ENGLISH TRANSLATION

MULTIFORMAT COLOR BAR

ARIB STANDARD

ARIB STD-B28 Version 1.0

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Association of Radio Industries and Businesses

General Notes to the English translation of ARIB

Standards and Technical Reports

3. The ARIB Standards and ARIB Technical Reports are usually written in Japanese and approved by the ARIB Standard Assembly. This document is a translation into English of the approved document for the purpose of convenience of users. If there are any discrepancies in the content, expressions, etc., between the Japanese original and this translated document, the Japanese original shall prevail.

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Preface

ARIB (Association of Radio Industries and Businesses) has established the "ARIB standards" for the basic technical conditions of standard specifications related to variety of radio communication equipments, broadcasting transmission equipments, and its reception equipments using radio wave with the participation of radio communication equipment manufacturers, broadcasting equipment manufacturers, electric communication companies, service providers and other users.

"ARIB standards" are nongovernmental standards established by combining governmental technical standards established for purpose of effective use of frequency and to avoid interference of other users, and nongovernmental optional standards established for convenience for radio communication equipment manufacturers, broadcasting equipment manufacturers, electric communication companies, service providers and users, in order to secure appropriate quality and compatibility of radio communication equipment and broadcasting equipment, etc.. This standard is intended to establish an HDTV color bar signal which can be used as not only an HDTV color bar but also an SDTV color bar when down-converted, and to facilitate video level control and monitor adjustment of SDTV down-converted from HDTV. It was established by the approval of the standardization committee, participated widely and indiscriminately by radio equipment manufacturers, broadcasting equipment manufacturers, telecommunication enterprises, broadcasters and users, to secure impartiality and clearness.

We hope that this standard will be put to practical use actively by radio communication equipment manufactures, broadcasting equipment manufactures, electric communication companies, service providers, users, and so on.

Notice:

In terms of this standard, no description about essential industrial property rights related to this standard is specified, however the holders of the said essential property rights have stated: "The industrial property rights listed in the annexed table related to this standard are owned by the person listed in the table. The holder will grant the execution of the rights without any conditions to the persons who plan to use this standard, and will never claim respecting these rights shown in the said annexed table. This shall not apply, however, to a user of this standard in case the user owns essential industrial property rights related to all of part of the content defined by this standard and if he asserts the execution of said rights."

Annexed table

Patent applicant	Name of invention	Patent number	Remarks
Asahi National Broadcasting Co., Ltd.	Color-bar signal generation unit compatible with plurality of television signal formats	Patent application 2000-164454	Japan
		Patent application 09/630,365	USA

Notice for publication of this specification in English:

The ARIB STD-B28 specification was originally written in Japanese and only the Japanese text was approved by ARIB. Since the English text is a translation of the Japanese one, the Japanese text precedes the English one, if there might be any technical difference between them.

Contents

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Chapter 1 Purpose

The objective of this standard is to establish an HDTV color bar signal which can be used as not only an HDTV color bar but also an SDTV color bar when down-converted, and to facilitate video level control and monitor adjustment of SDTV down-converted from HDTV.

Chapter 2 Scope of Application

This HDTV color bar signal standard shall be applied to HDTV video productions especially in multiformat environment where HDTV video sources are frequently converted and used as SDTV video contents.

Chapter 3 Formats for Patterns

The multiformat color bar signal is an HDTV color bar signal which can be used both for an HDTV color bar signal with an aspect ratio of 16:9 and a SDTV color bar with an aspect ratio of 4:3.

3.1 Composition

The multiformat color bar signal shall be composed of four patterns, shown in Fig. 3-1.

Pattern 1 shall consist of a 75% color bar signal within 4:3 aspect ratio area, and 40% Gray signals positioned in the outside of 4:3 area.

Pattern 2 shall consist of the chroma set signal (75% White) within 4:3 aspect area and 100% Cyan and 100% Blue signals in each side. The signal of area(*1) in Fig. 3-1 shall be chosen one among 75% White, 100% White and + I signal, according to each user's operational purpose.

