

VQCBA

VideoQ Color Bars Analyzer

Training Presentation

July 2022



www.videoq.com

General

The following slides provide detailed description of VQCBA functions and its usage in the automated workflow checking scenarios suitable for most users.

Appendix A provides additional information for the advanced users and system architects about VQCB test patterns features, test sessions scenarios, and other VideoQ software tools usage examples.

VQCBA – VideoQ Color Bars Analyzer program web-page:

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

VQCB – VideoQ Color Bars test patterns suite web-page:

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

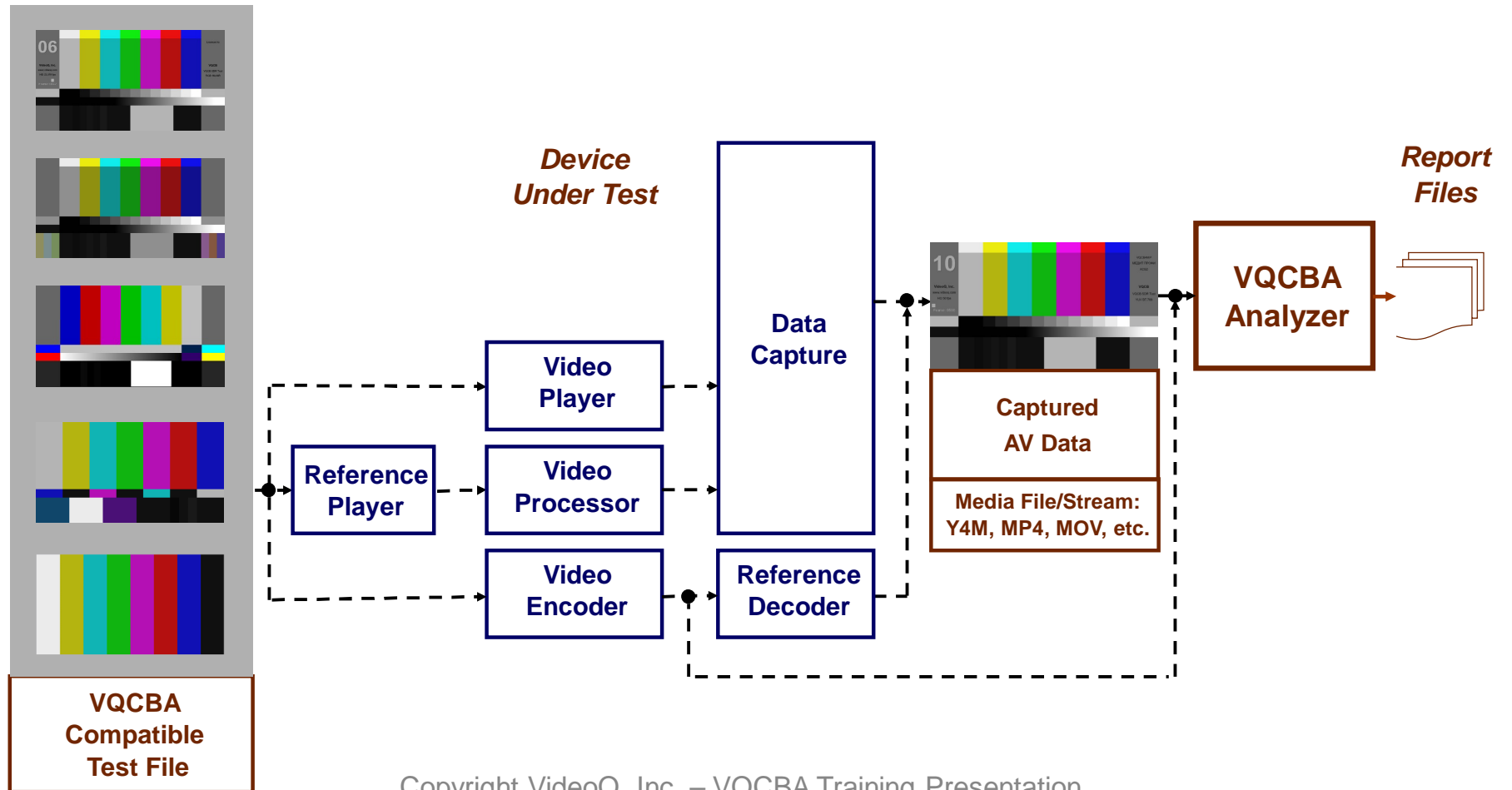
VQCBA Analyzer Overview

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**



VQCBA Workflow Variants



VQCBA Supported Color Bars Test Patterns Types

VQCBA supports 5 different 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*
- **SMPTE RP219**
- *widely used SDR test pattern*
- **SMPTE EG1**
- *legacy test pattern*
- **Full frame color bars**
- *the most common video test pattern*



