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| **Recommendation ITU-R BT.2111-2**  **(12/2020)** |
| **S****pecification of colour bar test pattern for high dynamic range television systems** |
| **BT Series**  **Broadcasting service**  **(television)** |

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|  |  |
| --- | --- |
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| **Series** | Title |
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| **BS** | Broadcasting service (sound) |
| BT | Broadcasting service (television) |
| **F** | Fixed service |
| **M** | Mobile, radiodetermination, amateur and related satellite services |
| **P** | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | Spectrum management |
| **SNG** | Satellite news gathering |
| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

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| ***Note***: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.* |

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RECOMMENDATION ITU-R BT.2111-2

Specification of colour bar test pattern for   
high dynamic range television systems

(2017-2019-2020)

Scope

This Recommendation specifies reference test patterns for the high dynamic range television systems specified in Recommendation ITU‑R BT.2100.

Keywords

Colour bars, HDR, HDR-TV, HLG, PQ, test pattern, test signal

The ITU Radiocommunication Assembly,

considering

*a)* that test patterns provide a convenient means of assessing chrominance and luminance performance in a television system;

*b)* that such a test pattern may be useful when broadcasting in multiple formats or when converting between formats;

*c)* that the use of a test pattern can simplify test procedures and reduce the opportunity for misinterpretation of signal parameters and misalignment of systems,

noting

that Recommendation ITU-R BT.2100 specifies image parameter values for high dynamic range television for use in production and international programme exchange,

recommends

that the test patterns defined in Annex 1 should be implemented and may be used for production and distribution purposes in high dynamic range television (HDR-TV) systems.

Annex 1  
(normative)  
  
Specifications of test pattern

# 1 Normative references

Recommendation ITU-R BT.471 ‒ Nomenclature and description of colour bar signals

Recommendation ITU-R BT.709 ‒ Parameter values for the HDTV standards for production and international programme exchange.

Recommendation ITU-R BT.2100 ‒ Image parameter values for high dynamic range television for use in production and international programme exchange

# 2 Purpose

The reference test pattern has several purposes:

– quality control of chrominance and luminance through the production chain;

– checking and adjusting the chrominance and luminance alignment of broadcast equipment, particularly video monitors;

– general testing of equipment for video production, emission and presentation;

– establishing that a video circuit is active and that associated audio is available.

It is not intended that this test pattern be used for black level adjustment, which is best set using a PLUGE signal.

# 3 System types

The pattern described in this Recommendation is intended for use with Recommendation ITU‑R BT.2100. These systems are distinguished by the proportions of their colour encoding (or “colorimetry”) and by their resolution.

# 4 Sections of test pattern[[1]](#footnote-1)

The various sections of the test pattern for the HLG system with narrow range coding are shown in Fig. 1; the pattern for the PQ system with narrow range coding is shown in Fig. 2, and the pattern for the PQ system with full range coding is shown in Fig. 3. A colour diagram is shown in Fig. 4. See also Attachments 1 and 2.

