



# VQCB

“Wonder Bars™”



*Victor Steinberg*

## VideoQ Color Bars Test Patterns Suite

*Training Presentation*

*May 2024*



[www.videoq.com/vqcb.html](http://www.videoq.com/vqcb.html)

[www.videoq.com](http://www.videoq.com)

# VideoQ VQCB Test Patterns Suite Applications

VQCB is the picture quality control, calibration and verification tool for general public, video installers, hardware and software developers, video development labs, production, post-production and content distribution facilities in the fields of:

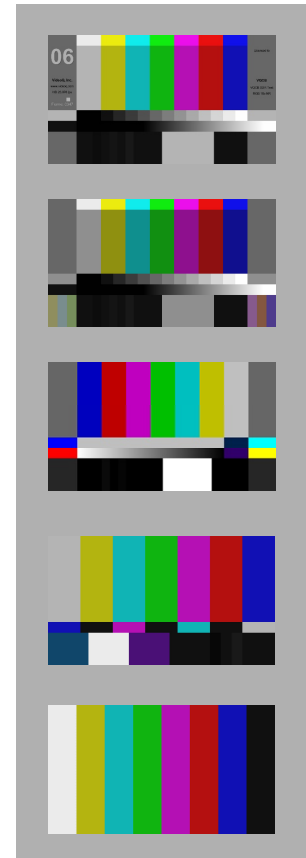
- Broadcast TV
- Consumer Electronics
- Video Transcoding
- Video Data Compression
- Digital Cinema
- Home Theatres
- IPTV, CDN, VOD, OTT
- Cloud video processing, transcoding and streaming

*VQCB tests are useful when broadcasting in multiple formats or when converting between formats. They can simplify test procedures and reduce the opportunity for misinterpretation of signal parameters and misalignment of systems. They are also useful for establishing that a video circuit is active, and associated audio is available.*

# VQCB vs. other Color Bars Test Patterns

Below is the list of 5 color bars types (with optional audio components):

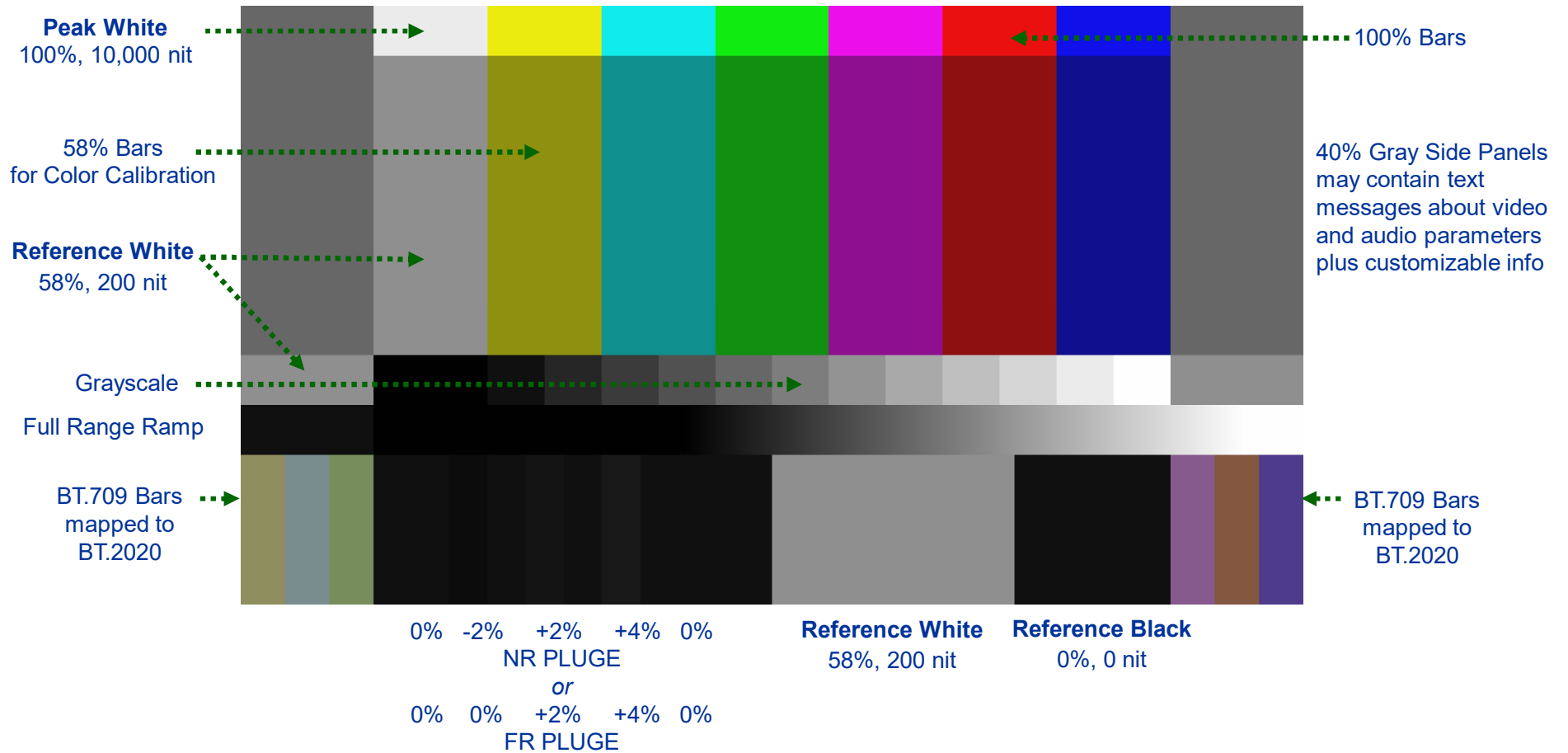
- **VideoQ VQCB** - dynamic **AV** test patterns: **HDR-PQ, HDR-HLG, SDR**  
- *recommended for the most comprehensive test results, ITU BT.2111 compliant*
- **ITU BT.2111 HDR-PQ and HDR-HLG** color bars test patterns  
- *fully specified, but not yet widely used test patterns, note the absence of **SDR** version*
- **SMPTE RP219**  
- *widely used **SDR** test pattern, **not compatible** with ITU BT.2111 **HDR** bars*
- **SMPTE EG1**  
- *legacy **SDR SD** test pattern, designed for **analog composite NTSC** workflows*
- **Full-frame color bars**  
- *the **oldest** and the **most common** video test pattern*  
*This tool is simple and convenient, but it may not be the best fit for modern video workflows.*



# VQCB Test Suite Features

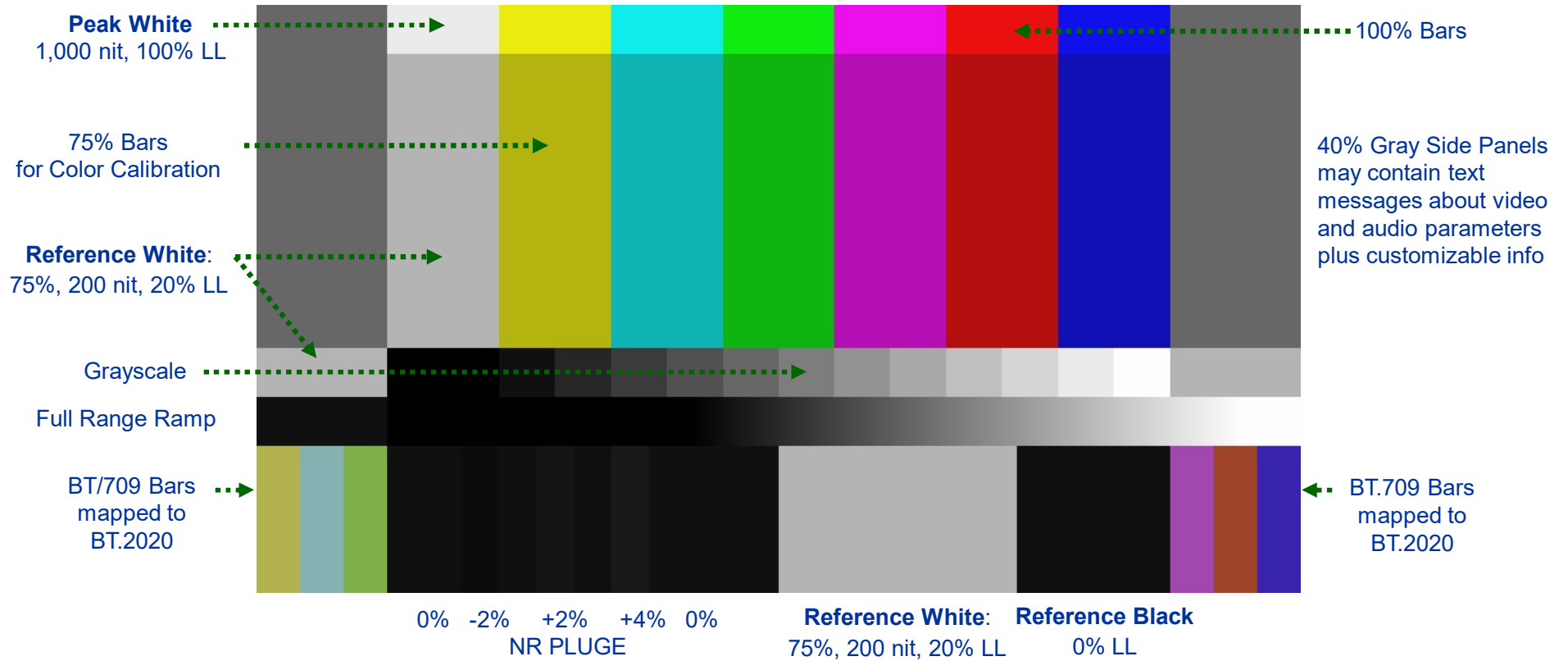
- All VideoQ Color Bars (VQCB) tests have the **same layout**, consisting of **5 horizontal bands**
- VQCB Test Patterns **pixel positions** strictly match the positions specified in **BT.2111** standard
- RGB and YUV **data levels** are calculated and provided with **16 bpc** (bits per component), i.e. **48 bpp** (bits per pixel), **accuracy**  
For practical usage they may be rounded to **12, 10, or 8 bit** by appropriate software or hardware devices, e.g. codecs
- Full Range and Narrow Range **RGB data levels** strictly match the **12 bit** values of the **BT.2111** standard tables
- The RGB levels of **SDR** tests are **exact copies** of the **BT.2111 HDR-HLG** test levels, except the **BT.709 Bars**, located in the bottom band
- The SDR tests **BT.709 Bars** RGB levels are calculated with maximal precision using the color space conversion matrices and an assumed SDR display “EOTF model”
- **YUV data levels** (*not specified by BT.2111 standard*) are derived from 16 bit RGB levels with 16 bit accuracy in YUV 444 format
- VQCB tests may contain **customizable texts** within left and right Grey panels, indicating 8K/UHD/HD frame size, HDR/SDR, RGB/YUV, FR/NR and Color Matrix info. Optionally they may contain test originator info and details of the audio stream(s)  
*Recommendation BT.2111: “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.”*

