SMPTE RP 219-1:2014
Revision of RP 219:2002

SMPTE RECOMMENDED PRACTICE

High-Definition, Standard-Definition Compatible Color Bar Signal

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Approved
July 14, 2014

Foreword

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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.

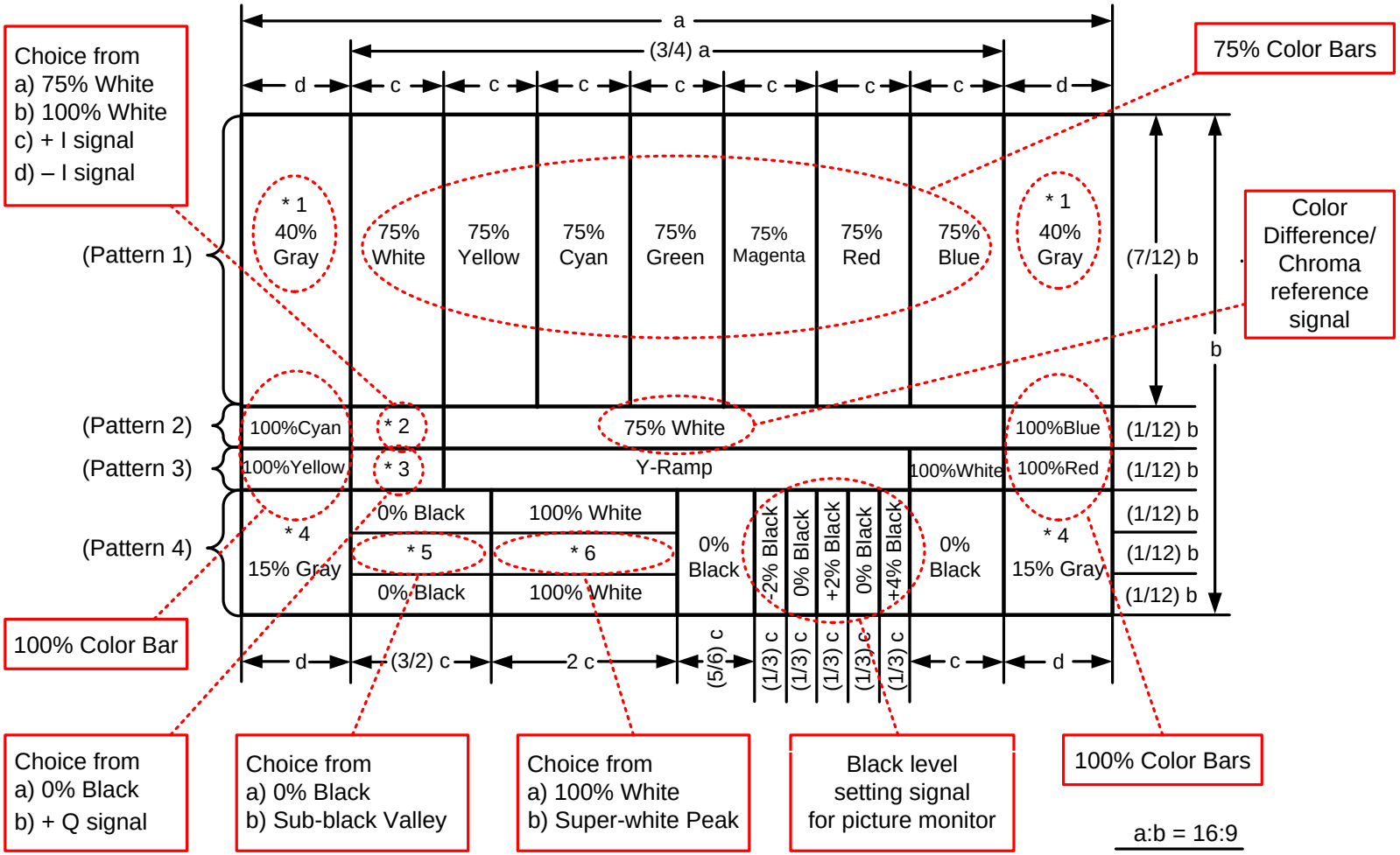

Figure 1 – A structure of the multi-format color bar signal

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 ± 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.

