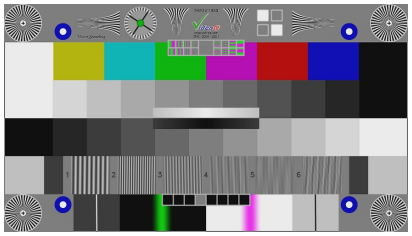

VQMA

Video Analyzer and Scope

Training Presentation

December 2024

www.videoq.com/vqma.html

www.videoq.com

About VideoQ

Customers & Partners

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

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Only in Slide Show Mode:
*Click on **TOC symbol***
in the upper-left corner
of any slide for this
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Features Summary 1

- 4th generation of VideoQ best-selling software product, suitable for any video format, any frame rate, any frame size from 192x108 to:
  - 1920x1080 (**HD** versions)
  - 4096x3072 (**4K** versions)
  - 7680x4320 (**8K** versions)
- Software executable under Windows™ (XP, 7, 8, 10, 11)
- USB dongle copy-protected, dongle-per-workstation
- Automated analysis on the companion **VQMA Matrix Test Pattern**
- Variety of VQMA Test Pattern formats: **Optical Chart**, **File**, **Signal**, **Stream**
- Unique patented algorithms for accurate & fast measurements (typically 2-5 seconds)
- Built-in YUV/RGB Waveform Scope
- Noise Measurement and Waveform Scope work on any static image
- Windows **GUI** Mode for R&D and product verification
- **C**ommand **L**ine **I**nterface (**CLI**) Mode for automated QA/QC operation

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Features Summary 2

- Video Analyzer for **objective** Video Processing Chain **Integrity** & **Performance** Validation
- Easy-to-use tool, instantly revealing performance of your **hardware** and/or **software workflow** as well as individual video **devices**: transcoders, encoders, scalers, media players, STBs, video cameras, etc.
- Two user-selectable **reporting modes**:

  a) machine-readable file with Pass/Fail marks,

  b) detailed multi-page on-screen document, printable to PDF
- VQMA opens **Matrix Test Pattern** in a variety of compressed and uncompressed video file formats:
  - Video Files: YUV, Y4M, AVI, MOV, MXF, MP4, MKV, WEBM.
  - Image Files: BMP, JPG, JPEG, JP2, JP2K, PNG, TIF, TIFF.
- With the VideoQ **VQMA-C Optical Reflectance Chart** it measures video **cameras**
- Combined with the appropriate **capture device**, e.g. Unigraf, BMD or AJA, VQMA measures the quality of SDI, DVI/HDMI, DisplayPort or LVDS video **signals**

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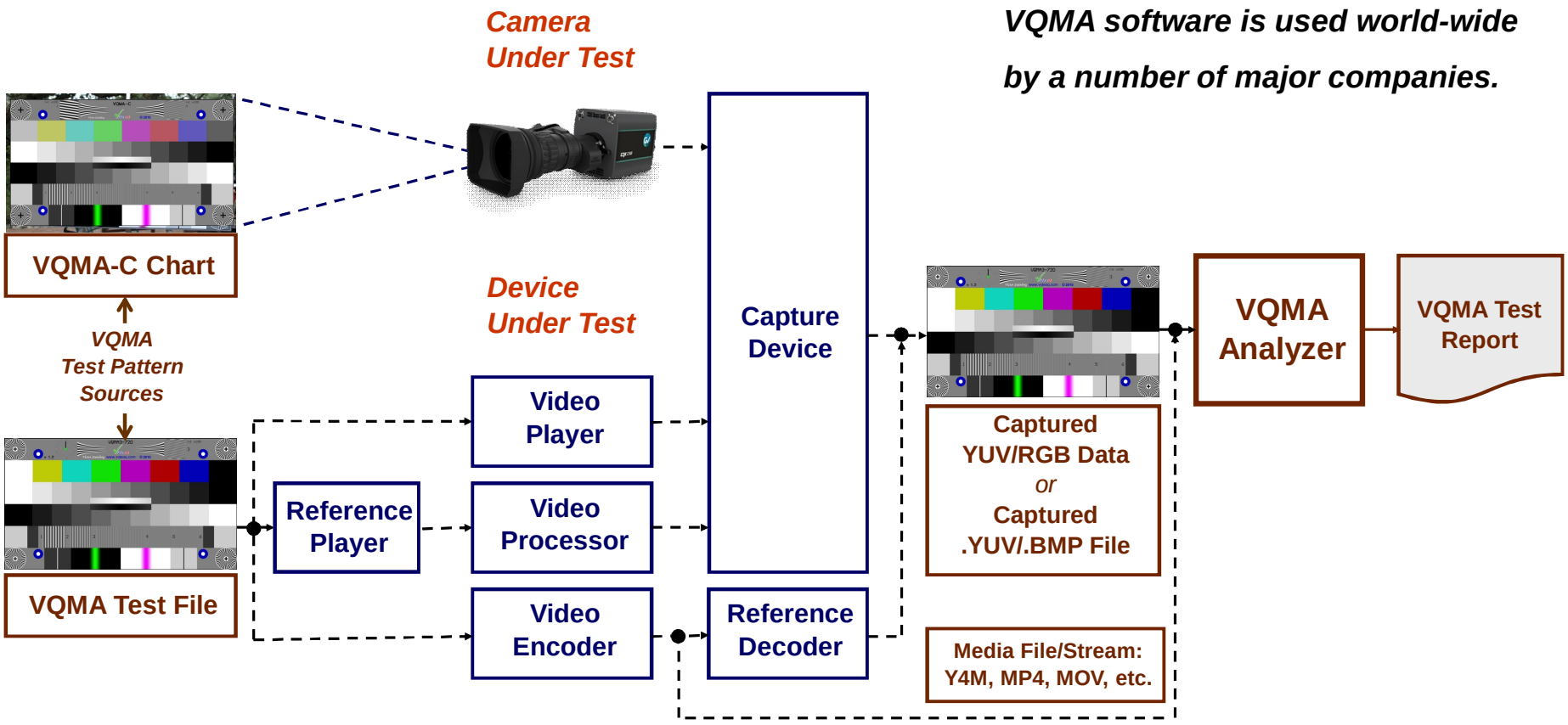
Workflow Variants



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VQMA Test Pattern Variants

- VQMA test pattern exists in a variety of formats: File, Signal, Stream, VQMA-C Optical Chart.
  Some test components are different or not present on VQMA-C Optical Chart
- VideoQ methodology allows triple usage: visual, instrumental and fully automated
- VQMA test pattern contains specially designed components making video calibration an easy and straight forward procedure
- The test pattern components are designed to be compatible with a majority of video cameras, software or hardware codecs and media players
- VQMA test pattern contains 6 relatively large bands, so it remains suitable for accurate measurements even after low bitrate coding and severe position and/or scaling errors; zoom-out down to 25% of original size, overscan up to 105%, optical chart tilt, flickering or non-uniform illumination are acceptable

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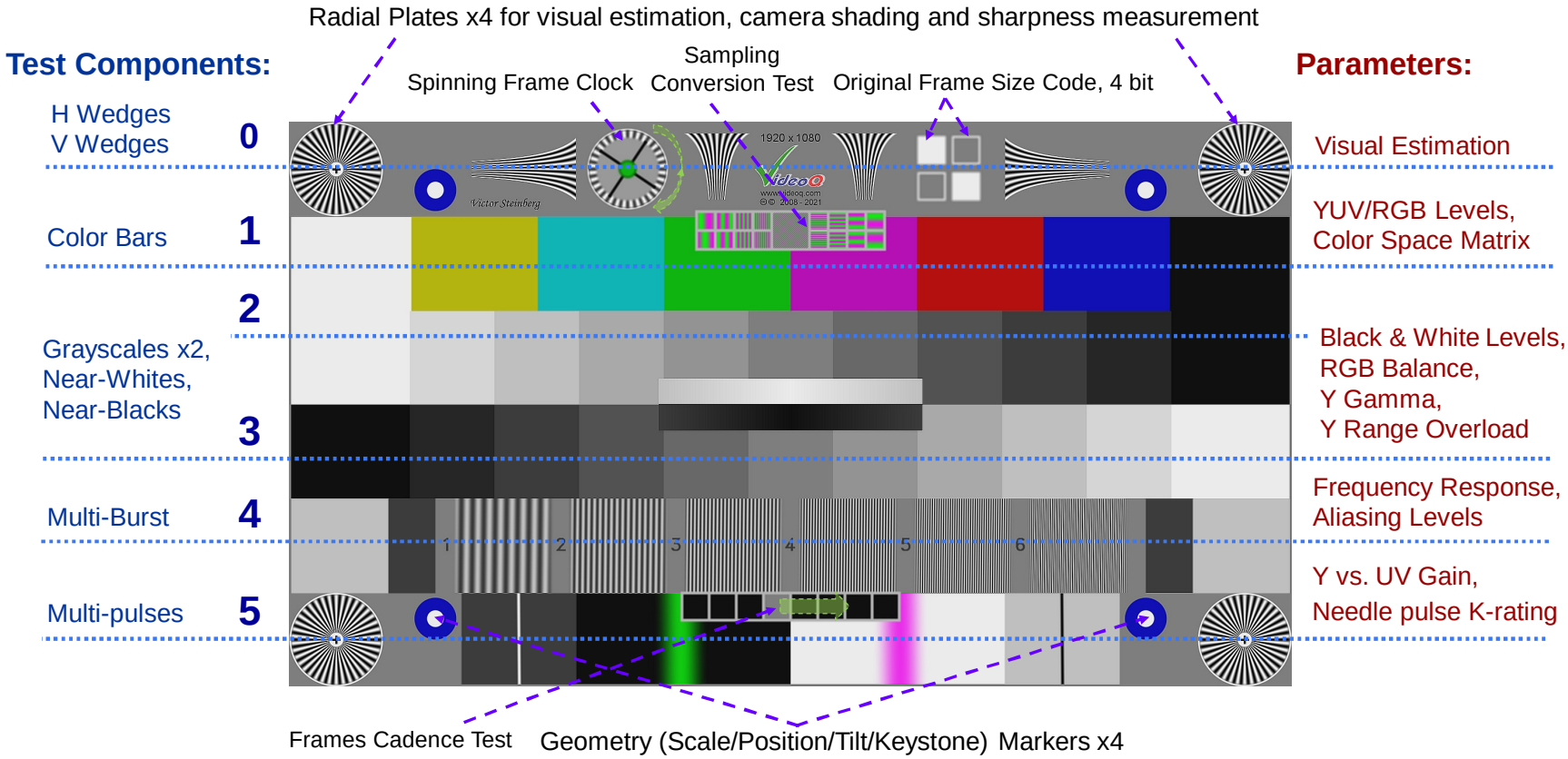
VQMA Test Pattern Composition

All-In-One: Single pattern allows automatic measurement of multiple video image parameters



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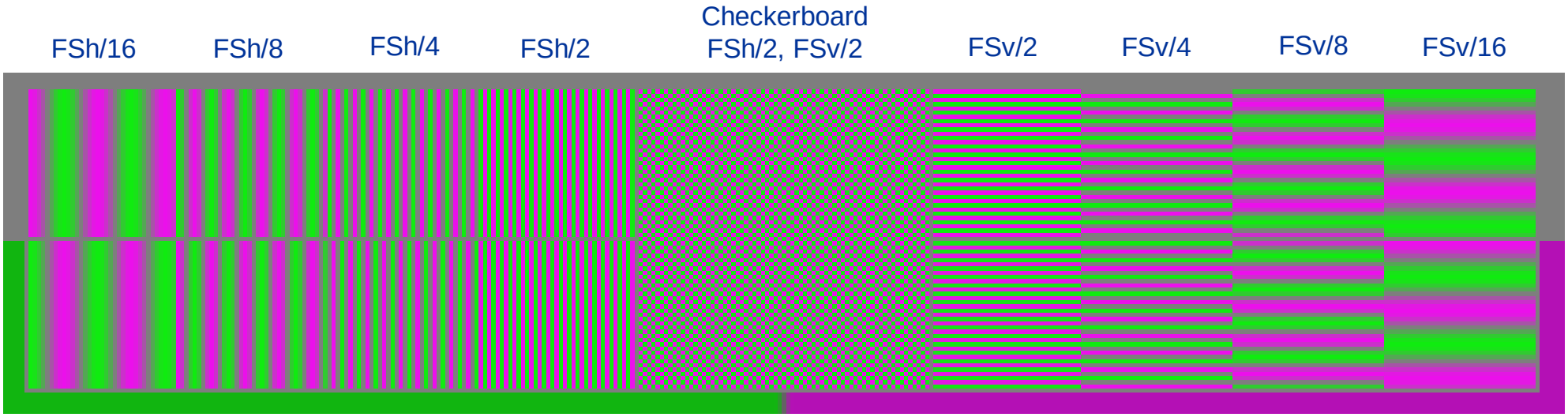
Sampling Conversion Test Details

FSh: Original Horizontal Sampling Rate, FSh value in tvl is equal to the original Frame Width, pixels
FSv: Original Vertical Sampling Rate, FSv value in tvl is equal to the original Frame Height, pixels



4:2:2 and 4:1:1 (UV H sub-sampling) Detection Area

H & V Scaling Detector
shows any conversion
vs. pristine 4:4:4 YUV/RGB

4:2:0 (UV V sub-sampling) Detection Area

Note: *Sampling Conversion Test is not present on VQMA-C Optical Test Chart*

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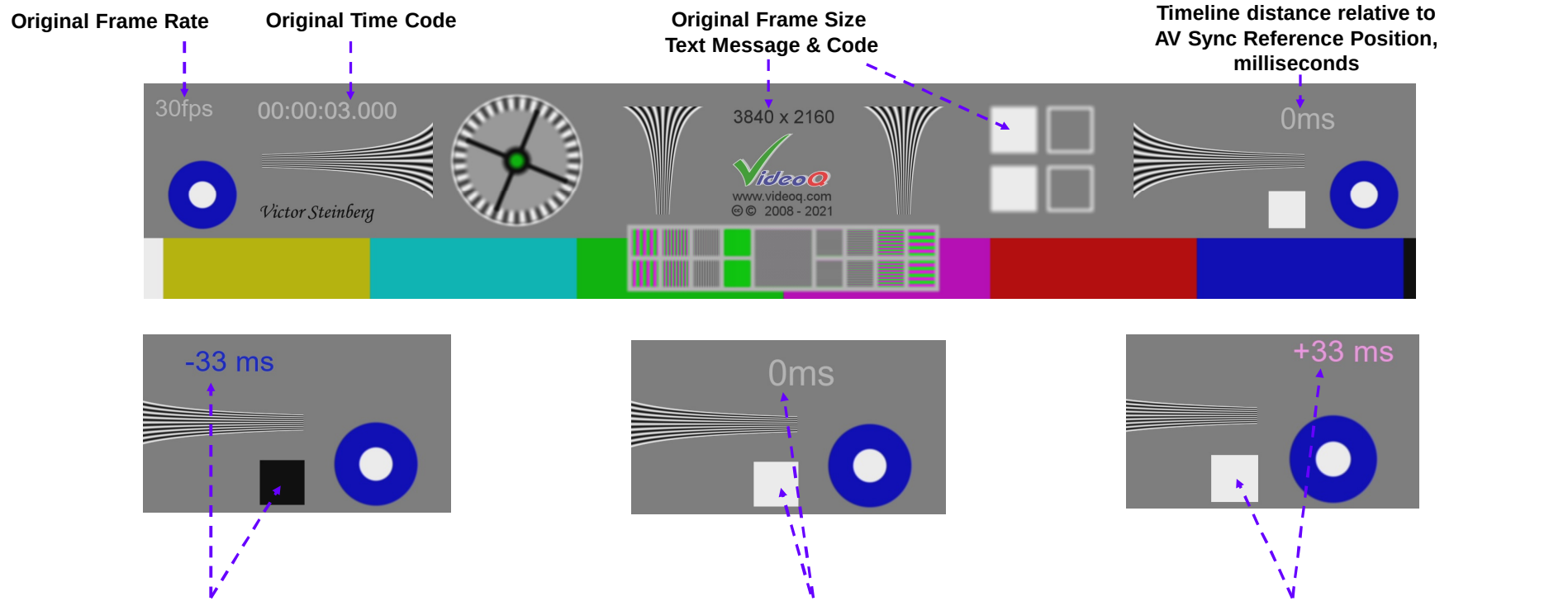
Variant with AV Sync & Dynamic Text