# VQCB HDR-PQ Test Composition

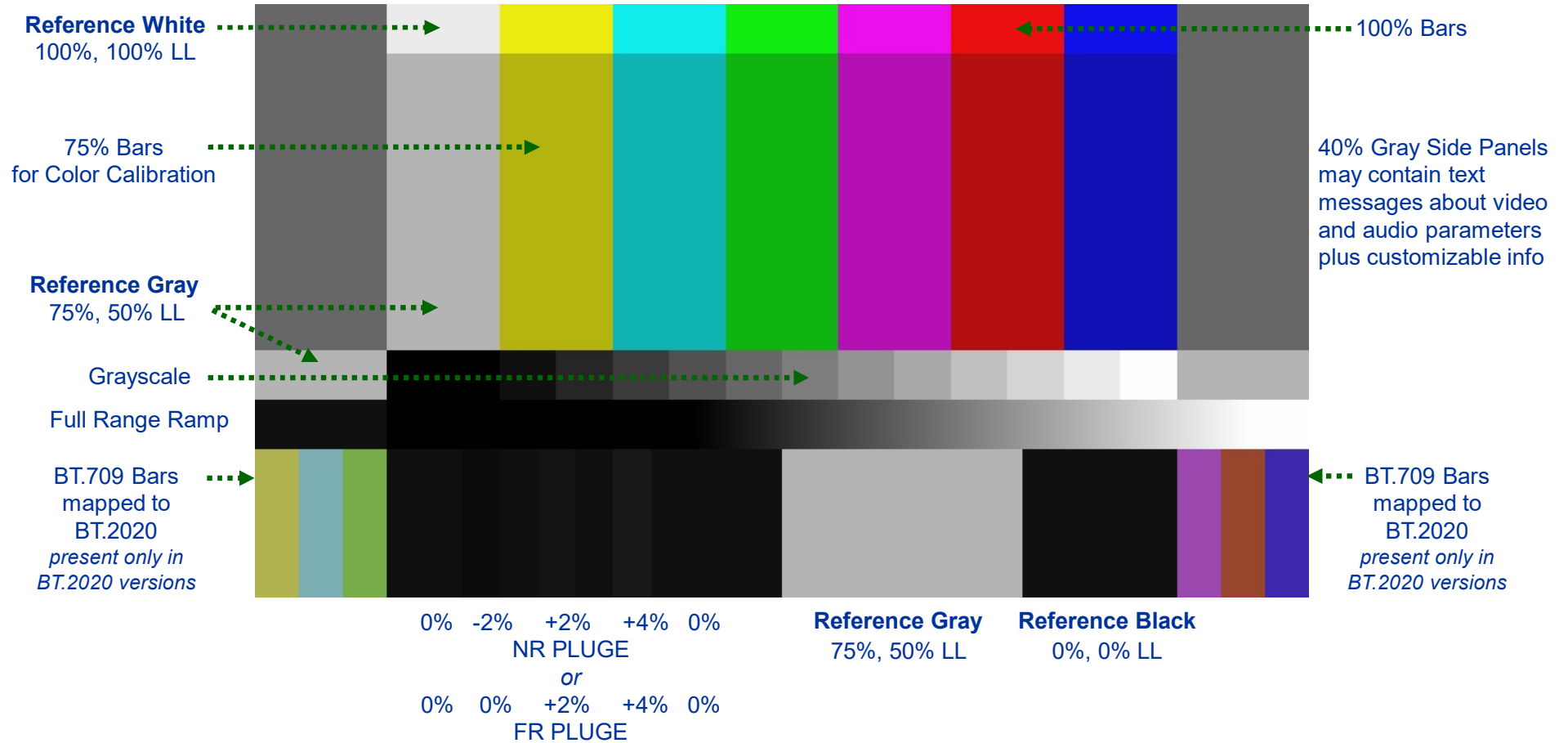


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# VQCB HDR-HLG Test Composition



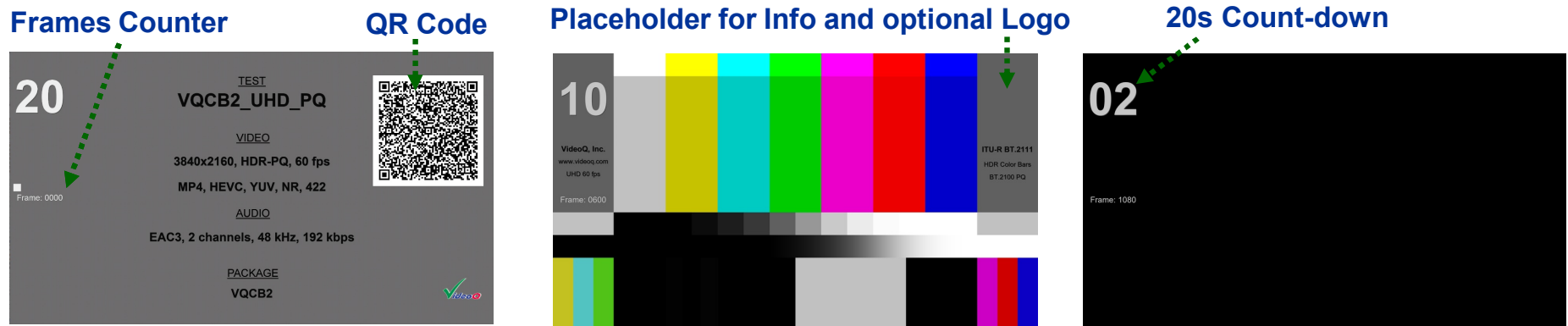
# VQCB SDR Test Composition



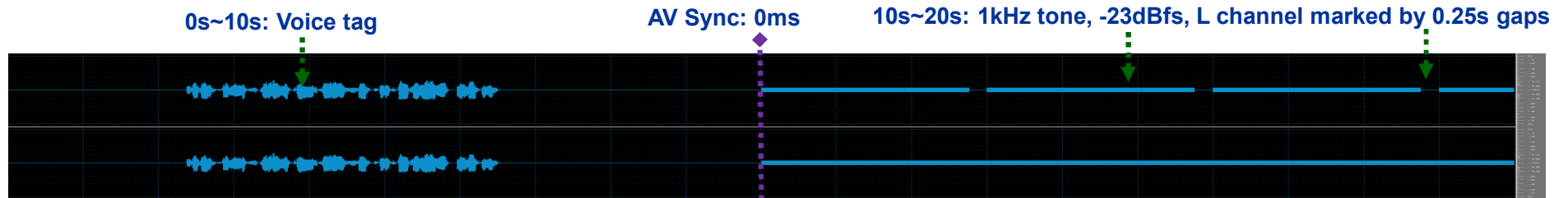
# VQCB Media File Timeline Segments

VQCB sequence is suitable for automated repetitive lab testing. The sequence consists of three segments:

- 0s~10s: **Text Box** containing all test pattern details and machine-readable **QR Code**,
- 10s~18s: **Color Bars** test pattern,
- 18s~20s: **Black**.



Optional audio stream composition (LR stereo, 48kHz, PCM 24b or AC3 192kbps):





# VQCB Text Box Example

Count-down in seconds    Test Pattern Codename and Format Details    QR Code

The image displays a VQCB (Video Quality Check Block) text box with the following content and annotations:

- Count-down in seconds:** A large number '20' is shown in the top left corner.
- Test Pattern Codename and Format Details:** The text 'TEST VQCB1\_HD\_PQ' is displayed in the center. Below it, 'VIDEO' is underlined, followed by '1920x1080, HDR-PQ, 23.976 fps'. Below that, 'MOV, PNG, RGB 16b NR' is shown. Further down, 'AUDIO' is underlined, followed by 'PCM, 2 channels, 48 kHz, 24 bit'. At the bottom, 'PACKAGE VQCB1' is displayed.
- QR Code:** A QR code is located in the top right corner.
- Sliding Frames Continuity Test:** A blue dashed arrow points to a small square icon with a right-pointing arrow, labeled 'Frame: 0000'.
- Frames Counter:** A green dashed arrow points to a circular zone plate pattern in the bottom left corner.
- Full Bandwidth Zone Plate Test:** A green dashed arrow points to a circular zone plate pattern in the bottom right corner.
- Half Bandwidth Zone Plate Test:** A green dashed arrow points to a circular zone plate pattern in the bottom right corner.
- videoQ logo:** The logo is located in the bottom right corner, featuring a green checkmark and the text 'videoQ'.

# VQCB Test Usage Example 1

Hundreds of test sequences have been encoded and used in the consumer devices extensive lab testing.

20s long VQCB leader



12min long feature film



20s long **VQCB** test was used as a “**reference leader**” concatenated with the main 12min long movie.

VideoQ encoded this sequence in a variety of formats:

- Frame rates: from **23.976fps** to **120fps**
- Frame sizes and dynamic range versions: **HD** and **UHD**, **HDR10** and **SDR**, **8bit**, **10bit** and **12bit**
- Video codecs: **DoVi**, **H.265**, **VP9**, **AV1**, **VVC**
- Video bitrates: from **6Mbps** to **100Mbps**
- Audio codecs: **AC-3** 2.0 and 5.1, **Atmos** 5.1.4, **DTS-X** 7.1.4, **48kHz**, **96kHz** and **192kHz** sampling rates
- Audio bitrates: from **128kbps** to **1344kbps**

Special attention was given to the insertion of correct metadata and providing the specified bitrates.

Presence of **QR codes** in the VQCB leaders provided for easy handling and analysis of test results data.

## VQCB Test Usage Example 2

**VQCB** test is included in 13s long “**reference leader**” concatenated with the main 5min long **test clip**. The clip was specially created for **International Electrotechnical Commission** standard **IEC 62087-2: Audio, video, and related equipment - Determination of power consumption - Part 2: Signals and media**. **All models of TV sets** should be tested **worldwide** in accordance with the IEC 62087-2 standard.

### IEC 3s Text Box + 10s VQCB = 13s leader



### 5min long special power consumption test clip



VideoQ encoded this sequence in a variety of formats:

- Frame rates: from **23.976fps** to **59.94fps**
- Frame sizes and dynamic range versions: **UHD**, **HD**, and **SD**, **HDR10**, **HLG**, and **SDR**, **10bit** and **8bit**
- Video codec: **HEVC**
- Video bitrates: from **9.5Mbps** to **75Mbps**
- Audio codec: **AAC LC 2.0**, sampling rate **48kHz**
- Audio bitrate: **128kbps**

## VQCB Test Suite – Packages of Media Files

VQCB suite includes **4 pre-packed sets** of media files; each set aimed at specific field of application

Package Code Name	VQCB8K	VQCB1		VQCB2		VQCB2HD
Typical Application	High-end Production and Post-production	Production, Post-production		Contribution, Distribution		Transcoding, Distribution
Frame Size	8K	UHD	HD	UHD	HD	HD
Container	MOV	MOV		MP4		MP4
Codec	PNG	PNG, JPEG2K		HEVC		HEVC, AVC
Sampling & Bit Depth	444, 48bpp, 16bpc	444, 48bpp, 16bpc		444, 10bpc		422, 10bpc
RGB, Full & Narrow Range	a	a	a			
YUV, Narrow Range		a	a	a	a	a
Media Files Count	48	144		48		48

Each media file is produced by a **lossless, variable bitrate** encoder. Other formats are available upon request for an additional fee.

For a given **frame size** each package includes **3 sub-sets** of media files of 3 different **dynamic range** formats: **HDR-PQ, HDR-HLG** and **SDR**.

For a given **dynamic range** format **each sub-set** includes **8 variants** with different **frame rates**: 23.976, 24, 25, 29.97, 30, 50, 59.94 and 60 fps.