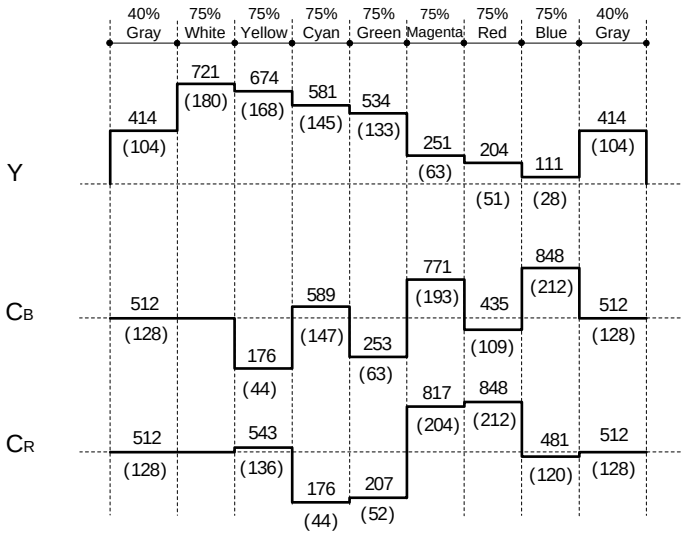

Figure 2 – Pattern 1 waveforms

4.3.2 Pattern 2

Waveforms defining pattern 2 are shown in Figure 3 through Figure 6.

(a) Sub-pattern *2 set to 75% white signal

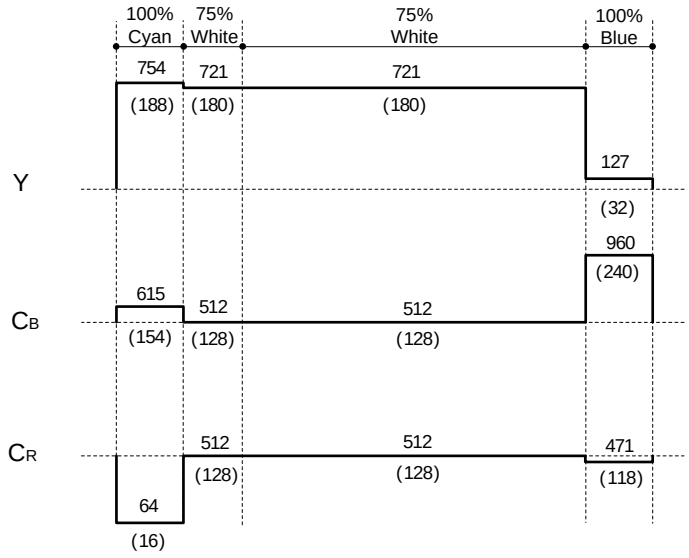

Figure 3 – Pattern 2 waveforms with 75% white signal (in *2 sub-pattern)

(b) Sub-pattern *2 set to 100% white signal:

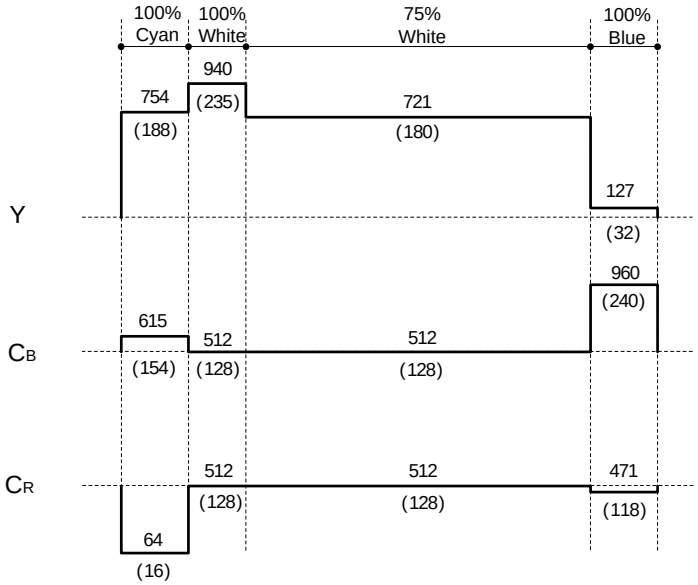

Figure 4 – Pattern 2 waveforms with 100% white signal (in *2 sub-pattern)

(c) Sub-pattern *2 set to +I signal:

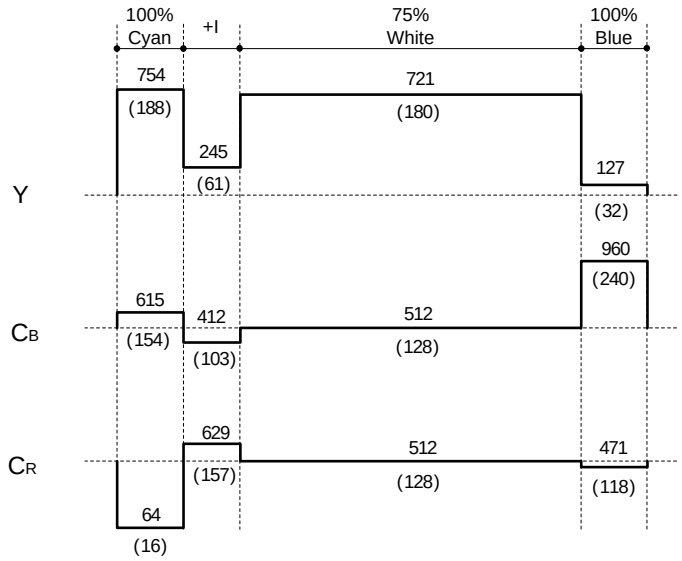

Figure 5 – Pattern 2 waveforms with +I signal (in *2 sub-pattern)

(d) Sub-pattern *2 set to – I signal:

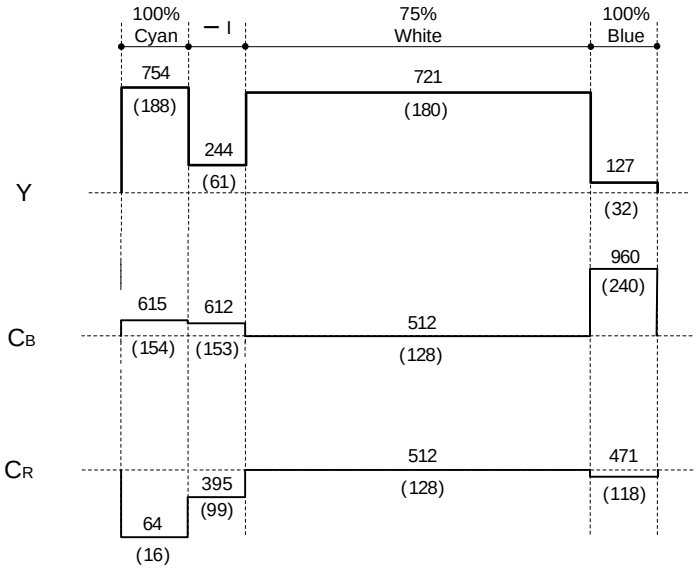

Figure 6 – Pattern 2 waveforms with – I signal (in *2 sub-pattern)

4.3.3 Pattern 3

Waveforms defining pattern 3 are shown in Figure 7 and Figure 8.

(a) Sub-pattern *3 set to black signal:

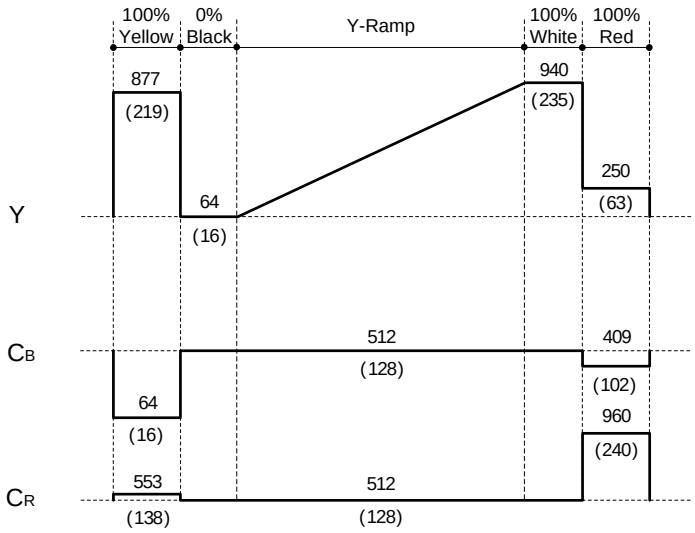

Figure 7 – Pattern 3 waveforms with black signal (in *3 sub-pattern)

(b) Sub-pattern *3 set to +Q signal:

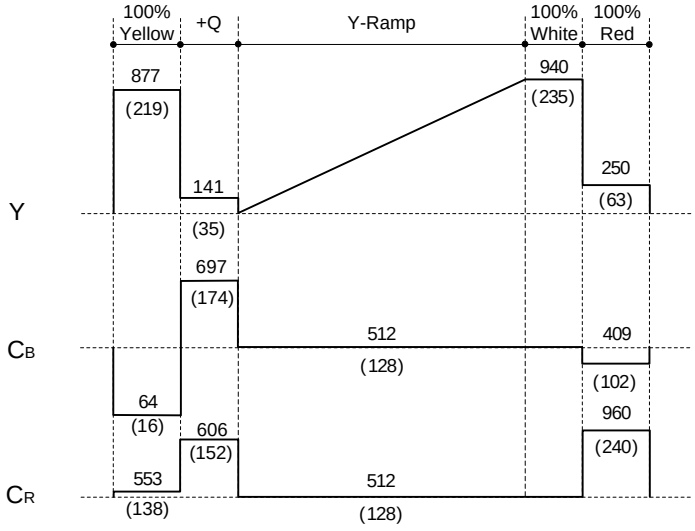

Figure 8 – Pattern 3 waveforms with +Q signal (in *3 sub-pattern)

4.3.4 Pattern 4

Waveforms defining pattern 4 are shown in Figure 9 and Figure 10.

(a) Sub-pattern *5 set to black signal and Sub-pattern *6 set to white signal:

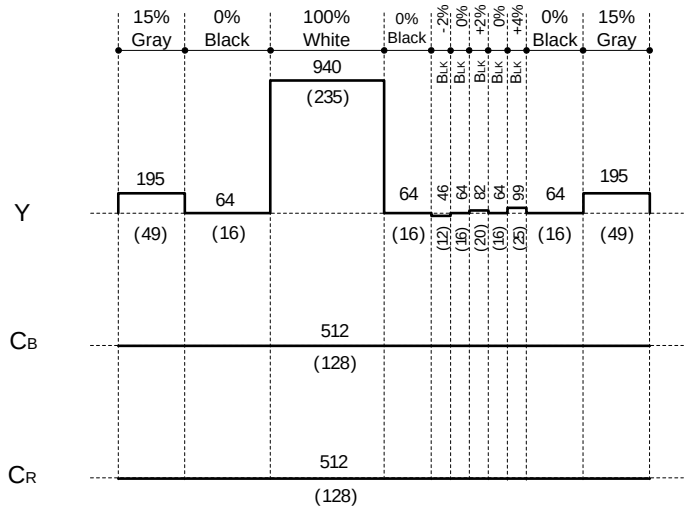

Figure 9 – Waveforms for pattern 4

(b) Sub-pattern *5 set to sub-black valley signal and Sub-pattern *6 set to super-white peak signal:

When the optional sub-black valley and optional super-white peak signals are used in sub pattern region *5 and *6 respectively, the top and bottom thirds of pattern 4 shall use the waveforms of Figure 9. The middle third of pattern 4 shall use the waveform of Figure 10. When either the sub-black valley signal or the super-white peak signal is selected, the other shall also be selected.

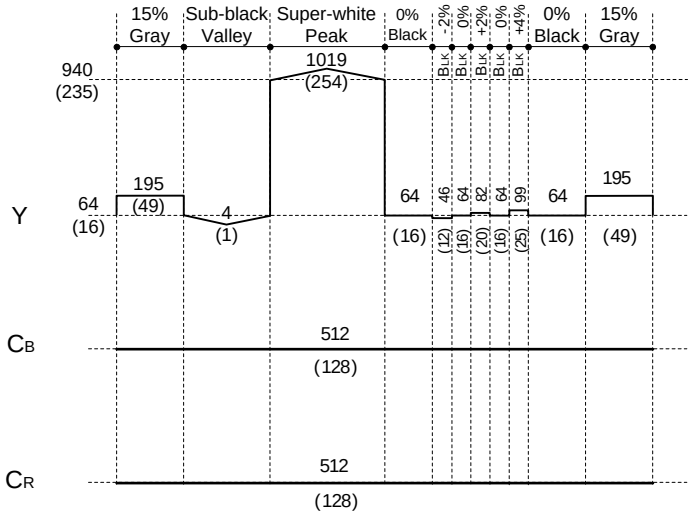

Figure 10 – Waveforms for pattern 4 with the sub-black valley (in *5 sub pattern) and super-white peak (in *6 sub pattern)

5 Use of the Color Bar Signal (Informative)

The multi-format color bar signal embodies a single signal constructed from the combination of a 100% color bar signal used in HDTV and a 75% color bar signal used in SDTV. Based on the difference in aspect ratio between HDTV and SDTV, a 4:3 aspect ratio center section is utilized as a common area for both SDTV and HDTV signals, while the outside of this area is utilized for HDTV only. This color bar signal format therefore serves both HDTV and SDTV systems. Additionally, it provides facilities for easy control of video source level and other operations such as monitor adjustments.

