

SMPTE RECOMMENDED PRACTICE

High-Definition, Standard- Definition Compatible Color Bar Signal



Table of Contents	Page
Foreword	2
Intellectual Property	2
Introduction.....	2
1 Scope	3
2 Conformance Notation	3
3 Normative References	3
4 Color Bar Signal Structure	4
4.1 Arrangement of Patterns	4
4.2 Rise and Fall Times of Bar Transitions	7
4.3 Waveforms	7
5 Use of the Color Bar Signal (Informative)	12
5.1 Monitor Adjustment	12
5.2 Ramp Signal.....	12
5.3 PLUGE Signals for Picture Monitor Black Level Setup.....	12
5.4 100% White Signal (Pattern 4).....	12
5.5 User-Selectable Bar (75% White, or 100% White, or + or- I Signal (Sub-Pattern *2)	13
5.6 Optional Sub-Black Valley (Sub-Pattern *5)	13
5.7 Optional Super-White Peak (Sub-Pattern *6)	13
Annex A Setup and Colorimetry (Informative)	14
A.1 Setup for Composite Signals	14
A.2 Colorimetry of the Direct and Down-Converted Color Bar Signals	14
Annex B Digital Coding Values for 8-, 10- or 12-Bit Implementation of Color Bar Signal (Normative)..	15
Annex C Values for Construction of Color Bar Signal (Normative)	18
C.1 Bar Widths.....	18
C.2 Pattern Heights	20
Annex D Bibliography (Informative)	21

Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

SMPTE RP 219-1 was prepared by Technology Committee 10E.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

The color bar signal described in this recommended practice is based on a signal originally standardized in Japan as ARIB STD-B28, which was published in 2000. In 2002, SMPTE worked with ARIB to make this an international recommended practice and it was published as RP 219. At that time several optional features were added to the original ARIB signal specification.

The 2014 revision of the Recommended Practice adds two new optional components that are useful in verifying whether systems are capable of passing the entire range of luminance levels permitted on the serial interface, and if the monitor is capable of displaying them.

1 Scope

This practice specifies a color bar pattern compatible with both high- and standard-definition environments. The multi-format color bar signal originates as an HDTV signal with an aspect ratio of 16:9 and may be down-converted to an SDTV color bar signal with an aspect ratio of either 4:3 or 16:9.

The color bar signal is generated with unconventionally slow rise and fall time values, and is therefore only intended to facilitate video level control and monitor color adjustments of HDTV and SDTV equipment. It can be applied to HDTV video productions, especially in a multi-format environment where HDTV video sources are frequently converted and used as SDTV video content either in 525 or 625 environments with the same frame frequencies as in the original HDTV signal.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 170:2004) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 170M-2004). Documents with the same root number (e.g. 170) and publication year (e.g. 2004) are functionally identical.

The following standards contain provisions that, through reference in this text, constitute provisions of this recommended practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this recommended practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 170:2004 (Stabilized 2010), Television — Composite Analog Signal — NTSC for Studio Applications

SMPTE ST 274:2008, Television — 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates

SMPTE ST 296:2012, 1280 x 720 Progressive Image 4:2:2 and 4:4:4 Sample Structure — Analog and Digital Representation and Analog Interface

4 Color Bar Signal Structure

The multi-format color bar signal shall be composed of four specific patterns as shown in Figure 1.

4.1 Arrangement of Patterns

The first part of the color bar signal represents a signal for the 4x3 aspect ratio; a second part of the total signal adds additional side panels for the 16x9 aspect ratio. A third part adds a luminance ramp and additional color information, and the last part completes the total signal by adding white and black bars, in addition to a set of near-black-level steps for monitor black level adjustment.

Pattern 1 shall consist of a 75% color bar signal within a 4:3 aspect ratio area, with 40% gray signals positioned on either side of the 4:3 area. The sub-pattern area marked *1 within pattern 1 in Figure 1 (single bar on right and left of pattern 1) shall be set to 40% gray as a default value. This value may be optionally adjustable to any other value in accordance with the operational requirements of the user.

Pattern 2 shall consist of the color difference/chroma setting reference signal (75% white) within the 4:3 area, with 100% cyan and 100% blue signals to the far left and far right sides respectively. Additionally, a signal in the sub-pattern area marked *2 in Figure 1 shall be selectable from 75% white, 100% white, + I signal and -I signal options, according to the user's operational preference. When the -I signal is selected in sub-pattern *2, the +Q signal shall be simultaneously selected in sub-pattern *3.