## VQCB Test Suite Video Formats

Standard packages of VQCB suite includes 26 different **combinations** of

- 3 **frame sizes**,
- 3 **dynamic range** modes,
- 4 **color spaces**

	HDR-PQ			HDR-HLG			SDR		
	8K	UHD	HD	8K	UHD	HD	8K	UHD	HD
RGB Full Range	a	a	a				a	a	a
RGB Narrow Range	a	a	a	a	a	a	a	a	a
YUV Narrow Range BT.2020	a	a	a	a	a	a	a	a	<sup>1)</sup>
YUV Narrow Range BT.709								<sup>2)</sup>	a

<sup>1)</sup> Non-standard, but often used, version, e.g. for UHD originated content down-scaled to HD

<sup>2)</sup> Non-standard seldom used version, e.g. for HD originated content up-scaled to UHD

*Special frame sizes, e.g. down-scaled 960x540, are available on request*

# VQCB4 – Special Post-production Test Suite

- All **VQCB4** tests have the **same layout**, consisting of 5 horizontal bands \*)
- Test Patterns **pixel positions**: as by **BT.2111** standard \*)
- **Sequence duration**: 2020 ms
- **Frame rate**: 23.976 fps
- **Frame sizes**: 1920x1080 (HD) and 3840x2160 (UHD)
- **Dynamic range and color components** formats:
  - **SDR**: YUV Narrow Range, RGB Narrow Range, RGB Full Range
  - **HDR-PQ**: YUV Narrow Range, RGB Narrow Range, RGB Full Range
  - **HDR-HLG**: YUV Narrow Range, RGB Narrow Range
- **Color components, lossless video compression codecs, and container** combinations:
  - **YUV 444 16bpc**: **JPEG2000 encoded** video frames in **.MOV container** and numbered %08d **.J2K frames** in a **folder**
  - **RGB 444 16bpc**: **PNG encoded** video frames in **.MOV container**, numbered %08d **.PNG** and %08d **.TIFF frames** in two **folders**
- **File set**, total **90** RAR archive files:
  - **56 RAR archives**, each archive contains a **folder** with **480** numbered **image files**
  - **34 RAR archives**, each archive contains one **MOV video file**
- Three **separate side-car audio files**: WAV, 48kHz, PCM 24b, 2020 ms, **2.0**, **5.1** and **7.1** variants
- Each **MOV** file contains one **embedded audio stream**: 48kHz, PCM 24b, 2020 ms, **2.0**



\*) *Except special DCI-P3 variants*

# VQCB4 Test Suite Formats

**VQCB4 suite** (*special post-production version*) includes **34 valid combinations** of

- 2 frame sizes: **UHD** and **HD**
- 3 dynamic range types: **HDR-PQ**, **HDR-HLG** and **SDR**
  - **HDR-PQ** set is further divided into 2 sub-sets for **2 Target Primaries**:
    - **BT.2020** aka Wide Color Gamut (*also compliant with BT.2111*)
    - **DCI-P3** aka Expanded Color Gamut, further divided into 3 sub-sets:
      - **DCI-P3-D65**, Test Pattern Layout, D65 White Point and Light Levels Range as by **BT.2111** (*only the BT.709 bars components are different*)
      - **DCI-P3-D60-D61-200**, special “greenish” D60-D61 White Bar, Light Levels Range limited to **200 nit**, **SMPTE RP 431-2**.
      - **DCI-P3-D60-D61-48**, special “greenish” D60-D61 White Bar, Light Levels Range limited to **48 nit**, **SMPTE 431-1**.
- 2 video data ranges: **Narrow Range** (NR) and **Full Range** (FR)
- 2 color components types: **RGB** (NR and FR) and **YUV** (NR)



	<b>HDR-PQ</b> <i>24 variants</i>		<b>HDR-HLG</b> <i>4 variants</i>		<b>SDR</b> <i>6 variants</i>	
	UHD	HD	UHD	HD	UHD	HD
<b>RGB Full Range</b>	a	a			a	a
<b>RGB Narrow Range</b>	a	a	a	a	a	a
<b>YUV Narrow Range BT.2020</b>	a	a	a	a	a	
<b>YUV Narrow Range BT.709</b>						a

# About VideoQ



## Company History

- Founded in 2005
- Formed by an Engineering Awards winning team sharing between them decades of global video technology.
- VideoQ is a renown player in calibration and benchmarking of Video Processors, Transcoders and Displays, providing tools and technologies instantly revealing artifacts, problems and deficiencies, thus raising the bar in productivity and video quality experience.
- VideoQ products and services cover all aspects of video processing and quality assurance - from visual picture quality estimation and quality control to fully automated processing, utilizing advanced VideoQ algorithms and robotic video quality analyzers, including latest UHD and HDR developments.

## Operations

- Headquarters in CA, USA
- Software developers in Silicon Valley and worldwide
- Distributors and partners in several countries
- Sales & support offices in USA, UK



## Appendix A: Challenge and Solution

Nowadays, moving color images are encountered nearly everywhere, not only in broadcast TV.

With the massive increase of volumes of hardware items and video related software, the strict rules established for the broadcast TV are not always recognized.

The major effort in capturing, delivering, and rendering of high-quality moving images demands the guidance and commonly accepted rules.

This affects camera manufacturers, display manufactures, cloud transcoding, telecom, video conference services providers, content originators, digital cinema systems, even the old movies de-archiving.

The solution is in establishing easy-to-use and straightforward rules and matching tools, such as further derivatives of the ubiquitous **Color Bars Test Pattern**.

The long history of broadcast TV demonstrates the path from the usage of physical reflectance test charts to the extremely successful practice of using color bars test patterns to check, calibrate and ensure reliable exchange of video images on a global scale.

VideoQ has been active in standards and test patterns creation, so we published and released the calibrated **VideoQ Color Bars (VQCB)** test tools suite that meet this challenge. *The best way to reliable QA is via reliable QC!*

# VQCBA Analyzer Overview

## VideoQ Color Bars Analyzer:

- **Applications:** Video production, post-production, transcoding, distribution
- **CLI program** for **on premise** and **cloud** tasks, **Windows** and **Linux** versions
- **Software module** of **VideoQ Productivity Tools** suite
- **Companion program** for **VQCB Wonder Bars™** Test Patterns Suite
- **Video workflow verification** tool for the 8K / 4K / 2K, HDR / SDR environment
- **Easy-to-use tool**, instantly revealing your video device / system / workflow **performance**
- **Unattended automated analysis tool**, suitable for **workstations** and **cloud computing**
- **VQCBA auto-detects** and **process 5 different types** of color bars tests (*see next slide*)

**Frame sizes:** from **480x270** to **8K UHD**

**Dynamic range formats:** **HDR-PQ**, **HDR-HLG**, and **SDR**

**Variety of color spaces, containers** and **encoding formats**, supported by **ffmpeg**

*Learn more about VQCBA:*

[www.videoq.com/vqcb.html](http://www.videoq.com/vqcb.html)

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## VQCB Suite Custom File Formats

On request VQCB test patterns are available as media files in the following formats:

- Frame size: 15360x8640 (16K), 7680x4320 (8K UHD), 3840x2160 (UHD), 1920x1080 (HD)
- Media file parameters:
  - RAW data, interleaved RGB/YUV components, 4:4:4, 16 bpc, 48 bpp, single frame,  
*this format is recommended for advanced users, raw data format is suitable for any bit depth & frame rate*
  - TIFF and PNG image sequences, RGB 48bpp 16bpc
  - AVI container: r210 and v210 lossless “uncompressed 10 bit” codecs
  - MKV container: FFV1 (RGB and YUV 444 48bpp 16bpc) lossless codec
  - MP4, MOV and WEBM containers: PNG, JPEG2000, HEVC, AVC, VP9, AV1, ProRes – lossless or lossy codecs
  - Seamless loop duration: single frame or N seconds
  - Pixel format: RGB 444, YUV 444, 422 or 420, 16b, 12b or 10 bit per component
  - SDR, HDR-PQ or HDR-HLG metadata embedded – as appropriate
- Frame rate: from 23.976 fps to 240 fps, other frame rates available upon request
- Optional audio streams: 2.0, 5.1 and 7.1, 48 ~ 192 kHz, PCM, AC3, EAC3, and OGG
- Other video & audio data formats and codecs are available upon request for an additional fee

## Background Info

**Color Bars** is the most used **Test Pattern** known for more than 60 years.

It can be used in classic full screen variant and it is also an important component of many other tests.

There are many standard and non-standard variants of this test.

The simplest and oldest color bars variant is a sequence of eight vertical bars of 100% (maximum intensity) colors.

This sequence can be produced in RGB format by a simple 3-bit counter.

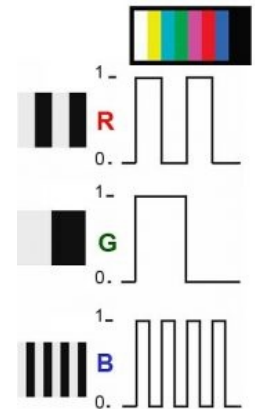
The standard color bar sequence is White, Yellow, Cyan, Green, Magenta, Red, Blue, Black.

Six colored bars show 3 Primary Colors – Red, Green, Blue

and 3 Complementary Colors – Cyan, Magenta, Yellow

White and Black bars provide for **Reference White & Reference Black** Signal Levels.

The arrival of new **HDR** and **WCG** technologies added new twist to the history of this test. Now we should test not only **RGB** and **YUV** Signal Levels, but also the **Light Levels (LL)** of the media files content and rendered images.



# Color Spaces, Data Ranges, and Conversion Options

International Telecommunication Union (ITU) Recommendation **BT.2020** defines various aspects of ultra-high-definition television (**UHDTV**) with standard dynamic range (**SDR**) and wide color gamut (**WCG**).

It mandates the use of RGB  $\leftrightarrow$  YUV Color Space Conversion **BT.2020 Matrices** for the frame sizes greater than HD. Note that RGB  $\leftrightarrow$  YUV conversion in ubiquitous **HD** format relies on significantly different **BT.709 Matrices**.

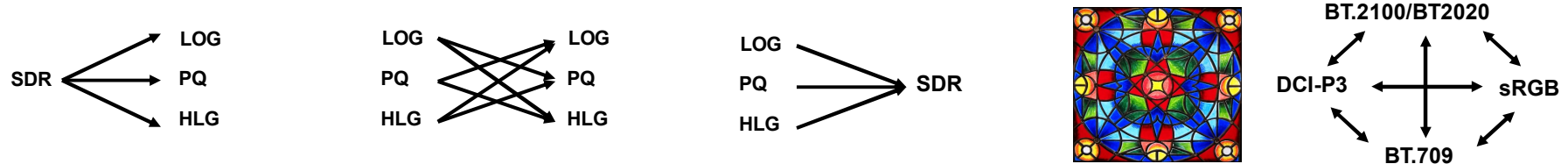
Since the introduction of **BT.601** standard YUV data are generated in **Narrow Range** format (abbreviated as **NR**). Main advantage of the NR format is the availability of extra levels below **Reference Black** and above **Reference White**.

However, the RGB data traditionally used in production and post-production are defined in two formats – **Full Range** format (**FR RGB**, without reserved levels) and **Narrow Range** format (**NR RGB**, similar to NR YUV).

Thus, generic RGB  $\leftrightarrow$  YUV conversion workflows should handle FR/NR RGB, NR YUV and BT.2020/BT.709 Matrices.

The **HDR/SDR** conversion processes are even more complicated, note the **Unified Reference White** concept:

[http://www.videoq.com/hdr\\_ref\\_white.html](http://www.videoq.com/hdr_ref_white.html)



## Color Bars Related Standards

Years ago ITU-R (United Nations agency division) issued Recommendation **BT.471** “Nomenclature and Description of Color Bar Signals”; it covers only **Full Frame Bars** and does not address modern **UHD**, **HDR** and **WCG** issues.

Widely used in several countries multi-band **SMPTE RP219 Bars** (derived from the legacy **SMPTE EG1 Bars**) are suitable *only* for **Standard Dynamic Range (SDR) YUV** formats.