FIGURE 1

Test pattern details for HLG narrow range

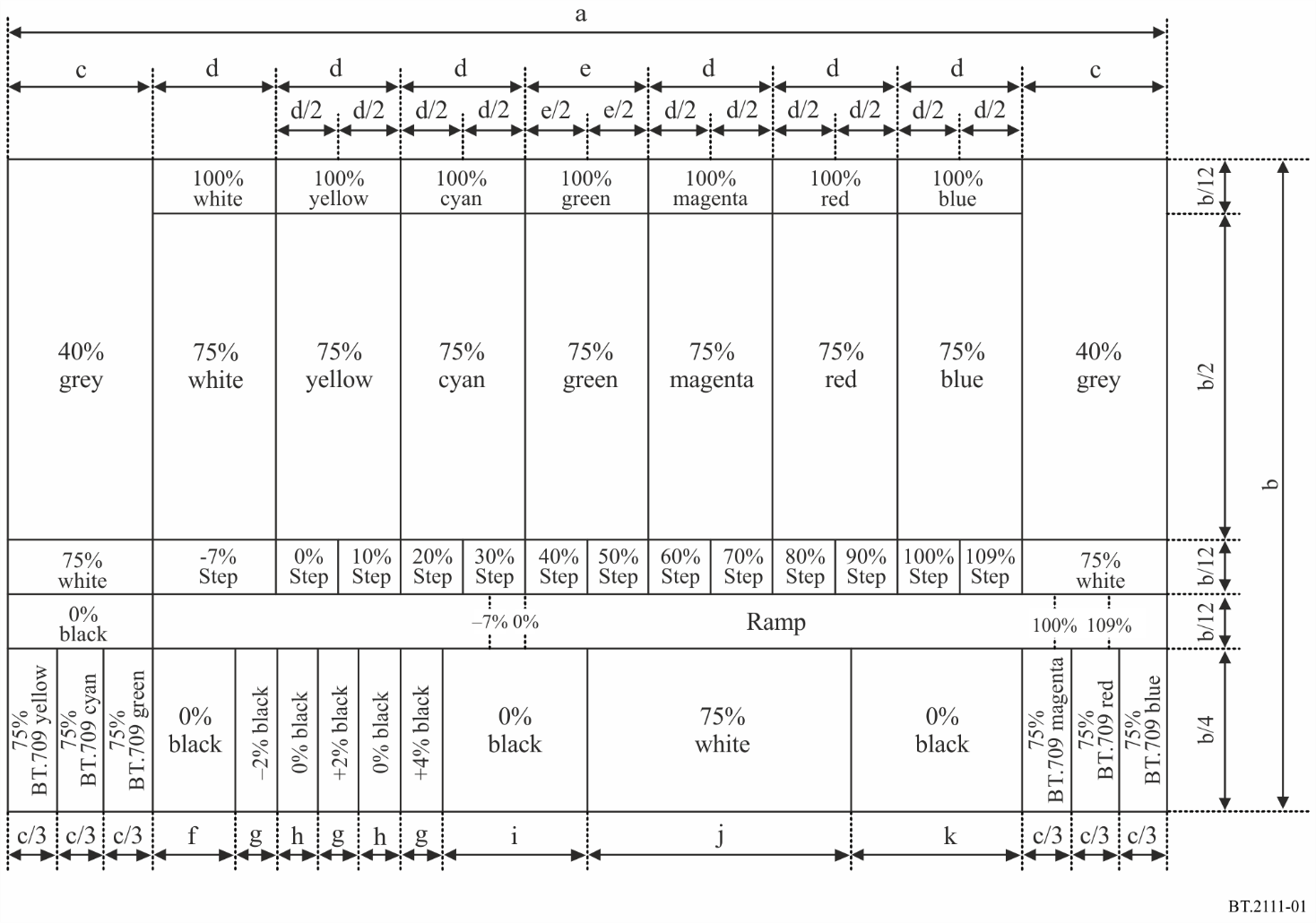


FIGURE 2

Test pattern details for PQ narrow range

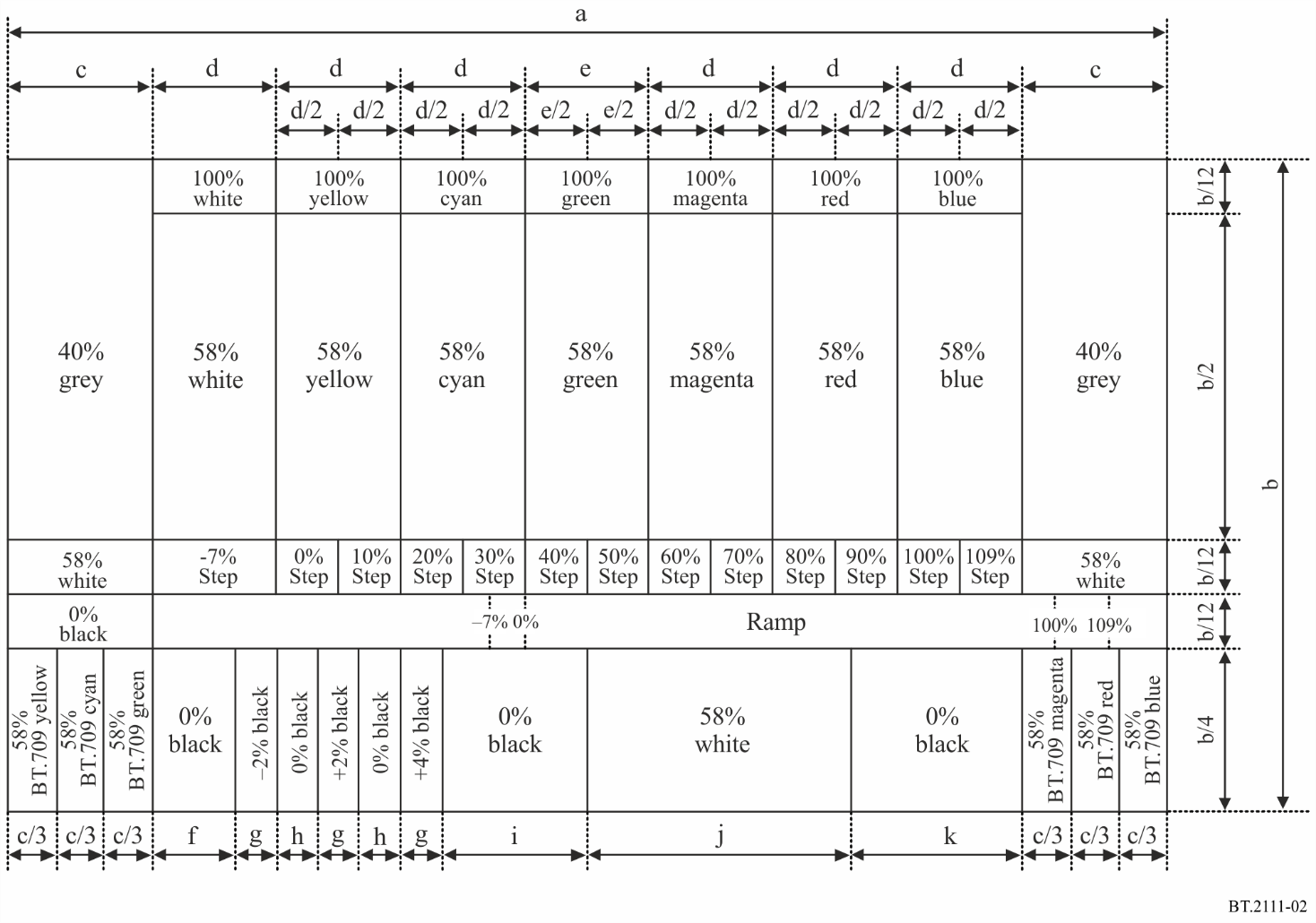


FIGURE 3

Test pattern details for PQ full range

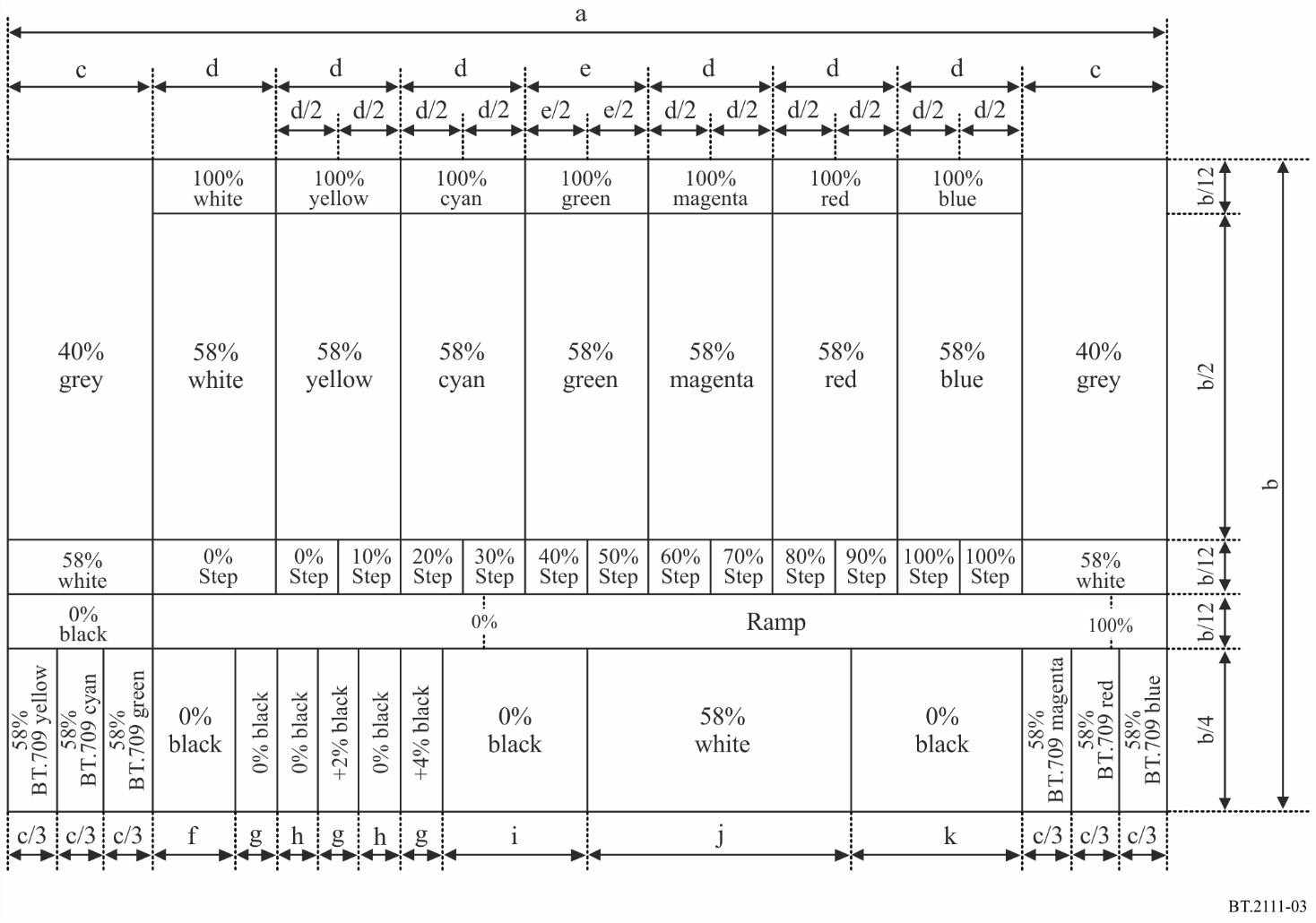


TABLE 1

Bar size to 2K, 4K and 8K format

|  |  |  |  |
| --- | --- | --- | --- |
| Bar size (pixel) | 2K | 4K | 8K |
| a | 1920 | 3840 | 7680 |
| b | 1080 | 2160 | 4320 |
| c | 240 | 480 | 960 |
| d | 206 | 412 | 824 |
| e | 204 | 408 | 816 |
| f | 136 | 272 | 544 |
| g | 70 | 140 | 280 |
| h | 68 | 136 | 272 |
| i | 238 | 476 | 952 |
| j | 438 | 876 | 1752 |
| k | 282 | 564 | 1128 |

FIGURE 4

Colour diagram of the test pattern



TABLE 2

Signal level for HLG narrow range

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 10 bits | | | 12 bits | | |
| Image Area | R´ | G´ | B´ | R´ | G´ | B´ |
| 100% White | 940 | 940 | 940 | 3 760 | 3 760 | 3 760 |