VQCBA Analyzer Features 1

- VQCBA provides for automated cloud-based QA/QC, generating machine-readable JSON reports. This is especially useful when streaming in multiple formats or when converting between formats.
- VQCBA performs the following functions:
 - Reads media file **video and audio data**
 - Detects the relevant **segments** of video timeline
 - Auto-detects **test pattern type**
 - Calculates **video and audio content parameters**
 - Compares the results with **user-defined** VQCBA.INI file **tolerances**
 - Checks the **workflow parameters, distortions** and **conversion footprints**
 - Finally, produces machine-readable detailed **JSON Report**, including pass/fail **test summary result**

VQCBA Analyzer Features 2

- If input file contains **continuous audio test tone**:
 - VQCBA detects this component and measures the **Audio Tone Level** in dBfs
 - Measured audio tone level is shown in Audio Test Results section
- In case of **VQCB test sequence**, containing **audio stream**:
 - VQCBA measures throughput **Audio Gain** and **AV Sync Error**
 - Audio Gain and AV Sync measurement results are stored in Audio Test Results section
- In case of **VQCB test sequence**, containing **Text Box** with **QR code**:
 - VQCBA decodes the **VQCB QR code data**,
decoded string data are shown in the Original VQCB Parameters section of the Report
 - VQCBA compares **measured parameters** with the **original ones** (read from the QR code),
comparison results are shown in the Workflow Parameters Info section

Supported Media Files Formats

- Input media file formats (extensions):
 - Static Images: BMP, PNG, TIF, TIFF, JP2, J2K, J2C, JPC
 - Video Containers: Y4M, MOV, MP4, MXF, AVI, MKV, MPG, M2V, TS, TP, TRP, M2T, M2TS
- AV Codecs: All codecs supported by FFmpeg
- Frame sizes: From 480x270 to 8K UHD
- Frame rates: any, e.g. 23.976, 24.0, 25.0, 29.97, 30, 50.0, 59.94, 60.0, 120, 240 fps
- Video Bit Depth: from 8 to 16 bpc (bits per component)
- Color spaces: RGB (Narrow and Full Range), YUV (Narrow and Full Range)
- Color matrices: BT.601, BT.709, BT.2020
- Transfer functions: SDR, HDR-PQ and HDR-HLG
- Audio channels: 1 (1.0 mono), 2 (2.0 stereo), 6 (5.1), 8 (7.1)

Portable VQCBA Pack

VQCBA uses MediaInfo and FFMPEG libraries.

Portable VQCBA pack consists of:

- For Windows 64b OS:
 - a) "**vqcba.exe**" - main executable, which should be co-located with the following programs:
 - b) "**MediaInfo.dll**"
 - c) set of ffmpeg "***.dll**" files (8 files)
 - d) "**vqqr.exe**" - QR code reader utility
- For Linux 64b OS:
 - a) "**vqcba**" binary containing statically linked medianfo and ffmpeg libraries
 - b) "**vqqr**" binary, which should be co-located with VQCBA binary

Portable here means that VQCBA does not require installation of any additional software.

VQCBA Analyzer CLI Usage Info

VideoQ, Inc. (c) 2019-present. VideoQ Color Bars Analyzer v.1.1.2
DEMO VERSION, EXPIRES 2022-08-01
This program uses MediaInfo and ffmpeg libraries

Usage (see more in ReadMe):

`vqcba [-tm | -cd] [-nr | -fr] [-sdr | -pq | -hlg] -i inFileFullPath [-o] or [-o outFileFullPath]`
Advanced Test Conditions Controls are stored in VQCBA.INI file co-sited with vqcba executable
If VQCBA.INI file is not found, then it will be auto-created with the default control values
Order of flags and parameters is mandatory and cannot be changed

`[-tm | -cd]` option flags are mutually exclusive, they enable special Timeline Test Modes
`[-tm]` option flag enables Trailer Mode, 20s long analyzed segment ends with the file end
In Trailer Mode input file duration must be ≥ 60 s
`[-cd]` option flag enables Captured Data Mode, this flag is relevant only when capturing VQCB test video
In case of asynchronous capture of VQCB test, video file duration must be ≥ 22 s