The HDR and WCG issues are mostly covered by ITU-R Recommendation **BT.2111** “Specification of colour bar test pattern for high dynamic range television systems”: <https://www.itu.int/rec/R-REC-BT.2111/en>

However, the Recommendation BT.2111 specifies the reference test patterns *only* for the **High Dynamic Range (HDR)** television systems specified in ITU-R Recommendation **BT.2100**.

This means that currently there is no *officially recommended* Color Bars Test Patterns matching BT.2111 and suitable for widely used **Standard Dynamic Range** workflows in mixed RGB/YUV, UHD/HD and WCG formats.

VideoQ has filled this gap by developing the suite of Color Bars Test Patterns, which includes all **BT.2111 HDR** variants **as well as** the newly developed **SDR** variants for the **BT.2020** Color Space **and** traditional **BT.709** Color Space.

*NB: By some obscure reasons the BT.709 color space was labeled by marketing people as “Narrow Color Gamut”.*

The layout, data levels and appearance of the SDR variants of **VQCB** test pattern suite are similar to the HDR variants, which makes much easier the usage of the whole VQCB suite in modern mixed formats environments.

## Appendix B: VQCB and VQV – Advanced Analysis Examples

This section provides more details about VQCB test sessions scenarios, VideoQ software tools usage examples and test patterns features.

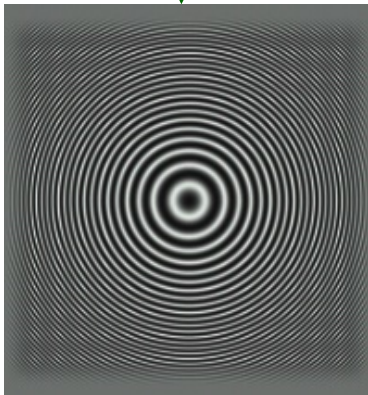
The screenshots and measurement results shown in this section are taken from VideoQ **VQV** – Media Files Viewer-Analyzer:

<http://www.videoq.com/vqv.html>

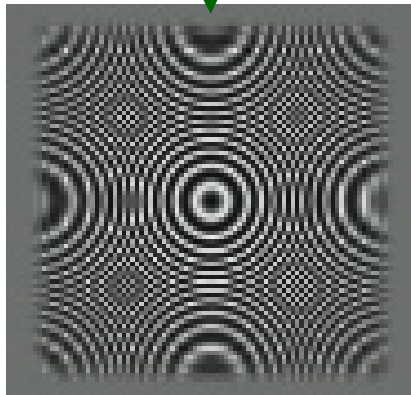
# Full Bandwidth Zone Plate Test Usage

Player window size scaling distortions:

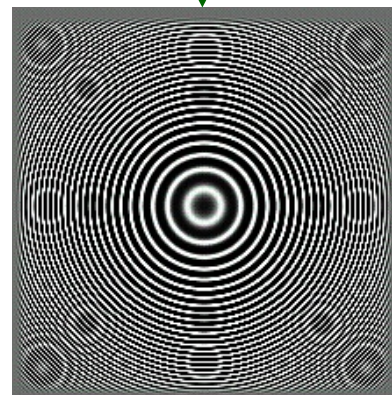
“Banding”



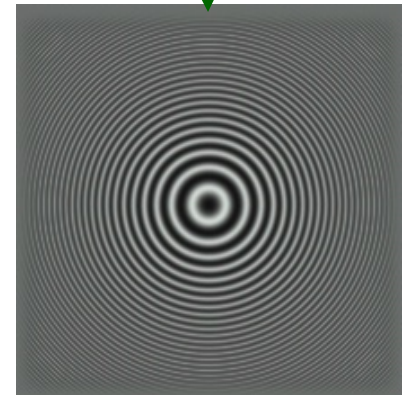
“Beating”



Display over-enhancement



Frame size reduction

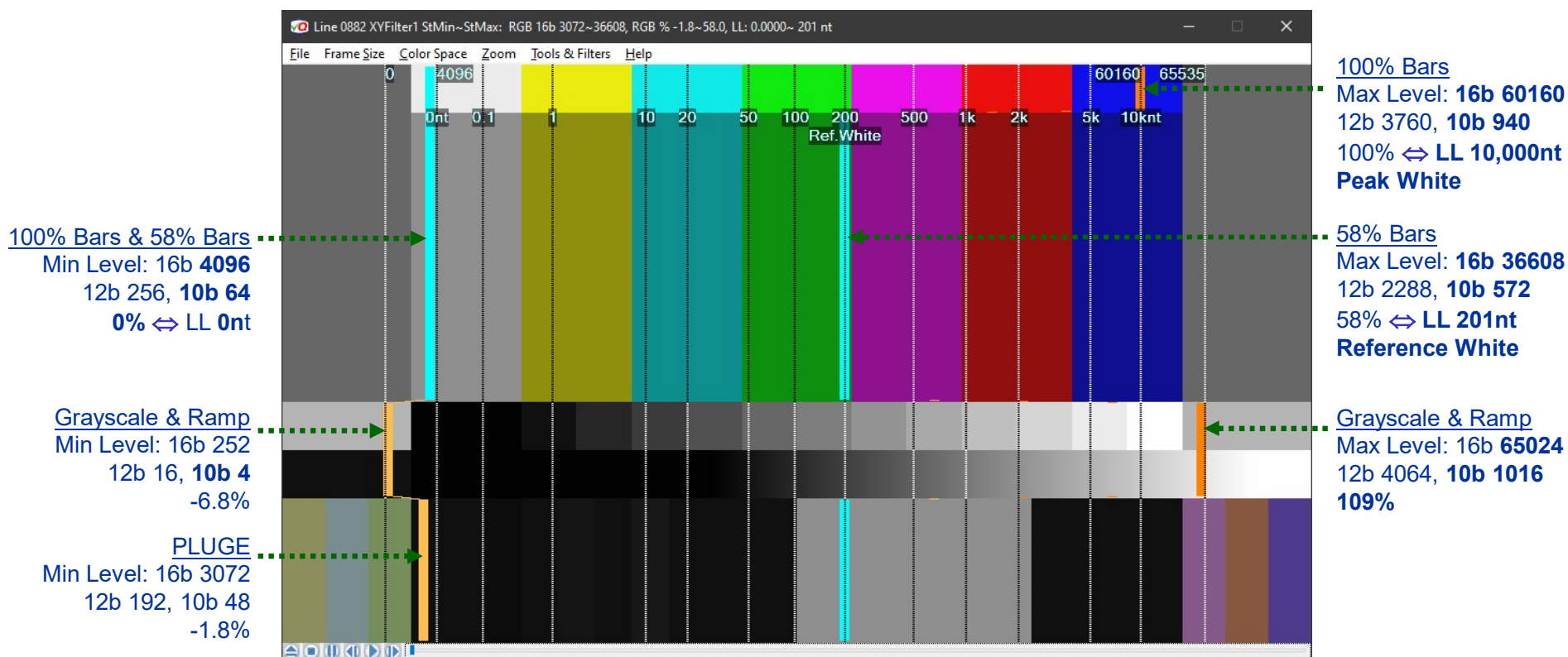




# VQCB HDR-PQ Test – FrameScope

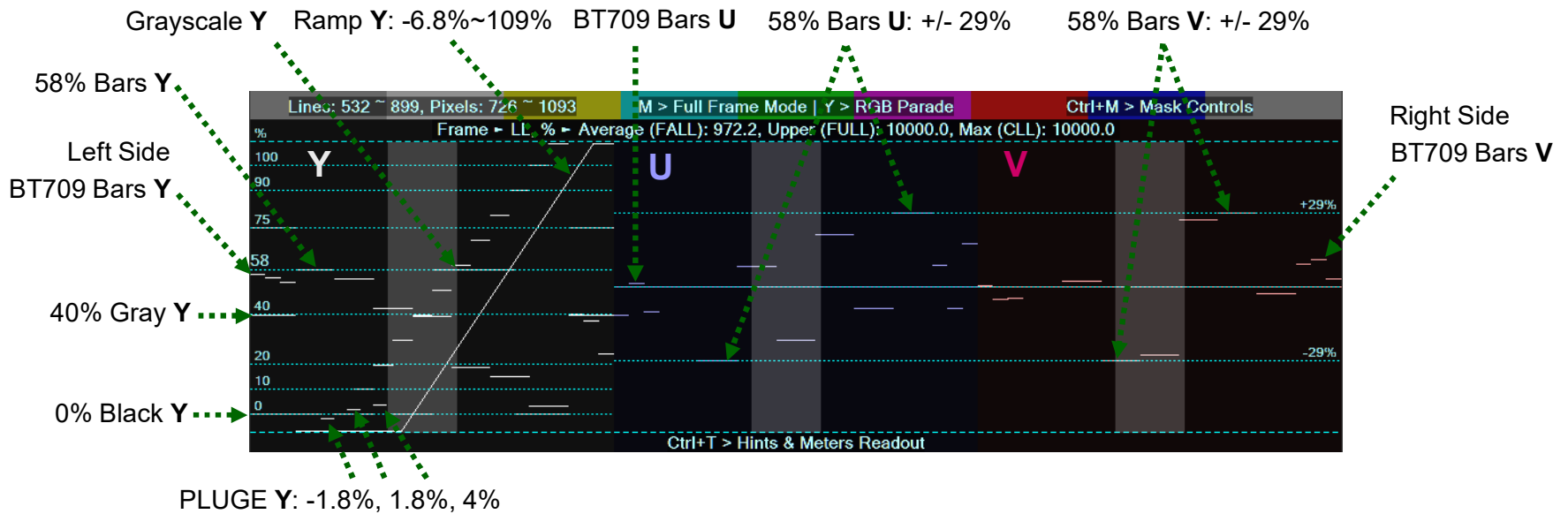
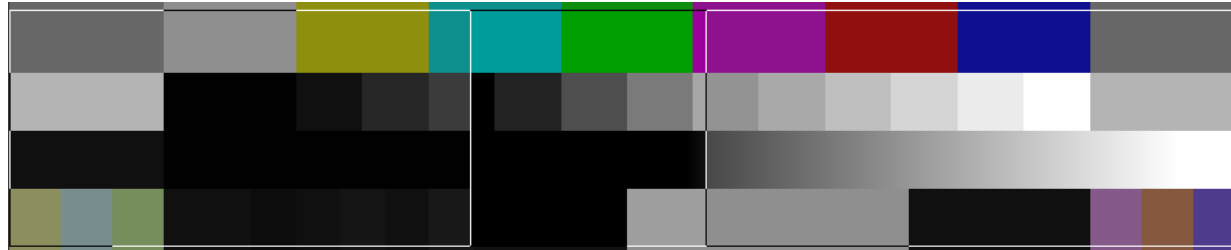
All data levels (Narrow Range HDR-PQ levels) are compliant with BT.2111 standard

HDR-PQ Mode: VQV Graticule Units auto-switched to nits, VQV title bar shows actual 16b values range for the currently selected line.