| 100% Yellow | 940 | 940 | 64 | 3 760 | 3 760 | 256 |
| 100% Cyan | 64 | 940 | 940 | 256 | 3 760 | 3 760 |
| 100% Green | 64 | 940 | 64 | 256 | 3 760 | 256 |
| 100% Magenta | 940 | 64 | 940 | 3 760 | 256 | 3 760 |
| 100% Red | 940 | 64 | 64 | 3 760 | 256 | 256 |
| 100% Blue | 64 | 64 | 940 | 256 | 256 | 3 760 |
| 75% White | 721 | 721 | 721 | 2 884 | 2 884 | 2 884 |
| 75% Yellow | 721 | 721 | 64 | 2 884 | 2 884 | 256 |
| 75% Cyan | 64 | 721 | 721 | 256 | 2 884 | 2 884 |
| 75% Green | 64 | 721 | 64 | 256 | 2 884 | 256 |
| 75% Magenta | 721 | 64 | 721 | 2 884 | 256 | 2 884 |
| 75% Red | 721 | 64 | 64 | 2 884 | 256 | 256 |
| 75% Blue | 64 | 64 | 721 | 256 | 256 | 2 884 |
| 40% Grey | 414 | 414 | 414 | 1 656 | 1 656 | 1 656 |
| −7% Step | 4 | 4 | 4 | 16 | 16 | 16 |
| 0% Step | 64 | 64 | 64 | 256 | 256 | 256 |
| 10% Step | 152 | 152 | 152 | 608 | 608 | 608 |
| 20% Step | 239 | 239 | 239 | 956 | 956 | 956 |