The + I signal shall have the following component values: R = 41.2545 [IRE], G= 16.6946 [IRE] and B= 0 [IRE]

Pattern 3 shall consist of the ramp signal and 100% Yellow and 100% Red signals in each side. The ramp signal is designed to check the specific bit-failure, may occur in digital processing.

The ramp signal shall be a linear slope of luminance from 0 to 100% white, settling its center at horizontal center of screen.

Pattern 4 shall consist of a 100% White signal, the black set signals both for HDTV and SDTV monitors [Pluge*], and 15% Gray signals at both sides.

The area of (*2) in both Pattern 1 and Pattern 4 of Fig.3-1 (one each pair of right and left areas of both the upper and the lower positions) shall be 40% Gray and 15% Gray respectively but these values can be changed to any value other than the standard values in accordance with the operation purpose by the user.

*1 Pluge: Picture Line Up Generating Equipment

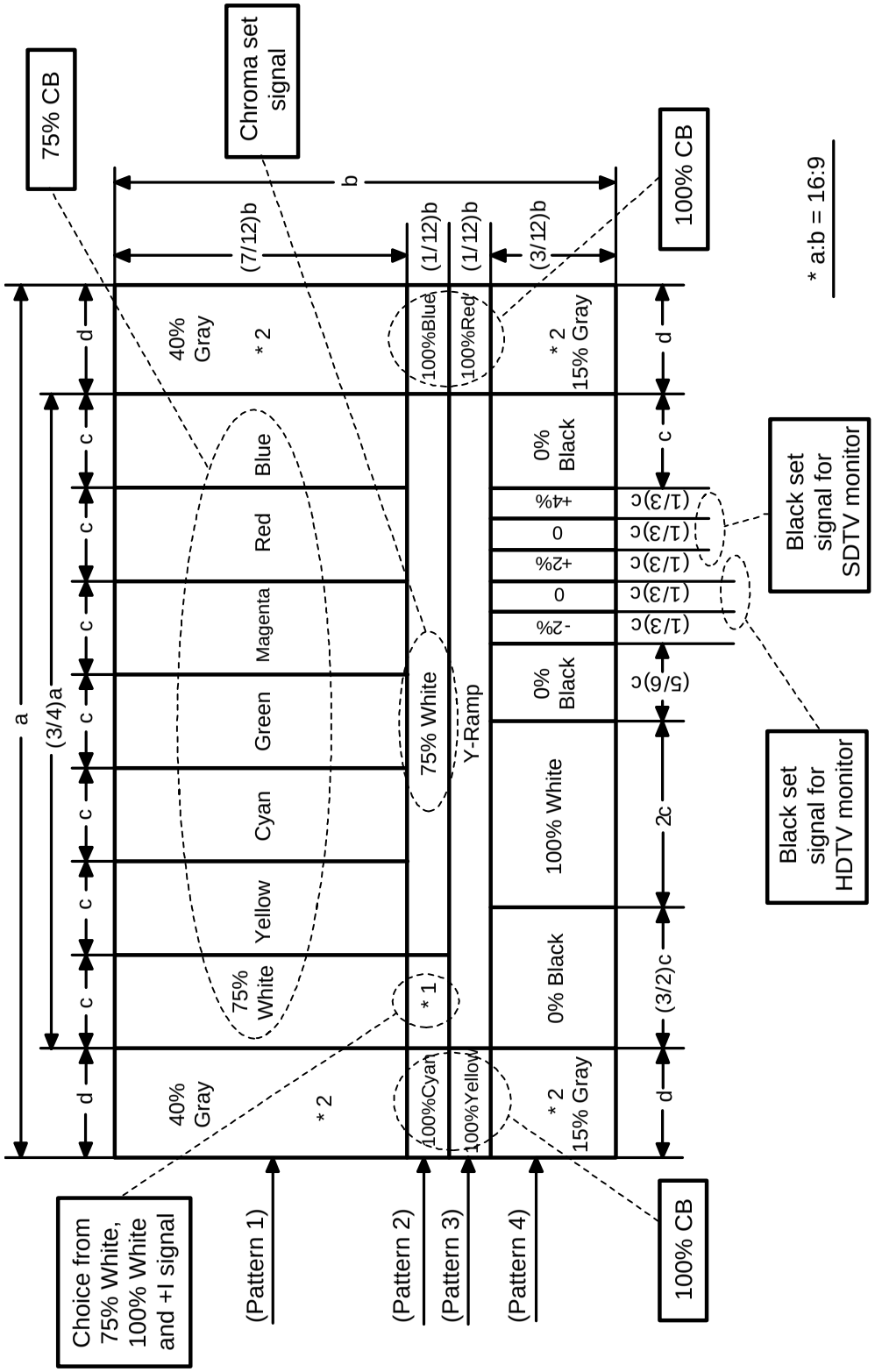

Fig.3-1 Format of multiformat color bar signal

3.2 Waveform

3.2.1 Patten 1

The waveform of the pattern 1 is shown in Fig.3-2.

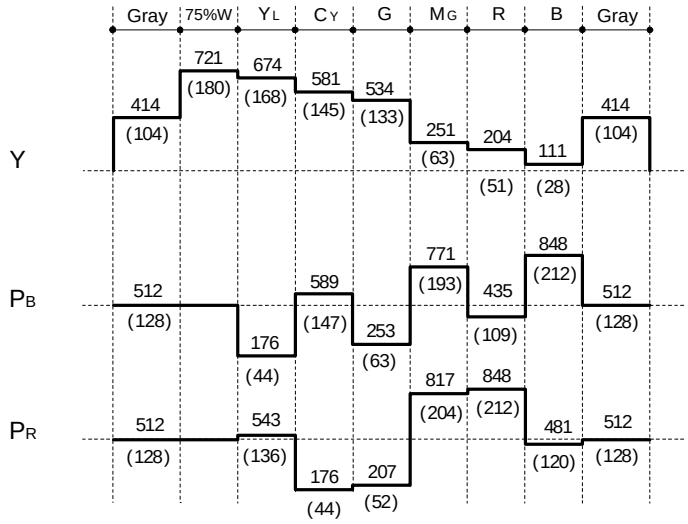

Fig.3-2 Waveform of the pattern 1

3.2.2 Patten 2

The waveforms of the pattern 2 are shown in Fig.3-3 to Fig3-5.

(a) In the choice of 75% White

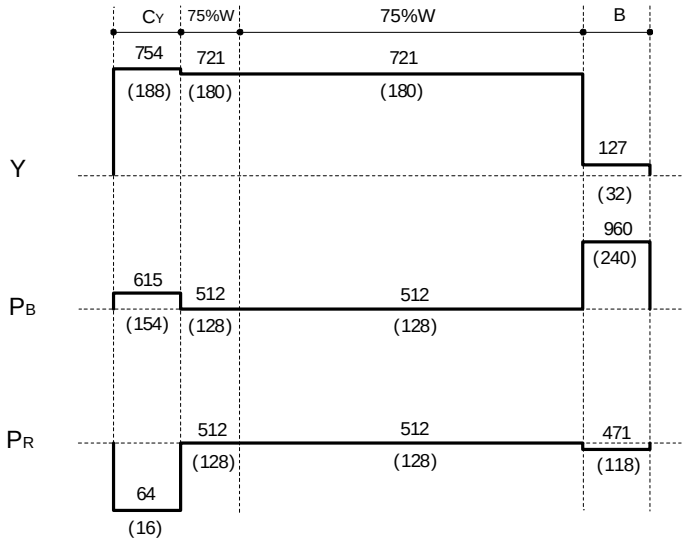

Fig.3-3 Waveform in the choice of 75% White

(Note) The nominal values of 10 bits (8 bits value in the parenthesis) are shown.