If `[-tm | -cd]` flags are not present, analysis starts at frame number 0 in default Leader Mode
In Leader Mode the analyzed segment size may vary from single frame to 120s
In case of VQCB suite test patterns analysis, input file duration must be ≥ 20 s

`[-nr | -fr]` flags force analysis of Video Data in Narrow Range or Full Range Mode

`[-sdr | -pq | -hlg]` flags force analysis of Video Data in the specified Dynamic Range Mode

`[-o outFileFullPath]` option specifies full Path\FileName.Ext
If `[-o]` is present but outFileFullPath omitted, outFileFullPath = inFileFullPath.vqcba.json

If `[-o]` is omitted, Report will be sent to console (no JSON file created)

If Path\FileName contains spaces or special characters use double quotes

All File names, Report and Log files are in multi-lingual UTF-8 encoding format

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User-defined VQCBA.INI File Example

```
;VideoQ VQCBA.INI file created 2022-06-24T00:53:27.779Z
;User can edit or replace this file as needed, add your notes below:
;User can modify only the string values after "=" symbol.
;
;The number of user comments lines is not limited.
;
[BlackLevelDelta_pct]
BlackLevelDelta_pct=0.5
[WhiteLevelDelta_pct]
WhiteLevelDelta_pct=0.75
[ColorBarsLevelsDelta_pct]
ColorBarsLevelsDelta_pct=0.75
[VideoGainDelta_pct]
VideoGainDelta_pct=1.0
[ColorBalanceDelta_pct]
ColorBalanceDelta_pct=1.0
[ColorSaturationDelta_pct]
ColorSaturationDelta_pct=2.5
[PLUGE_LevelDelta_pct]
PLUGE_LevelDelta_pct=0.5
[AudioTestToneRefLevel_dBFS]
AudioTestToneRefLevel_dBFS=-23.0
[AudioLevelsDelta_dB]
AudioLevelsDelta_dB=0.75
[AVSyncDelta_ms]
AVSyncDelta_ms=50.0
[VideoLevelProfilesReport]
VideoLevelProfilesReport=YES
[SingleFrameFileOut]
SingleFrameFileOut=NO
[ThumbnailFileOut]
ThumbnailFileOut=NO
[ConfiguredBy]
ConfiguredBy=Victor Steinberg, VideoQ Inc.
```

VQCBA JSON Report Sections

- "header": Program version and copyright info, license info, report timestamp, configuration file (VQCBA.INI), input and output file names
- "generalInputFileInfo": Input file name, its time tags, number of video or image streams, and number of *optional* audio streams
- "videoStreams" or "imageStreams" and *optional* "audioStreams" sections: Processed Media Info data for each stream
- "testConditions": Configuration info, consists of processed CLI arguments and one sub-section containing VQCBA.INI file data
 - "testCaseInitParameters": Complete set of the user-defined data, read from VQCBA.INI file
- "testResults": This section contains four sub-sections:
 - "testSummary": **Main result** = "allTestsPassed" string = **Yes** (*if all partial tests passed*) or **No** (*if at least one of partial tests failed*)
 - "partialTestsPassed": 13 partial tests results, i.e. pass/fail boolean values in Yes/No string format
 - "testPatternComposition": Detected layout, number of bands, color bars number and nomenclature, number of PLUGE bars, etc.
 - "videoTestResults" and *optional* "audioTestResults": Measured parameters values, including conversion/distortion footprints
- "videoSegments": Detected test sequence segments timeline positions and durations - in video frames, ms and TC1000 strings
- "qrCodeBasedInfo": This section is present only if **VQCB** test sequence detected; it contains two sub-sections:
 - "originalTestPatternInfo": Decoded QR Code data, in multi-string format
 - "workflowParametersInfo": AV parameters comparison – measured vs. original - *useful for workflow checks and debugging*
- "videoLevelsProfiles": Measured RGB/YUV values for each test pattern component and sample position – *useful for advanced analysis*