TABLE 2 (*end*)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 10 bits | | | 12 bits | | |
| Image Area | R´ | G´ | B´ | R´ | G´ | B´ |
| 30% Step | 327 | 327 | 327 | 1 308 | 1 308 | 1 308 |
| 40% Step | 414 | 414 | 414 | 1 656 | 1 656 | 1 656 |
| 50% Step | 502 | 502 | 502 | 2 008 | 2 008 | 2 008 |
| 60% Step | 590 | 590 | 590 | 2 360 | 2 360 | 2 360 |
| 70% Step | 677 | 677 | 677 | 2 708 | 2 708 | 2 708 |
| 80% Step | 765 | 765 | 765 | 3 060 | 3 060 | 3 060 |
| 90% Step | 852 | 852 | 852 | 3 408 | 3 408 | 3 408 |
| 100% Step | 940 | 940 | 940 | 3 760 | 3 760 | 3 760 |
| 109% Step | 1 019 | 1 019 | 1 019 | 4 076 | 4 076 | 4 076 |
|  | See Fig. 5 and Table 5 | | | | | |
| 75% BT.709 Yellow | 713 | 719 | 316 | 2 852 | 2 876 | 1 264 |
| 75% BT.709 Cyan | 538 | 709 | 718 | 2 152 | 2 836 | 2 872 |
| 75% BT.709 Green | 512 | 706 | 296 | 2 048 | 2 824 | 1 184 |
| 75% BT.709 Magenta | 651 | 286 | 705 | 2 604 | 1 144 | 2 820 |
| 75% BT.709 Red | 639 | 269 | 164 | 2 556 | 1 076 | 656 |
| 75% BT.709 Blue | 227 | 147 | 702 | 908 | 588 | 2 808 |
| 0% Black | 64 | 64 | 64 | 256 | 256 | 256 |
| −2% Black | 48 | 48 | 48 | 192 | 192 | 192 |
| +2% Black | 80 | 80 | 80 | 320 | 320 | 320 |
| +4% Black | 99 | 99 | 99 | 396 | 396 | 396 |

TABLE 3

Signal level for PQ narrow range

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 10 bits | | | 12 bits | | |
| Image Area | R´ | G´ | B´ | R´ | G´ | B´ |
| 100% White | 940 | 940 | 940 | 3 760 | 3 760 | 3 760 |
| 100% Yellow | 940 | 940 | 64 | 3 760 | 3 760 | 256 |
| 100% Cyan | 64 | 940 | 940 | 256 | 3 760 | 3 760 |
| 100% Green | 64 | 940 | 64 | 256 | 3 760 | 256 |
| 100% Magenta | 940 | 64 | 940 | 3 760 | 256 | 3 760 |
| 100% Red | 940 | 64 | 64 | 3 760 | 256 | 256 |
| 100% Blue | 64 | 64 | 940 | 256 | 256 | 3 760 |

TABLE 3 (*end*)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 10 bits | | | 12 bits | | |
| Image Area | R´ | G´ | B´ | R´ | G´ | B´ |
| 58% White | 572 | 572 | 572 | 2 288 | 2 288 | 2 288 |
| 58% Yellow | 572 | 572 | 64 | 2 288 | 2 288 | 256 |
| 58% Cyan | 64 | 572 | 572 | 256 | 2 288 | 2 288 |
| 58% Green | 64 | 572 | 64 | 256 | 2 288 | 256 |
| 58% Magenta | 572 | 64 | 572 | 2 288 | 256 | 2 288 |
| 58% Red | 572 | 64 | 64 | 2 288 | 256 | 256 |
| 58% Blue | 64 | 64 | 572 | 256 | 256 | 2 288 |
| 40% Grey | 414 | 414 | 414 | 1 656 | 1 656 | 1 656 |
| −7% Step | 4 | 4 | 4 | 16 | 16 | 16 |
| 0% Step | 64 | 64 | 64 | 256 | 256 | 256 |
| 10% Step | 152 | 152 | 152 | 608 | 608 | 608 |
| 20% Step | 239 | 239 | 239 | 956 | 956 | 956 |
| 30% Step | 327 | 327 | 327 | 1 308 | 1 308 | 1 308 |
| 40% Step | 414 | 414 | 414 | 1 656 | 1 656 | 1 656 |
| 50% Step | 502 | 502 | 502 | 2 008 | 2 008 | 2 008 |
| 60% Step | 590 | 590 | 590 | 2 360 | 2 360 | 2 360 |
| 70% Step | 677 | 677 | 677 | 2 708 | 2 708 | 2 708 |
| 80% Step | 765 | 765 | 765 | 3 060 | 3 060 | 3 060 |
| 90% Step | 852 | 852 | 852 | 3 408 | 3 408 | 3 408 |
| 100% Step | 940 | 940 | 940 | 3 760 | 3 760 | 3 760 |
| 109% Step | 1 019 | 1 019 | 1 019 | 4 076 | 4 076 | 4 076 |
| Ramp | See Fig. 5 and Table 5 | | | | | |
| 58% BT.709 Yellow | 568 | 571 | 381 | 2 272 | 2 284 | 1 524 |
| 58% BT.709 Cyan | 484 | 566 | 571 | 1 936 | 2 264 | 2 284 |
| 58% BT.709 Green | 474 | 564 | 368 | 1 896 | 2 256 | 1 472 |
| 58% BT.709 Magenta | 536 | 361 | 564 | 2 144 | 1 444 | 2 256 |
| 58% BT.709 Red | 530 | 350 | 256 | 2 120 | 1 400 | 1 024 |
| 58% BT.709 Blue | 317 | 236 | 562 | 1 268 | 944 | 2 248 |
| 0% Black | 64 | 64 | 64 | 256 | 256 | 256 |
| −2% Black | 48 | 48 | 48 | 192 | 192 | 192 |
| +2% Black | 80 | 80 | 80 | 320 | 320 | 320 |
| +4% Black | 99 | 99 | 99 | 396 | 396 | 396 |

