VQMA

Video Quality Measurement Software

Version 2.4.3

User Manual

VQMA

Video Quality Measurement Software

by VideoQ Inc

Software Video Analyzer to measure the quality of captured and streamed video.

Ideal tool for video development labs, software developers and high volume manufacturing instantly revealing your video capture device performance.

VQMA User Manual

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Special thanks to:

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Revision History

Revision	Date	Description
1.1	2005, January 14	Beta
2.2	2005, October 06	Release
2.3	2006, March 31	Release
2.4.1	2008, August 28	Release
2.4.2	2009, April 26	Release
2.4.3	2009, May 12	Release

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1   Introduction

VQMA is a self-contained software solution allowing manual or automated measurement of the performance of video capture devices in a PC running **Windows™** OS. Used in cascade with high quality capture device VQMA can measure the quality of the incoming video signal.

System Requirements:
- Windows 2000, XP or higher
- About 1250 Kb of disk space

VQMA measures and display the following parameters:
- Black and White levels of Grey Scale pattern
- Differential Gain and Phase
- Frequency Response on standard multi-burst frequencies
- K-rating on 2T pulse
- Y vs. C, Gain and Delay on 20T pulse
- Chroma Vectors Display (Vectorscope) with +/-2.5% zones
- Weighted and Unweighted SNR for Y and UV, Noise Spectrum Display

A source of special VQMA Matrix Test Pattern - DVD player(s) or test signal generator - should be connected to the input(s) of the capture device as shown on the diagram below.

Tuner input performance should be tested via the external RF modulator (not supplied). Optional second RF modulator can be used to simulate an interference channel.
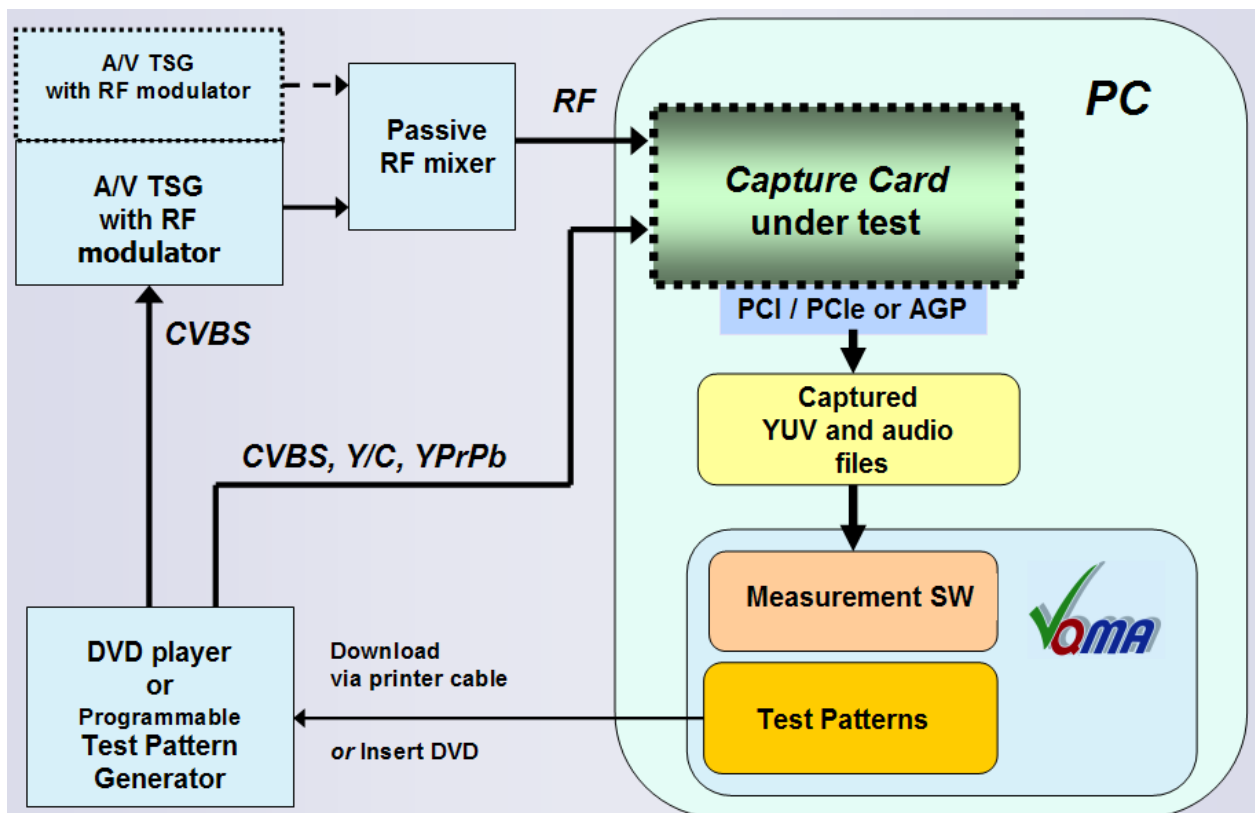
Captured test pattern video data should be stored on fast access media, e.g. HDD, in a file of suitable format, e.g. *.AVI file containing at least *8 consecutive uncompressed video frames* in UYVY or YUV2 format with *native 4:2:2 resolutions*:

- **720 x 480** or **720 x 486** for **NTSC**

- **720 x 576** for **PAL** or **SECAM**

VQMA analyzes YUV video data stored in this file, e.g. in .AVI video clip, and produces detailed test report.

Measured values are automatically checked against values stored in the .INI file, e.g. values from the Microsoft MCE requirements. Editable .INI files allow customization of the test requirements to match the performance of particular devices or board types/models.

The accuracy of measurements is typically better than 1/10 of the target tolerance range, e.g. typical errors are about 0.5% for video levels and about +/- 0.1 dB for frequency response.

Analysis of decompressed video, e.g. after MPEG encode-decode, is also possible, if the output is presented in 4:2:2 YUV format compatible with VQMA software.

Horizontal and vertical image position errors of few pixels do not affect VQMA results accuracy. On the other hand, scaling and/or cropping of captured video data may produce very big errors, therefore they should be switched off during VQMA test.

Partial test procedures result in several partial "pass/fail" flags corresponding to each particular parameter, such as white level, or Y/C delay. These flags are combined together using logical AND function, thus providing a global single bit "pass/fail" flag.

VQMA software can be launched and used in two modes:

- Windows GUI mode

- DOS box mode

Windows GUI mode
Starting VQMA.EXE without any command line parameters brings up standard Windows GUI. This mode is intended for laboratory design, adjustments and verification procedures with measurements results presented in graphical format suitable for printing, e.g. creating PDF document. In Windows GUI mode it is possible to produce printed reports with more details, containing all results, including diagrams and screenshots. Short-form *.TXT or *.CSV machine-readable report files are also available and can be saved as required.

DOS box mode

DOS box mode (under Windows) requires command line parameters and usually involve running batch file in the background (unattended) mode.This provides log file with all important test results presented in machine readable format for inclusion in higher level automated QA systems. In DOS window mode, test results are always presented as a set of comma separated values within a report file of *.TXT or *.CSV format.

2   Supported File Formats

VQMA.EXE can open any one file of the following types:

*.AVI   AVI video clip
this is default extension for dialog box, recommended mode

*.YUV   Single frame of raw YUV data
suitable for quick video parameters check, also saving HDD space

*.NTS   Multiple frames of raw YUV (NTSC) data without any header or wrapper
used mainly in the design lab environment, instead of .AVI

*.PAL   Multiple frames of raw YUV (PAL/SECAM) data without any header or wrapper
used mainly in the design lab environment, instead of .AVI

File name **extensions** directly control VQMA operation. All **other** file types and extensions are **not supported**.

To provide for full and accurate measurement any input video file should contain a number of captured TV frames with *uncompressed* YUV data of VQMA test pattern. **Total duration** of .AVI, .NTS or .PAL video file should be equal or greater than **8 TV frames.** VQMA analyzes only **first 32 frames**; larger sizes of input files are acceptable, but it does not improve the VQMA measurement accuracy.

All video quality parameters can also be measured by fast analysis of single-frame .YUV files, but with significantly lower accuracy.

In any case, video file should contain video data of VQMA test pattern arranged as **4:2:2 UYVY** ... ("UYVY") or **YUYV**... ("YUY2" also known as "YUV2") multiplex of 720 pixels (1440 samples), of 480 or 486 TV lines (NTSC) or 576 TV lines (PAL). Data should conform to 8 bit D1 (601) quantization scale: Black_Y = 16d, White_Y = 235d, Grey_UV = 128d .

Currently, there are only two **FOURCC** codes supported: **UYVY** and **YUY2**.