(b) In the choice of 100% White

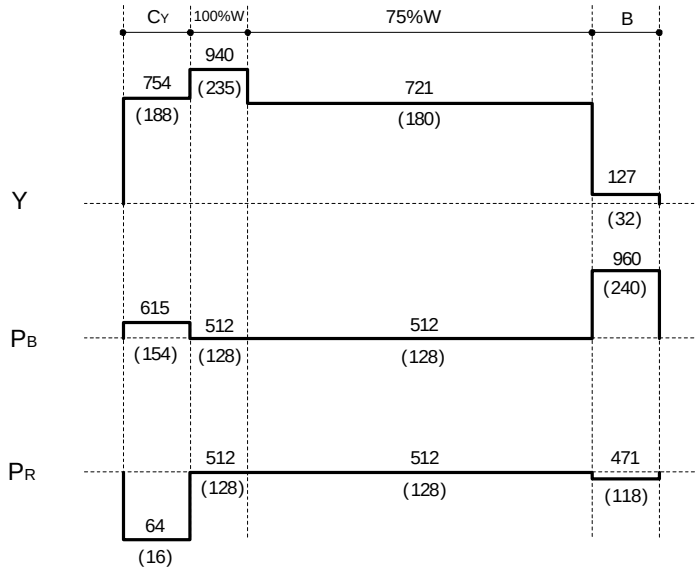

Fig.3-4 Waveform in the choice of 100% White

(c) In the choice of +I signal

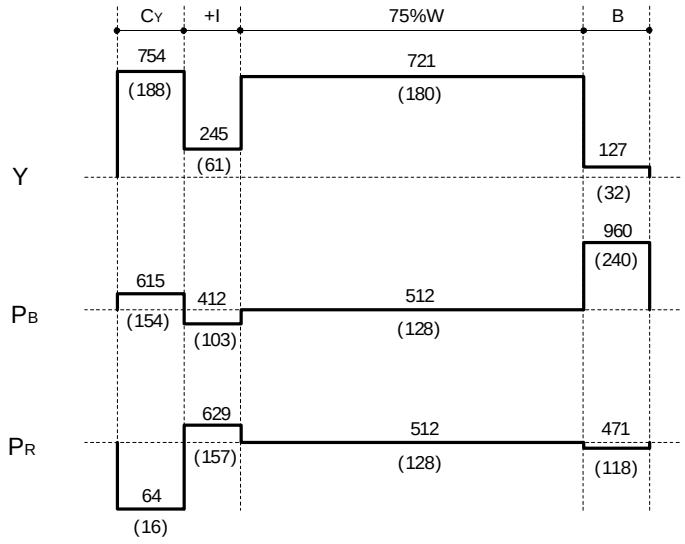

Fig.3-5 Waveform in the choice of +I signal

(Note) The nominal values of 10 bits (8 bits value in the parenthesis) are shown.

3.2.3 Pattern 3

The waveform of the pattern 3 is shown in Fig.3-6.

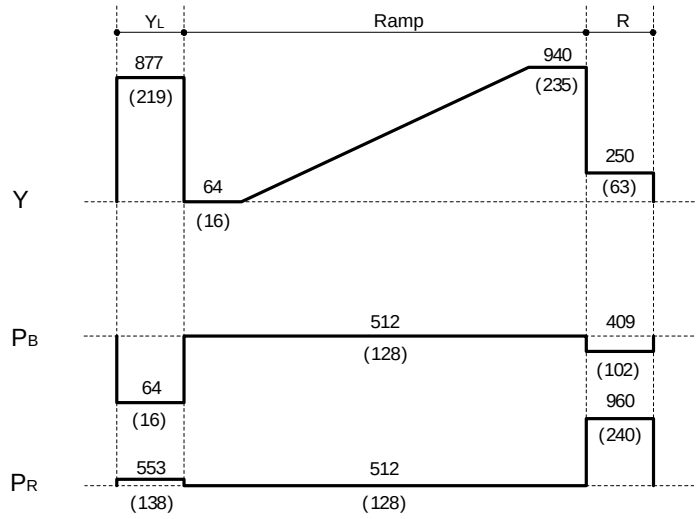

Fig.3-6 Waveform of the pattern 3

3.2.4 Pattern 4

The waveform of the pattern 4 is shown in Fig.3-7.