Precision setup of fixed pixel matrix (FPM) displays is beyond the scope of this Recommended Practice.

Values associated with % are related to a full value of the signal based on 100% of a full digital signal, defined in a relevant signal format document. See Annex B for a complete listing of coding values for 8-bit, 10-bit and 12-bit digital systems.

5.1 Monitor Adjustment

5.1.1 Adjustment of a composite picture monitor

Turning on the blue channel only in the monitor, chroma gain and chroma phase are adjusted to give the same brightness level in each main blue bar and the 75% white signal below, in a manner similar to the use of SMPTE color bars as defined in SMPTE EG 1.

5.1.2 Adjustment of a component picture monitor

Turning on the blue channel only in the monitor, C_B/P_B gain is adjusted to give the same brightness level in the blue bars and the 75% white signal area located below the blue bars.

Turning on the red channel only in the monitor, C_R/P_R gain is adjusted to give the same brightness level in the red bars and the 75% white signal area located below the red bars.

5.2 Ramp Signal

A “Y ramp signal” located in the middle of the screen as part of pattern 3 allows easy monitoring of specific bit failures in a luminance signal.

5.3 PLUGE Signals for Picture Monitor Black Level Setup

The PLUGE signals in pattern 4 (-2, 0, +2, 0 and +4%) are a combination of signal sequences for picture monitor use. See note under pattern 4 in Section 4.1

To set the black level in a picture monitor, the brightness control is adjusted until the +2% and the +4% steps are visible with respect to the black surround but the -2% step is not visible

The signal sequence of [-2%, 0 and +2%] was adopted in accordance with ARIB TR-B10.

The signal sequence of [+2%, 0 and +4%] is in harmony with SMPTE EG 1, even though SMPTE EG 1 recommends ±4% for the black level setting signal. The -4% level was eliminated due to the current environment where negative signal excursions are often clipped.

5.4 100% White Signal (Pattern 4)

This signal provides the standard level of 100% brightness.

5.5 User-Selectable Bar (75% White, or 100% White, or + or- I Signal (Sub-Pattern *2)

The selection is based on individual operating practices and environments as follows:

5.5.1 75% white

This signal is used when neither a +(-) I signal nor 100% white is required.

5.5.2 100% white

This signal is used to facilitate level setting: the amplitude of the chroma in the 75% color bar signal is adjusted to be equal to the level of the 100% white signal in the waveform of an NTSC composite signal (displayed at V rate).

5.5.3 + I or – I signal

This signal is located on the I axis of an NTSC vector-scope; its amplitude is equal to the burst level in the composite signal. Since skin tone colors are located in the neighborhood of the +I axis, the +I signal can be used as an approximate skin color reference signal with HDTV systems, providing a color reference similar to that available in NTSC systems.

5.6 Optional Sub-Black Valley (Sub-Pattern *5)

This signal is used to determine if equipment is capable of passing the minimum permitted luminance level, and if the monitor is capable of displaying it.

5.7 Optional Super-White Peak (Sub-Pattern *6)

This signal is used to determine if equipment is capable of passing the maximum permitted luminance level, and if the monitor is capable of displaying it.

Annex A Setup and Colorimetry (Informative)

A.1 Setup for Composite Signals

The composite encoded color bar signal of a 525-line television system used in American broadcasting contains a “set up” signal. However, this set up signal is not present in 525-line composite encoded signal television systems used in Japan.

SMPTE ST 170 defines parameters of all elements present in a composite encoded signal, including the set up signal. Set up is an offset signal of 7.5 IRE units amplitude, which is added to the black level of the luminance channel in the composite encoded signal during the final stages of the encoding process.

A.2 Colorimetry of the Direct and Down-Converted Color Bar Signals

Refer to published signal standards for HDTV and SDTV for definitions of the colorimetry relevant to the respective signal formats.

Equipment designers need to be aware that an appropriate colorimetry conversion process between the HDTV and the down-converted SDTV color bar signals is recommended (refer to SMPTE EG 36).