*Next slide shows details of Audio Reference Signal – **Beep-Bop** burst*

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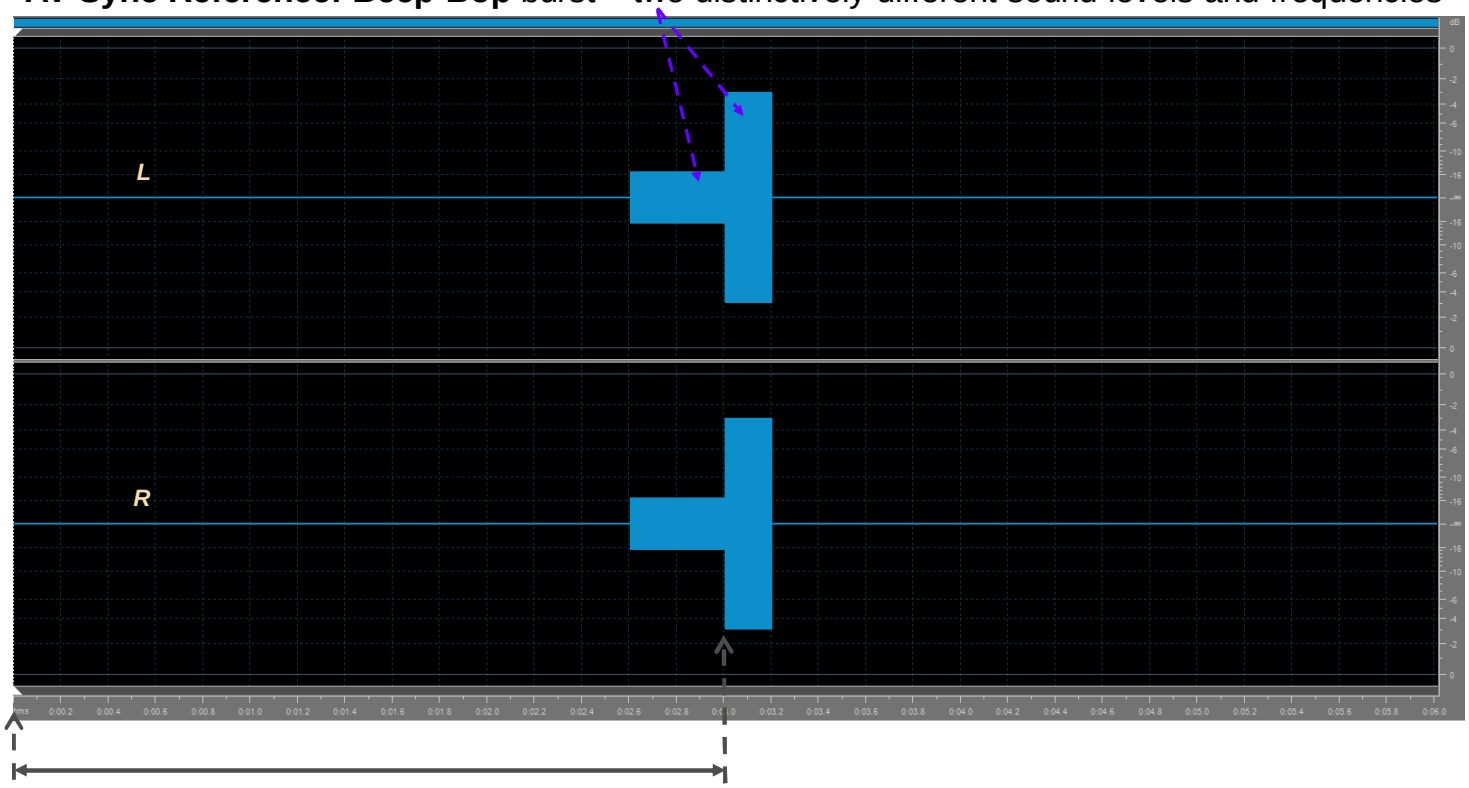
AV Sync Test Audio Component

*Loop duration: **6,000 ms** (**6,006 ms** for 23.976, 29.97 and 59.94 fps)*

AV Sync Reference: Beep-Bop burst – two distinctively different sound levels and frequencies



*AV Sync Reference Position = **3000 ms** (**3003 ms** for 23.976, 29.97 and 59.94 fps)*

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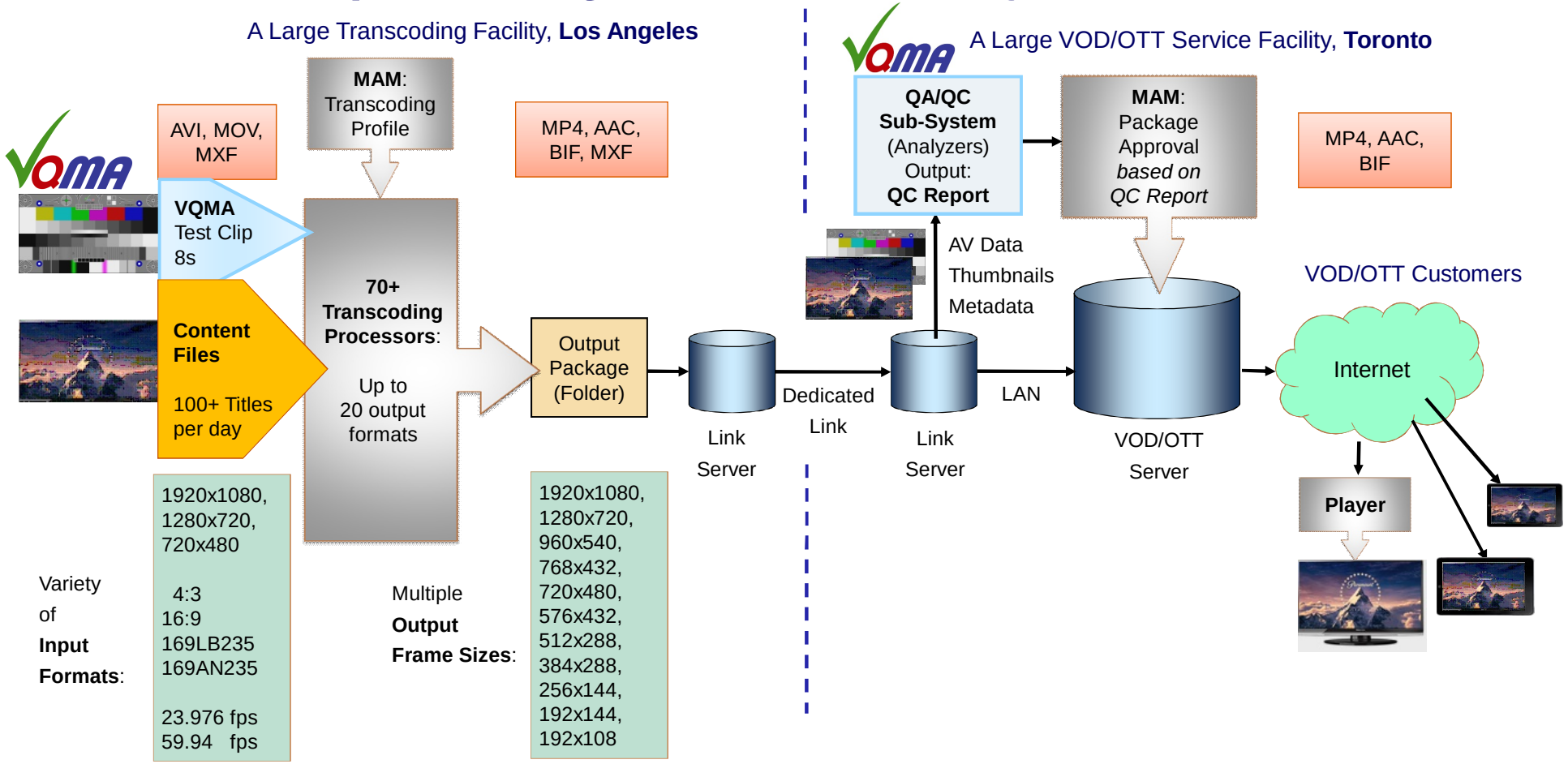
Example of Large Scale QA/QC System Workflow



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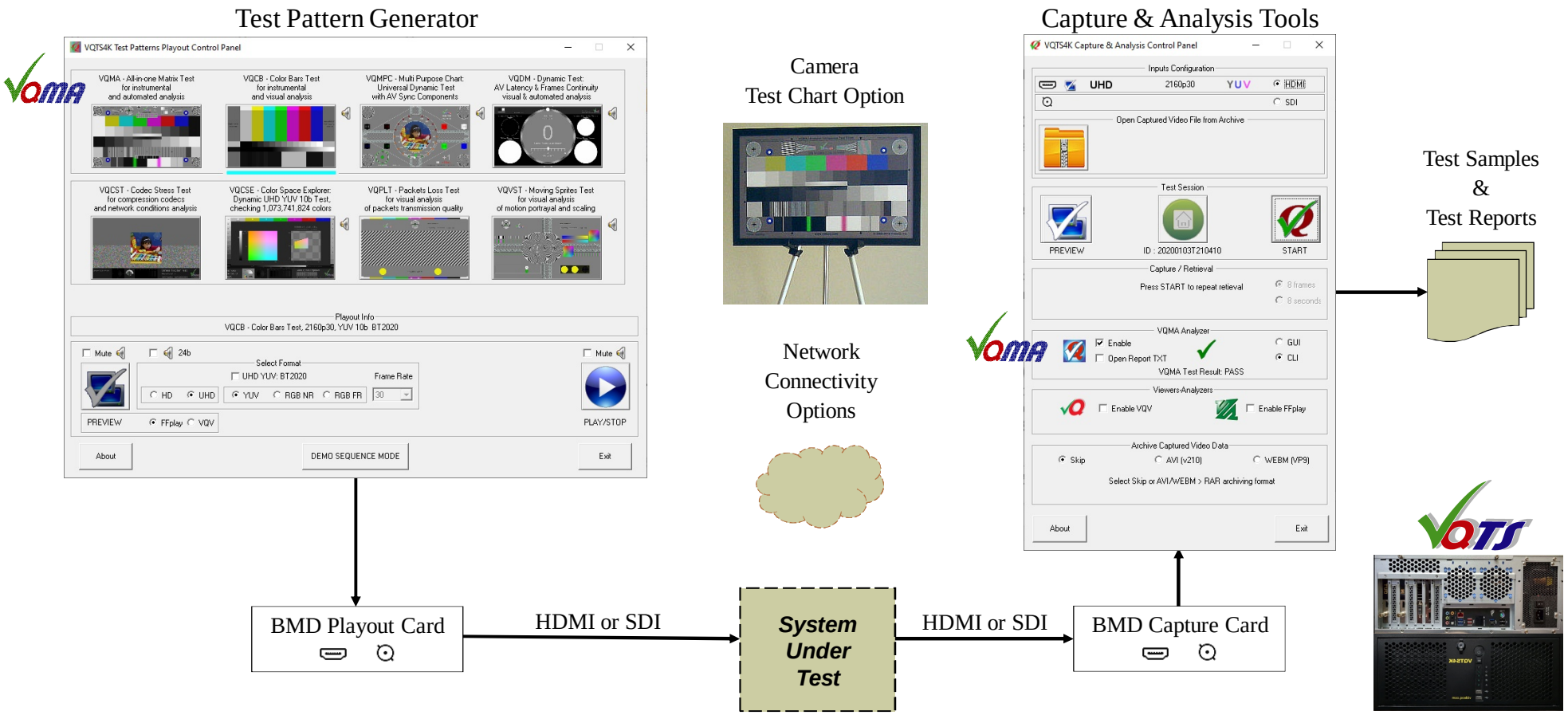
Example of VQMA Integration within VQTS4K Test System



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Analyzed Parameters

PASS

FAIL

- **Geometry**: Scaling, Aspect Ratio, Position, Tilt, Keystone
- **Levels**: Black, White, Color Bars, RGB Balance, Gamma
- **H & V Shading** (Levels Spatial Uniformity)
- **Frequency Response**: in dB vs. scalable tvl, including aliasing levels
- **UV vs. Y Gain** (Color Saturation)
- **K-rating** on needle pulse
- Comprehensive **Noise Analysis**
- Optionally: **Frames Cadence** Check and **AV Sync Error** Check

VQMA checks video data against the **target tolerance values** contained within **customizable configuration file** – ***no reference video data required***.

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VQMA Noise Analyzer Features

- Y SNR: unfiltered, band-limited and weighted
- UV, R, G, B and "Dark B" SNR values
- Y Noise Spectral Density plots in dB vs. relative frequency (F/Flimit, %)
- Noise Image, +24dB boost for better visibility
- Y, R, G, B Noise Histograms Display
- Reference true Gaussian noise curve overlay
- 0.1 dB accurate SNR measurement
- SNR Read-out match industry standard tools
- Noise measurement on just 8 frames of video

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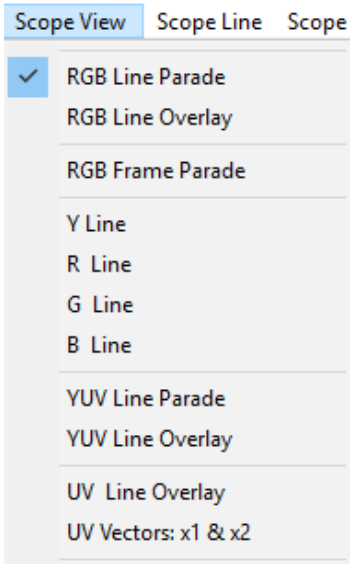
Waveform Scope Features

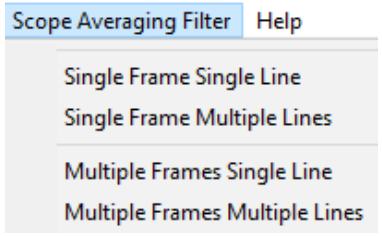
- **Components Selection:**
  Y, R ,G, B; UV, YUV or RGB combinations
- **Cursor**:
  Selected/Current Line Position Highlight
- **Smart Graticules**:
  YUV/RGB, in % and 8 bit levels
- **Smart Read-out**:
  YUV & RGB in 8b and in %
- **Smart Analytics**:
  Min, Max, Mean for ROI
- **Smart Display**:
  Shows relevant data only
- **Smart Navigation**:
  Persistent display mode



UV Vectors Display:

- UV Gain x1 for Signal Processors

- UV Gain x2 for Cameras (Optical Chart)



Averaging Filter Controls:

- No filtering, labeled "Single Frame Single Line"
- Spatial filtering only, labeled "Single Frame Multiple Lines"
- Temporal filtering only, labeled "Multiple Frames Single Line"
- Spatial and Temporal filtering , labeled "Multiple Frames Multiple Lines"

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VQMA Reference Files AV Formats

Set of test pattern video files (optional extras: audio files):

- Raw formats:

  .RGB, interleaved 4:4:4 16, 12, 10, 8 bit, Full Range or Narrow Range

  .YUV, planar YUV 4:4:4 16, 12, 10, 8 bit or interleaved UYVY 4:2:2 8 bit, BT601, BT709 and BT2020 color matrices

  .WAV: 2.0 LR or 5.1 surround sound, 48 kHz, 24 bit.