# Checking HDR-PQ YUV Levels – Waveform Monitor

User-selected Waveform Monitor Analysis Area: Lines Range & Pixels Highlight Mask



# Checking RGB Data Range – VectorScope

SDR FR RGB data correctly specified as FR



SDR FR RGB data incorrectly specified as NR

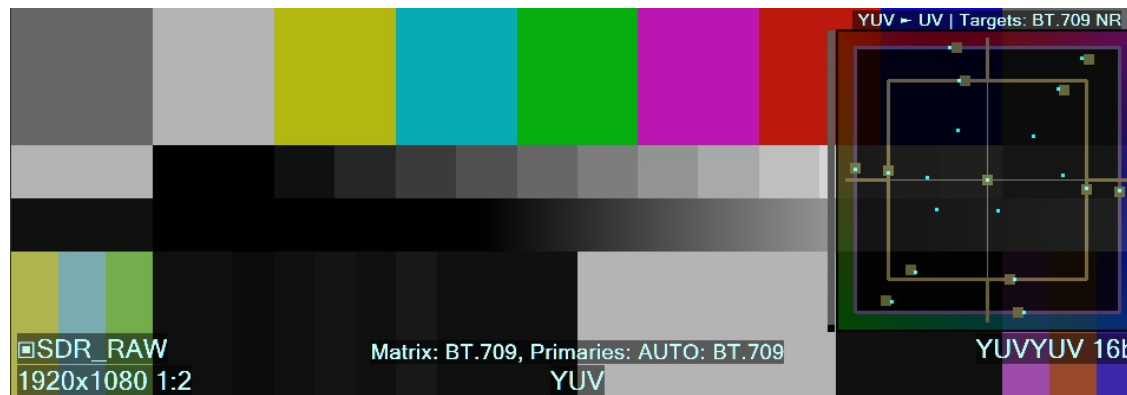


# Checking Color Matrix – VectorScope

HD file metadata correctly specify Color Matrix as BT.2020 (probably, due to the down-conversion from UHD source)



HD file metadata are wrong: Color Matrix incorrectly reported as BT.709 (default for HD frame size)



# Checking HDR-PQ RGB Data vs. File Metadata – VectorScope

Media file metadata correctly specify HDR-PQ RGB Narrow Range format.  
Both 100% Bars and 58% Bars hit the centers of target boxes.



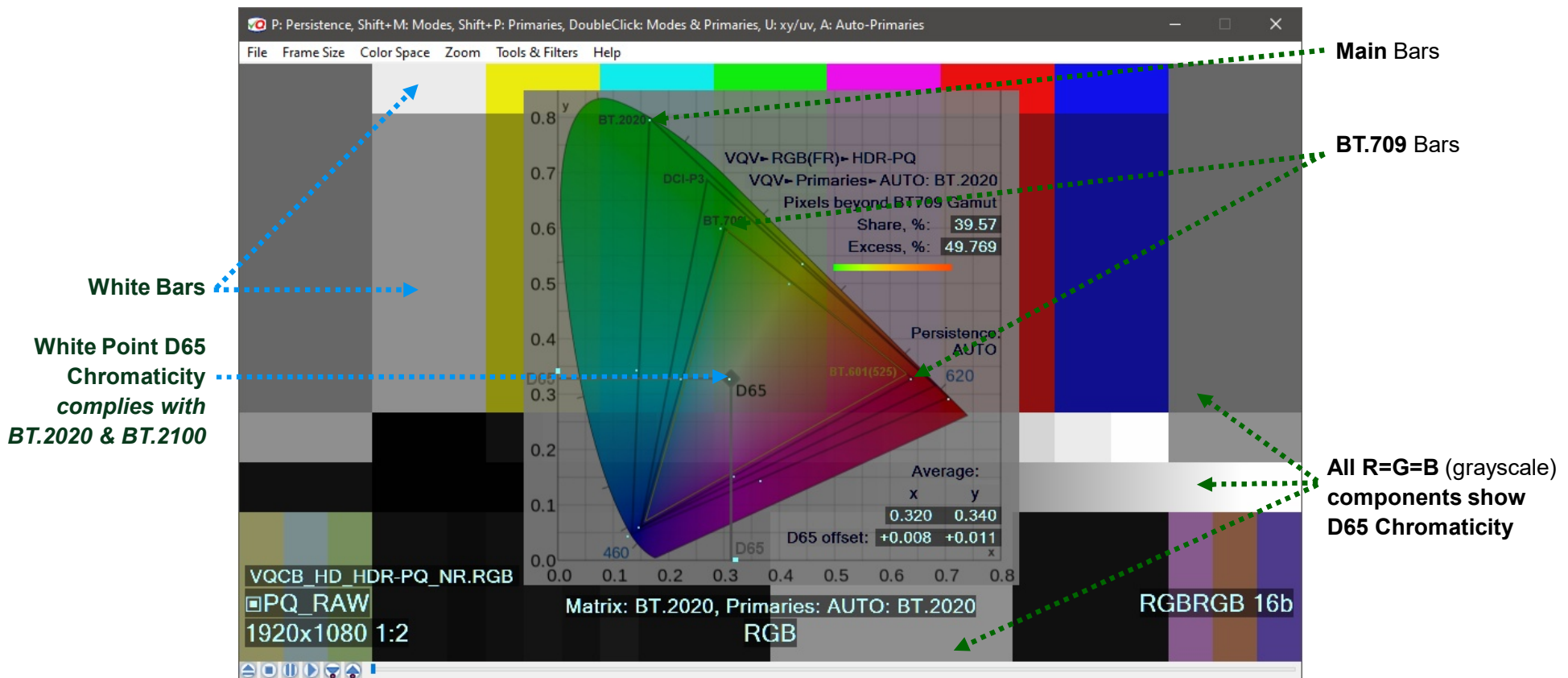
Media file metadata correctly specify HDR-PQ RGB Full Range format.  
Both 100% Bars and 58% Bars hit the centers of target boxes.



# VQCB HDR-PQ Test – ChromaScope

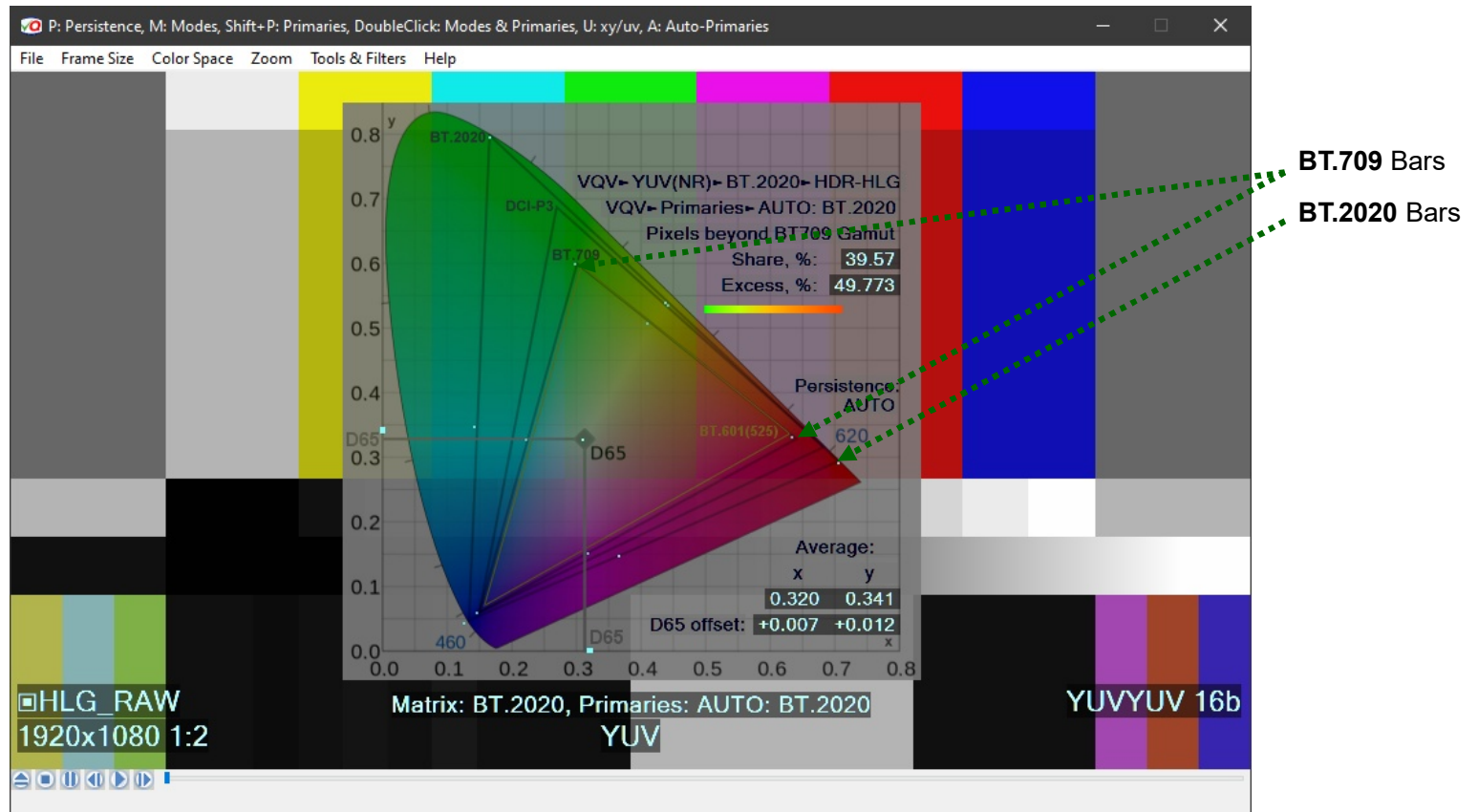
VQV ChromaScope auto-switched to BT.2020 primaries mode.

Main Bars and BT.2111 compliant BT.2020 ↔ BT.709 Bars hit vertices and sides of the corresponding triangles.



# VQCB HDR-HLG Test – ChromaScope

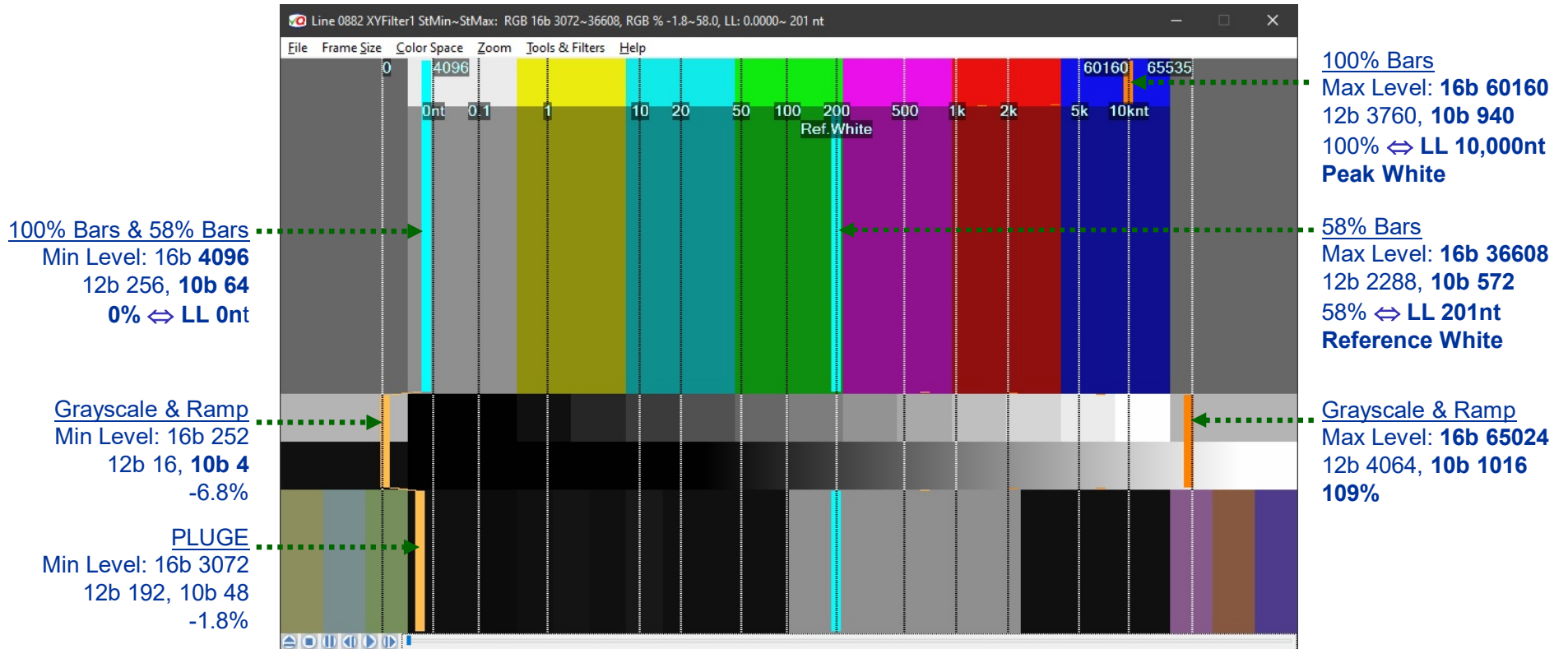
Media file metadata correctly specify HDR-HLG YUV format.  
Both BT.2020 Bars and BT.709 Bars hit the corresponding triangles.