Annex B Digital Coding Values for 8-, 10- or 12-Bit Implementation of Color Bar Signal (Normative)

The following tables specify the digital coding values that shall be used for 8-, 10-, or 12-bit implementations of the color bar signal.

Note: The calculated tabulated values are based on formulas of the SMPTE ST 274 and SMPTE ST 296.

Note: Down-conversions of the color bar signal to SDTV will result in either 8-bit or 10-bit implementations only.

Pattern 1

Table B.1 – Digital Coding Values for Pattern 1

		75% White	75% Yellow	75% Cyan	75% Green	75% Magenta	75% Red	75% Blue	40% Gray
Y	8-bit	180	168	145	133	63	51	28	104
	10-bit	721	674	581	534	251	204	111	414
	12-bit	2884	2694	2325	2136	1004	815	446	1658
C_B	8-bit	128	44	147	63	193	109	212	128
	10-bit	512	176	589	253	771	435	848	512
	12-bit	2048	704	2356	1012	3084	1740	3392	2048
C_R	8-bit	128	136	44	52	204	212	120	128
	10-bit	512	543	176	207	817	848	481	512
	12-bit	2048	2171	704	827	3269	3392	1925	2048

Pattern 2

Table B.2 – Digital Coding Values for Pattern 2: 75% White signal selected

		100% Cyan	75% White	100% Blue
Y	8-bit	188	180	32
	10-bit	754	721	127
	12-bit	3015	2884	509
C_B	8-bit	154	128	240
	10-bit	615	512	960
	12-bit	2459	2048	3840
C_R	8-bit	16	128	118
	10-bit	64	512	471
	12-bit	256	2048	1884

Table B.3 – Digital Coding Values for Pattern 2: 100% White signal selected

		100% Cyan	100% White	75% White	100% Blue
Y	8-bit	188	235	180	32
	10-bit	754	940	721	127
	12-bit	3015	3760	2884	509
C_B	8-bit	154	128	128	240
	10-bit	615	512	512	960
	12-bit	2459	2048	2048	3840
C_R	8-bit	16	128	128	118
	10-bit	64	512	512	471
	12-bit	256	2048	2048	1884

Table B.4 – Digital Coding Values for Pattern 2: +I signal selected

		100% Cyan	+I	75% White	100% Blue
Y	8-bit	188	61	180	32
	10-bit	754	245	721	127
	12-bit	3015	982	2884	509
C_B	8-bit	154	103	128	240
	10-bit	615	412	512	960
	12-bit	2459	1648	2048	3840
C_R	8-bit	16	157	128	118
	10-bit	64	629	512	471
	12-bit	256	2516	2048	1884

Table B.5 – Digital Coding Values for Pattern 2: –I signal selected

		100% Cyan	-I	75% White	100% Blue
Y	8-bit	188	61	180	32
	10-bit	754	244	721	127
	12-bit	3015	976	2884	509
C_B	8-bit	154	153	128	240
	10-bit	615	612	512	960
	12-bit	2459	2448	2048	3840
C_R	8-bit	16	99	128	118
	10-bit	64	395	512	471
	12-bit	256	1580	2048	1884

Pattern 3

Table B.6 – Digital Coding Values for Pattern 3: Black signal selected

		100% Yellow	0% Black	Ramp 100%	100% White	100% Red
Y	8-bit	219	16	235	235	63
	10-bit	877	64	940	940	250
	12-bit	3507	256	3760	3760	1001
C_B	8-bit	16	128	128	128	102
	10-bit	64	512	512	512	409
	12-bit	256	2048	2048	2048	1637
C_R	8-bit	138	128	128	128	240
	10-bit	553	512	512	512	960
	12-bit	2212	2048	2048	2048	3840

Table B.7 – Digital Coding Values for Pattern 3: +Q signal selected

		100% Yellow	+Q	Ramp 100%	100% White	100% Red
Y	8-bit	219	35	235	235	63
	10-bit	877	141	940	940	250
	12-bit	3507	564	3760	3760	1001
C_B	8-bit	16	174	128	128	102
	10-bit	64	697	512	512	409
	12-bit	256	2787	2048	2048	1637
C_R	8-bit	138	152	128	128	240
	10-bit	553	606	512	512	960
	12-bit	2212	2425	2048	2048	3840