TABLE 4

Signal level for PQ full range

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 10 bits | | | 12 bits | | |
| Image Area | R´ | G´ | B´ | R´ | G´ | B´ |
| 100% White | 1 023 | 1 023 | 1 023 | 4 095 | 4 095 | 4 095 |
| 100% Yellow | 1 023 | 1 023 | 0 | 4 095 | 4 095 | 0 |
| 100% Cyan | 0 | 1 023 | 1 023 | 0 | 4 095 | 4 095 |
| 100% Green | 0 | 1 023 | 0 | 0 | 4 095 | 0 |
| 100% Magenta | 1 023 | 0 | 1 023 | 4 095 | 0 | 4 095 |
| 100% Red | 1 023 | 0 | 0 | 4 095 | 0 | 0 |
| 100% Blue | 0 | 0 | 1 023 | 0 | 0 | 4 095 |
| 58% White | 593 | 593 | 593 | 2 375 | 2 375 | 2 375 |
| 58% Yellow | 593 | 593 | 0 | 2 375 | 2 375 | 0 |
| 58% Cyan | 0 | 593 | 593 | 0 | 2 375 | 2 375 |
| 58% Green | 0 | 593 | 0 | 0 | 2 375 | 0 |
| 58% Magenta | 593 | 0 | 593 | 2 375 | 0 | 2 375 |
| 58% Red | 593 | 0 | 0 | 2 375 | 0 | 0 |
| 58% Blue | 0 | 0 | 593 | 0 | 0 | 2 375 |
| 40% Grey | 409 | 409 | 409 | 1 638 | 1 638 | 1 638 |
| 0% Step | 0 | 0 | 0 | 0 | 0 | 0 |
| 10% Step | 102 | 102 | 102 | 410 | 410 | 410 |
| 20% Step | 205 | 205 | 205 | 819 | 819 | 819 |
| 30% Step | 307 | 307 | 307 | 1 229 | 1 229 | 1 229 |
| 40% Step | 409 | 409 | 409 | 1 638 | 1 638 | 1 638 |
| 50% Step | 512 | 512 | 512 | 2 048 | 2 048 | 2 048 |
| 60% Step | 614 | 614 | 614 | 2 457 | 2 457 | 2 457 |
| 70% Step | 716 | 716 | 716 | 2 867 | 2 867 | 2 867 |
| 80% Step | 818 | 818 | 818 | 3 276 | 3 276 | 3 276 |
| 90% Step | 921 | 921 | 921 | 3 686 | 3 686 | 3 686 |
| 100% Step | 1 023 | 1 023 | 1 023 | 4 095 | 4 095 | 4 095 |
| Ramp | See Fig. 6 and Table 6 | | | | | |
| 58% BT.709 Yellow | 589 | 592 | 370 | 2 356 | 2 370 | 1 480 |
| 58% BT.709 Cyan | 491 | 586 | 592 | 1 964 | 2 345 | 2 368 |
| 58% BT.709 Green | 478 | 584 | 355 | 1 915 | 2 339 | 1 420 |
| 58% BT.709 Magenta | 551 | 347 | 584 | 2 206 | 1 389 | 2 336 |
| 58% BT.709 Red | 544 | 334 | 225 | 2 178 | 1 337 | 900 |
| 58% BT.709 Blue | 296 | 201 | 582 | 1 184 | 805 | 2 328 |
| 0% Black | 0 | 0 | 0 | 0 | 0 | 0 |
| +2% Black | 20 | 20 | 20 | 82 | 82 | 82 |
| +4% Black | 41 | 41 | 41 | 164 | 164 | 164 |