# VQCB4 HDR-PQ DCI-P3-D65 Test – FrameScope

Data levels are compliant with BT.2111 standard, *except special P3↔BT.709 Bars within the 5<sup>th</sup> band.*

HDR-PQ Mode: VQV Graticule Units auto-switched to nits, VQV title bar shows actual 16b values range for the currently selected line.

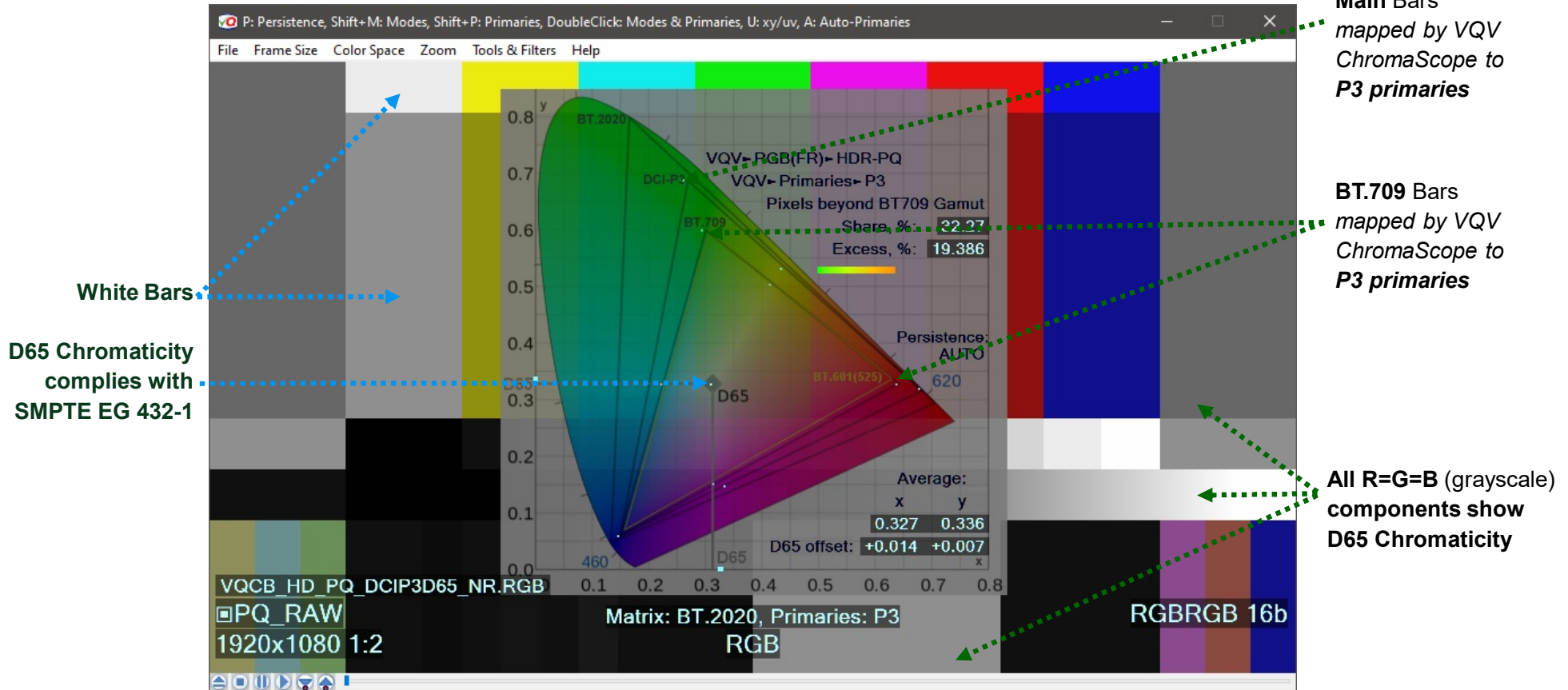




# VQCB4 HDR-PQ DCI-P3-D65 Test – ChromaScope

VQV ChromaScope switched to P3 primaries mode.

Main Bars and special P3↔BT.709 Bars hit vertices and sides of the corresponding triangles.

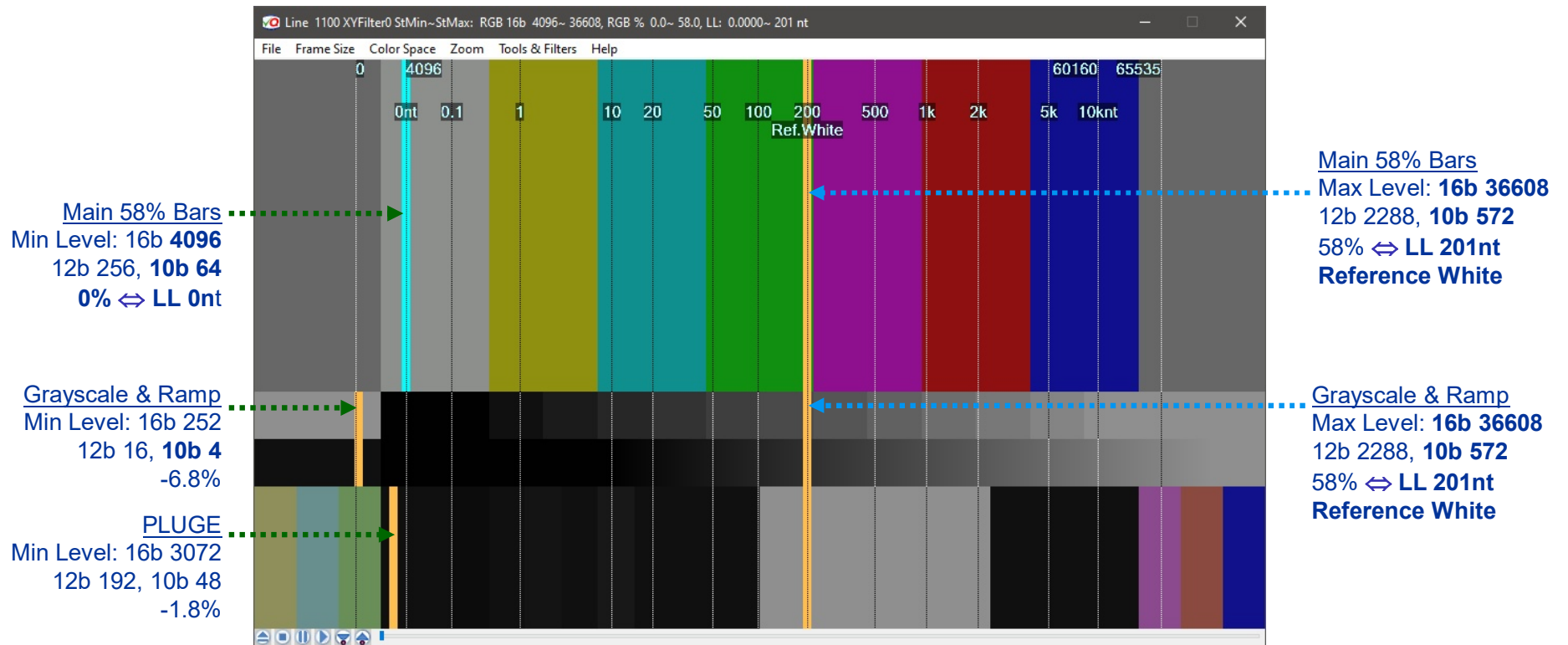


# VQCB4 HDR-PQ DCI-P3-D60-D61-200 Test – FrameScope

*Pattern layout and data levels are not compliant with BT.2111 standard. Note the absence of 100% bars.*

Special P3↔BT.709 Bars are identical to D65 variant.

**Max light level of all test pattern components limited to 200nt (SMPTE RP 431-2).**



# VQCB4 HDR-PQ DCI-P3-D60-D61-200 Test – ChromaScope

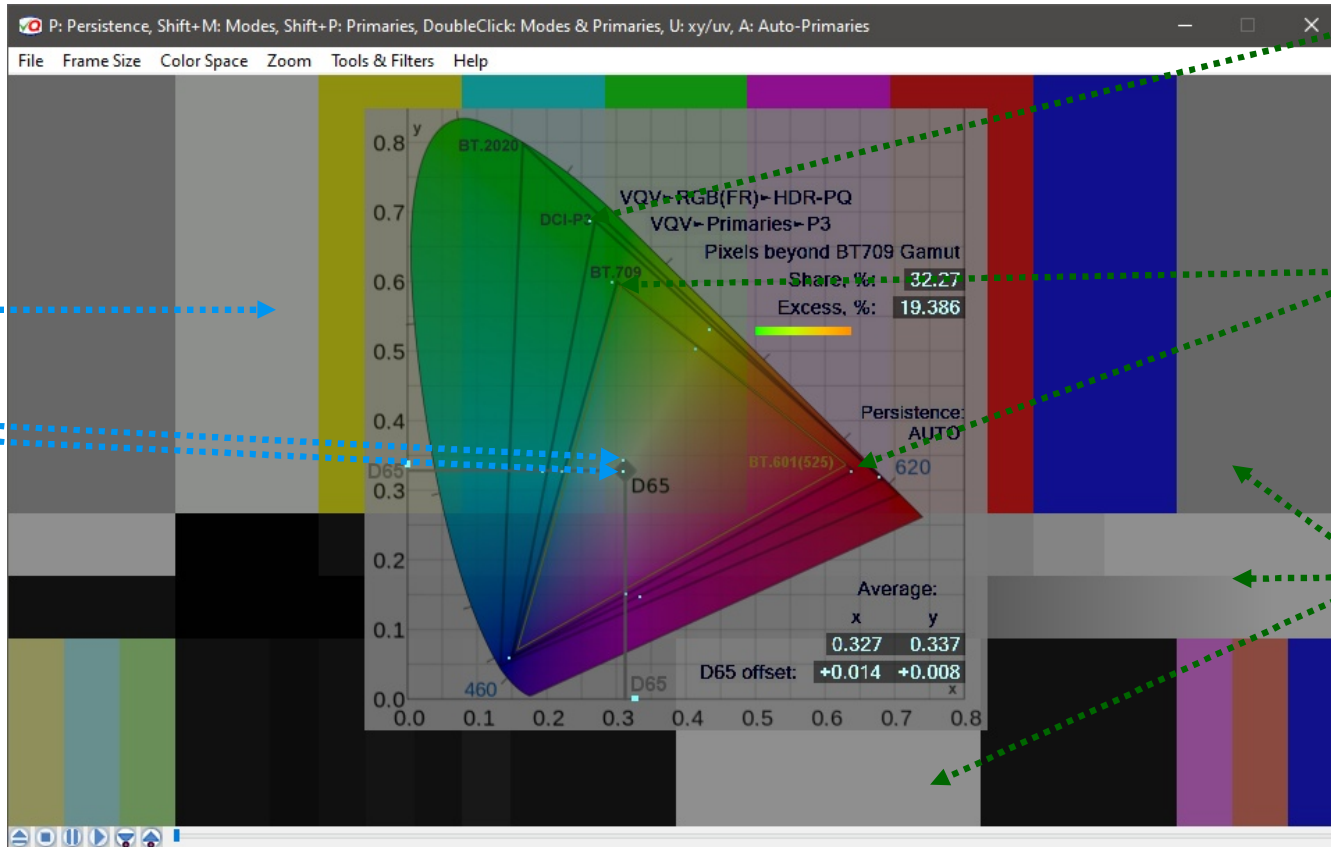
VQV ChromaScope switched to P3 primaries mode.