Pattern 4

Table B.8 – Digital Coding Values for Pattern 4

		15% Gray	0% Black	Sub-black Valley	100% White	Super-white Peak	-2% Black	+2% Black	+4% Black
Y	8-bit	49	16	1	235	254	12	20	25
	10-bit	195	64	4	940	1019	46	82	99
	12-bit	782	256	16	3760	4079	186	326	396
C_B	8-bit	128	128	128	128	128	128	128	128
	10-bit	512	512	512	512	512	512	512	512
	12-bit	2048	2048	2048	2048	2048	2048	2048	2048
C_R	8-bit	128	128	128	128	128	128	128	128
	10-bit	512	512	512	512	512	512	512	512
	12-bit	2048	2048	2048	2048	2048	2048	2048	2048

Annex C Values for construction of color bar signal (Normative)

In Figure C.1, dimensions a and b, the width and height respectively of the active image area, shall be as defined by the source image format standards SMPTE ST 274 and SMPTE ST 296.

The following values should be used for construction of the color bar signal. When the color bar signal is being generated, there are some simplifications that may be made to simplify the implementation depending upon design and/or manufacturing restrictions. Individual ideal parameters are shown in this recommended practice for reference, however some parameters have alternative values to simplify the implementation.

C.1 Bar Widths

The bar widths for picture elements of the color bar signal are specified as fractions of the total line width, so that the color bar signal is scalable between the different HDTV image formats. The number of samples for specific bar widths may therefore be a fraction, depending on the relationship of the number of horizontal picture elements to the total line width. For digital interfaces, it is desirable for each picture element width to be an integer number of samples. Additionally, because of the 4:2:2 chroma sub-sampling, in order for the color difference signal to be an integer number of samples, the luminance signal must be an even number of samples.

At the edge of a picture element, shaping is applied so that the rise and fall times are in conformance with Section 4.2. It may be desirable to increase the width of the 4:3 central part of the color bar signal so there is an overlap at the edges when the signal is down-converted to a 4:3 SDTV color bar signal.

The following tables present three sets of recommended widths:

a. the ideal width, rounded to the closest integer;

b. even number sample width;

c. modified 4:3 width. The width of both 75% White and Blue bar regions was increased to avoid any overlap at the 4:3 boundary when the color bar signal is down-converted.

Note: Equipment designers need to be aware that suggested bar widths serve only as a guide. Due to actual rise and fall time implementations, it might be required that the bar width in pixels of "f to f" in Table C.1 and "k to m" in Table C.2 be higher than the theoretical value of 1440 pixels for 4x3 aspect ratio. Similarly, it might be required that the bar width in pixels of "f to f" in Table C.3 and "k to m" in Table C.4 be higher than the theoretical value of 960 pixels for 4x3 aspect ratio.