FIGURE 5

HLG/PQ narrow range signal levels of the ramp

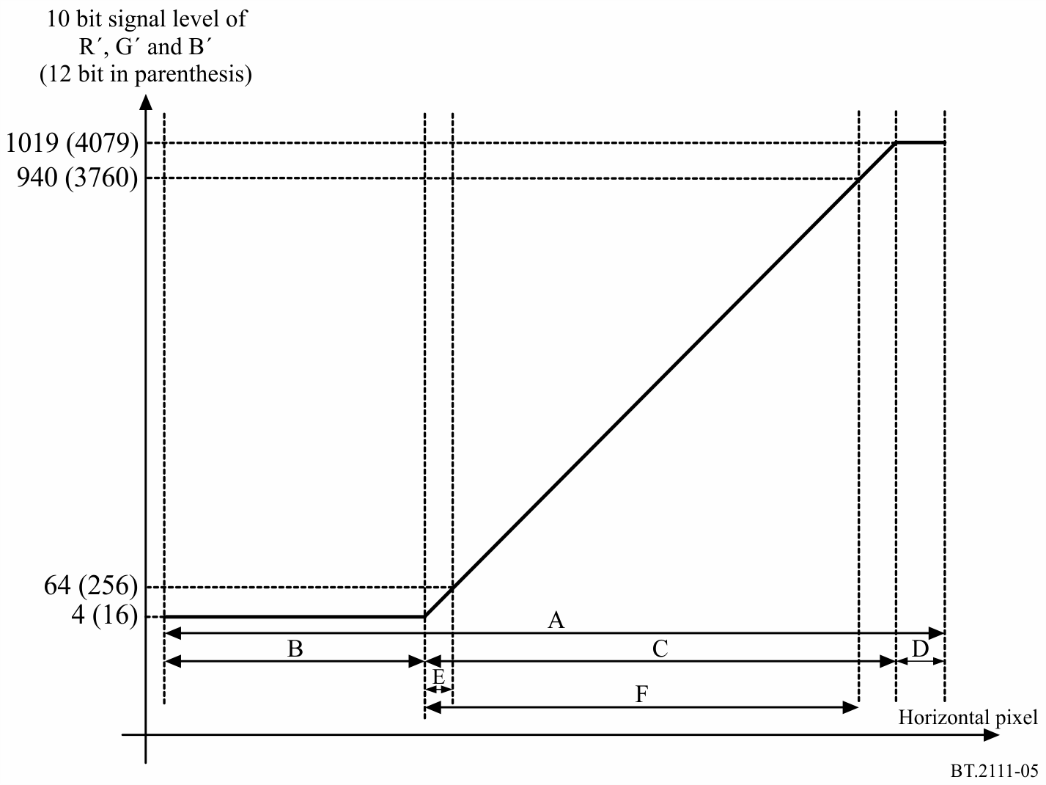


TABLE 5

HLG/PQ Narrow Range Ramp width to 2K, 4K and 8K format

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Width (pixel) | 2K | | 4K | | 8K | |
| 10 bits | 12 bits | 10 bits | 12 bits | 10 bits | 12 bits |
| A | 1 680 | 1 680 | 3 360 | 3 360 | 6 720 | 6 720 |
| B | 559 | 559 | 1 118 | 1 117 | 2 236 | 2 233 |
| C(1) | 1 014 | 1 015 | 2 028 | 2 031 | 4 056 | 4 062 |
| D | 107 | 106 | 214 | 212 | 428 | 425 |
| E(2) | 59 | 59 | 118 | 119 | 236 | 239 |
| F(3) | 935 | 935 | 1 870 | 1 871 | 3 740 | 3 743 |
| (1) C corresponds to the signal level range from 5 to 1 018 in 10 bits and from 17 to 4 078 in 8K 12 bit, 18 to 4078 in 4K 12 bit, and 20 to 4076 in 2K 12 bits.  (2) E corresponds to the signal level range from 5 to 63 in 10 bits and from 17 to 255 in 8K 12 bit, 18 to 254 in 4K 12 bit, and 20 to 252 in 2K 12 bits.  (3) F corresponds to the signal level range from 5 to 939 in 10 bits and from 17 to 3 759 in 8K 12 bit, 18 to 3758 in 4K 12 bit, and 20 to 3756 in 2K 12 bits. | | | | | | |