Main Bars and special P3↔BT.709 Bars hit vertices and sides of the corresponding triangles.

“Greenish”  
DCI White Point  
Reference Bar

Its “D60-D61”  
Chromaticity  
complies with  
SMPTE 431-1

Note the significant  
distance between  
the DCI White Point  
and D65 White Point  
of all other  
“gray” components



Main Bars  
mapped by VQV  
ChromaScope to  
P3 primaries

BT.709 Bars  
mapped by VQV  
ChromaScope to  
P3 primaries

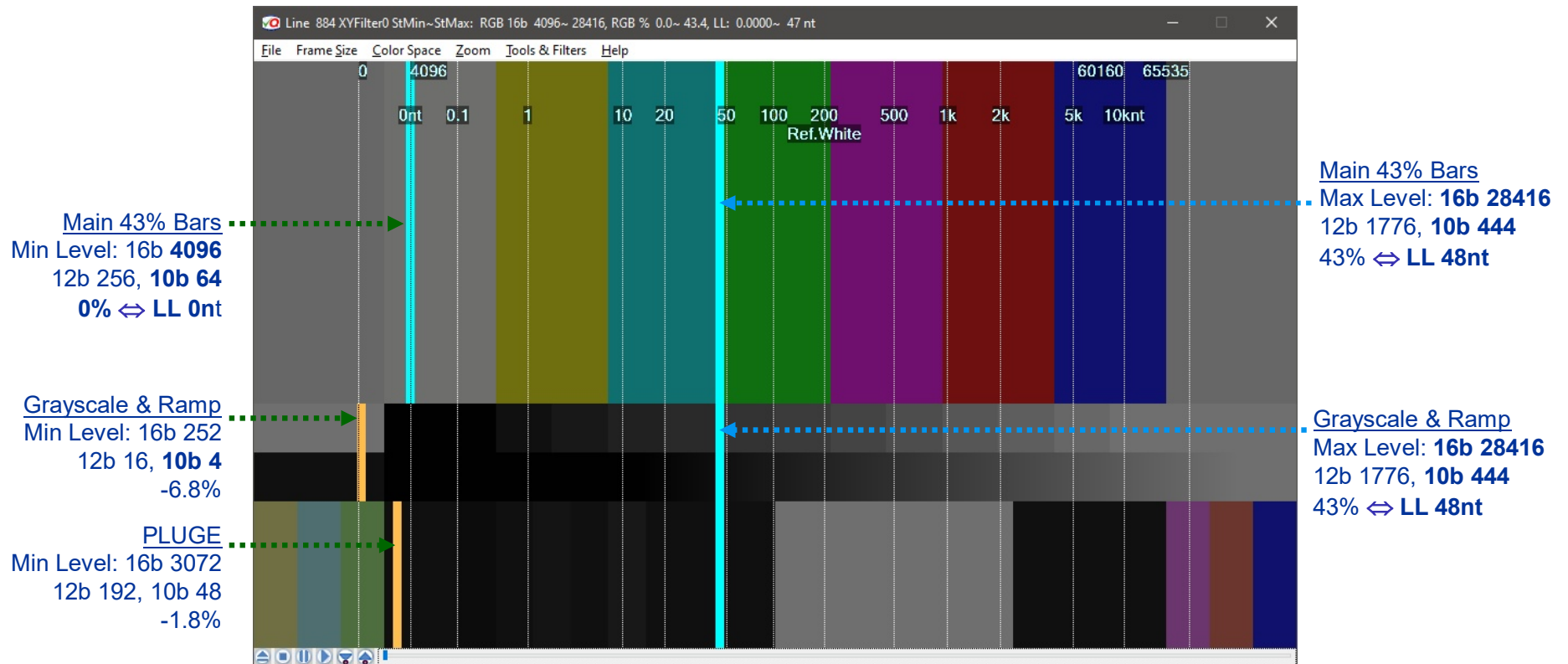
All R=G=B (grayscale)  
components show  
D65 Chromaticity

# VQCB4 HDR-PQ DCI-P3-D60-D61-48 Test – FrameScope

DCI-P3-D60-D61-48 test pattern is similar to DCI-P3-D60-D61-200, except the max level of 43%  $\leftrightarrow$  LL 48nt.

*Pattern layout and data levels are not compliant with BT.2111 standard.*

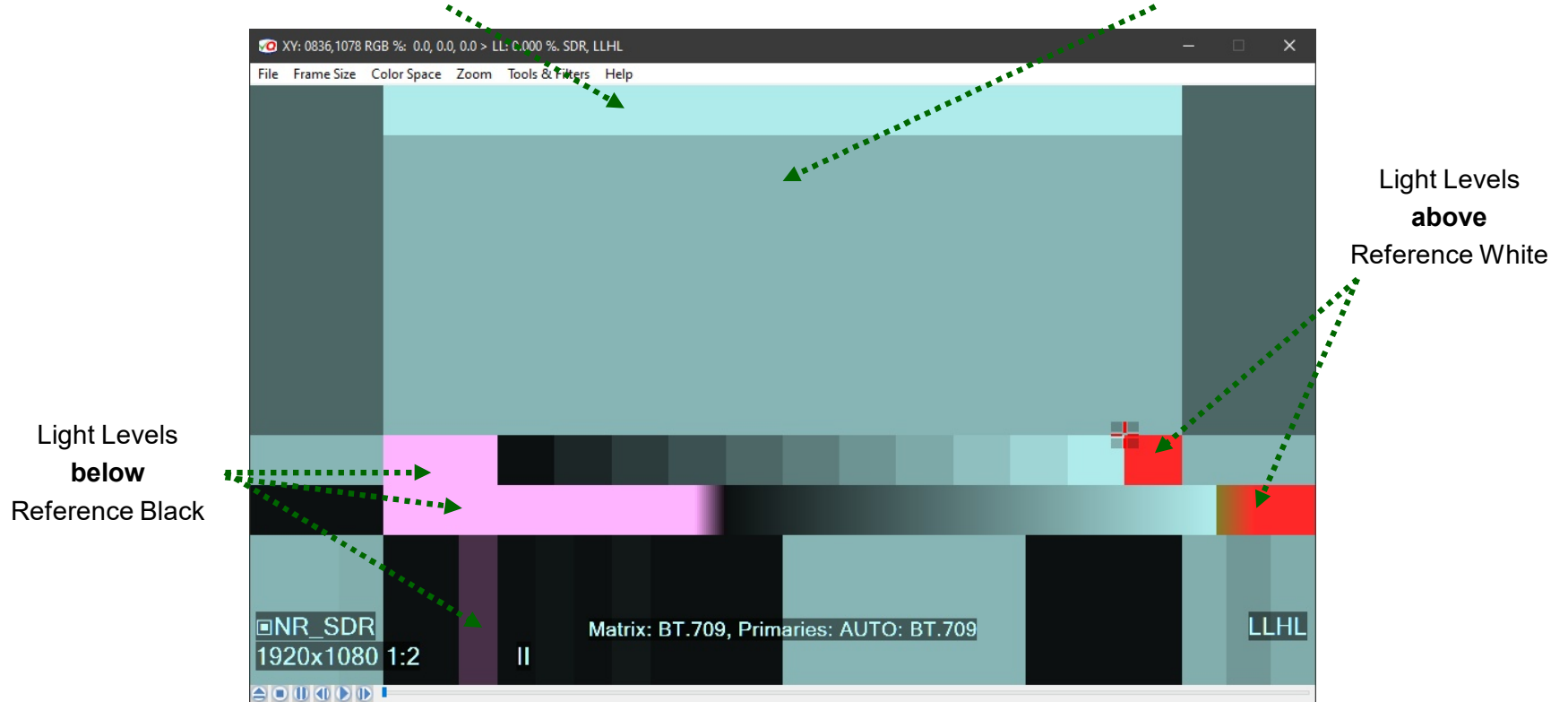
*Max light level of all test pattern components limited to 48nt (SMPTE RP 431-1).*



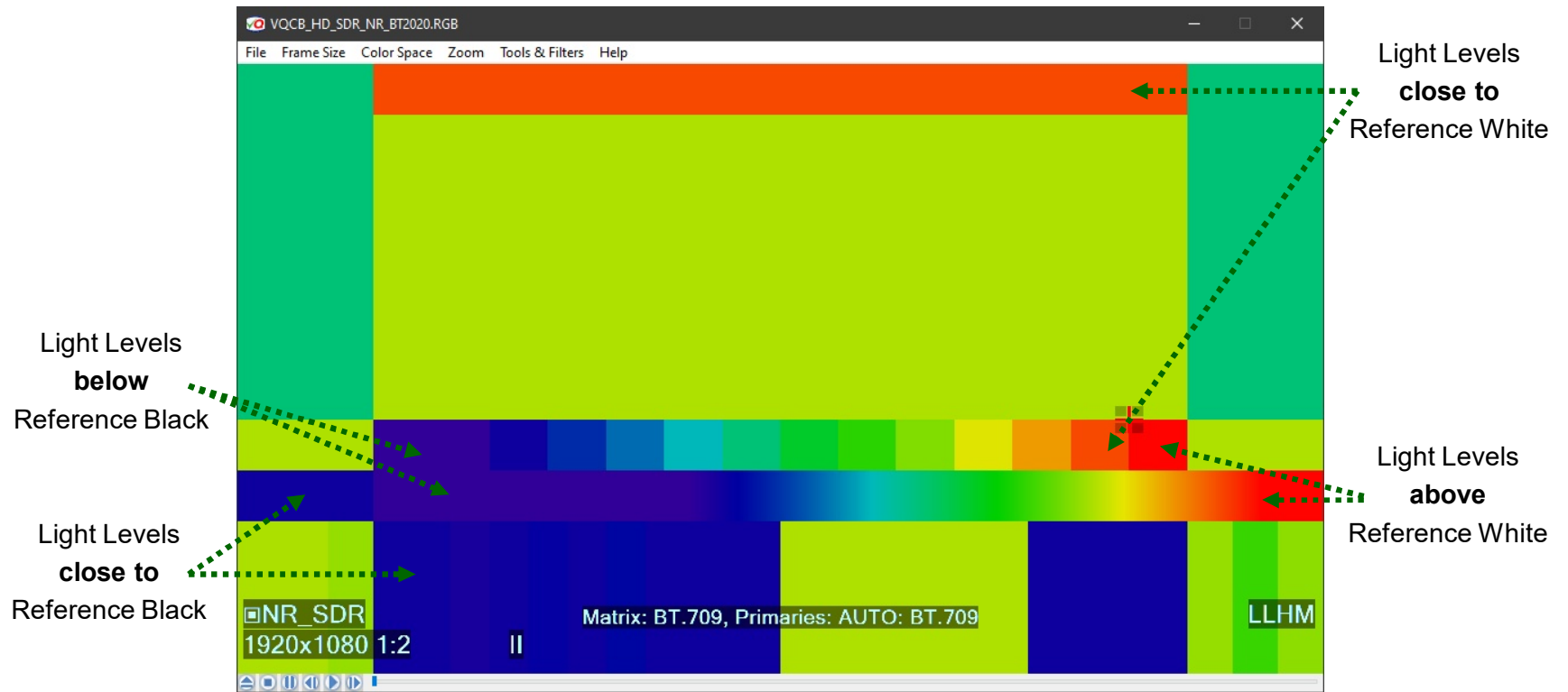
# Checking SDR Light Levels – Light Levels Highlighter