- Encoded formats:

  .AVI, 4:2:2, 10 bpc, YUV v210 or RGB r210 uncompressed video data, PCM 24b or 16b audio data

  .MP4, 4:2:0, 8 bpc, AVC, AC3, fixed GOP size = 1s, medium to high bitrate

  .MOV, 4:4:4, 16 bpc, lossless rgb48 PNG codec

- 6 frame sizes, various frame rates:

  7680x4320p (UHD 8K 16:9), 23.976, 24.0, 25.0, 29.97, 30.0, 50.0, 59.94, and 60.0 fps

  3840x2160p (UHD 4K 16:9), 23.976, 24.0, 25.0, 29.97, 30.0, 50.0, 59.94, and 60.0 fps

  1920x1080p (HD 16:9), 23.976, 24.0, 25.0, 29.97, 30.0, 50.0, 59.94, and 60.0 fps

  1280x720p (SubHD 16:9), 50, 59.94 and 60.0 fps

  720x576p (SD 4:3), 25, 50 fps

  720x480p (SD 4:3), 23.976, 24.0, 29.97, 30.0, 59.94, and 60.0 fps

  Other frame sizes and frame rates are available on request

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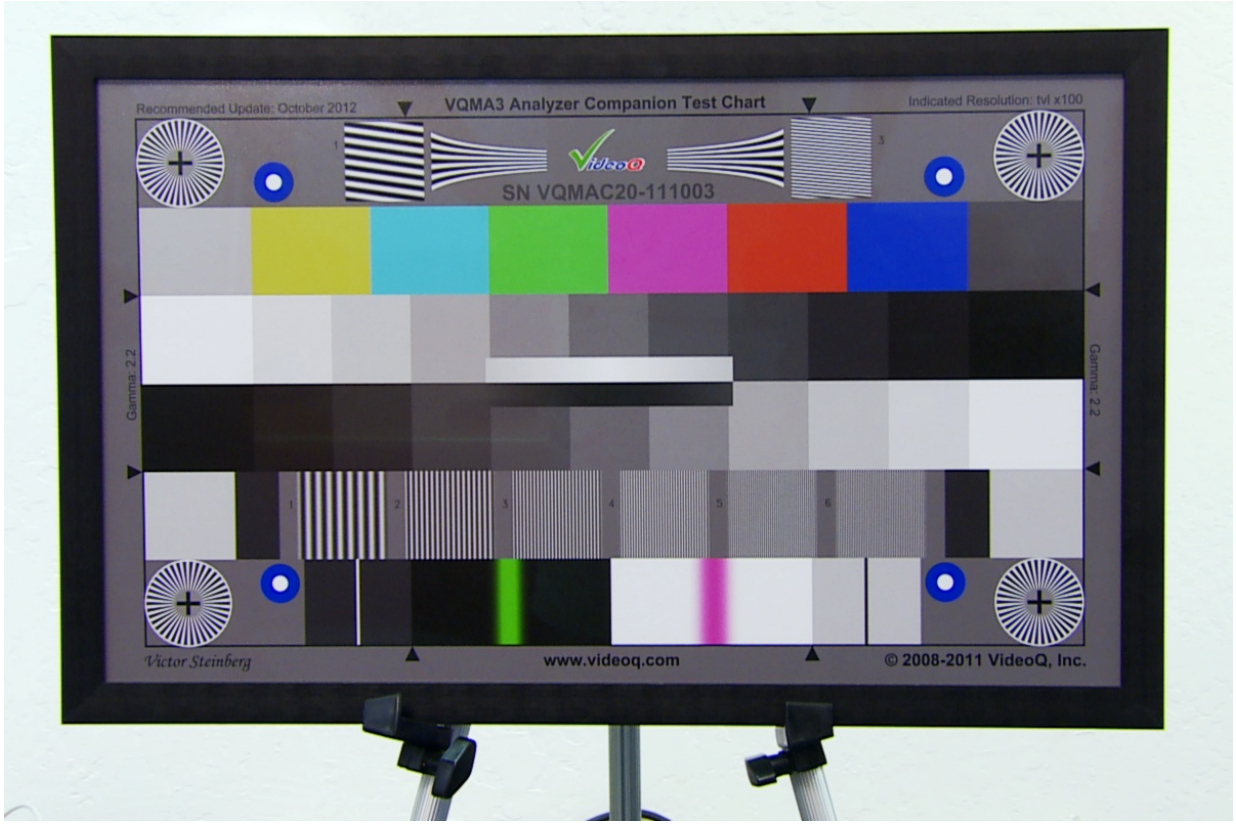
VQMA-C Optical Chart

- Precise color bars XYZ and grayscale densities
- Robust metal frame
- Abrasion-resistant low-glare glass
- Adjustable tilt to minimize reflections

VQMAC20: 20” diagonal size variant



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Appendix A: GUI Mode Menus and Examples

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

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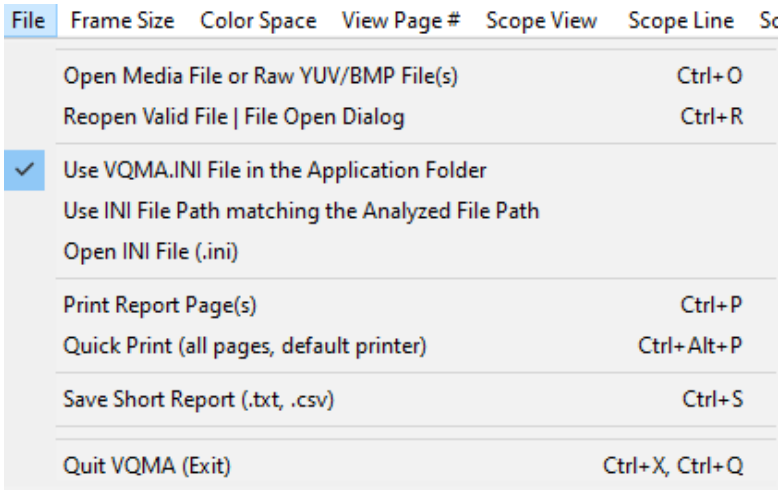
File Menu



VQMA locks the analyzed file only for very short time needed to read video data from hard drive.

Then the file can be modified by the user, while VQMA presents/print/save Test Report Pages.

Reopening the file also updates all target values read from customizable .INI file. This feature can be very useful to check the ***same test file*** *against* ***different sets of target values.***

Open File invokes standard "File Open" dialog box.

Reopen is useful for recurrent test sessions, allowing update as desired.

The .INI file location depends on three mutually exclusive menu items:

- Use VQMA.INI File in the Application Folder (*default: fixed VQMA.INI file name*).

- Use INI File Path matching the Analyzed File Path, e.g. opening of ***c:/temp/current.yuv*** file automatically implies opening and use of ***c:/temp/current.ini*** file.

- Open INI File – browse for any *.INI file located in any local/network folder.

Print Report Page(s) – seven on-screen pages of VQMA test results can be printed separately or all pages together. **Quick Print** allows bypassing printer selection and page number dialog.

It is recommended to choose PDF printer as a default printer. Also it is recommended to save PDF file co-sited with the analyzed file.

Save Short Report – save report in .TXT or .CSV format. See next slides for the Short Report file structure.

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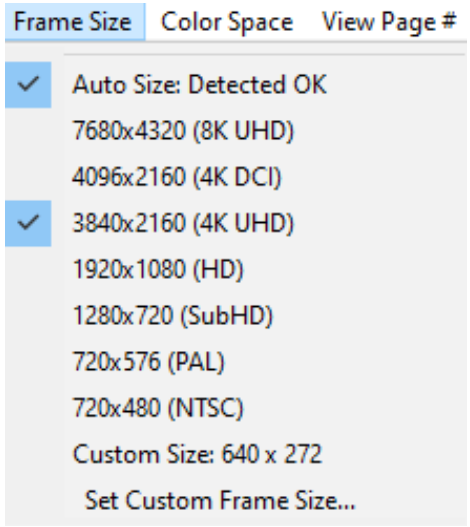
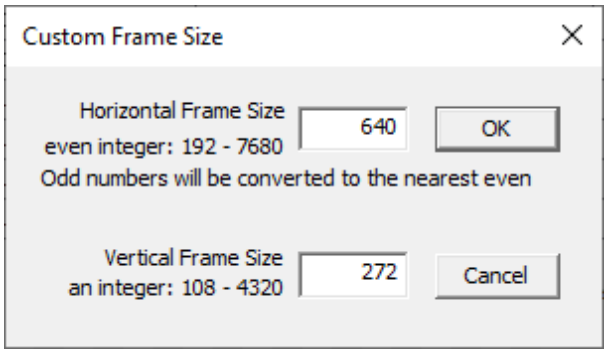
Frame Size Menu



This menu is used mainly for opening **RAW YUV files**. It allows selection of "Auto Size" mode (default) or particular Frame Size in Y pixels and choose either custom size or one of seven standard sizes from 720x480 to 7680x4320.

Selection of particular size disables Auto Size mode, which can be re-enabled by clicking on the corresponding menu item. Any change in this menu leads to input file reloading and new analysis cycle.

In case of compressed/wrapped file opening the "Auto Size" mode is enabled **automatically**, i.e. this menu serves only for indication of the auto-selected parameters.



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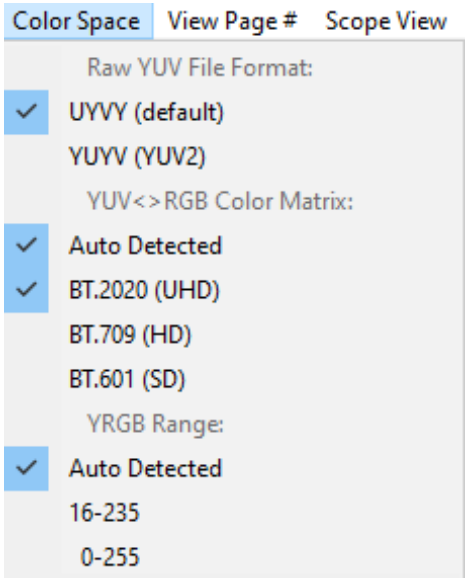
Color Space Menu



This menu is divided in 3 sections (sub-menus):

- **Raw YUV File Format** – user may select one of two alternative formats:
  - UYVY
  - YUV2
- **YUV<>RGB Color Matrix** – user may select "Auto" (recommended default) or one of 3 standard color matrices:
  - BT.2020 (UHD)
  - BT.709 (HD)
  - BT.601 (SD)
- **YRGB Range** – user may select “Auto” or one of 2 ranges:
  - 16-235 aka ‘Narrow Range‘
  - 0-255 aka 'Full Range‘

The Color Matrix and YURGB Range selections affects all analyzed file formats.

Note that these user selections will be checked or even replaced (with appropriate warning messages) by the analyzer engine.

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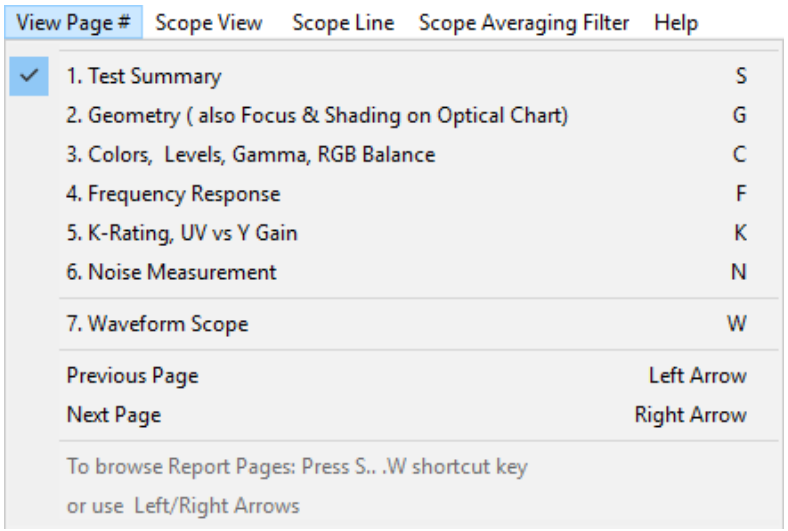
View Page Menu



This menu allows selection of Test Summary page or partial test result Pages described in the following sub-sections.

Default page selection is "Test Summary".

User may browse pages by:

· Clicking the corresponding menu item

· Pressing the shortcut letter key, e.g. "W" for Waveform Scope Page or "S" for Summary

· Quickly browse thru all 7 pages by pressing Left Arrow / Right Arrow.

This method is especially useful for "at glance" check of all parameters.

Choice of selected page is persistent, same page will be shown after analysis of any new file or reopening of the updated file.

It is possible to pre-select any desired page before opening YUV/BMP file, e.g. page # 7 "Waveform Scope". In this case, VQMA opens the selected file and then goes straight to the selected page display, skipping summary page.