FIGURE 6

**PQ full range signal levels of the ramp**

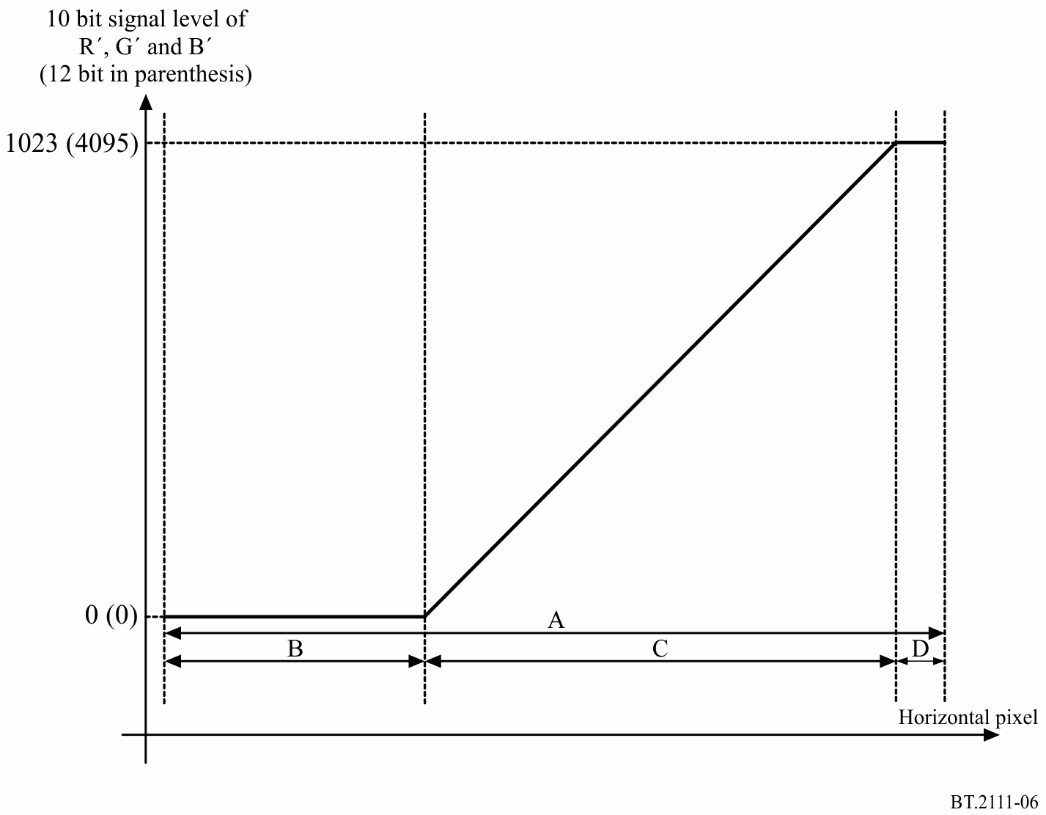


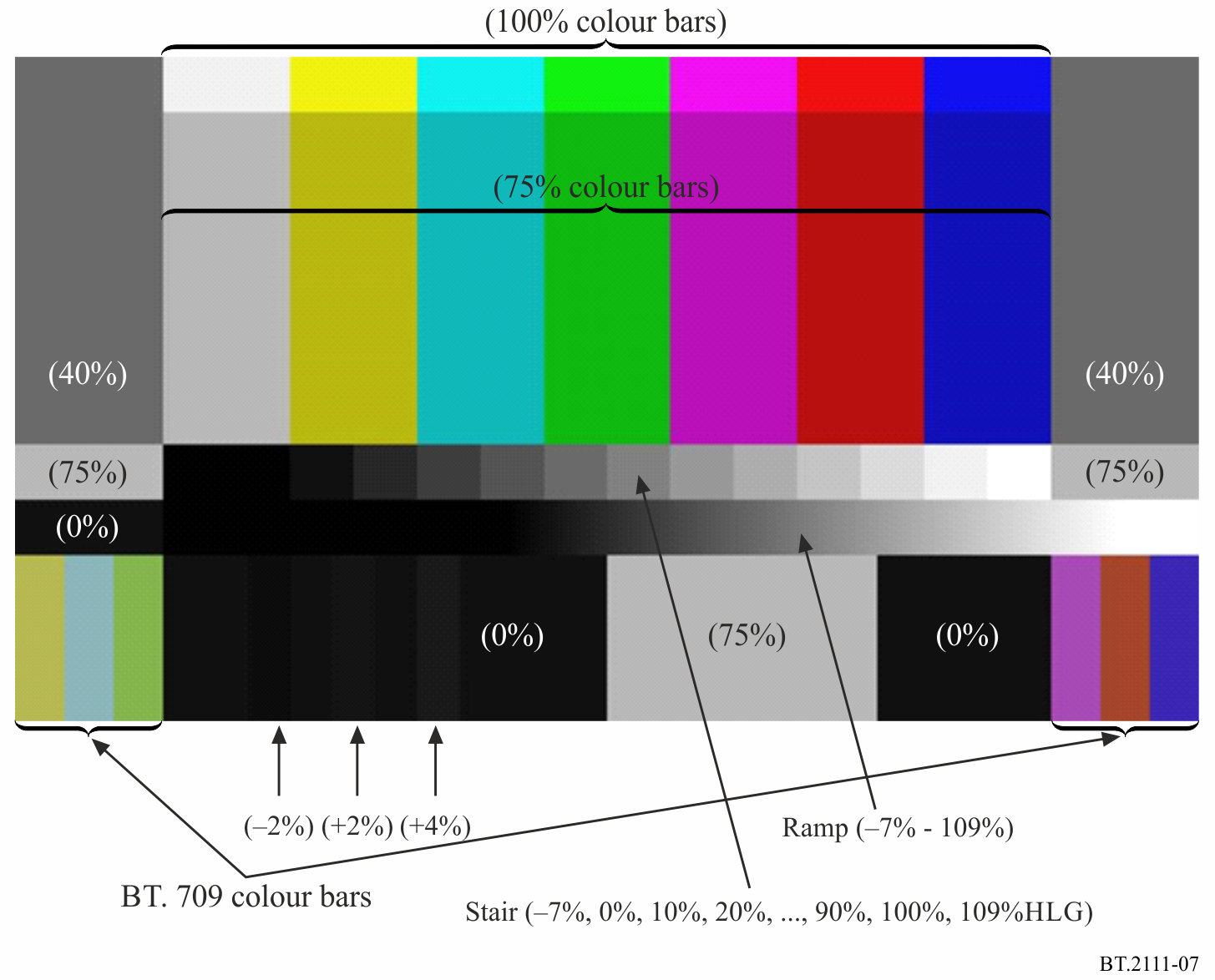
TABLE 6

PQ Full Range Ramp width to 2K, 4K and 8K format

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Width (pixel) | 2K | | 4K | | 8K | |
| 10 bits | 12 bits | 10 bits | 12 bits | 10 bits | 12 bits |
| A | 1 680 | 1 680 | 3 360 | 3 360 | 6 720 | 6 720 |
| B | 551 | 551 | 1 102 | 1 101 | 2 204 | 2 201 |
| C(1) | 1 022 | 1 023 | 2 044 | 2 047 | 4 088 | 4 094 |
| D | 107 | 106 | 214 | 212 | 428 | 425 |
| (1) C corresponds to the signal level range from 1 to 1 022 in 10 bits and from 1 to 4 094 in 8K 12 bit, 2 to 4094 in 4K 12 bit, and 4 to 4092 in 2K 12 bits. | | | | | | |

Attachment 1  
to Annex 1  
(informative)   
  
Sections comprising the HLG test pattern

figure 7



Colour Bars: The main colour bars are 75%HLG, with 100%HLG colour bars at the top.

BT.709 Colour Bars: Generated by using the HLG OETF and a linear matrix. BT.709 colour bars are placed at the left and right bottom to avoid overlaps with the main colour bars on a waveform monitor.

Ramp: Levels are from −7%HLG to 109%HLG. 0% video level is at the left edge of the Green bar.

Stair: Levels are from −7%HLG to 109%HLG. Left edge of the 0% step is at the left edge of the Yellow bar. 10% interval between 0%HLG and 100%HLG. The width of each step is a half of the colour bar. The step signal and the ramp signal are placed not to overlap on a waveform monitor.

Black signal: consisting of 0%, −2%, 0%, +2%, 0%, +4% and 0% video levels are placed at the lower left away from the bright areas for better visibility.

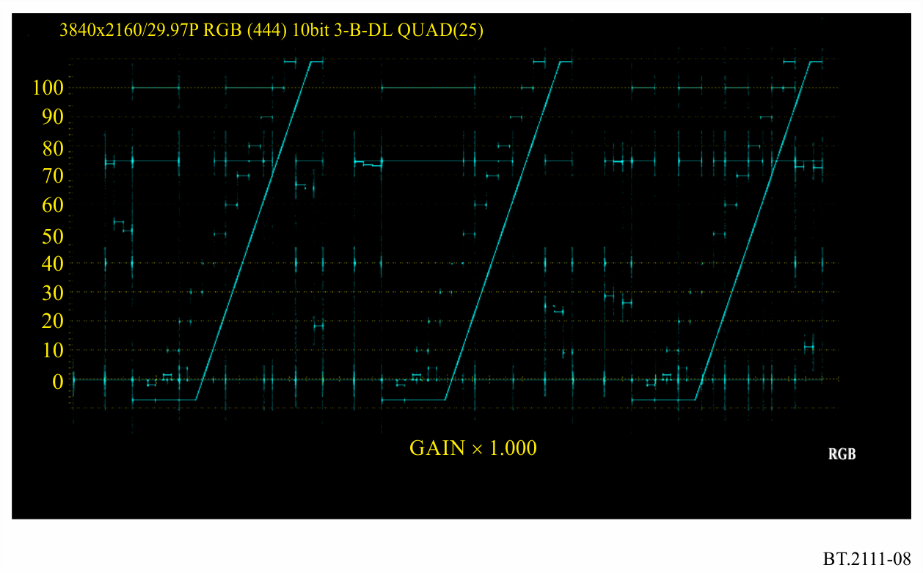
Grey bars (right and left): These areas may optionally be used to include other patterns for specific needs.

Attachment 2  
to Annex 1  
(informative)   
  
HLG waveform on a waveform monitor

Figure 8 shows the HLG waveform of the test pattern on a waveform monitor.

FIGURE 8

Waveform on waveform monitor  
(Red, Green, and Blue, respectively)



Attachment 3  
to Annex 1  
(informative)  
  
Information on conversion of HLG/BT.2020 colour bars to SDR/BT.709

Figure 9 shows the HLG/BT.2020 colour bars including the BT.709-equivalent colour bars and their snapshots of the waveform and vectorscope set to BT.2020 colorimetry.