VQCBA Analyzer JSON Report Example

```

> (0) "header": {} (19)
> (0) "generalInputFileInfo": {} (28)
> (0) "videoStreams": {} (2)
> (0) "audioStreams": {} (2)
v (0) "testConditions": {} (10)
  1."timelinePositionControl" "Auto"
  1."selectedTimeLinePosition" "Leader"
  1."audioStreamAnalysis" "Yes"
  1."audioVideoDurationsWarning" "Audio and video streams durations differ"
  1."audioChannelsNumber" "2"
  1."referenceAudioChannel" "FR"
  1."thumbnailFileOut" "No"
  1."singleFrameVideoFileOut" "No"
  1."videoLevelProfilesReport" "Yes"
v (1) "testCaseInitParameters": {} (12)
  2."iniFileDateTimeUTC" "2022-07-02T17:49:42.176Z"
  2."configuredBy" "Victor Steinberg, VideoQ Inc."
  2."BlackLevelDelta_pct" "0.5"
  2."WhiteLevelDelta_pct" "0.75"
  2."ColorBarsLevelsDelta_pct" "0.75"
  2."VideoGainDelta_pct" "1"
  2."ColorBalanceDelta_pct" "1"
  2."ColorSaturationDelta_pct" "2.5"
  2."PLUGE_LevelsDelta_pct" "0.5"
  2."AudioTestToneRefLevel_dBfs" "-23"
  2."AudioLevelsDelta_dB" "0.75"
  2."AVSyncDelta_ms" "50"
v (0) "testResults": {} (5)
  v (1) "testSummary": {} (3)
    2."testPatternType" "VQCB - VideoQ Color Bars"
    2."allTestsPassed" "Yes"
    > (2) "partialTestsPassed": {} (13)
      v (1) "videoSegments": {} (5)
        2."relevantTimelineSegments" "1"
        2."testPatternTimeLine" "Leader"
        2."analyzedFramesCount" "1200"
        2."analyzedDurationTC1000" "00:00:20.020"
        > (2) "Segment1": {} (5)
          > (1) "testPatternComposition": {} (22)
          > (1) "videoTestResults": {} (9)
          > (1) "audioTestResults": {} (4)
          > (0) "qrCodeBasedInfo": {} (2)
          > (0) "videoLevelProfiles": {} (8)

```

```

> (0) "generalInputFileInfo": {} (28)
> (0) "videoStreams": {} (2)
> (0) "audioStreams": {} (2)
> (0) "testConditions": {} (10)
v (0) "testResults": {} (5)
  > (1) "testSummary": {} (3)
  > (1) "videoSegments": {} (5)
  > (1) "testPatternComposition": {} (22)
  v (1) "videoTestResults": {} (9)
    2."testPatternType" "VQCB - VideoQ Color Bars"
    2."dynamicRangeFormat" "HDR-PQ"
    2."colorSpace" "YUV"
    2."bitsPerComponent" "10"
    v (2) "colorMatrix": {} (4)
      3."medialInfo" "BT.2020"
      3."codecCtx" "BT.2020"
      3."expected" "BT.2020"
      3."detected" "BT.2020"
      > (2) "dataRange": {} (9)
      v (2) "colorBars": {} (7)
        3."videoGainError_pct" "0"
        3."colorBalanceError_pct" "0"
        3."videoLevelsError_pct" "0.65"
        3."saturationError_pct" "-2.23"
        3."colorMatrixingErrorFootprint" "na"
        3."wideColorGamutMapping" "No"
        > (3) "videoLevels": {} (8)
        v (2) "plugeBars": {} (2)
          3."blackClipOnPLUGE" "No"
        > (3) "videoLevels": {} (7)
        v (2) "grayScale": {} (10)
          3."scaleMin_level" "4"
          3."scaleMin_pct" "-6.84"
          3."scaleMax_level" "1019"
          3."scaleMax_pct" "109.02"
          3."scaleStepMin_pct" "9.93"
          3."scaleStepMax_pct" "10.05"
          3."scaleNonLinearity_pct" "0"
          3."whiteClipOnGrayScale" "No"
          3."hdrToneMappingFootprint" "No"
          > (3) "videoLevels": {} (2)
          v (1) "audioTestResults": {} (4)
            2."audioContent" "VQCB Audio Test"
            2."avsyncError_ms" "17"
            2."audioTestLevel_dBfs" "-23.04"
            2."audioGainError_dB" "-0.039999"