There is also a **special file name** reserved for .YUV files which contain only noise on flat grey background. If the file is saved as "**noise*.yuv**" (any name starting with "noise", e.g. "NOISE32.YUV"), then VQMA performs noise measurement by processing multiple lines of a single video frame instead of analysis of multiple video frames. All other test procedure are in this case not applicable, so the corresponding menu items are disabled and shown in grey.

It is possible to use other test patterns, e.g. full field 75% color bars or modulated ramp, but with limited functionality. Some pages of VQMA display still can be used, e.g. Staircase Display Page (it will show any waveform found in TV lines of Band 4 of VQMA matrix pattern). VQMA does not support *measurement* of video quality parameters on any other test pattern, except the original VQMA matrix test pattern.

3   Software Installation and General Setup

1. Install VQMA software as follows:

Create a folder on the PC hard drive, for example "c:\VQMA", and copy there the following files:

1. VQMA.EXE   Main executable

   Note that in some versions the executable file name can be shortened to VQM.EXE

2. VQNTSC.INI   Optional customized configuration file for NTSC standard

3. VQPAL.INI   Optional customized configuration file for PAL/SECAM standard

If these two .INI files are not found in the program folder, then they are created automatically by VQMA.EXE with the default tolerance values. This happens when the video data file of the corresponding standard is opened first time, e.g. VQPAL.INI will be created only if necessary - when PAL standard .AVI file has to be processed.

VQMA is a copy protected program using uniquely encrypted USB dongle, matched with the copy of your executable as installed. This dongle must be inserted into USB port of the PC where VQMA is installed whenever the VQMA.EXE is running. In case of loss or damage of this USB dongle, VideoQ reserve the right to revoke the license.

Please note that when the dongle is not connected, the protected application will stop running. If you purchased multiple copies of VQMA please be sure to use the dongle with the same registration number as the copy number on the distribution CD. Installation on networked computer system (LAN or WAN) is not possible with this version.

2. Connect VQMA test pattern source to the appropriate input of capture device

3. Run the appropriate capture software to create .AVI (recommended) or .YUV file with video data

4. Run VQMA program to measure the performance of the device under test

   Repeat steps 3 and 4 as required.

Removing VQMA software is quite simple. VQMA does not make records in Windows system registry, except the location of the last opened video data file. Therefore, to remove VQMA from the system it is enough to delete the executable file VQMA.EXE.

## 3.1 Test Pattern Files and DVDs as Video Source

There are **two .MP4 video files** supplied – one for NTSC and one for PAL/SECAM, providing the reference matrix test pattern video source on the CVBS, S-Video (Y/C) and/or YPbPr (YUV) outputs of a professional or semi-professional video play-out card (if such card is installed on a PC).

*Note that typically Video Out signals provided by video players via **PC graphic adapter or graphic card** on CVBS output are **not suitable** for VQMA analysis.*

There are also **two DVD disks** supplied – one for NTSC and one for PAL/SECAM, providing the reference matrix test pattern video source on the CVBS, S-Video (Y/C) and/or YPbPr (YUV) outputs of any good quality DVD player

If necessary, CVBS signal from video play-out card or DVD player can be converted into RF signal via optional external modulator (not supplied).