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S: Example of VQMA Summary Page (GUI Mode)

VQMA Test Results

File Frame Size Color Space View Page # Scope View Scope Line Scope Averaging Filter Help

Frame Size: 7680 x 4320, Chart: 7680 x 4320

1. Test Summary

VQMA Test Result: PASSED

Parameter	Measurement	Unit	Target	Pass
Black Level	0.0, (16.0)	%, (8b D1)	-5.0 ~ +5.0	✓
White Level	100.0, (235.0)	%, (8b D1)	95.0 ~ 105.0	✓
Unfiltered Y SNR	100.0	dB	> 40.0	✓
K Rating on 2T Pulse	0.0	%	< 3.0	✓
UV vs. Y Gain	0.0	dB	-1.0 ~ +1.0	✓
Luminance Gamma	1.00		0.8 ~ 1.1	✓
RGB Balance Error	0.0	%	< 10.0	✓
Y Range Black Overload	0.0	%	< 15.0	✓
Y Range White Overload	0.0	%	< 15.0	✓
Frequency Response @F1 = 300 tvl	0.0	dB	-1.0 ~ +0.5	✓
Frequency Response @F2 = 600 tvl	0.0	dB	-2.0 ~ +1.0	✓
Frequency Response @F3 = 900 tvl	0.0	dB	-3.0 ~ +1.0	✓
Frequency Response @F4 = 1200 tvl	0.0	dB	-4.0 ~ +1.0	✓
Frequency Response @F5 = 1500 tvl	0.0	dB	-5.0 ~ +1.0	✓
Frequency Response @F6 = 1800 tvl	0.0	dB	-6.0 ~ +1.0	✓

C:_ Work\VQMA4_3_1_2\Release\VQMA.INI

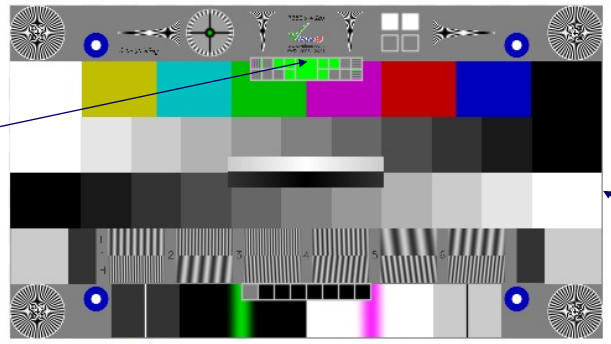
Automatically selected YRGB Nominal Range: 16-235

Automatically selected BT.2020 YUV<>RGB Matrix

Analyzed: 8 frames
VQMA Test Pattern detected
Original Frame Size: 7680 x 4320

Analyzed MOV File Metadata

Codec name:	png
Color space:	rgb48be
Frames count:	200
Frame rate:	25.000
Duration_s:	8.000
Duration_TC:	00:00:08.000



*T-shaped solid Green area of Thumbnail Image indicates original **unscaled** image*

Small Thumbnail Image produced by fast resizing (sampling frequency reduction)

VideoQ VQMA v4.3.1.2 - 2021 Apr 25 Sun 17:18:33

C:\- - Work\' - _VQMA_8K_4K_2K_plus\VQMA8KNR_PNG_rgb48_25fps_8s.MOV

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G: Geometry Page Example (Camera)

Frame Size: 1920 x 1080, Chart: 875 x 492 Frame Aspect Ratio: 1.778, Chart Aspect Ratio: 1.778

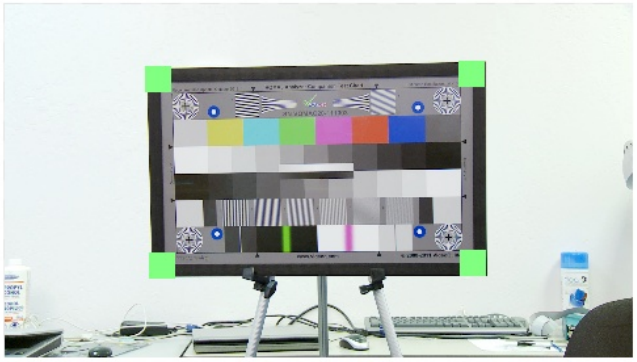
2. Geometry, Focus, Shading

Avrg. Corner Contrast:	83 %
Avrg. Corner Focus:	70 %
Test Chart Tilt:	-1.1 °

	Horizontal	Vertical
Chart to Frame Ratio:	46 %	46 %
Position Offset:	-0.5 %	-2.7 %
Keystone Distortions:	-2.4 %	1.0 %
Black Level Shading:	10.6 %	10.6 %
White Level Shading:	5.2 %	4.5 %

Test Conditions Validated

Contrast	89 %		66 %	Contrast
Focus	71 %		73 %	Focus
Contrast	89 %		87 %	Contrast
Focus	65 %		68 %	Focus



VQMA Chart Detected

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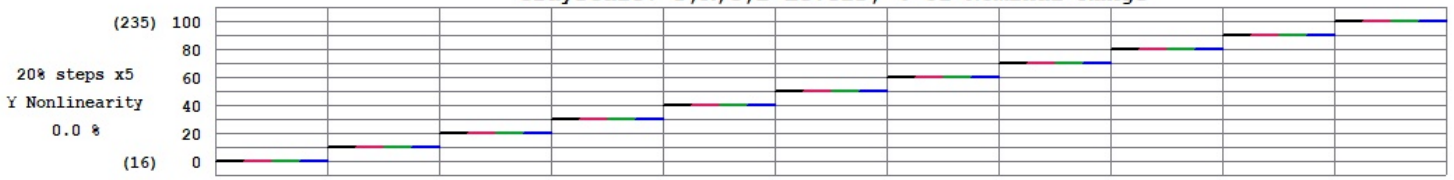
C: Colors and Levels Page Example (Reference File)

Frame Size: 7680 x 4320, Chart: 7680 x 4320 — Original Frame Size: 7680 x 4320
Nominal Y,R,G,B Range: 16-235

3. Levels, Gamma, RGB Balance

Black Level: +0.0 %, (16.0) — Y Transfer Function Gamma: 1.00 — White Level: 100.0 %, (235.0)
Black Crush (Y Range Overload): 0.0 % — White Crush (Y Range Overload): 0.0 %
RGB Black Balance Error: 0.0 % — RGB Dynamic Balance Error: 0.0 % — RGB White Balance Error: 0.0 %

Grayscale: Y,R,G,B Levels, % of Nominal Range



Max_Error 8 bit values: R-Y: 0, G-Y: 0, B-Y: 0, Y-Yref: 0

Y / Yref	diff	16 / 16	0	38 / 38	0	60 / 60	0	82 / 82	0	104 / 104	0	126 / 126	0	147 / 147	0	169 / 169	0	191 / 191	0	213 / 213	0	235 / 235	0

Color Bars: Y,U,V,R,G,B Levels, 8 bit values

		White	Yellow	Cyan	Green	Magenta	Red	Blue	Black	Max_Error
Derived Values	Y / Yref diff	235 / 235 0	170 / 170 0	137 / 137 0	127 / 127 0	69 / 69 0	59 / 59 0	26 / 26 0	16 / 16 0	0
	U / Uref diff	128 / 128 0	44 / 44 0	151 / 151 0	68 / 68 0	188 / 188 0	105 / 105 0	212 / 212 0	128 / 128 0	0
	V / Vref diff	128 / 128 0	135 / 135 0	44 / 44 0	51 / 51 0	205 / 205 0	212 / 212 0	121 / 121 0	128 / 128 0	0
Captured Data	R / Rref diff	235 / 235 0	180 / 180 0	16 / 16 0	16 / 16 0	180 / 180 0	180 / 180 0	16 / 16 0	16 / 16 0	0
	G / Gref diff	235 / 235 0	180 / 180 0	180 / 180 0	180 / 180 0	16 / 16 0	16 / 16 0	16 / 16 0	16 / 16 0	0
	B / Bref diff	235 / 235 0	16 / 16 0	180 / 180 0	16 / 16 0	180 / 180 0	16 / 16 0	180 / 180 0	16 / 16 0	0

Max RGB Error: 0

VQMA Test Pattern detected — Automatically selected BT.2020 YUV<>RGB Matrix

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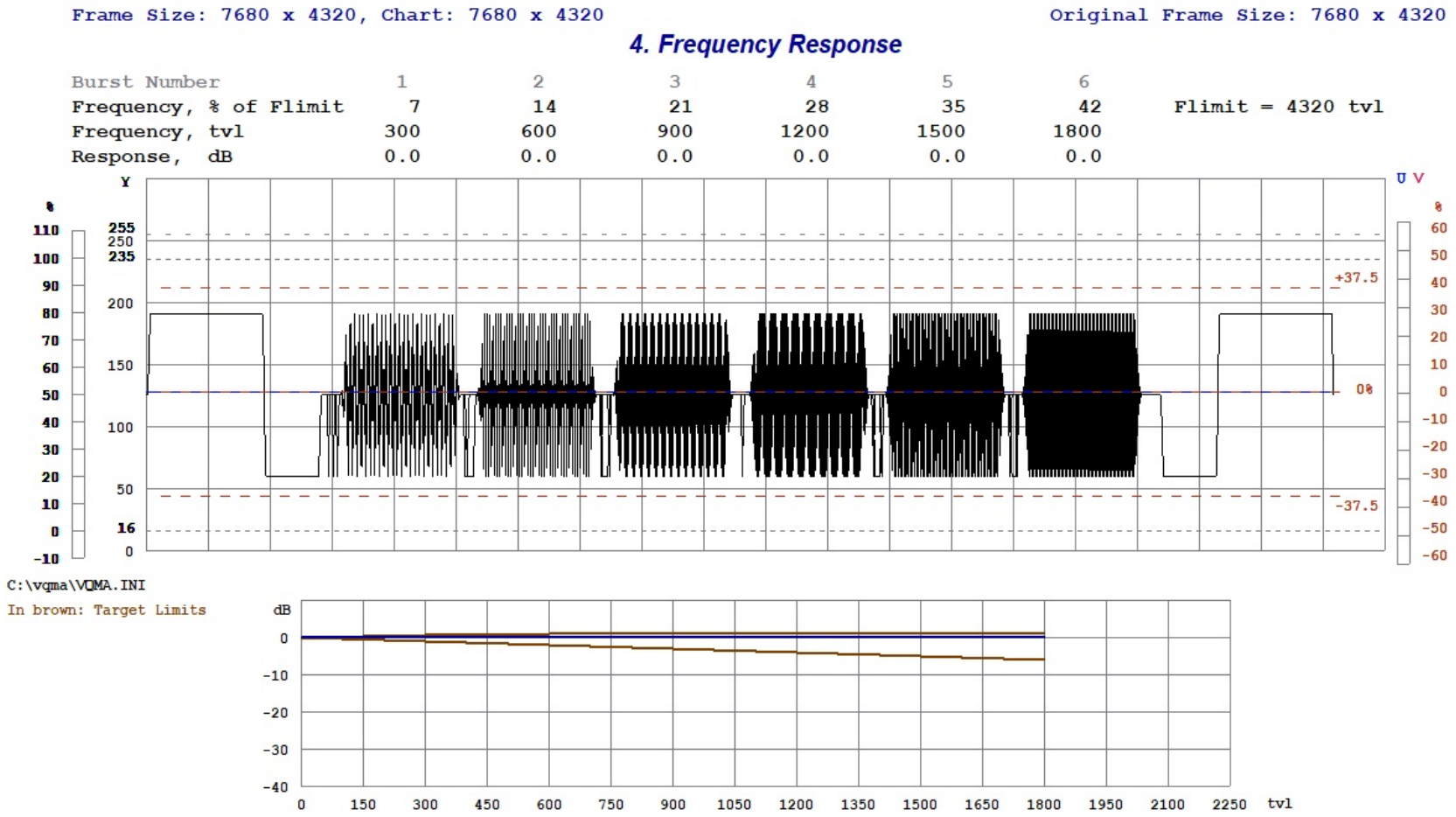
F: Frequency Response Page Example (Reference File)



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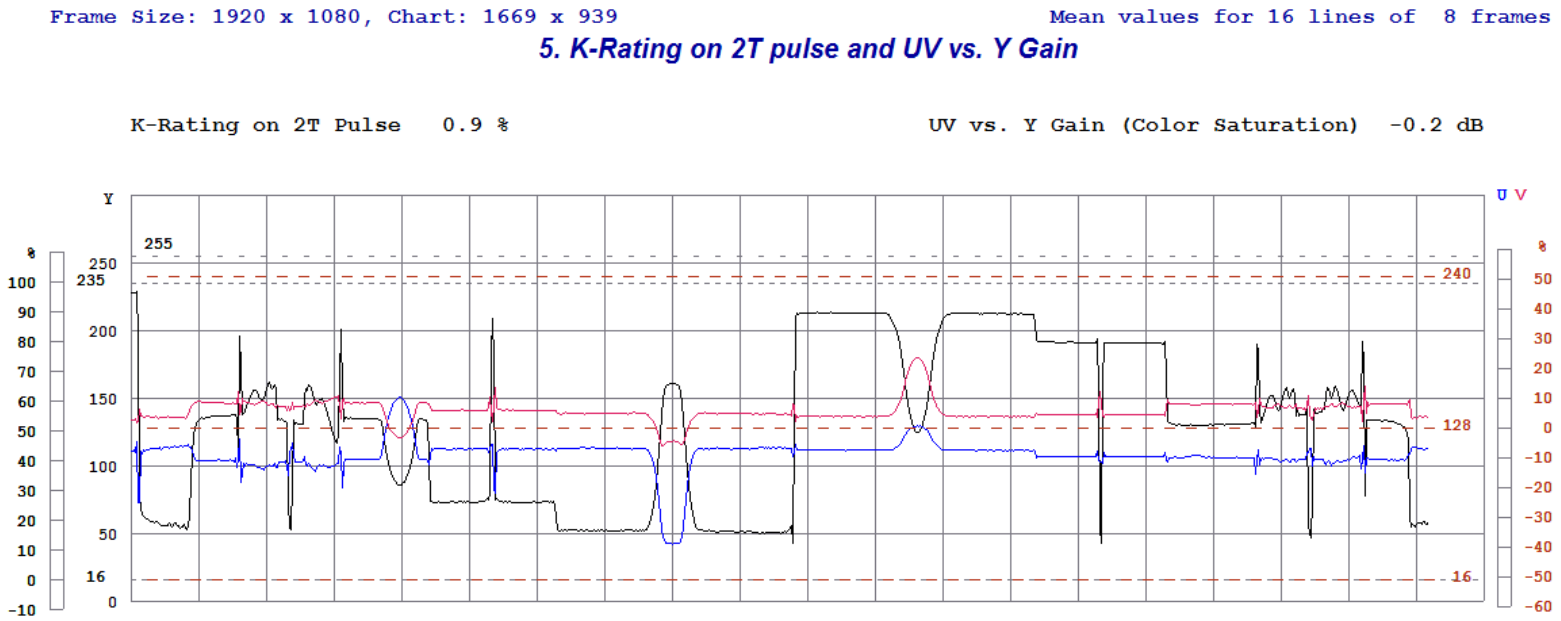
K: K-Rating and Color Saturation Page Example (Camera)



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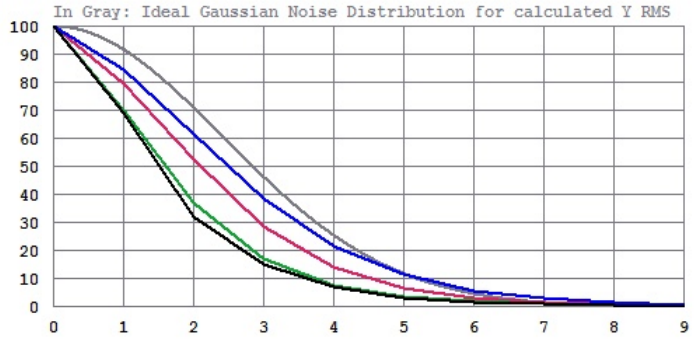
N: Noise Analyzer Page Example (Camera)