```

```

> (0) "generalInputFileInfo": {} (28)
> (0) "videoStreams": {} (2)
> (0) "audioStreams": {} (2)
> (0) "testConditions": {} (10)
> (0) "testResults": {} (5)
v (0) "qrCodeBasedInfo": {} (2)
  > (1) "originalTestPatternInfo": {} (17)
  v (1) "workflowParametersInfo": {} (1)
    2."analyzedParametersCount" "12"
    2."modifiedParametersCount" "9"
    2."undefinedParametersCount" "0"
    v (2) "frameSize": {} (2)
      3."original" "1920x1080"
      3."detected" "1920x1080"
    v (2) "transferCharacteristics": {} (2)
      3."original" "HDR-PQ"
      3."detected" "HDR-PQ"
    v (2) "colorSpace": {} (2)
      3."original" "RGB"
      3."detected" "YUV"
    > (2) "videoDataRange": {} (2)
    v (2) "samplingStructure": {} (2)
      3."original" "444"
      3."detected" "420"
    v (2) "bitsPerComponent": {} (2)
      3."original" "16"
      3."detected" "10"
    v (2) "frameRate": {} (2)
      3."original" "23.976"
      3."detected" "59.940"
    v (2) "mediaFileContainer": {} (2)
      3."original" "MOV"
      3."detected" "MP4"
    v (2) "videoCodec": {} (2)
      3."original" "PNG"
      3."detected" "HEVC"
    v (2) "audioCodec": {} (2)
      3."original" "PCM"
      3."detected" "EAC3"
    v (2) "audioChannels": {} (2)
      3."original" "6"
      3."detected" "2"
    v (2) "audioSamplingRate": {} (2)
      3."original" "48000"
      3."detected" "44100"
  > (0) "videoLevelProfiles": {} (8)

```

More Info & Support

To learn more about VQCB, VQV, other VideoQ Test Patterns and Analyzers see the corresponding **Training Presentations**.

Learn more on VideoQ site: www.videoq.com

Contact VideoQ team: support@videoq.com

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 – Additional Color Bars Info

This section provides additional information for the advanced users and system architects.

Learn more about the role of Color Bars test patterns in the long history of TV broadcast industry, the related color space issues, format conversion issues, and international standards.

VideoQ 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.

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.

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!*

Historical Background

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.

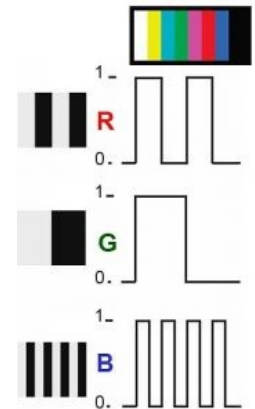
The standard color bar sequence is White, Yellow, Cyan, Green, Magenta, Red, Blue, Black.

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 \hat{U} YUV conversion in ubiquitous **HD** format relies on significantly different **BT.709 Matrices**.

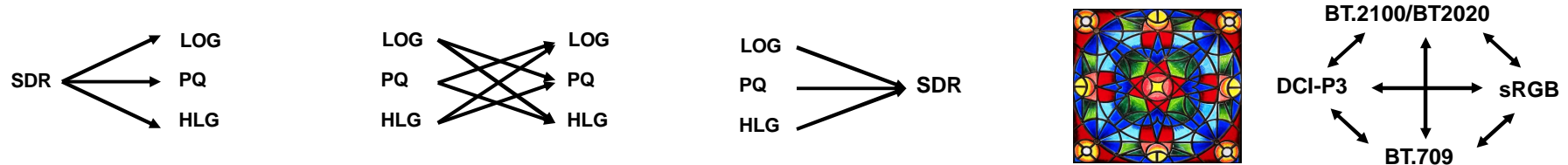
Since the introduction of **BT.601** standard YUV data are generated in **Narrow Range** format (abbreviated as **NR**). Main advantage of the NR format is the availability of extra levels below **Reference Black** and above **Reference White**.

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 \hat{U} 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



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**.