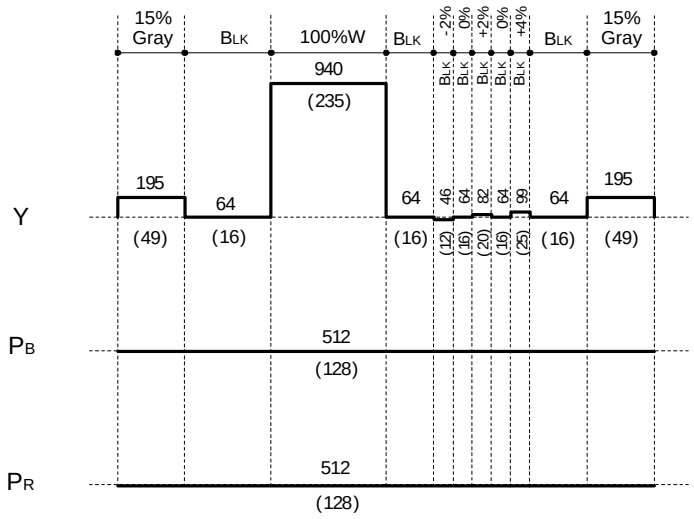

Fig.3-7 Waveform of the pattern 4

(Note) The nominal values of 10 bits (8 bits value in the parenthesis) are shown.

Chapter 4 Explanation

The multiformat color bar signal embodies a single color bar based on the combination of a 100% color bar signal used in HDTV and a 75% color bar signal used in SDTV. Using Making use of the aspect ratio difference between HDTV and SDTV, 4:3 aspect ratio area is utilized as the common area for SDTV and HDTV color bar signals and the outside of 4:3 area are only for HDTV use. Thus, this color bar gives benefit both for HDTV and SDTV. It provides facilities for not only video source level control but also other operational benefits such as monitor adjustments.

4.1 Chroma Set Signal for the Picture Monitor

The signal for monitor adjustment of SMPTE color bar signal is effective for adjusting composite monitor, but it is not sufficient for the adjustment of component monitor. Then 75% White for component monitor is introduced.

(1) Adjusting the composite picture monitor

Setting the monitor blue channel only, chroma gain and chroma phase are adjusted to the same brightness level of each main blue bar and the 75% White signal below, in the similar manner as SMPTE color bar.

(2) Adjusting the component picture monitor

Setting the monitor blue channel only, P_B gain is adjusted to the same brightness level of the blue bars and the 75% White signal area below.

P_R gain is also adjusted to the same level of the red bars and the 75% White signal area below, after setting the monitor red channel only. The 75% White signal is beneficial for P_R gain adjustment, because all the red bars are bordered on the bottom by the 75% White signal area and the more accurate adjustment is guaranteed with easier operation comparing with the adjustment using SMPTE color bar.

4.2 Ramp Signal

A “Y ramp signal” is introduced to allow easy monitoring of the specific bit-failure of the luminance signal, which causes critical visual defects.

4.3 Black set signal for the Picture Monitor

The black set signal (-2, 0, +2, 0 and +4%) is a combination signal sequence for both HDTV monitor and SDTV monitor use. That is the signal sequence (-2, 0, +2%) is used for HDTV and the sequence (+2, 0, +4%) is for SDTV.

(1) Adjustment of HDTV monitor

To set the black level of an HDTV monitor, the picture monitor brightness control is adjusted so that +2% is visible with respect to the black surround and -2% is not visible. (Note 1)

(2) Adjustment of SDTV monitor

In the case of an SDTV monitor, the picture monitor brightness is adjusted so that +4% is visible but +2% is not visible. (Note 2)

4.4 100% White (Pattern 4)

This signal provides the standard level of 100% brightness and is also used for the white balance adjustment of picture monitor.

4.5 Choice from 75% White, 100% White and + I Signal (Pattern 2)

The user could make a suitable selection to the individual operating manner and environment as follows:

(1) 75% White

Use this signal when neither + I signal nor 100%White is necessary in operation.

(2) 100% White

Use this signal to facilitate setting of the level by adjusting the amplitude of the chroma signal of the 75% color bar signal to the level of the 100% White signal in the V rate waveform of NTSC.

(3) + I signal

This signal, located on the I axis on the NTSC vector scope, and the amplitude is equivalent to the burst level of the composite signal. Indication of skin color on the NTSC vector scope is located in the neighborhood of +I axis. Both +I axis and the amplitude of burst level are used as the standard of the skin color in many cases at the program production sites. Therefore, +I signal shall be used as the standard of skin color signal with HDTV systems to have similar color control to that of NTSC systems.