Frame Size: 1920 x 1080, Chart: 1900 x 1069
Nominal Y,R,G,B Range: 16-235

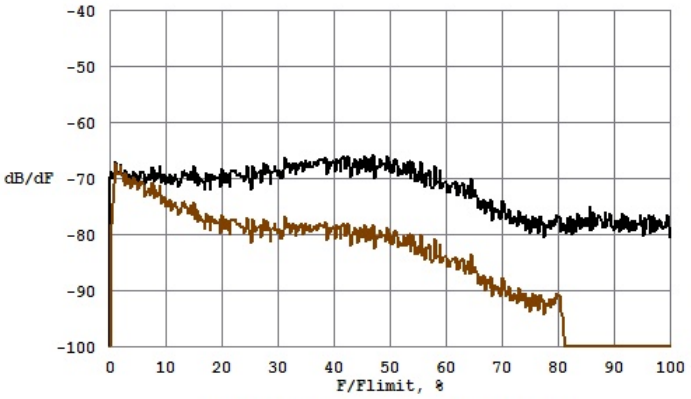
6. Noise Measurement

Noise values calculated from 8 frames

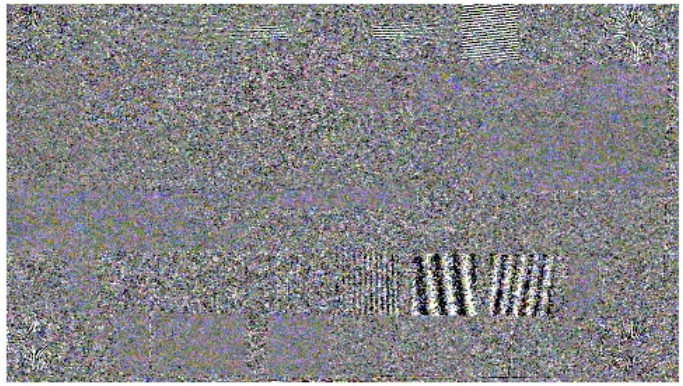
Y	RMS unfiltered	1.1 % (2.4 8bD1, 8 mV)
Y	SNR unfiltered	39.1 dB
Y	SNR bandlimited	39.3 dB
Y	SNR weighted	47.0 dB
UV	SNR bandlimited	48.1 dB
R	SNR unfiltered	36.8 dB
G	SNR unfiltered	37.7 dB
B	SNR unfiltered	35.8 dB
B	SNR on dark areas	37.9 dB



Normalized Probabilities of Y,R,G,B Noise Magnitudes (8 bit levels)



Y Noise Spectrum (weighted - in brown)



Noise Image (contrast boosted +24 dB)

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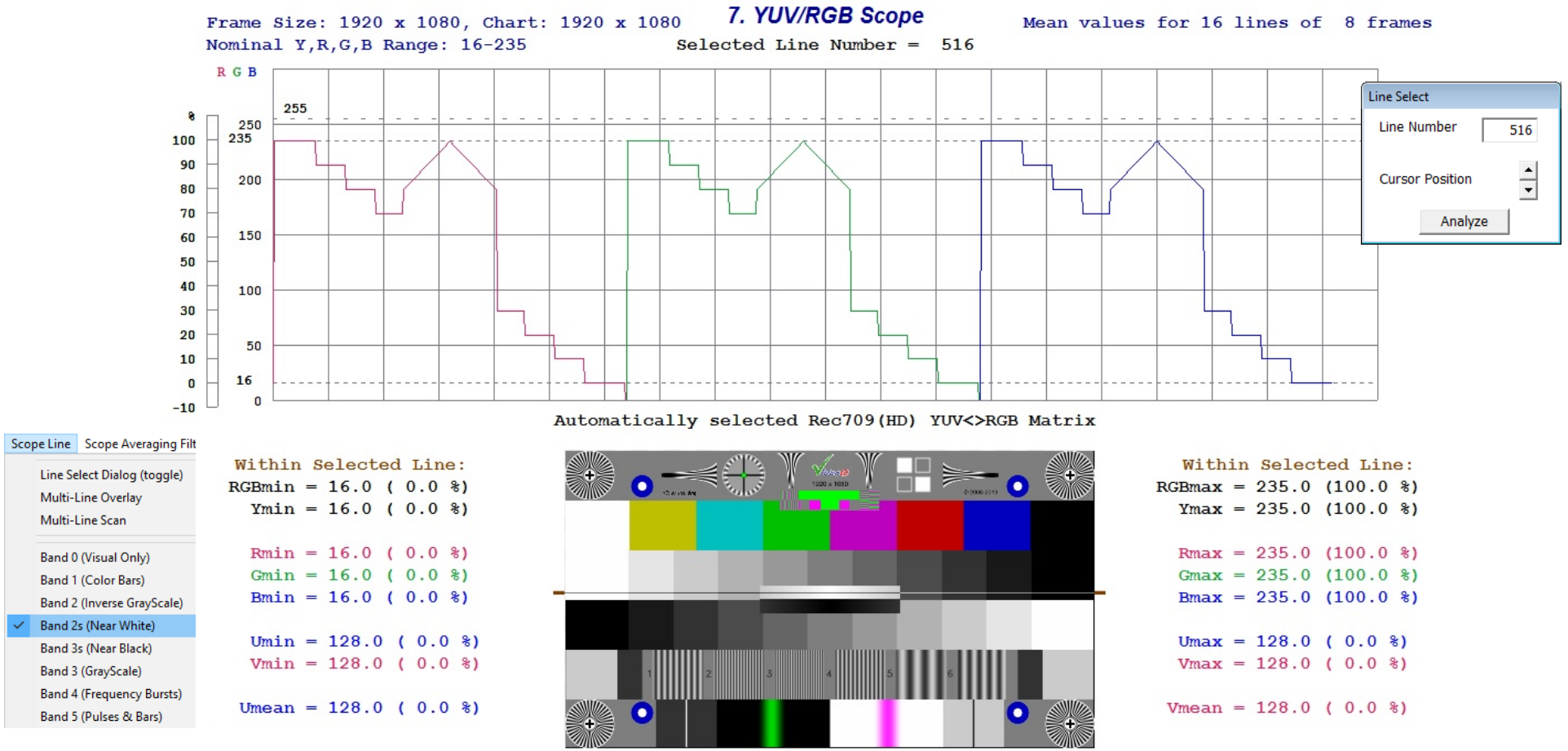
W: Waveform Scope Page Example (Reference File)



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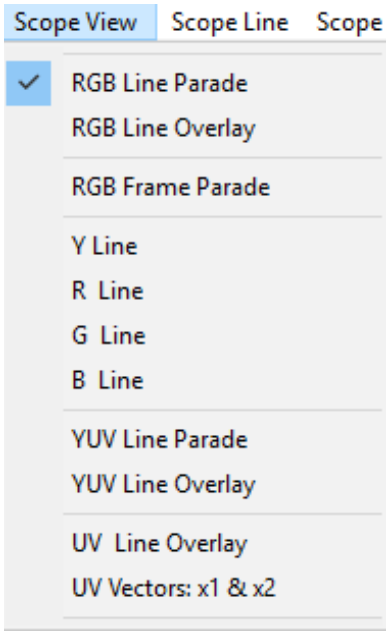
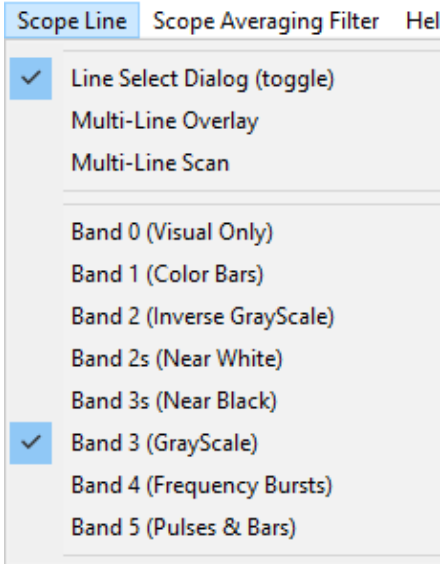
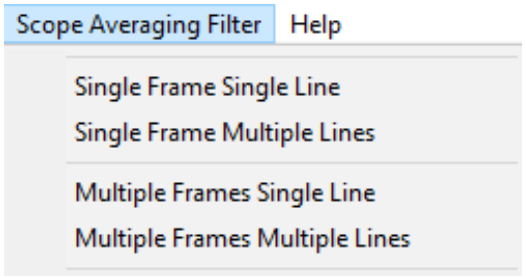
Waveform Scope Menus







There are 3 menus controlling Waveform Scope:

- **Scope View** allowing selection of Y, R, G, B components or YUV, UV, RGB combinations, and display time-base: frame parade, line parade, line overlay, singe component line, frame histogram vector.
- **Scope Line** allowing selection of desired line, desired band center (8 presets) or overlay modes
- **Scope Averaging Filter** allowing selection of temporal and/or spatial noise reduction filters

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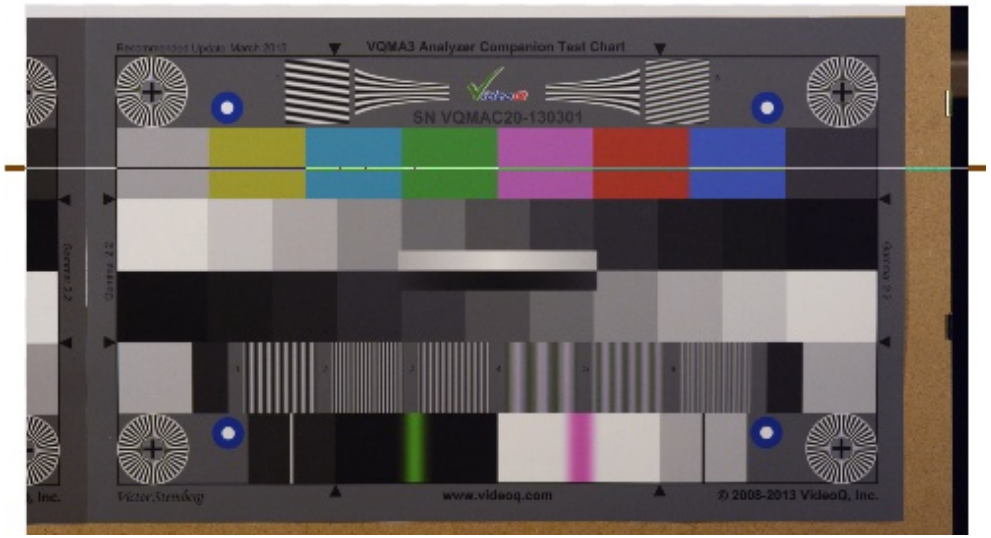
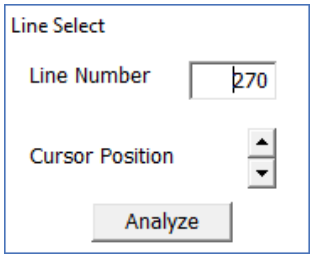
Waveform Scope Line Selection Controls





Floating pop-up Dialog Box contains two controls allowing manual selection of the analyzed line number:

- **Edit Box**, where user can directly type-in the desired **line number**
- **Up/Down Arrows** moving up or down **highlighted line** on the thumbnail image.

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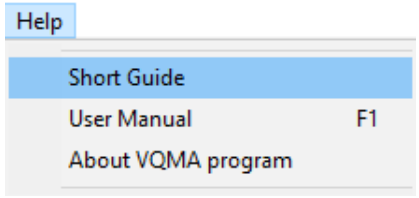
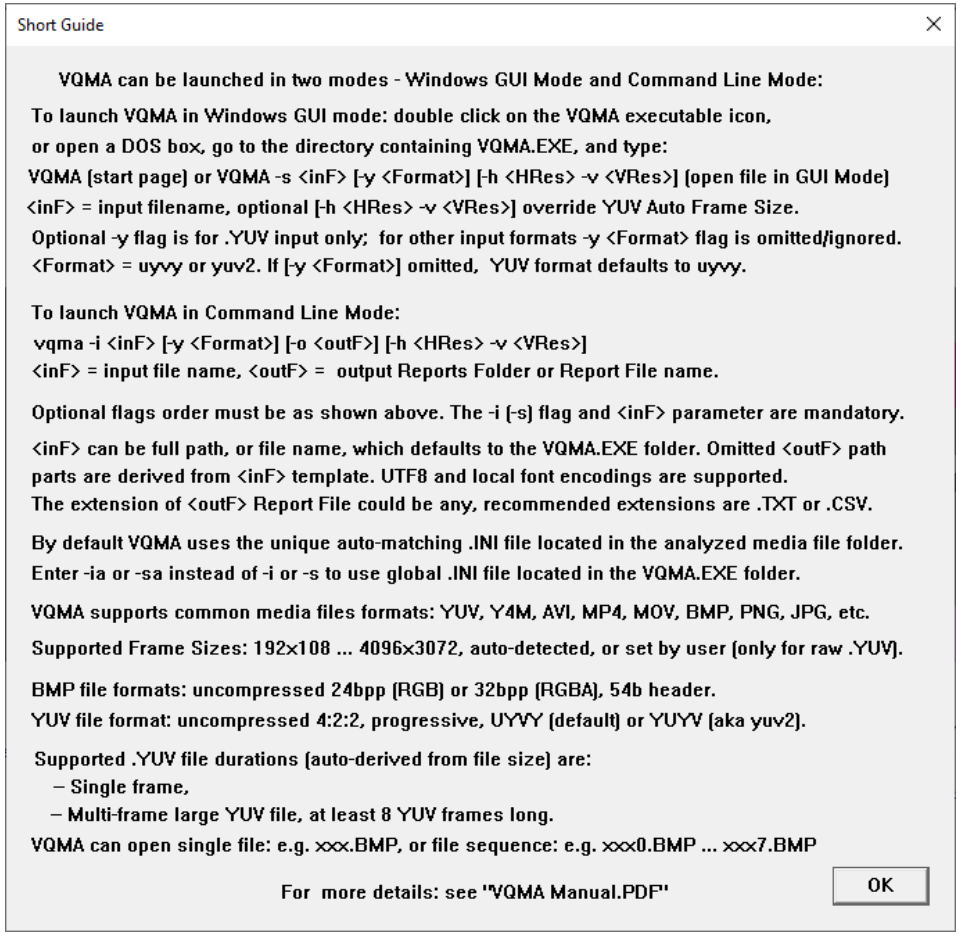
Help Menu





This menu contains three self-explanatory items:

- **Short Guide** pop-up message box
- **User Manual** (Shortcut F1) menu item opens external PDF file in the default PDF viewer, e.g. Adobe Reader.
- **About VQMA** pop-up message box

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Appendix B: CLI Commands Structure

To run the VQMA.EXE **unattended** within Windows DOS box use the following **command line**:

VQMA.exe -i <InFileName> [-y <Format>] [-o <OutFileName>] [-h <HSize> -v <VSize>]

Optional <OutFileName> can be absolute path, folder name (without extension) or just a file name.

If the whole -o <OutFileName> component or some of its parts are omitted, they are created automatically - using <InFileName> as a template with the addition of current date and time.

For example:

<InFileName> = c:\Test\current.yuv

<OutFileName> = c:\MyTests\Report1.txt.

Short Report file will be saved exactly as specified by <OutFileName> full path.