The + I signal shall have the component values shown in Table B.4.

The -I signal shall have the component values shown in Table B.5.

Pattern 3 shall consist of a ramp signal, with 0% black and 100% white signals to the immediate left and right respectively in the 4:3 area, and 100% yellow and 100% red signals to the far left and far right sides, respectively. The ramp signal is designed for checking specific bit failures that can occur in digital processing. The ramp shall be a linear slope of luminance from 0% to 100% white.

Note: Previous versions of this Recommended Practice did not specify the width of the white region to the right of the ramp. Signals generated in compliance to those versions of this Recommended Practice are considered to be compliant with this Recommended Practice. The fact that the ramp is linear does not imply that it changes by a value of 1 for every pixel.

Additionally a signal in the sub-pattern area marked *3 in Figure 1 shall be selectable from 0% black and +Q signal options, according to the user's operational preference. When the +Q signal is selected in sub-pattern *3, the -I signal shall be simultaneously selected in sub-pattern *2.

The + Q signal shall have the component values shown in Table B.7.

Pattern 4 shall consist of a 0% black signal divided vertically into three equal parts, a 100% white signal divided vertically into three equal parts, and a set of near-black signals for picture monitor black level adjustment. The 15% gray signal panels are then added at each end of pattern 4. The sub-pattern area marked *4 within pattern 4 in Figure 1 (single bar on right and left of pattern 4) shall be set to 15% gray as a default value. This value may be optionally adjustable to any other value in accordance with the operational requirements of the user.

Note: The set of near-black signals are known collectively as PLUGE (PLUGE: Picture Line Up Generating Equipment). For specific instructions see Section 5.3 and SMPTE EG 1, Section 4.2.

Additionally a signal in the sub-pattern area marked *5 in Figure 1 shall be selectable from 0% black and sub-black valley signal options, according to the user's operational preference. The sub-black valley signal shall begin at the 0% black level, shall decrease in a linear ramp to the minimum permitted level at the mid-point, and shall increase in a linear ramp to the 0% black level at the end of the black bar. When the sub-black valley signal is selected in sub-pattern *5, the super-white peak signal shall be simultaneously selected in sub-pattern *6.

Additionally a signal in the sub-pattern area marked *6 in Figure 1 shall be selectable from 100% white and super-white peak signal options, according to the user's operational preference. The super-white peak signal shall begin at the 100% white level, shall increase in a linear ramp to the maximum permitted level at the midpoint, and shall decrease in a linear ramp to the 100% white level at the end of the white bar. When the super-white peak signal is selected in sub-pattern *6, the sub-black valley signal shall be simultaneously selected in sub-pattern *5.