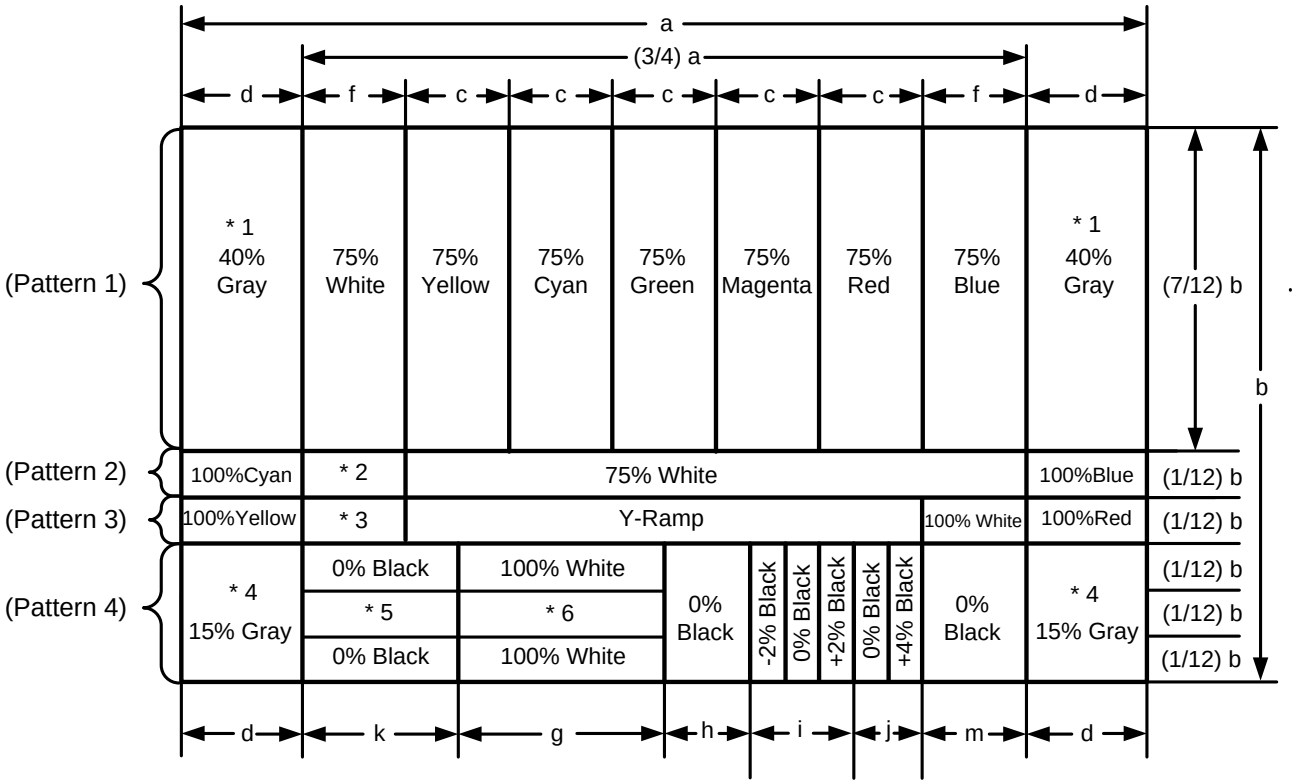

Figure C.1 – Reference diagram for Tables C.1 to C.5

Table C.1 – Bar widths for pattern 1 – 1920 x 1080 images (see note)

a Basic Pattern 1 in Figure C.1	d Gray	f 75% White	c 75% Yellow	c 75% Cyan	e 75% Green	c 75% Magenta	c 75% Red	f 75% Blue	d Gray
(a) Integer width (1920)	240	205	206	206	206	206	206	205	240
(b) Even Integer width (1920)	240	206	206	206	204	206	206	206	240
(c) Modified 4:3 width (1920)	236	210	206	206	204	206	206	210	236

Table C.2 – Bar widths for pattern 4 – 1920 x 1080 images (see note)

¾ a Pattern 4 in Figure C.1	k 0% Black	g 100% White	h 0% Black	i -2 / 0 /+2 Black	j 0 / +4 Black	m 0% Black
(a) Integer width (1440)	309	411	171	69/68/69	68/69	206
(b) Even Integer width (1440)	308	412	170	68/70/68	70/68	206
(c) Modified 4:3 width (1448)	312	412	170	68/70/68	70/68	210

Table C.3 – Bar widths for pattern 1 – 1280 x 720 images (see note)

a Basic Pattern 1 in Figure C.1	d Gray	f 75% White	c 75% Yellow	c 75% Cyan	e 75% Green	c 75% Magenta	c 75% Red	f 75% Blue	d Gray
(a) Integer width (1280)	160	137	137	137	138	137	137	137	160
(b) Even Integer width (1280)	160	138	136	138	136	138	136	138	160
(c) Modified 4:3 width (1280)	156	142	136	138	136	138	136	142	156

Table C.4 – Bar widths for pattern 4 – 1280 x 720 images (see note)

¾ a Pattern 4 in Figure C.1	k 0% Black	g 100% White	h 0% Black	i -2 / 0 /+2 Black	j 0 / +4 Black	m 0% Black
(a) Integer width (960)	206	274	115	46/45/46	46/45	137
(b) Even Integer width (960)	206	274	116	46/44/46	46/44	138
(c) Modified 4:3 width (968)	210	274	116	46/44/46	46/44	142

C.2 Pattern Heights

The heights of the patterns in the color bar signal are specified as integer multiples of a common factor equal to the total number of vertical samples divided by 12.

Table C.5 – Pattern Heights

	b	7/12 b Pattern 1	1/12 b Pattern 2	1/12 b Pattern 3	1/3 b Pattern 4	1/12 b Sub pattern *5, *6
1280 x 720 HDTV System	720	420	60	60	180	60
1920 x 1080 HDTV system	1080	630	90	90	270	90

Annex D Bibliography (Informative)

Recommendation ITU-R BT.1700 (2005), Characteristics of Composite Video Signals for Conventional Analogue Television Systems

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