*Optional **Format**, **Hsize** and **Vsize** strings are used only for **raw RGB/YUV** inputs*

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Appendix C: Advanced Analysis Examples

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

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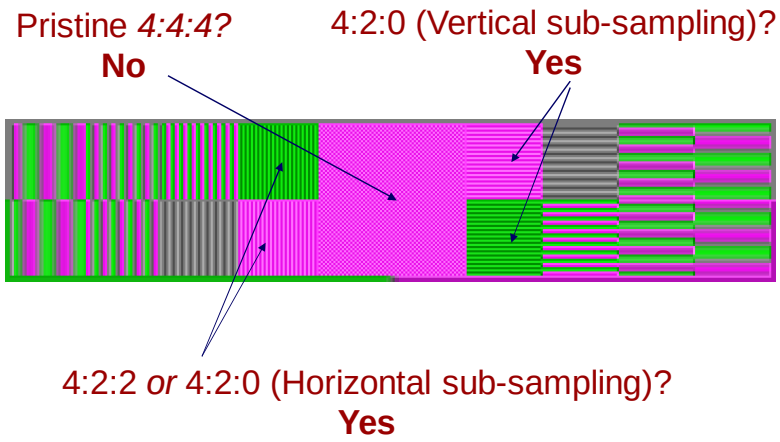
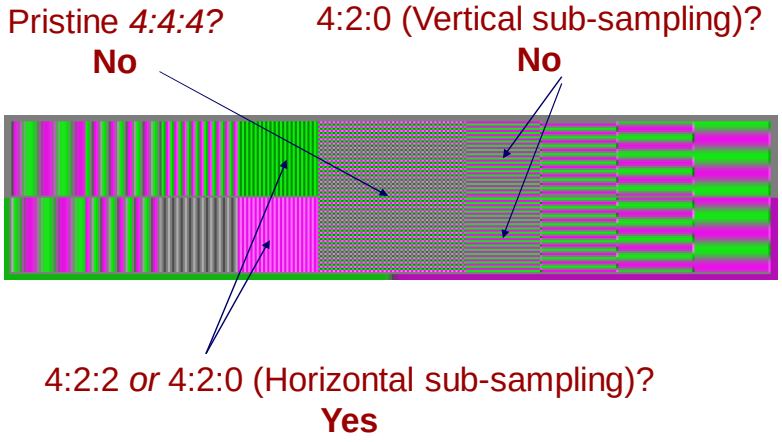
Sampling Conversion Test Usage

The Sampling Conversion Test appearance may change after codec

Particular dedicated areas indicate particular UV sub-sampling issues:



Test Result:
4:2:0 sub-sampling mode detected



Test Result:
4:2:2 sub-sampling mode detected

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Summary Page Example (Smartphone Camera)

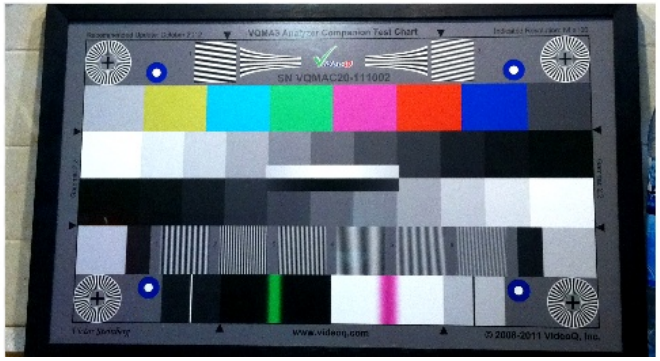
Frame Size: 1920 x 1080, Chart: 1512 x 851

1. Test Summary

VQMA Test Result: FAILED

Parameter	Measurement	Unit	Target	Pass
Black Level	2.7 %, (21.9)	%, (0.0-255.0)	-5.0 -- +5.0 %	✓
White Level	102.3 %, (240.0)	%, (0.0-255.0)	95.0 -- 105.0 %	✓
Unfiltered Y SNR	34.7	dB	> 40 dB	✗
K Rating on 2T Pulse	2.2	%	< 1.5 %	✗
UV vs. Y Gain	2.0	dB	-1.0 -- +1.0 dB	✗
Luminance Gamma	1.6		1.8 -- 2.5	✗
RGB Balance Error	12.3	%	< 10 %	✗
Y Range Black Overload	0.0	%	< 15 %	✓
Y Range White Overload	0.0	%	< 15 %	✓
Frequency Response @F1 = 128 tvl	-0.3	dB	-0.5 -- +0.5 dB	✓
Frequency Response @F2 = 255 tvl	-0.5	dB	-1.0 -- +1.0 dB	✓
Frequency Response @F3 = 382 tvl	-1.0	dB	-2.0 -- +1.0 dB	✓
Frequency Response @F4 = 509 tvl	-2.2	dB	-4.0 -- +-1.0 dB	✓
Frequency Response @F5 = 636 tvl	-4.4	dB	-6.0 -- +-2.0 dB	✓
Frequency Response @F6 = 763 tvl	-8.5	dB	-12.0 -- +-3.0 dB	✓

Automatically selected YRGB Nominal Range: 16-235 Automatically selected Rec709(HD) YUV<>RGB Matrix VQMA-C Optical Test Chart detected



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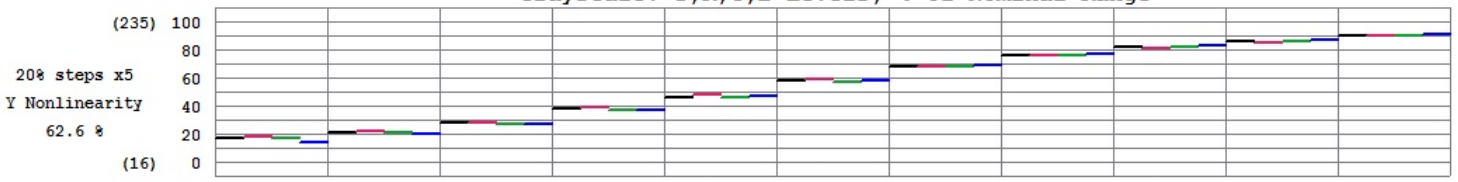
Levels and Colors Page Example (Camera)

Frame Size: 1920 x 1080, Chart: 875 x 492 — Mean values for 16 lines of 8 frames
Nominal Y,R,G,B Range: 16-235

3. Levels, Gamma, RGB Balance

Black Level: 17.3 %, (53.8) — Y Gamma: 3.0, Inverse Y Gamma: 0.33 — White Level: 90.3 %, (213.8)
Black Crash (Y Range Overload): 0.0 % — with reference to display gamma 2.2 — White Crash (Y Range Overload): 0.0 %
RGB Black Balance Error: 4.1 % — RGB Dynamic Balance Error: 4.1 % — RGB White Balance Error: 1.6 %

Grayscale: Y,R,G,B Levels, % of Nominal Range



Max_Error 8 bit values
R-Y: 3
G-Y: 1
B-Y: 7

Y / Yref	diff	54 / 16	38	62 / 38	24	76 / 60	16	99 / 82	17	118 / 104	14	142 / 126	16	165 / 147	18	182 / 169	13	196 / 191	5	204 / 213	-9	214 / 235	-21

Y-Yref: 38

Color Bars: Y,U,V,R,G,B Levels, 8 bit values

		White	Yellow	Cyan	Green	Magenta	Red	Blue	Black	Max_Error
Captured Data	Y	189	187	178	174	138	115	88	113	17
	Yref	180	174	163	157	122	116	104	98	
	diff	9	13	15	17	16	-1	-16	15	
	U	129	86	140	93	154	106	180	129	12
	Uref	128	86	138	96	160	118	170	128	
	diff	1	0	2	-3	-6	-12	10	1	
	V	128	131	93	101	162	176	105	129	19
	Vref	128	132	86	90	166	170	124	128	
	diff	0	-1	7	11	-4	6	-19	1	
Derived Values	R	189	192	124	132	189	189	53	115	45
	Rref	180	180	98	98	181	181	98	98	
	diff	9	12	26	34	8	8	-45	17	
	G	189	193	192	193	117	97	89	112	18
	Gref	180	180	180	180	99	99	98	98	
	diff	9	13	12	13	18	-2	-9	14	
	B	191	111	200	110	185	75	183	115	23
	Bref	180	98	181	99	180	98	180	98	
	diff	11	13	19	11	5	-23	3	17	

Max RGB Error: 45

VQMA-C Optical Test Chart detected — Automatically selected Rec709(HD) YUV<>RGB Matrix

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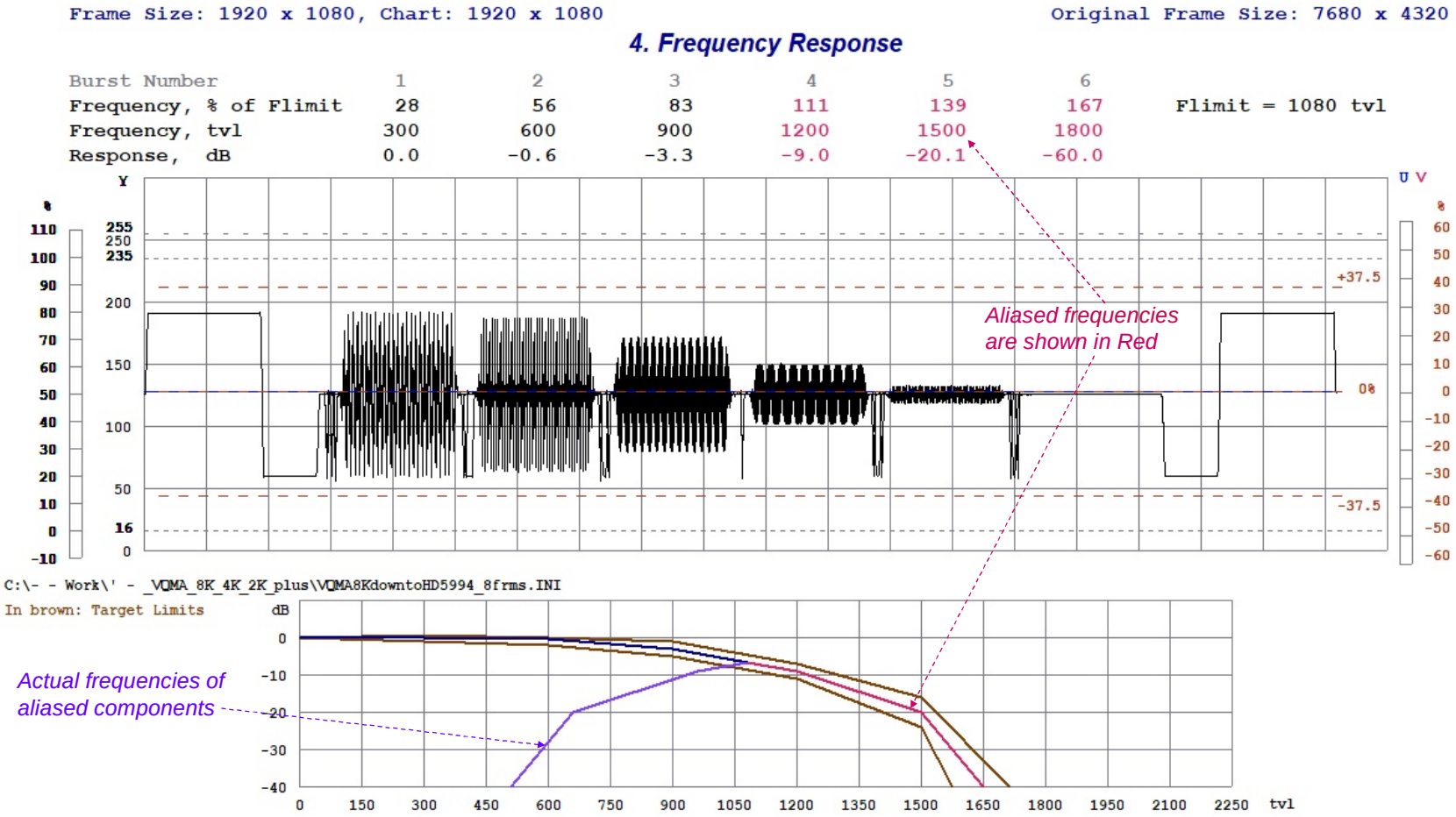
Frequency Response Page Example (8K down to HD)



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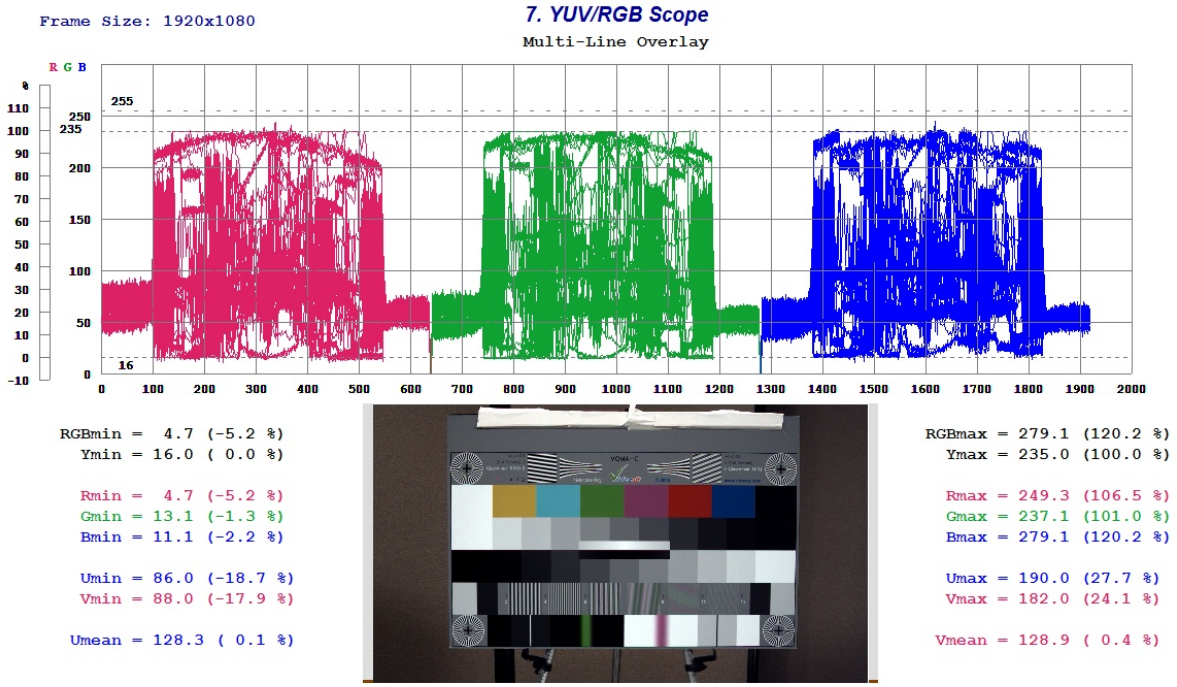
Waveform Scope Page Example (Camera)



RGB Line Parade with Multi-line Overlay shows:

- Good RGB Black Balance and White Balance
- Moderate White Shading - about 10% (camera lens?)
- No significant Black Shading or Black Crush

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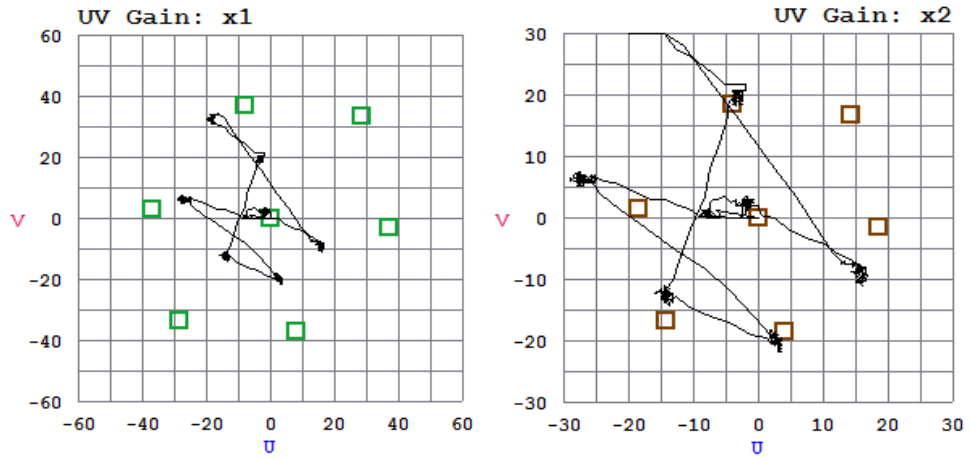
UV VectorScope Example (Camera Color Rendition)