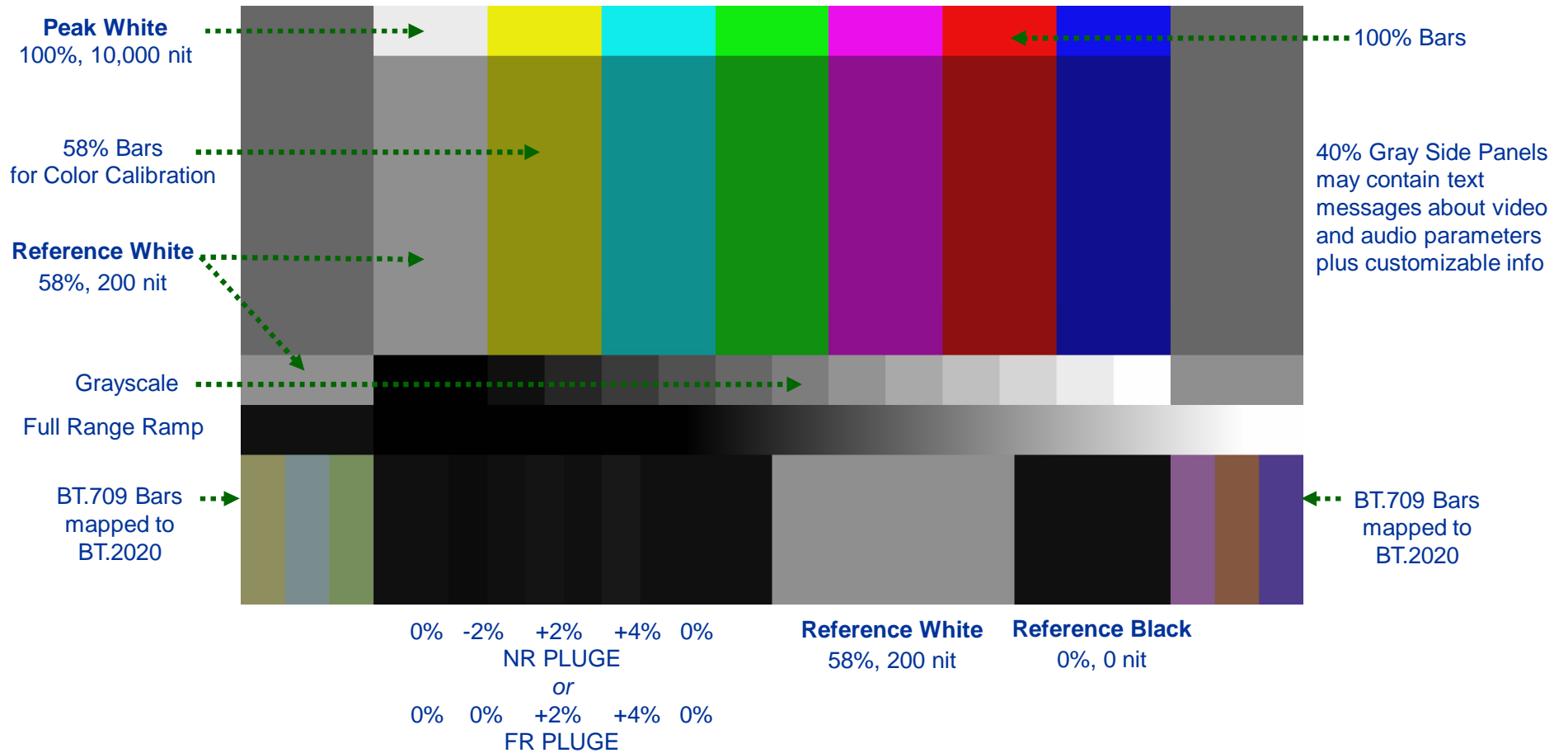
This means that currently there is no *officially recommended* Color Bars Test Patterns matching BT.2111 and suitable for widely used **Standard Dynamic Range** workflows in mixed RGB/YUV, UHD/HD and WCG formats.

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.