The screen images when one of each 75% White, 100% White and +I signal is chosen are shown in Fig.4-1.

(Note 1) The signal sequence of [-2%, 0 and +2%] was adopted in accordance with ARIB TR-B10 “HDTV Multi-Pattern” and BTA S-1002 “HDTV Standard Viewing Condition”.

(Note 2) The signal sequence of [+2%, 0 and +4%] is according to SMPTE EG1-1990. Although SMPTE EG1-1990 recommends ±4% for black set signal, this signal sequence was adopted considering the current environment where the negative brightness level is often clipped in the process of down conversion from HDTV video source to SDTV.

(a) In the choice of 75% White

(b) In the choice of 100% White

(c) In the choice of +I signal

Fig.4-1 Screen images of each choice in *1 area of Pattern 2

Normative References

(1) SMPTE EG1-1990	Alignment Color Bar Test Signal for Television Picture Monitors (1990)
(2) Rec. ITU-R BT.814-1	SPECIFICATIONS AND ALIGNMENT PROCEDURES FOR SETTING OF BRIGHTNESS AND CONTRAST OF DISPLAYS (1992-1994)
(3) BTA S-001B	1125/60 HDTV Production Systems (Version B Mar.1998)
(4) BTA S-002B	Digital Representation and Bit-parallel Interface for 1125/60 HDTV Production Systems (Version B Mar.1998)
(5) BTA S-1002	HDTV Standard Viewing Condition(Dec.1990)
(6) ARIB TR-B10	HDTV Multi-Pattern(Version 2.0 Oct.1999)

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Annex

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Annex

A. Parameters

When multiformat color bar pattern is being generated on the hardware, there are some errors depending upon design and/or manufacturing restrictions. Individual parameters are shown in this standard for your reference, within the scope of not loosing user's convenience, and so that the burden on hardware may be lightened.

These parameters will not impose any restrictions in the generation of signals.

A.1 Levels

Levels are shown in Fig. 3-2 to Fig. 3-7 in Chapter 3. The tolerance allows for the conversion errors resulting from the hardware configuration. Table A-1 to Table A-4 show nominal values in terms of analog signals.

Table A-1 The level of Pattern 1 (unit: mV)

	40%Gray	75%W	YL	CY	G	MG	R	B
Y	280	525	487.1	413.4	375.5	149.5	111.6	37.9
PB	0	0	-262.5	60.2	-202.3	202.3	-60.2	262.5
PR	0	0	24.1	-262.5	-238.4	238.4	262.5	-24.1

Table A-2 The level of Pattern 2 (unit: mV)

	100%CY	100%B	75%W	100%W	+I
Y	551.2	50.5	525	700	145.0
PB	80.2	350	0	0	-78.1
PR	-350	-32.1	0	0	91.3

Table A-3 The level of Pattern 3 (unit: mV)

	100%YL	100%R	Ramp min	Ramp max
Y	649.5	148.8	0	700
PB	-350	-80.2	0	0
PR	32.1	350	0	0

Table A-4 The level of Pattern 4 (unit: mV)

	15%Gray	100%W	-2%BLK	+2%BLK	+4%BLK
Y	105	700	-14	14	28
PB	0	0	0	0	0
PR	0	0	0	0	0

A.2 Ramp Signal

The inclination of the ramp signal shall be 1 level (10 bits) for each sample in the case of 1920 horizontal samples.

A.3 Stripe Width

With regard to the stripe width, the number of samples shall be the fraction, because of the relationship with the number of horizontal picture elements. Considering that the digital interface of video signal is 4:2:2, an integral number is desirable. For this reason, if the color difference signal will be an integer, the luminance signal must be an even sample number.

At the edge of the stripe, there is a transient described in A.5, technically it is possible to set a changeover point between sample points, and it depends on relations with the configuration of hardware.