UV Vectors Display shows:

- UV Gain x1 display:
  Color saturation is much lower than 75%, marked by green target boxes (*optical chart saturation = 37.5%*)

- UV Gain x2 display:
  Saturation is good, but black and white balances are biased and colors are far away from 37.5% brown target boxes

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Fragment of VQMA Test Report (CLI Mode)

Command Line: `c:\_ Work\VQMA4_3_1_2\Release>start vqma -i "c:\- - Work\' - _VQMA_8K_4K_2K_plus\VQMA8KdowntoHD5994_8frms.yuv"`

*Note that **-i** flag in the command line implies usage of the **.INI** config file with **name matching** the **test file name**.*

VQMA Test Report:

```
; VideoQ Inc. Copyright [c] 2005-present
; VQMA v4.3.1.2 Test Report
LOCAL_DATE_TIME, 2021-04-25T15:50:19.443
UTC_DATE_TIME, 2021-04-25T14:50:19.443Z
;
REPORT_FILE, "c:\- - Work\' - _VQMA_8K_4K_2K_plus\VQMA8KdowntoHD5994_8frms_YUV_20210425T155018_PASS.TXT"
TEST_FILE, "c:\- - Work\' - _VQMA_8K_4K_2K_plus\VQMA8KdowntoHD5994_8frms.yuv"
INI_FILE, "c:\- - Work\' - _VQMA_8K_4K_2K_plus\VQMA8KdowntoHD5994_8frms.INI"
;
TEST_RESULT, PASSED
;
VQMA_MODE, CLI
DATA_TYPE, YUV
FRAMES_ANALYZED, 8
FRAME_WIDTH, 1920
FRAME_HEIGHT, 1080
VQMA_CHART_VALIDATION, Success
CHART_TYPE, Test_Pattern
ORIGINAL_FRAME_WIDTH, 7680
ORIGINAL_FRAME_HEIGHT, 4320
CHART_WIDTH, 1920
CHART_HEIGHT, 1080
YRGB_RANGE_SELECTION, Auto
SELECTED_YRGB_RANGE, 16-235
COLOR_MATRIX_SELECTION, Auto
SELECTED_COLOR_MATRIX, BT.2020
DETECTED_COLOR_MATRIX, BT.2020
COLOR_BARS_MAX_RGB_ERROR,   2, 8 bit value
MAX_RGB_ERROR_COLOR, Cyan
;
SNR, 100.0, dB, Success
K_RATING, 0.0, %, Success
UV_Y_GAIN, 0.0, dB, Success
Y_GAMMA, 1.0,  , Success
RGB_BALANCE_ERROR, 0.0, %, Success
Y_BLACK_RANGE_ERROR, 0.0, %, Success
Y_WHITE_RANGE_ERROR, 0.0, %, Success
FREQUENCY_RESPONSE_1, 0.0, dB, Success
FREQUENCY_RESPONSE_2, -0.6, dB, Success
FREQUENCY_RESPONSE_3, -3.3, dB, Success
FREQUENCY_RESPONSE_4, -9.0, dB, Success
FREQUENCY_RESPONSE_5, -20.1, dB, Success
FREQUENCY_RESPONSE_6, -60.0, dB, Success
```

*Significant drop-down of Frequency Response is **within the limits** specified by the **selected config file**.*
*Thus, the over-all test result is "**PASS**".*

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Transcoder Test – Screenshot #1

Test Session #1: ***reference*** 1920x1080 test pattern and ***default*** VQMA.INI file with relatively strict target values

Visual Check:
T-shaped Green Area indicates that pattern is unscaled

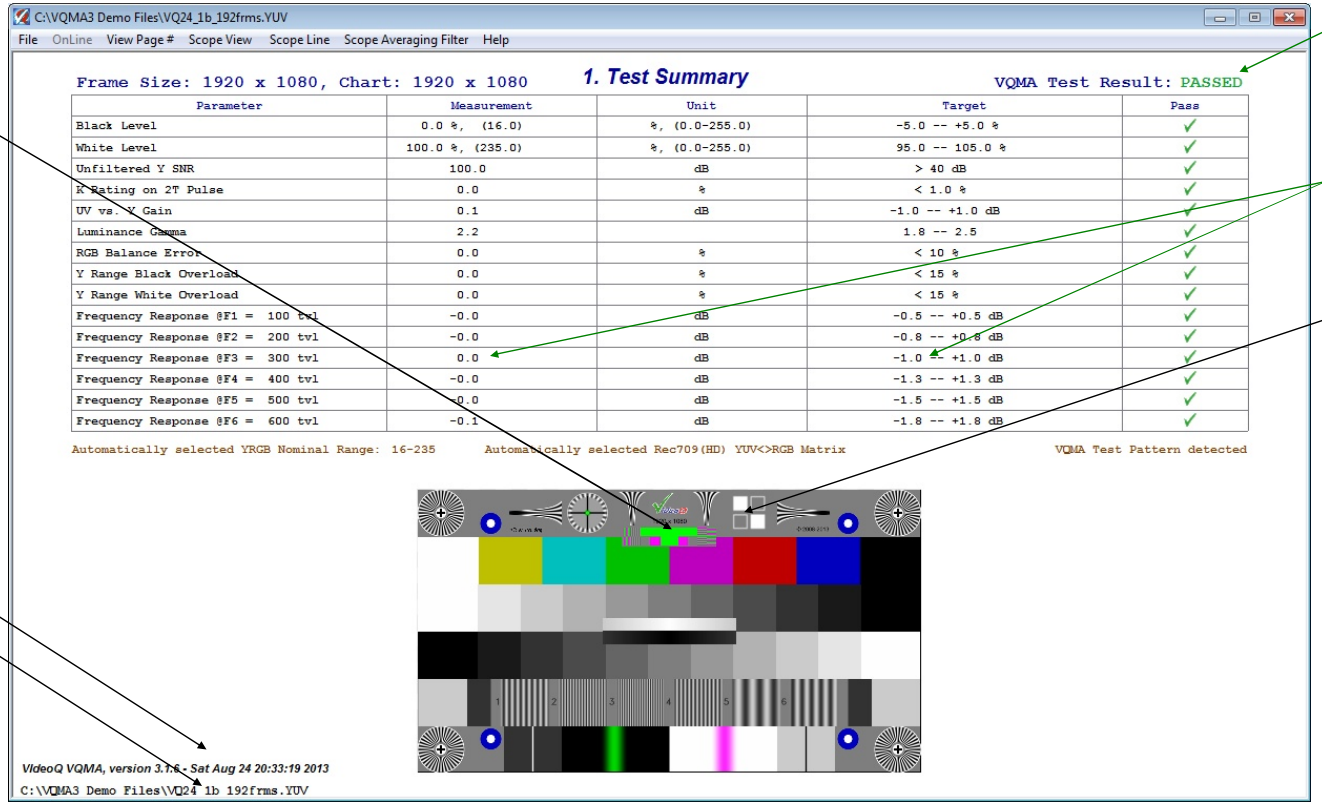
All tests OK

Frequency Response Test is OK because the rather strict target values are applied to the **original unscaled** file

Original Frame Size Code: "1920x1080"

Test Session Date & Time

File Name



Parameter	Measurement	Unit	Target	Pass
Black Level	0.0 %, (16.0)	%, (0.0-255.0)	-5.0 -- +5.0 %	✓
White Level	100.0 %, (235.0)	%, (0.0-255.0)	95.0 -- 105.0 %	✓
Unfiltered Y SNR	100.0	dB	> 40 dB	✓
K Rating on 2T Pulse	0.0	%	< 1.0 %	✓
UV vs. Y Gain	0.1	dB	-1.0 -- +1.0 dB	✓
Luminance Gamma	2.2		1.8 -- 2.5	✓
RGB Balance Error	0.0	%	< 10 %	✓
Y Range Black Overload	0.0	%	< 15 %	✓
Y Range White Overload	0.0	%	< 15 %	✓
Frequency Response @F1 = 100 tvl	-0.0	dB	-0.5 -- +0.5 dB	✓
Frequency Response @F2 = 200 tvl	-0.0	dB	-0.8 -- +0.8 dB	✓
Frequency Response @F3 = 300 tvl	0.0	dB	-1.0 -- +1.0 dB	✓
Frequency Response @F4 = 400 tvl	-0.0	dB	-1.3 -- +1.3 dB	✓
Frequency Response @F5 = 500 tvl	-0.0	dB	-1.5 -- +1.5 dB	✓
Frequency Response @F6 = 600 tvl	-0.1	dB	-1.8 -- +1.8 dB	✓

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Transcoder Test – Screenshot #2

Test Session #2: 1080 to 720 ***down-sampled*** file, same VQMA.INI file as #1 – ***too strict*** for this case!

Visual Check

T-shaped Green not visible; it means **H & V down-scaling**

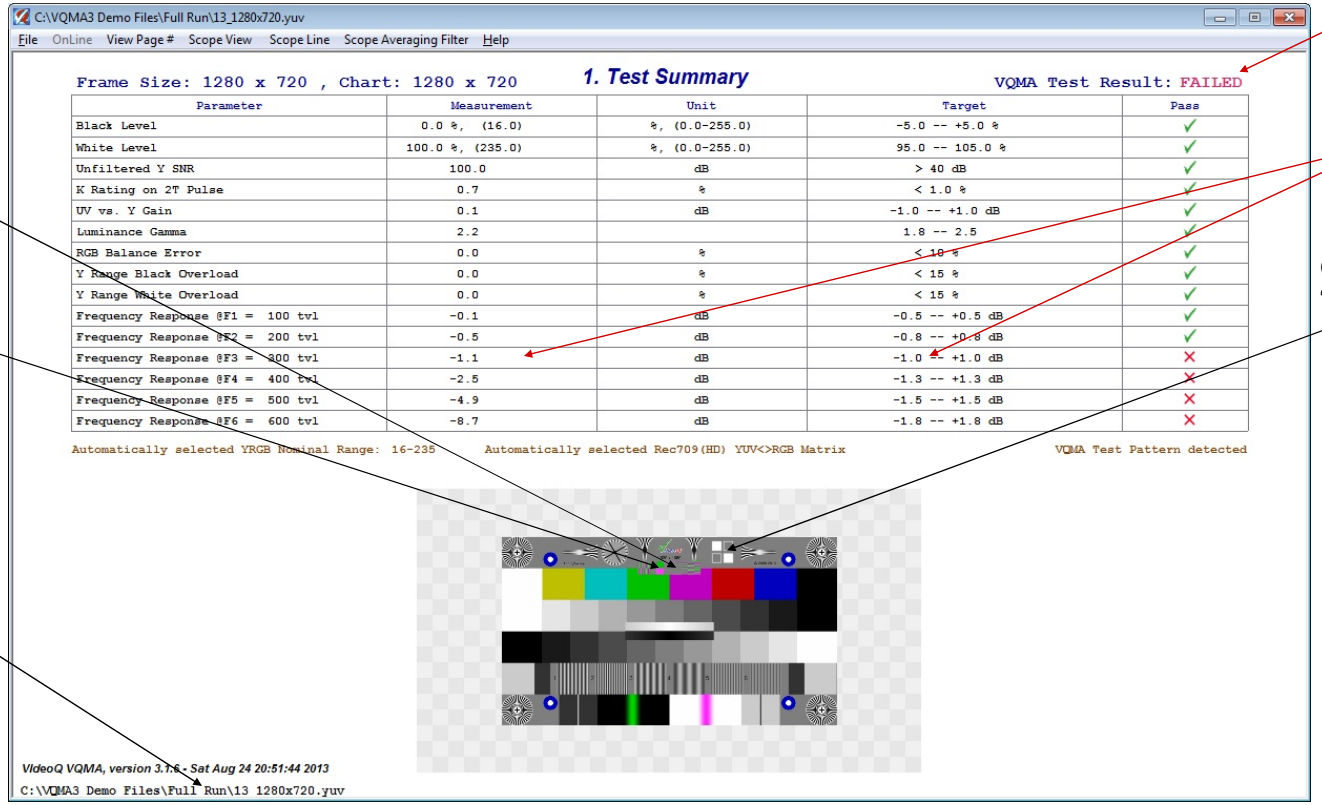
Green & Magenta squares indicate **4:2:0 encoding**

File Name

Some tests failed

Frequency Response Test failed because target values are **too strict** for the case

Original Frame Size Code: "1920x1080"



Parameter	Measurement	Unit	Target	Pass
Black Level	0.0 %, (16.0)	%, (0.0-255.0)	-5.0 -- +5.0 %	✓
White Level	100.0 %, (235.0)	%, (0.0-255.0)	95.0 -- 105.0 %	✓
Unfiltered Y SNR	100.0	dB	> 40 dB	✓
K Rating on 2T Pulse	0.7	%	< 1.0 %	✓
UV vs. Y Gain	0.1	dB	-1.0 -- +1.0 dB	✓
Luminance Gamma	2.2		1.8 -- 2.5	✓
RGB Balance Error	0.0	%	< 10 %	✓
Y Range Black Overload	0.0	%	< 15 %	✓
Y Range White Overload	0.0	%	< 15 %	✓
Frequency Response @F1 = 100 tvl	-0.1	dB	-0.5 -- +0.5 dB	✓
Frequency Response @F2 = 200 tvl	-0.5	dB	-0.8 -- +0.8 dB	✓
Frequency Response @F3 = 300 tvl	-1.1	dB	-1.0 -- +1.0 dB	✗
Frequency Response @F4 = 400 tvl	-2.5	dB	-1.3 -- +1.3 dB	✗
Frequency Response @F5 = 500 tvl	-4.9	dB	-1.5 -- +1.5 dB	✗
Frequency Response @F6 = 600 tvl	-8.7	dB	-1.8 -- +1.8 dB	✗

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Transcoder Test – Screenshot #3

Test Session #3: as #2, but using ***modified*** VQMA.INI file with ***amended*** target values

