VQTS-100
Video Quality Test System

VideoQ, Inc
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www.videoq.com
Key Features

- Complete self-contained unit combining hardware and software tools to measure the quality of analog or digital video
- Suitable for testing both simple single stage CVBS-to-CVBS links and complex multi-stage CVBS video links, which may include RF modems and/or digital codecs
- Comprised of:
  - Test Signal Generator Module
    - VQMA only option: Play-out of VQMA test pattern in a variety of formats
    - VQL Option: Play-out of full comprehensive library of VideoQ sophisticated test patterns and sequences
  - Video Capture Module
  - VQMA - fully automated Software Video Analyzer
- Ideal tool for video link facilities and video development labs, instantly revealing your video system performance
VQTS-100 Value Proposition

Competitor Solution

Pros:
- Standard off-the-shelf products from established supplier

Cons:
- Extremely high cost of the already aged equipment ($50-100K per set)
- Bulky Solution: Two units (TSG and Analyzer) plus PC for automation
- Labor-intensive tests by highly skilled staff
- Control and integration in the system via old-style RS and/or GPI connections is not easy

VQTS-100 from VideoQ

- Reasonably priced all-in-one PC-based compact system
- Accurate automated video measurement methodology: *full report in just few seconds, no video engineer required*
- Flexible, easy to customize Windows XP GUI and robotic ‘batch’ mode
- Build-in network connectivity
- Expandable Modular Solution with future upgrades into multi-format Test Generator/Analyzer
VQTS-100 Architecture

Capture Module
- Captured .AVI files

Playout Module
- Reports & Log Files
- VQL Test Library

HDD

Optional inputs:
- CVBS Y/C
- Optional: HDMI YPrPb SDI

Output
- CVBS Y/C
- Optional: HDMI YPrPb SDI
VQTS-100 Application Diagram

Device or System under the test

Capture Module

Playout Module

HDD

Captured .AVI files

Reports & Log Files

VQL Test Library

VQMA Analyzer SW

Optional System Interface

For example:
RF Demodulator and/or MPEG Decoder

Optional: HDMI YPrPb SDI

CVBS Y/C

Optional System Interface

For example:
Compressor/Encoder and/or RF Modulator

Optional: HDMI YPrPb SDI

CVBS Y/C
VQTS-100 Operation

There are three major modes of VQTS-100 system operation:

- Preview
- Automated Measurement
- Off-line Analysis

The VQTS-100 system modules can be launched at any moment in any one of these three modes; two or even all three modes can be used in parallel.

- Test Result in ‘Pass/Fail’ format appears in few seconds
- Machine-readable VQTS-Log.txt file can be opened at any time in any text viewer/editor
- Detailed report can be printed at any time, e.g. in PDF file format
- Test Generator Module starts automatically on a system power-up
VQMA - Auto-Matrix Test Pattern used by VQTS system

All-In-One: Single pattern allows automatically measure multiple video signal parameters

Parameters:
- Chroma Vectors
- Color Matrix Check
- Frequency Response
- Nonlinearity, Y Levels
- 2T pulse K-rating, Y vs. C Gain & Delay
- Differential Gain, Differential Phase
- YUV2RGB conversion
- Detection (Illegal Colors)

