aspect ratios are 4:3 and 16:9.

4 System colorimetry

4.1 The RGB signals shall be suitable for a color display device having primary colors with the following chromaticities in the CIE S002 system of specifications:

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		<i>x</i>	<i>y</i>
Red	(R)	0.630	0.340
Green	(G)	0.310	0.595
Blue	(B)	0.155	0.070

NOTES

1 The display primaries with the chromaticities specified above are commonly referred to as the SMPTE C set.

2 This specification does not preclude the continued use of equipment built to the color parameters of the NTSC 1953 color television transmission standard for which the chromaticities in the CIE S002 system were specified at the values listed below. Signals produced using the original NTSC specifications will not display properly on modern display devices:

		<i>x</i>	<i>y</i>
Red	(R)	0.67	0.33
Green	(G)	0.21	0.71
Blue	(B)	0.14	0.08

4.2 The system reference white is an illuminant which causes equal primary signals to be produced by a reference camera and which is reproduced by a reference display device when driven by equal primary signals. For this system, the reference white is specified in terms of its CIE S002 chromaticity coordinates which have been chosen to match those of CIE S002 illuminant D₆₅:

$$x = 0.3127 \quad y = 0.3290$$

4.3 The individual component amplitudes shall be equal for picture areas whose chromaticity corresponds to the system reference white.

5 Transfer characteristics

5.1 The reference reproducer for this system is representative of cathode ray tube displays, which have an inherently nonlinear electro-optical transfer characteristic (see annex B). To achieve an overall system transfer characteristic that is linear, it is necessary to specify compensating nonlinearity elsewhere in the system. This is

done at the signal source. For purposes of precision, particularly in digital signal processing applications, exactly inverse characteristics are specified for the reference camera and reproducer.

The respective transfer characteristics as defined in 5.1.1 and 5.2 shall be applied to all three channels. It is recognized that operating values may vary from the precise values given in order to meet operational requirements in practical systems.

5.1.1 Electro-optical transfer characteristic of the reference camera shall be:

$$V_c = 1.099 \times L_c^{(0.4500)} - 0.099 \text{ for } 0.018 \leq L_c \leq 1$$

$$V_c = 4.500 \times L_c \text{ for } 0 \leq L_c \leq 0.018$$

where V_c is the video signal output of the reference camera normalized to the system reference white and L_c is the light input to the reference camera normalized to system reference white.

5.2 Electro-optical transfer characteristic of the reference reproducer shall be:

$$L_T = [(V_r + 0.099)/1.099]^{(1/0.4500)} \text{ for } 0.0812 \leq V_r \leq 1$$

$$L_T = 4.500 \times V_r \text{ for } 0 \leq V_r \leq 0.0812$$

where V_r is the video signal level driving the reference reproducer normalized to the system reference white and L_T is the light output from the reference reproducer normalized to system reference white.

6 RGB component set

The RGB component set, as shown in figure 1, originates as equiband and gamma-corrected (see clause 5) RGB primary signals from a picture source, such as a camera or telecine, or as synthetically generated RGB video from a character generator, graphics generator, or test signal generator. These video signals are positive going, and each shall have a maximum peak level of 700 mV from blanking level with zero setup. The green signal shall have a negative-going sync pulse of amplitude 300 mV from blanking level that conforms to the timing requirements of clause 7.

NOTES

1 Some applications may require a four-channel interface (with sync carried separately). Such an implementation is described in annex A.