Figure 11 shows the colour bars converted from HLG/BT.2020 to SDR/BT.709 using the scene‑referred conversion method depicted in Fig. 10, which is the inverse of the “SDR to HDR mapping (scene-referred)”. Note this method does not include tone-mapping. HDR signals are hard-clipped when converted to SDR. The BT.709-equivalent colour bars land on the vectorscope targets after the scene-referred conversion.

Figure 13 shows the colour bars converted from HLG/BT.2020 to SDR/BT.709 using the display‑referred conversion method depicted in Fig. 12, which is the inverse of the “SDR to HLG mapping without gamma adjustment (display-referred)”. Note this method does not include tone-mapping. HDR signals are hard-clipped when converted to SDR. The BT.709-equivalent colour bars land on slightly different positions of the vectorscope targets.

Table 7 summarises the signal levels for input 75%HLG and BT.709-equivalent colour bars and the converted SDR/BT.709 colour bars. The BT.709-equivalent colour bars are converted to the same signal levels as the original SDR/BT.709 colour bars by the scene-referred conversion. Some of the signal levels of the resultant SDR colour bars by the scene-referred conversion are not exactly the same levels as the original SDR/BT.709, for example the signal levels of the Green bar are not (64, 940, 64) but (71, 939, 66) due to rounding errors.

FIGURE 9

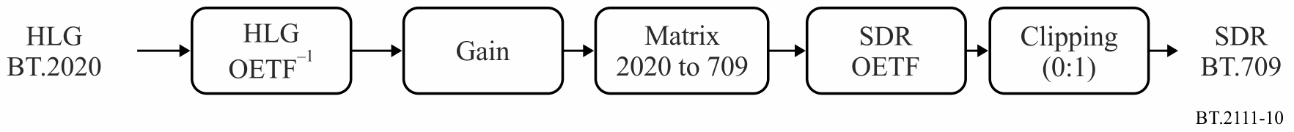
HLG/BT.2020 colour bars and their snapshots of the waveform and vectorscope set to BT.2020 colorimetry

Graphical user interface, application

Description automatically generated

FIGURE 10

Scene-referred conversion method from HLG/BT.2020 to SDR/BT.709



NOTE – The gain is set so that 75%HLG corresponds to 100%SDR. The colour conversion matrix is as described in § 2 of Report [ITU-R BT.2407](https://www.itu.int/rec/R-REP-BT.2407/en) – “Simple conversion from BT.2020 to BT.709 based on linear matrix transformation”. Note other methods may result in different signal levels for input signals outside of the BT.709 colour volume.

FIGURE 11

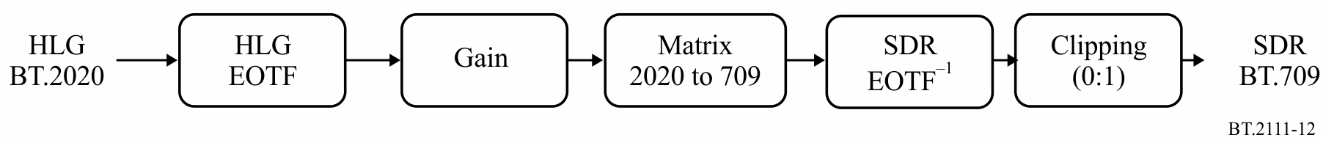
Colour bars converted to SDR/BT.709 using the scene-referred conversion and their snapshots of the waveform and vectorscope set to BT.709 colorimetry

Graphical user interface

Description automatically generated

FIGURE 12

Display-referred conversion method from HLG/BT.2020 to SDR/BT.709



NOTE – The gain is set so that 75%HLG corresponds to 100%SDR. The colour conversion matrix is the same as that in Fig. 10.

FIGURE 13

Colour bars converted to SDR/BT.709 using the display-referred conversion and their snapshots of the waveform and vectorscope set to BT.709 colorimetry

Graphical user interface

Description automatically generated

TABLE 7

Signal levels in 10 bits for input 75%HLG and BT.709-equivalent colour bars and output SDR/BT.709 colour bars converted by the methods in Figs 10 and 12

| Image Area | Input signal level (HLG/BT.2020, 10 bits) | | | Output signal level (SDR/BT.709, 10 bits)  (No tone-mapping applied, simple colour conversion) | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Scene-referred conversion | | | Display-referred conversion | | |
|  | R | G | B | R | G | B | R | G | B |
| 75% White | 721 | 721 | 721 | 940 | 940 | 940 | 940 | 940 | 940 |
| 75% Yellow | 721 | 721 | 64 | 940 | 940 | 64 | 940 | 939 | 64 |
| 75% Cyan | 64 | 721 | 721 | 64 | 940 | 940 | 64 | 940 | 924 |
| 75% Green | 64 | 721 | 64 | 64 | 940 | 64 | 64 | 940 | 64 |
| 75% Magenta | 721 | 64 | 721 | 940 | 64 | 940 | 940 | 64 | 894 |
| 75% Red | 721 | 64 | 64 | 940 | 64 | 64 | 940 | 64 | 64 |
| 75% Blue | 64 | 64 | 721 | 64 | 64 | 940 | 64 | 64 | 789 |
| 75% BT.709 Yellow | 713 | 719 | 316 | 939 | 940 | 64 | 933 | 934 | 64 |
| 75% BT.709 Cyan | 538 | 709 | 718 | 64 | 940 | 939 | 64 | 924 | 922 |
| 75% BT.709 Green | 512 | 706 | 296 | 71 | 939 | 66 | 124 | 915 | 99 |
| 75% BT.709 Magenta | 651 | 286 | 705 | 940 | 65 | 940 | 854 | 89 | 853 |
| 75% BT.709 Red | 639 | 269 | 164 | 940 | 64 | 64 | 835 | 64 | 64 |
| 75% BT.709 Blue | 227 | 147 | 702 | 66 | 64 | 940 | 93 | 64 | 768 |

1. It is desirable that implementers should include in this test signal some visual identification of the signal format (HLG narrow range, PQ narrow range, or PQ full range). The test pattern includes grey bars (top right and top left) that may optionally be used for this and/or other purposes. [↑](#footnote-ref-1)