Visual Check

T-shaped Green not visible; it means **H & V down-scaling**

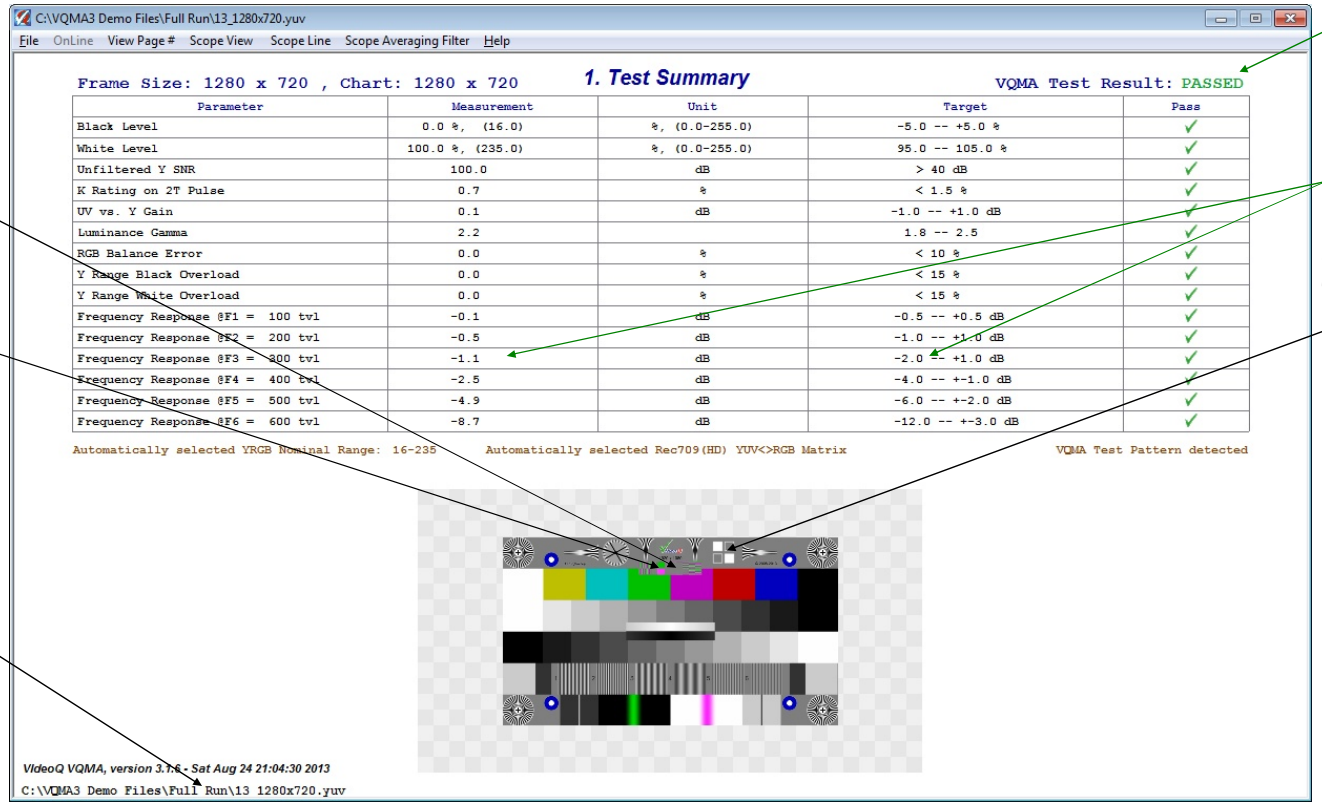
Green & Magenta squares indicate **4:2:0 encoding**

Same File Name as #2

All tests now OK

Frequency Response Test is now OK because the **amended target values** are **matching** the **down-conversion** case

Original Frame Size Code: “1920x1080”



Parameter	Measurement	Unit	Target	Pass
Black Level	0.0 %, (16.0)	%, (0.0-255.0)	-5.0 -- +5.0 %	✓
White Level	100.0 %, (235.0)	%, (0.0-255.0)	95.0 -- 105.0 %	✓
Unfiltered Y SNR	100.0	dB	> 40 dB	✓
K Rating on 2T Pulse	0.7	%	< 1.5 %	✓
UV vs. Y Gain	0.1	dB	-1.0 -- +1.0 dB	✓
Luminance Gamma	2.2		1.8 -- 2.5	✓
RGB Balance Error	0.0	%	< 10 %	✓
Y Range Black Overload	0.0	%	< 15 %	✓
Y Range White Overload	0.0	%	< 15 %	✓
Frequency Response @F1 = 100 tvl	-0.1	dB	-0.5 -- +0.5 dB	✓
Frequency Response @F2 = 200 tvl	-0.5	dB	-1.0 -- +1.0 dB	✓
Frequency Response @F3 = 300 tvl	-1.1	dB	-2.0 -- +1.0 dB	✓
Frequency Response @F4 = 400 tvl	-2.5	dB	-4.0 -- +-1.0 dB	✓
Frequency Response @F5 = 500 tvl	-4.9	dB	-6.0 -- +-2.0 dB	✓
Frequency Response @F6 = 600 tvl	-8.7	dB	-12.0 -- +-3.0 dB	✓

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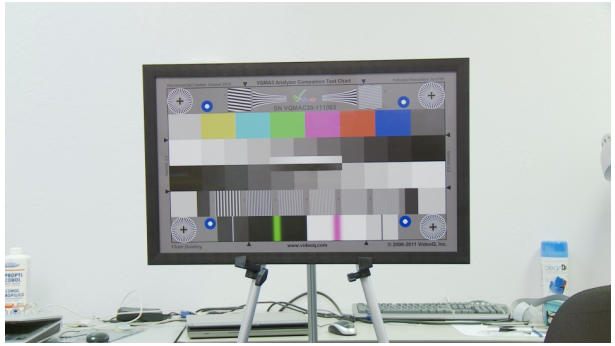
Broadcast Camera Test with VQMAC20 Optical Chart



Fragment of VQMA.INI file used

```
;VideoQ VQMA v4.3.1.2. .INI file created 20210413T172937;
;THIS IS DEFAULT VQMA.INI FILE - to be edited or replaced as needed
;
[Y_BLACK_LEVEL_]
Y_BLACK_LEVEL_UNIT=%
Y_BLACK_LEVEL_MIN=-5.00
Y_BLACK_LEVEL_MAX=5.00
[Y_WHITE_LEVEL_]
Y_WHITE_LEVEL_UNIT=%
Y_WHITE_LEVEL_MIN=95.00
Y_WHITE_LEVEL_MAX=105.00
[Y_SNR_]
Y_SNR_UNIT=dB
Y_SNR_MIN=40.00
```

Fragment of Test Report in machine-readable format

```
; VideoQ Inc. Copyright [c] 2005-present
; VQMA v4.3.1.2 Test Report
LOCAL_DATE_TIME, 2021-04-25T19:43:36.582
UTC_DATE_TIME, 2021-04-25T18:43:36.582Z
;
REPORT_FILE, "C:\- - Work\' - _VQMA_8K_4K_2K_plus\VQTS_20120916_173402_ReflectanceChartZoomOut_yuv_20210425T194329_FAIL.TXT"
TEST_FILE, "C:\- - Work\' - _VQMA_8K_4K_2K_plus\VQTS_20120916_173402_ReflectanceChartZoomOut.yuv"
INI_FILE, "C:\_ Work\VQMA4_3_1_2\Release\VQMA.INI"
;
TEST_RESULT, FAILED
;
VQMA_MODE, GUI
DATA_TYPE, YUV
FRAMES_ANALYZED, 8
FRAME_WIDTH, 1920
FRAME_HEIGHT, 1080
VQMA_CHART_VALIDATION, Success
CHART_TYPE, Optical_Chart
CHART_WIDTH,  875
CHART_HEIGHT,  492
YRGB_RANGE_SELECTION, Auto
SELECTED_YRGB_RANGE, 16-235
COLOR_MATRIX_SELECTION, Auto
SELECTED_COLOR_MATRIX, BT.709
DETECTED_COLOR_MATRIX, NA
COLOR_BARS_MAX_RGB_ERROR,  45, 8 bit value
MAX_RGB_ERROR_COLOR, Blue
;
SNR,  46.6, dB, Success
K_RATING, 1.0, %, Success
UV_Y_GAIN, -1.1, dB, Failure
Y_GAMMA, 3.0,  , Failure
RGB_BALANCE_ERROR, 4.1, %, Success
Y_BLACK_RANGE_ERROR, 0.0, %, Success
Y_WHITE_RANGE_ERROR, 0.0, %, Success
FREQUENCY_RESPONSE_1, 1.2, dB, Failure
FREQUENCY_RESPONSE_2, 4.1, dB, Failure
FREQUENCY_RESPONSE_3, -2.1, dB, Success
FREQUENCY_RESPONSE_4, -10.7, dB, Failure
FREQUENCY_RESPONSE_5, -21.8, dB, Failure
FREQUENCY_RESPONSE_6, -21.4, dB, Failure
;
```

Fragment of VQMA_Log.TXT file created

```
;
2021-04-25T19:42:56, File opened in GUI Mode:
"C:\- - Work\' - _VQMA_8K_4K_2K_plus\VQTS_20120916_173402_ReflectanceChartZoomOut.yuv"
Config file:
"C:\_ Work\VQMA4_3_1_2\Release\VQMA.INI"
TEST_RESULT, FAILED
2021-04-25T19:43:36, Report file saved in GUI Mode:
"C:\- - Work\' - _VQMA_8K_4K_2K_plus\VQTS_20120916_173402_ReflectanceChartZoomOut_yuv_20210425T194329_FAIL.TXT"
```

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Fisheye Surveillance Camera Test

Big Wall-mounted VQMA-C Chart (***2.3 m diagonal*** variant), fluorescent light source

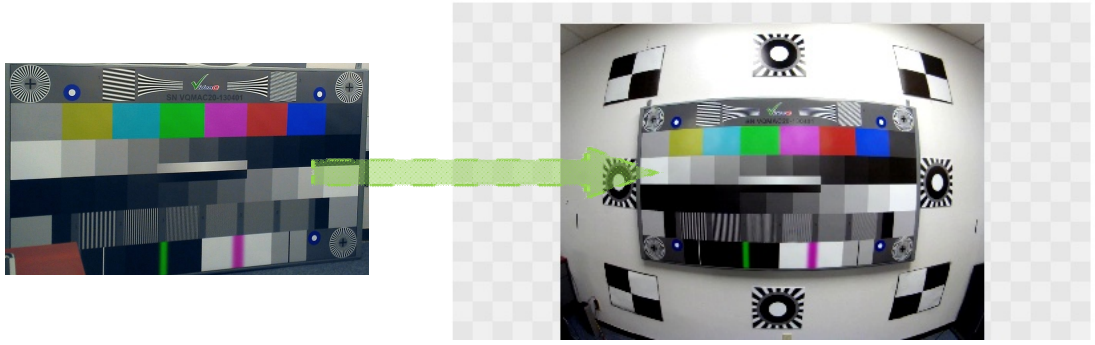
Frame Size: 1280 x 960 , Chart: 868 x 488

1. Test Summary

VQMA Test Result: FAILED

Parameter	Measurement	Unit	Target	Pass
Black Level	-2.3, (11.0)	%, (8b D1)	-5.0 ~ +5.0	✓
White Level	91.2, (215.6)	%, (8b D1)	95.0 ~ 105.0	✗
Unfiltered Y SNR	49.6	dB	> 40.0	✓
K Rating on 2T Pulse	7.3	%	< 3.0	✗
UV vs. Y Gain	+2.2	dB	-1.0 ~ +1.0	✗
Luminance Gamma	1.25		1.8 ~ 2.5	✗
RGB Balance Error	3.3	%	< 10.0	✓
Y Range Black Overload	0.0	%	< 15.0	✓
Y Range White Overload	0.0	%	< 15.0	✓
Frequency Response @F1 = 112 tvl	-1.3	dB	-1.0 ~ +0.5	✗
Frequency Response @F2 = 222 tvl	-2.9	dB	-2.0 ~ +1.0	✗
Frequency Response @F3 = 333 tvl	-3.1	dB	-3.0 ~ +1.0	✗
Frequency Response @F4 = 443 tvl	-14.6	dB	-4.0 ~ +1.0	✗
Frequency Response @F5 = 554 tvl	-34.0	dB	-5.0 ~ +1.0	✗
Frequency Response @F6 = 664 tvl	-28.0	dB	-6.0 ~ +1.0	✗

C:\vqma\VQMA.INI
Automatically selected YRGB Nominal Range: 16-235
Automatically selected BT.709 YUV<>RGB Matrix
Analyzed: 8 frames
VQMA-C Optical Test Chart detected



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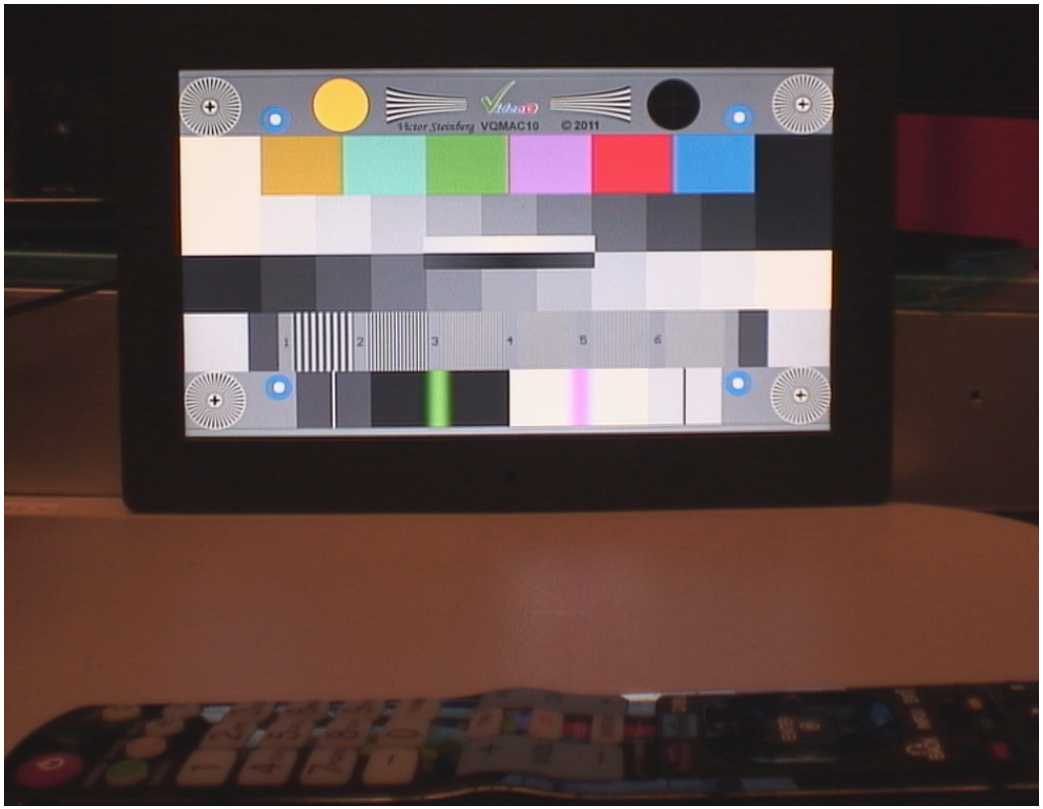
Teleconference Camera Test with compact 10” Backlit Chart

Measuring camera performance in very low light conditions



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Related VideoQ Products

VQPT – A suite of software modules for advanced video processing workflow

http://www.videoq.com/vqpt.html

VQCBA – VideoQ Color Bars Analyzer, companion program for **VQCB** Test Patterns Suite

http://www.videoq.com/vqcba.html

VQL – Comprehensive library of sophisticated static and dynamic test patterns

http://www.videoq.com/vql.html

VQTS4K – 12G / 4K / SDI / HDMI Video Generator-Analyzer

Industrial PC with SDI / HDMI Interfaces, VideoQ Test Patterns Library and VQMA Analyzer & Scope

http://www.videoq.com/vqts4k.html

VQV – Media Files Player / Viewer / Analyzer

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