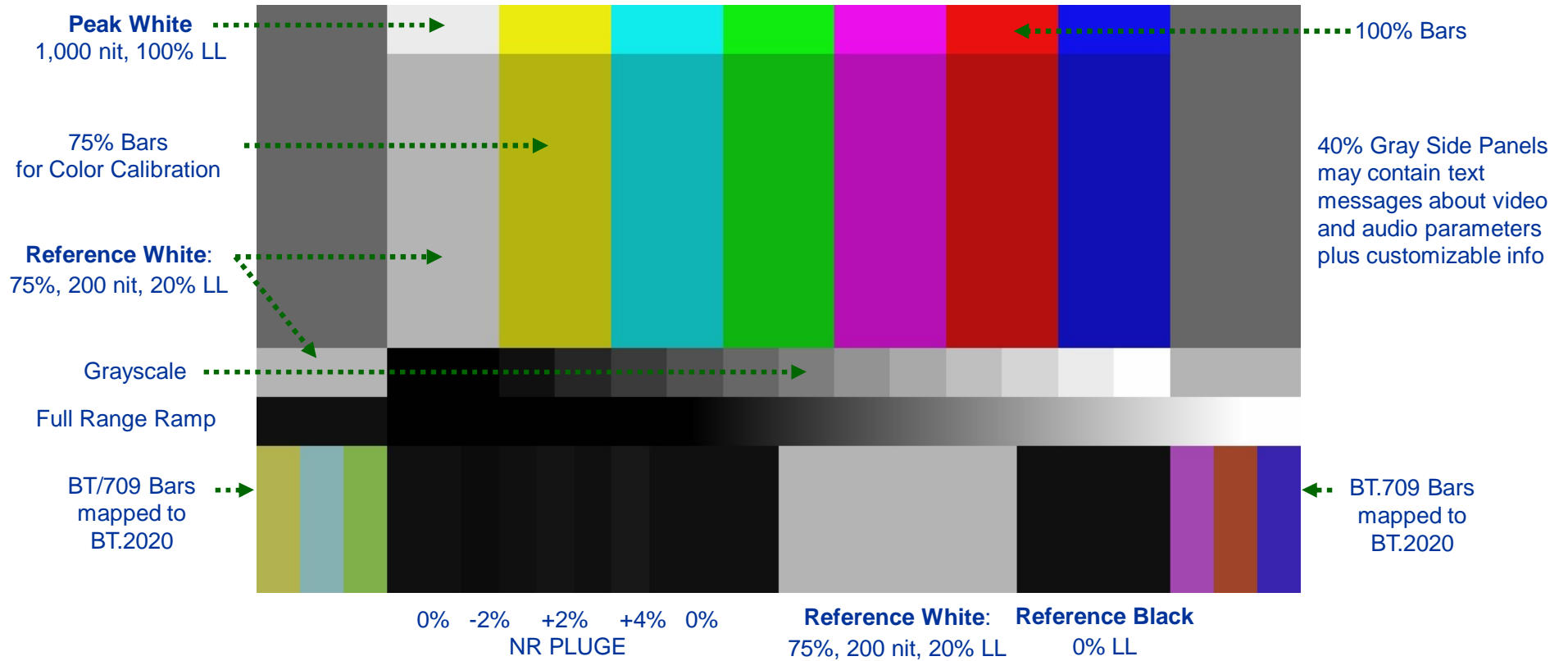
NB: By some obscure reasons the BT.709 color space was labeled by marketing people as “Narrow Color Gamut”.

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.