All six 100% Bars have the same 100% Light Level

All six 75% Bars have the same 50% Light Level



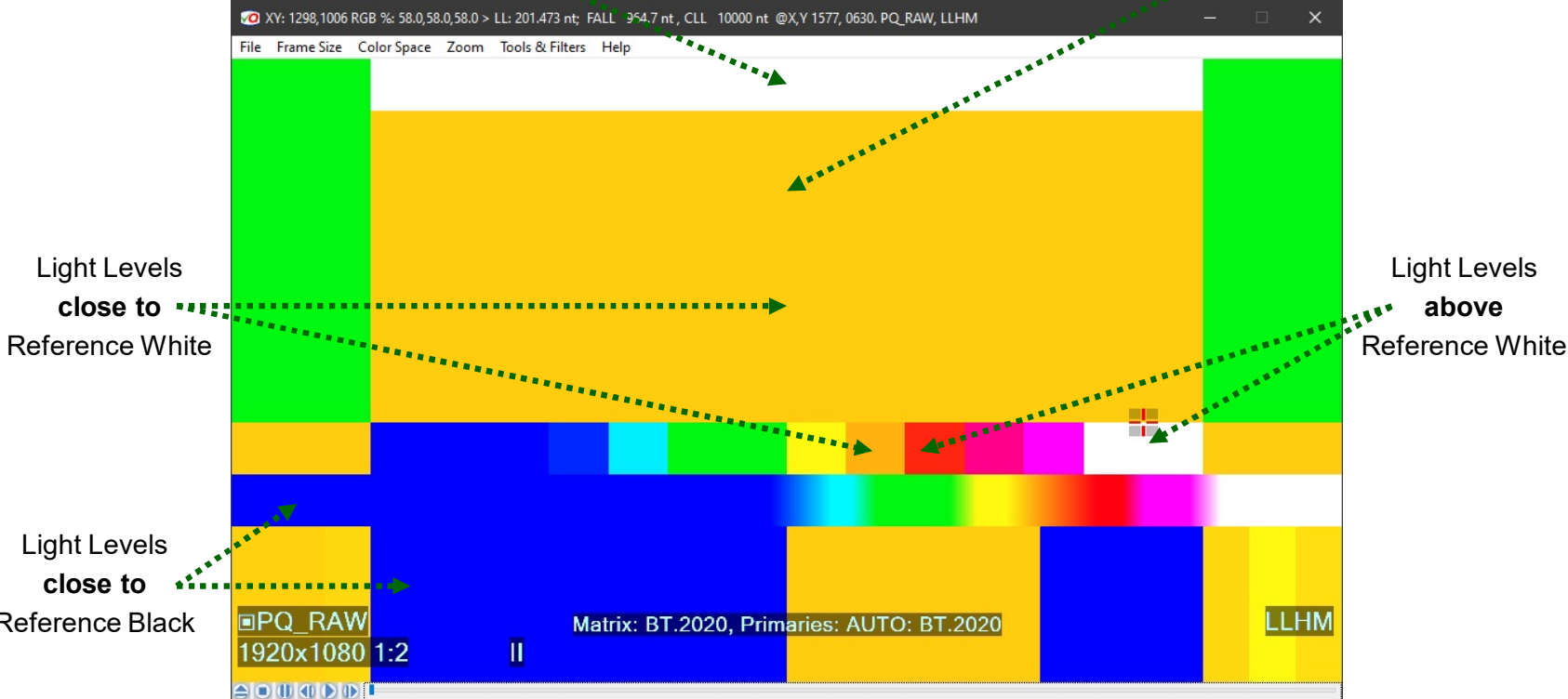
# Checking SDR Light Levels – Light Levels Heat Map



# Checking HDR-PQ Light Levels – Light Levels Heat Map

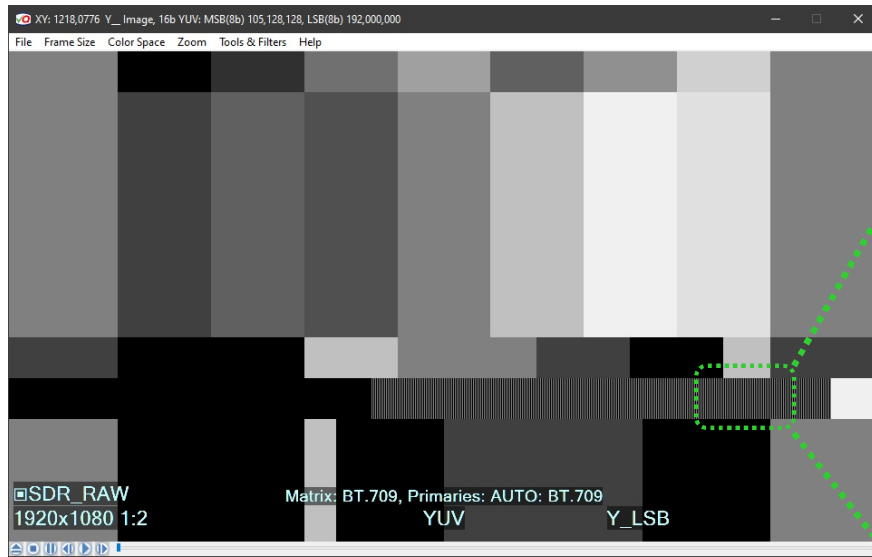
All six 100% Bars have the same 10,000 nit Light Level

All six 58% Bars have the same 200 nit Light Level



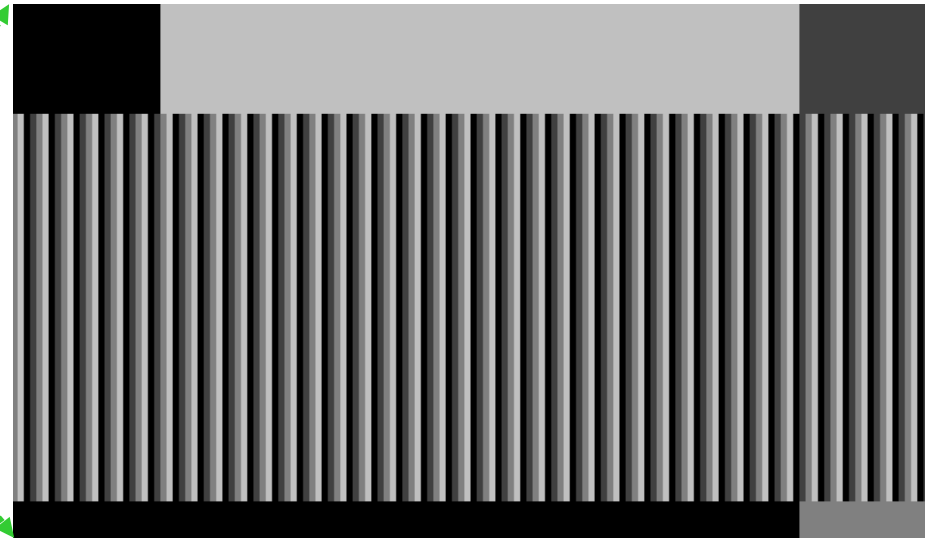
# Checking HD Version Ramp Bit Depth – LSB Image

16b YUV source, Y channel 8b LSBs Image



Within the Ramp area

8b LSBs image shows **4 gradations**, i.e. only **2 LSBs** are active.  
It means that actual bit depth of the Ramp is: 8 MSBs + 2 LSBs = **10 bit**



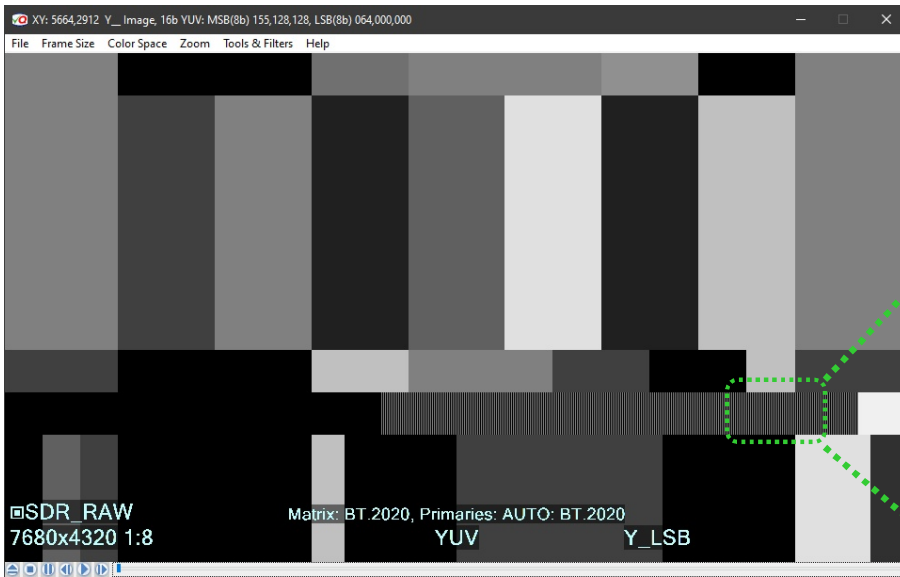
Max 4:1 Zoom centered on the Ramp Area

LSB image gradations pattern is **uniform**, it means that the original data **have been not scaled**: – preserving one 10b increment per pixel



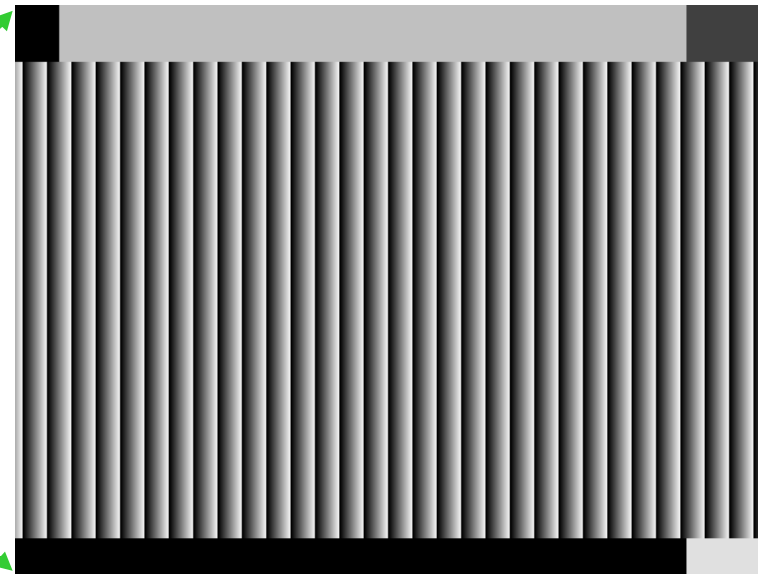
# Checking 8K Version Ramp Bit Depth – LSB Image

16b YUV source, Y channel 8b LSBs Image



Within the Ramp area

8b LSBs image shows **16 gradations**, i.e. **4 LSBs** are active.  
It means that actual bit depth of the Ramp is: 8 MSBs + 4 LSBs = **12 bit**



Max 1:1 Zoom centered on the Ramp Area

LSB image gradations pattern is **uniform**, it means that the original data **have been not scaled**: – preserving one 12b increment per pixel