Noise & Interferences accurately measured on any static image by analysis of frame differences
## Key Video Measurements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>VQMA Test Matrix Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black &amp; White Levels</td>
<td>%</td>
<td>Black &amp; White Bars</td>
</tr>
<tr>
<td>Nonlinearity, Y levels</td>
<td>%</td>
<td>Gray-scale</td>
</tr>
<tr>
<td>K-rating</td>
<td>%</td>
<td>2T Pulse</td>
</tr>
<tr>
<td>C vs. Y Gain &amp; Delay</td>
<td>dB, ns</td>
<td>20T Pulses</td>
</tr>
<tr>
<td>Frequency Response</td>
<td>dB vs. MHz</td>
<td>Multi-Burst</td>
</tr>
<tr>
<td>Differential Phase &amp; Gain</td>
<td>deg, %</td>
<td>Modulated Ramp</td>
</tr>
<tr>
<td>UV Vector Errors</td>
<td>%, deg</td>
<td>Color Bars</td>
</tr>
<tr>
<td>SNR &amp; Noise Spectrum</td>
<td>dB, dB vs. MHz</td>
<td>VQMA pattern (all bands)</td>
</tr>
</tbody>
</table>
### Video Quality Test Summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement</th>
<th>Unit</th>
<th>Target</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Level</td>
<td>3.5 %, (23.6)</td>
<td>%, (8 bits)</td>
<td>≤ 5.0 -- ≤ 5.0 %</td>
<td>✓</td>
</tr>
<tr>
<td>White Level</td>
<td>101.6 %, (220.5)</td>
<td>%, (8 bits)</td>
<td>≥ 55.0 -- 105.0 %</td>
<td>✓</td>
</tr>
<tr>
<td>Unfiltered Y SNR</td>
<td>35.75</td>
<td>dB</td>
<td>&gt; 40 dB</td>
<td>×</td>
</tr>
<tr>
<td>X Rating on 2T Pulse</td>
<td>1.47</td>
<td>dB</td>
<td>&lt; 3 dB</td>
<td>✓</td>
</tr>
<tr>
<td>Chroma vs Luma Gain</td>
<td>1.58</td>
<td>dB</td>
<td>0.0 -- 0.0 dB</td>
<td>×</td>
</tr>
<tr>
<td>Chroma vs Luma Delay</td>
<td>287</td>
<td>ns</td>
<td>-60 -- +60 ns</td>
<td>×</td>
</tr>
<tr>
<td>Differential Gain</td>
<td>5.76</td>
<td>%</td>
<td>&lt; 5 %</td>
<td>×</td>
</tr>
<tr>
<td>Differential Phase</td>
<td>1.1</td>
<td>degree</td>
<td>&lt; 5 degree</td>
<td>✓</td>
</tr>
<tr>
<td>Freq. Response @ 1.00 MHz</td>
<td>-0.04</td>
<td>dB</td>
<td>-1.0 -- +1.0 dB</td>
<td>✓</td>
</tr>
<tr>
<td>Freq. Response @ 2.00 MHz</td>
<td>-1.11</td>
<td>dB</td>
<td>-1.0 -- +1.0 dB</td>
<td>×</td>
</tr>
<tr>
<td>Freq. Response @ 3.00 MHz</td>
<td>-2.06</td>
<td>dB</td>
<td>-2.0 -- +1.0 dB</td>
<td>×</td>
</tr>
<tr>
<td>Freq. Response @ 5.56 MHz</td>
<td>-4.1</td>
<td>dB</td>
<td>-4.0 -- +1.0 dB</td>
<td>×</td>
</tr>
<tr>
<td>Freq. Response @ 4.20 MHz</td>
<td>-26.16</td>
<td>dB</td>
<td>-6.0 -- +1.0 dB</td>
<td>×</td>
</tr>
<tr>
<td>Freq. Response @ 5.80 MHz</td>
<td>-31.43</td>
<td>dB</td>
<td>-20.0 -- -1.0 dB</td>
<td>×</td>
</tr>
</tbody>
</table>

#### Reference vs Test Image

![Reference Image](C:\wq\NTSC Tuner 1mV.png)

![Test Image](C:\wq\NTSC Tuner 1mV.png)
VQTS-100 Rear Panel
VQTS-100 Specifications

- 4U case, Pedestal or Rack-mounted:
  - Weight: 12 kg
  - Dimensions (D x W x H): 522 mm x 430 mm x 176 mm
    (20.5" x 16.9" x 6.9")
  - Detachable handles for easy carrying
  - Detachable rack mount ears

- Power Supply Unit:
  - Redundant x2, 400 Watt, 115-230 V, 50/60 Hz
  - Easy swap 2 x 80 mm rear fans, 1 x 120 mm front fan
  - PCI expansions slots x 3
  - USB ports x 8
  - Intel Pentium Dual Core 2.2 GHz
  - 2 GB RAM
  - 250 GB HDD
  - DL +/-RW DVD Drive
  - Windows XP Pro OS

- Video output:
  - NTSC/PAL CVBS, 1Vpp on 75 Ohm, BNC x1

- Video input:
  - NTSC/PAL CVBS, 1Vpp on 75 Ohm, BNC x1

Copy Protection USB Dongle
VQMA Software Analyzer (also see next 11 slides)

- Software executable running under Windows
- Unique Matrix Test Pattern to check ALL parameters in one process
- Detailed and sophisticated analysis of video data using spatial and temporal filtering
- Highly accurate and consistent results due to sophisticated processing algorithms
- 0.1 dB accuracy of SNR and frequency response meters
- 0.1 dB and 0.1 degree accuracy of differential gain and differential phase
- Built-in spectrum analyzer with industry standard weighting filters
- NTSC and PAL standards supported
- User-friendly intuitive GUI for off-line analysis
- Unattended (‘robotic’) mode provides machine-readable log file
VQMA Modes of Operation

VQMA software can be launched in two ways:

1. **Windows GUI mode** – aimed for a video design and verification environment. It provides a detailed multi-page printable report file with all test results in both numerical and graphic representation.

2. **Unattended mode** provides machine readable log file with numerical representation of test results for automated production environment or automated software drivers verification, e.g. for inclusion in higher level automated QA systems.

Either mode allows customization of the tolerance values by direct editing of the .INI files to match the performance of particular board types/models.