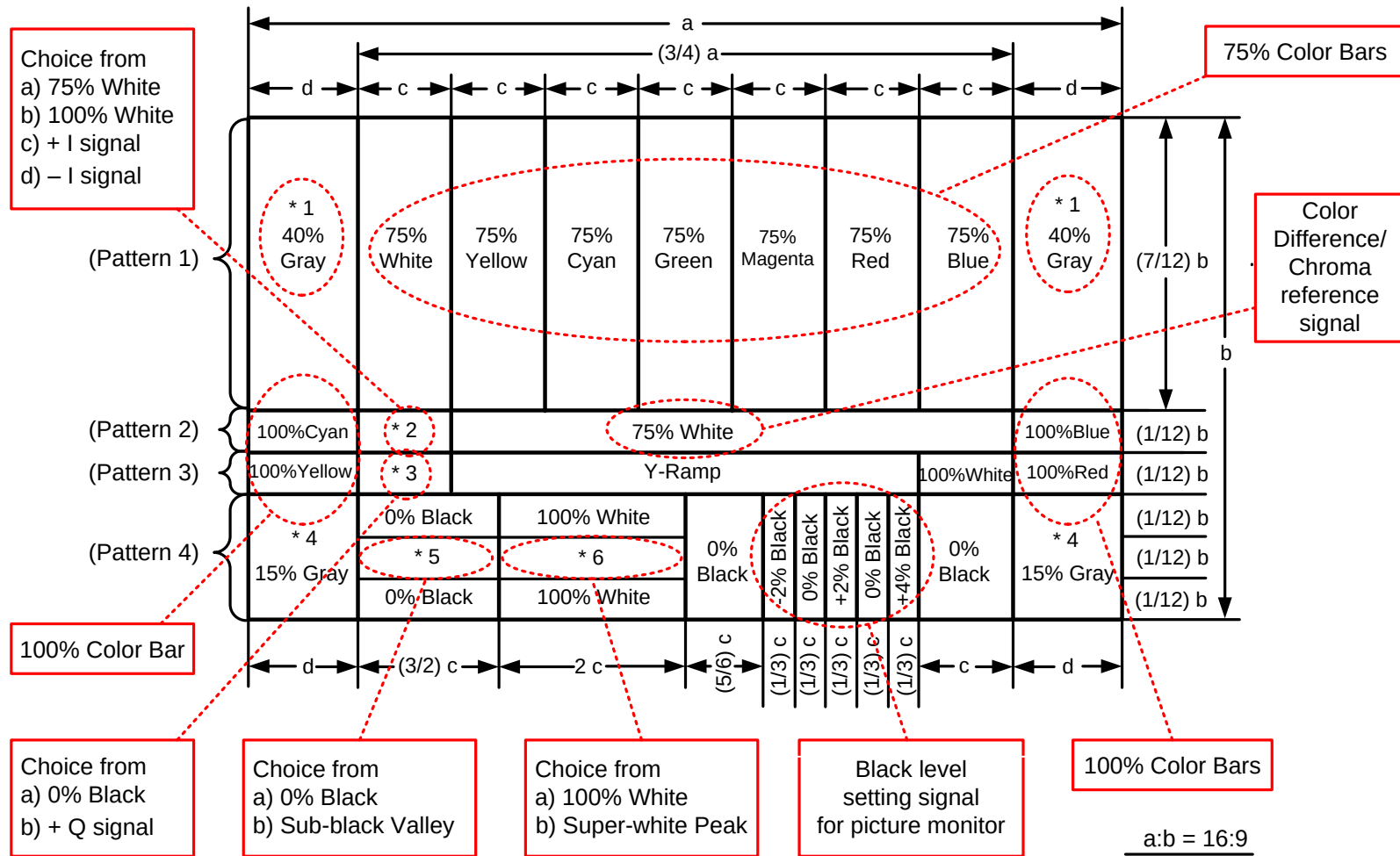


Figure 1 – A structure of the multi-format color bar signal

4.2 Rise and Fall Times of Bar Transitions

Implementers of this Recommended Practice shall follow practices of proper shaping (rise and fall times for bar transitions) for individual bars.

Nominal values for rise and fall time of the HDTV color bars shall be identical for luminance and C_B / C_R signals, and set to 55 ns, which does not exercise the full bandwidth capability of an HDTV system. These rise and fall time definitions are based on a transition from 10% to 90%. The tolerance on the rise/fall times shall be $\pm 10\%$ of the nominal values. The actual shape of the transition should be similar to integrated sine-squared pulse shape.

The rise and fall times of the down converted SDTV color bar signal would follow the recommendation of the relevant SDTV standards.

4.3 Waveforms

Note: Values shown in Figure 2 through Figure 10 are associated with a 10-bit digital system; values shown in parentheses are associated with an 8-bit digital system. See Annex B for a complete listing of coding values for 8-bit, 10-bit and 12-bit digital systems.

4.3.1 Pattern 1

Waveforms defining pattern 1 are shown in Figure 2.

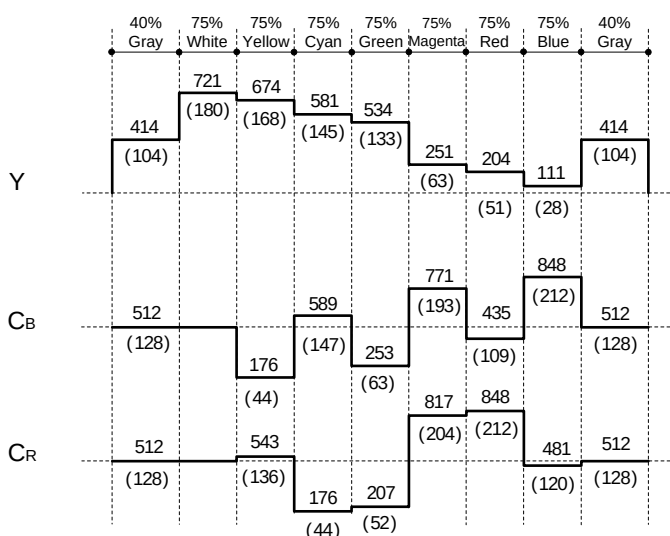


Figure 2 – Pattern 1 waveforms