In case of 1920 horizontal samples, typical values are:

(a) the ideal width, when it is an integer

(b) even number width

(c) modified width in which no overlap on each color will arise at both edges in the transient when aspect ratio 4:3 is selected.

The expansion width of both 75% White and Blue stripe as to avoid any overlap on every color was set at 4 samples, because the transient period is 6 to 9 samples (3 to 5 samples on one side).

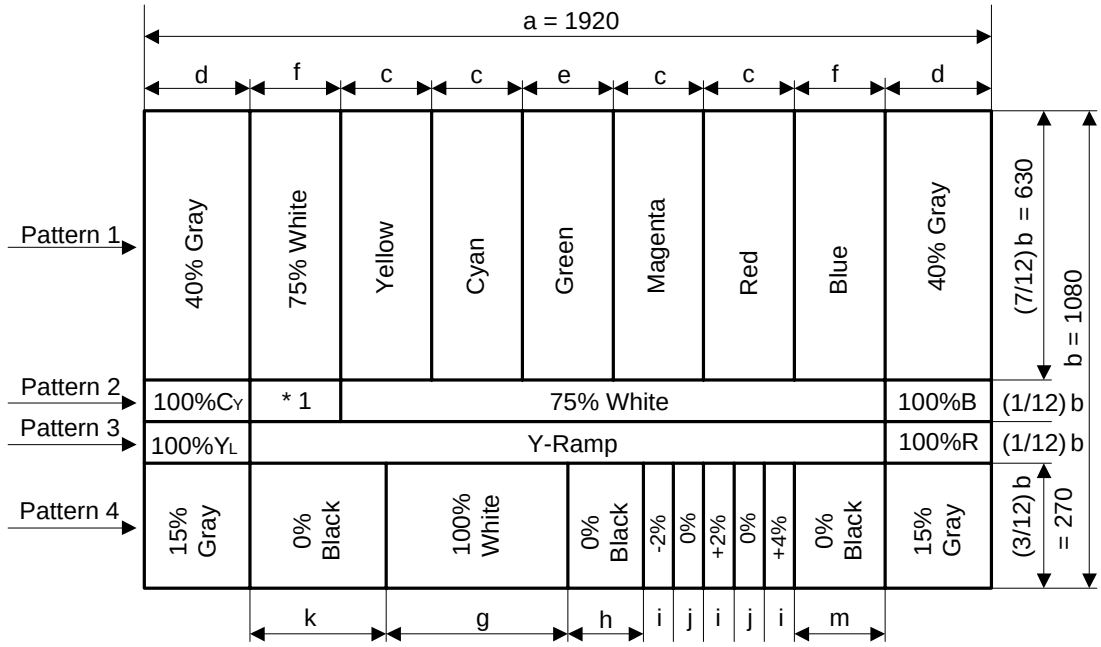

Fig.A-1 Stripe width

Table A-5 Typical stripe width

Mark in Fig.	d GY	f 75W	c YL	c CY	e G	c MG	c R	f B	d GY
(a) Ideal width	240	205	206	206	206	206	206	205	240
(b) Even number width	240	206	206	206	204	206	206	206	240
(c) Modified width	236	210	206	206	204	206	206	210	236

Mark in Fig.	k 0 BLK	g 100 W	h 0 BLK	i -2/+2/+4 BLK	j 0 BLK	m 0 BLK
(a) Ideal width	309	411	171	69	68	206
(b) Even number width	308	412	170	68	70	206
(c) Modified width	312	412	170	68	70	210

A.4 Split Height

There are no errors on the split height of this color bar, because the value of split height is specified with an integer calculated by integral times of the divisor 12 of the vertical sample number.

The height of the pattern 1 to 4 will be 630, 90, 90 and 270, in this order, in the case of 1080 lines.

A.5 Transient

Ringing may occur when the stripe level of this color bar is suddenly changed, then this may possibly cause operational inconvenience. Therefore, it is necessary to carry out design while limiting bandwidths for leading edge and falling edge.

The number of samples to be used for the transient shall be 6 to 9, in the case of 1920 horizontal samples, although it may depend upon the scale of hardware, process performance and the so-called “make up”.

MULTIFORMAT COLOR BAR

ARIB STANDARD

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