VQMA program checks the captured video data against the **tolerance values** contained within the customizable .INI file.
Screenshot Example - Staircase Display

Black Level: 3.5 %, (23.6)
White Level: 101.6 %, (238.5)
Screenshot Example - K-Rating & C vs. Y

Chroma vs Luma Gain       1.58 dB
Chroma vs Luma Delay      287 ns
K Rating on 2T Pulse      1.47 %

Blue:  U
Red:   V
Black: Y
Screenshot Example - Frequency Response

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Decibels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>-0.04 dB</td>
</tr>
<tr>
<td>2.0</td>
<td>-1.11 dB</td>
</tr>
<tr>
<td>3.0</td>
<td>-3.06 dB</td>
</tr>
<tr>
<td>3.58</td>
<td>-7.41 dB</td>
</tr>
<tr>
<td>4.2</td>
<td>-26.16 dB</td>
</tr>
<tr>
<td>5.8</td>
<td>-31.43 dB</td>
</tr>
</tbody>
</table>

Luma

- 250
- 200
- 150
- 100
- 50
- 0  

Time (ns) - 0 to 700
Screenshot Example - Differential Gain & Differential Phase

Differential Gain  5.76 %

Differential Phase  1.1 degree
Screenshot Example - Chroma Vectors
### Screenshot Example - Noise Measurement Results

<table>
<thead>
<tr>
<th>Y Noise Level RMS</th>
<th>3.56 (8 bit level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y SNR unfiltered</td>
<td>35.79 dB</td>
</tr>
<tr>
<td>Y SNR 4.2 MHz</td>
<td>36.13 dB</td>
</tr>
<tr>
<td>Y SNR 6.0 MHz</td>
<td>36.10 dB</td>
</tr>
</tbody>
</table>

| UV SNR 1.5 MHz      | 43.36 dB           |
| Y SNR 4.2 MHz weighted | 42.08 dB       |
| Y SNR 6.0 MHz weighted | 42.07 dB       |

![Noise Spectrum](image1.png)

![Noisy Image](image2.png)
Noise Spectrum Display – Interference Detection

![Graph showing Noise Spectrum Display](image)

- **Low Level Interference Signal**
Noise Pattern View – magnified

In this example: both additive noise & sync jitter are visible
Automated Mode – Fragment of Log File

VideoQ Inc. Copyright [c] 2005-2008
V2.4.1, 03/31/08 12:13:14 PM
BL, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 2.8, %, Success
WL, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 99.3, %, Success
SNR, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 52.23, dB, Success
KR, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 0.94, %, Success
CYG, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 1.51, dB, Failure
CYD, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 2, ns, Success
DG, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 1.21, %, Success
DP, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 0.8, degree, Success
FR1, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 0.12, dB, Success
FR2, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, -0.77, dB, Success
FR3, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, -1.35, dB, Failure
FR36, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, -1.88, dB, Failure
FR42, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, -3.05, dB, Failure
FR58, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, -4.38, dB, Failure
Customizable Target Values – Fragment of .INI File

VQNTSC.ini - VideoQ inc. Copyright [c] 2005 - 2008

; [BL]
; BLUNIT=%
; BLMIN=-5.00
; BLMAX=5.00

; [WL]
; WLUNIT=%
; WLMIN=95.00
; WLMAX=105.00

; [SNR]
; SNRUNIT=dB
; SNRMIN=40.00

; [KR]
; KRUNIT=%
; KRMAX=3.00
; FR36MAX=1.00

; [FR42]
; FR42UNIT=dB
; FR42MIN=-1.00
; FR42MAX=1.00

; [FR58]
; FR58UNIT=dB
; FR58MIN=-1.00
; FR58MAX=1.00
Other VQTS-related VideoQ Products
VQL – Library of Test Files

Software Coders, Transcoders, Players, Analyzers

VQL Compatible Hardware Players/Generators

3Genie by NuMedia

VQTS by VideoQ

Other (3rd party) players
VQL/VQMA in Multi-Resolution Applications

Input test files, e.g. MP2 TS

Test Patterns Library

VQMA2Plus

Optional Semi-custom Automated Testing Controller

VQMA2

Universal Up/Down Reference Scaler & Video Analyzer

Batch Processor (.bat): one device & one source/target set per run

Input test files, e.g. MP2 TS

Devices under test

=> 192x144

=> 320x240

=> 480x320

=> 480x272

=> 640x480

=> 720x480

=> 1280x720

=> 1920x1080

YUV single frame dumps

Full Height, Full Width

=> 720x480

720x480 YUV

VQMA2

Report .csv

YUV single frame UpScaler

Universal Up/Down Reference Scaler & Video Analyzer

API

VideoQ, Inc.
VQB – Video Quality Benchmarking Tool

VQB is a sophisticated video benchmarking tool for multiple segments of IPTV, PC and CE industries. It is targeted at:

- Industry analysts
- Computers, video servers and related hardware manufacturers
- GPU and CPU suppliers
- Software developers
- System integrators
- PC-based home theatre installers and customers
- PC users interested in getting top video performance
VQB Methodology

All parameters critical for video quality of professional, semi-professional and consumer devices can be sub-divided into two classes:

1. **Classical** (deterministic) video processors parameters:
   - Picture Size, Aspect Ratio and Position, Black Bands (Letterbox/Pillar-box)
   - Y and UV Gain and Offset
   - Frequency Response, including its off-band part, i.e. Aliasing
   - Pulse Response (K-rating)
   - Inter-frame Random Noise and Periodic Interferences
   - Differential Phase and Differential Gain (affected by YUV=>RGB conversion)

2. **Digital Compression** (pseudo-random) artifacts:
   - Blockiness and Mosquito Noise (aka Digital Noise)
   - Video Frames Drop/Freeze and related AV sync problems