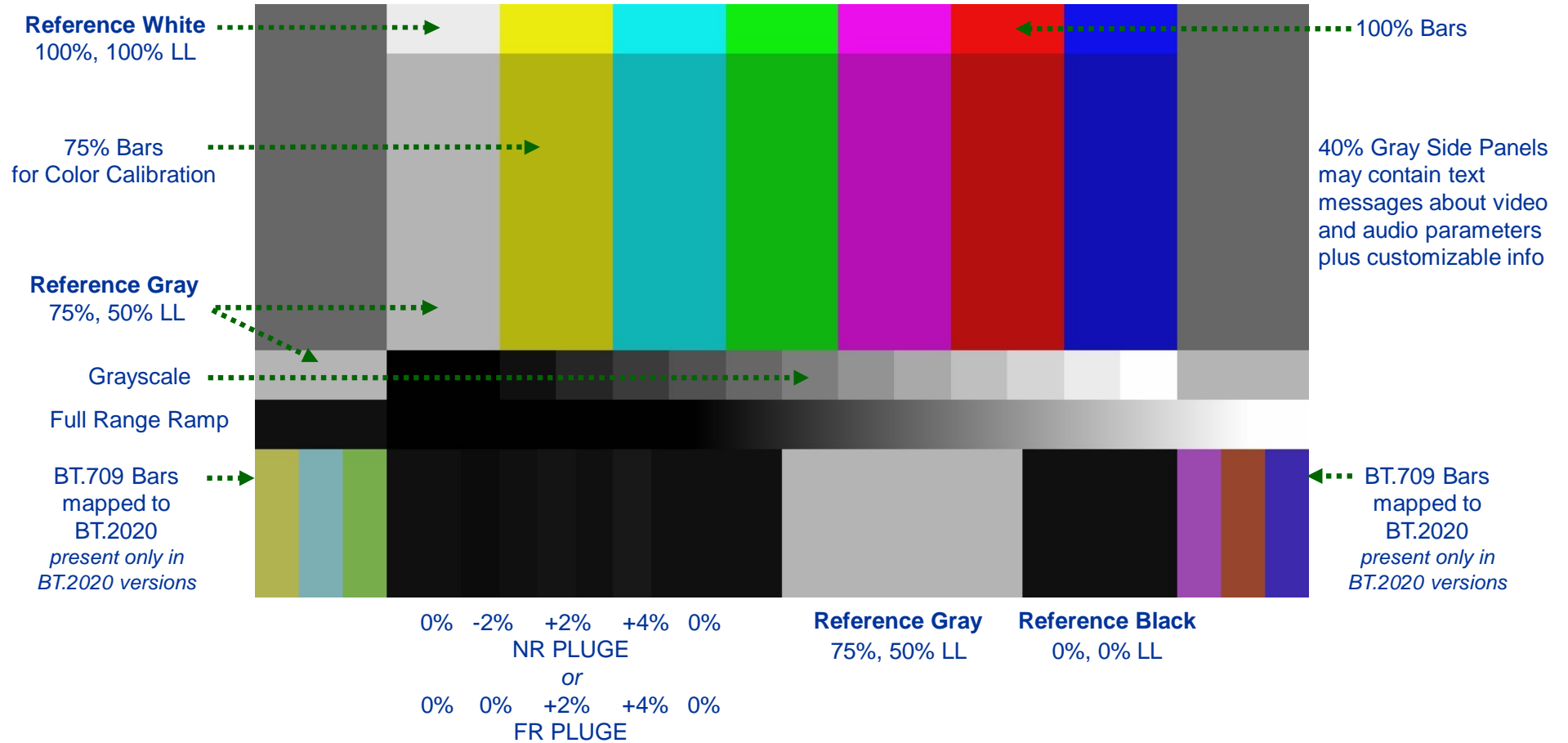
VQCB HDR-PQ Test Composition



VQCB HDR-HLG Test Composition



VQCB SDR Test Composition



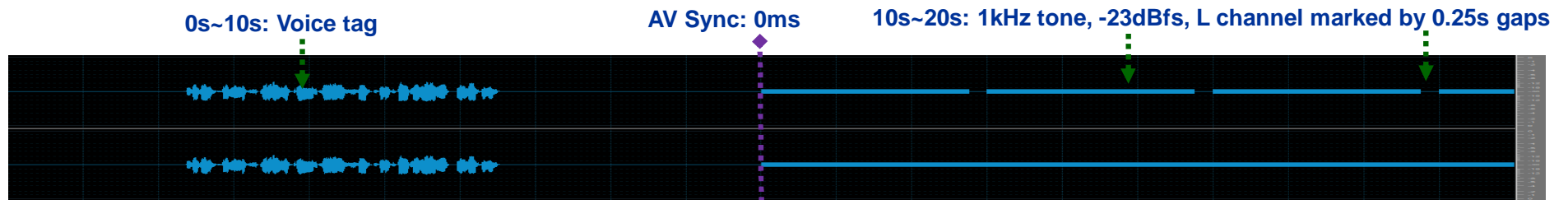
VQCB Media File Timeline Segments

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 text box with the following content:

- Count-down in seconds:** 20
- Test Pattern Codename and Format Details:**
 - TEST
VQCB1_HD_PQ
 - VIDEO
1920x1080, HDR-PQ, 23.976 fps
 - MOV, PNG, RGB 16b NR
 - AUDIO
PCM, 2 channels, 48 kHz, 24 bit
 - PACKAGE
VQCB1
- QR Code:** A QR code located in the top right corner.
- Sliding Frames Continuity Test:** A blue dashed arrow pointing to a small square labeled "Frame: 0000".
- Frames Counter:** A green dashed arrow pointing to a small square labeled "Frame: 0000".
- Full Bandwidth Zone Plate Test:** A green dashed arrow pointing to a circular zone plate pattern on the bottom left.
- Half Bandwidth Zone Plate Test:** A green dashed arrow pointing to a circular zone plate pattern on the bottom right.
- VideoQ Logo:** A logo with a green checkmark and the text "videoQ" is located in the bottom right corner.

VQCB Suite Video Formats

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	¹⁾
YUV Narrow Range BT.709								²⁾	a

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

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

Special frame sizes, e.g. 960x540, are available on request

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 Suite Custom File Formats

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

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