Note that video levels are measured as supplied by the actual source. Some DVD players may output non-calibrated video, with up to 25% errors of sync pulse level. This may affect the test results. Higher degree of accuracy can be achieved by using the professional hardware-based well-calibrated test signal generator loaded with VQMA test matrix pattern.
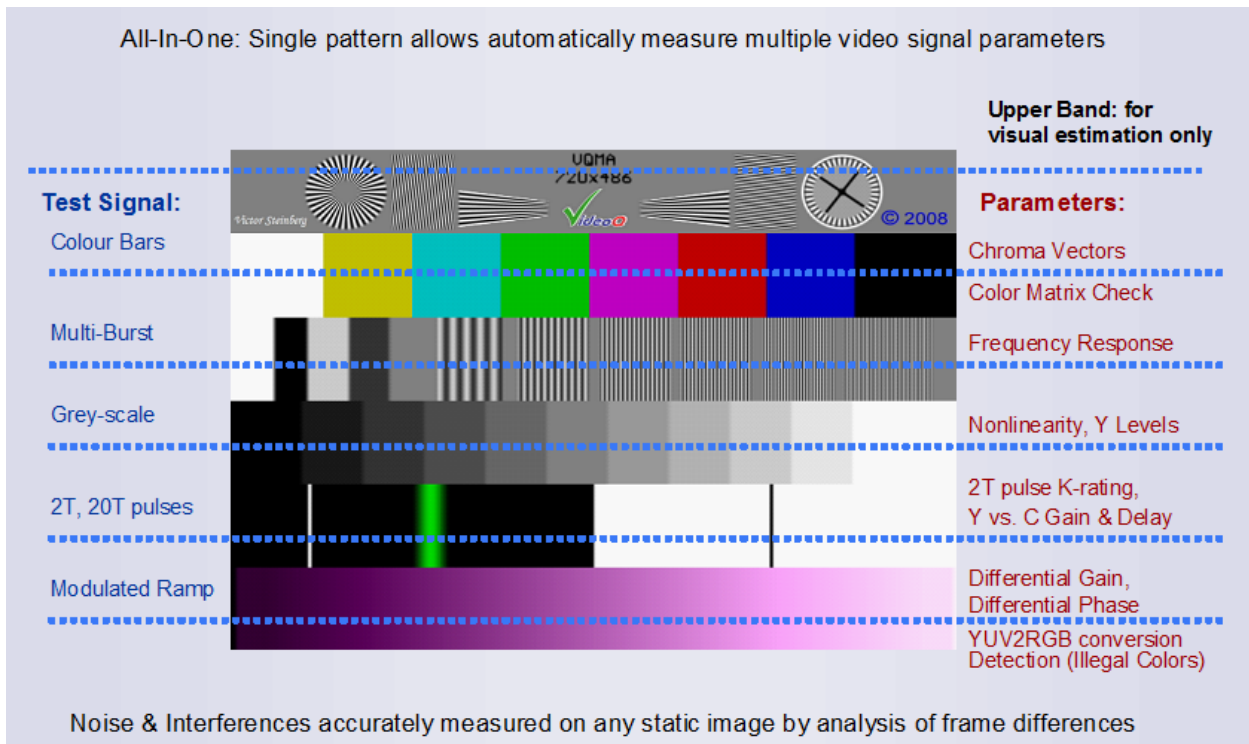
First (topmost) band of VQMA test pattern serves for visual assessment of monochrome or non-saturated colors rendition. It is also useful for revealing timebase errors, scalers/deinterlacers/codecs performance, patterned noise, interferences and other artefacts. Currently, this band is not used for any objective measurements. The appearance of this band may differ in customized versions of VQMA.

The upper band layout of actual test patterns encoded as .MP4 files or recorded on DVD as .VOB (MPEG2) files may slightly differ. It does not affect the program performance and the accuracy of the results.

Five lower bands of the matrix serve for simultaneous (parallel) analysis of all parameters describing the performance of signal transmission chain or the signal capture device under test:

Note that some parts of VQMA matrix pattern contain *illegal colors*, e.g. modulated ramp contains zero Y value pixels with non-zero UV values - so called "colored black". For this reason any conversion of VQMA test video data into RGB or BMP format, or any other processing forcing *color legalization*, is not acceptable. After legalization, even if the test pattern *look* the same, it cannot be used for measurements.

Important: because SECAM color subcarrier is *frequency modulated*, the *differential phase* and *differential gain* distortions do not affect the demodulated YUV data on modulated ramp, i.e. on Band 6 of matrix test pattern. Thus, in case of demodulated SECAM signal these two parameters are irrelevant and should be ignored.

SECAM decoders typically use low-pass or notch filters in demodulated luminance channel, which implies special (not so strict) target values for VQMA automatic analysis of frequency response and K-rating, i.e. measurements of Bands 3 and 5.

Customized versions of NTSC and PAL/SECAM DVDs supplied with the program may contain the VQMA Test Matrix as above plus some other test patterns; these are just useful extras, not related to VQMA measurement process.

3.2 Capturing and Saving Video Data File

1. Supply CVBS, S-Video, YPbPr or RF signal of the VQMA matrix test pattern to the appropriate input of capture device under test.

2. Run any capture software driver or Direct Show graph, available on the system, e.g. "AMCAP":

   2.1. The specified **capture time** should be equal or greater than **8 TV frames**, recommended capture duration is slightly more than **32 frames**, e.g. **2 seconds**
   Note that capturing video clip of longer duration is acceptable,
   *but it **does not improve the accuracy** of VQMA results*

   2.2. Select file format as **uncompressed** .AVI with FOURCC code = **UYVY** or **YUV2**

   2.3. Select **native** (full) resolution: **720 x 480** or **720 x 486** for NTSC, **720 x 576** for PAL or SECAM

All this actions should be done by user prior to the measurement and analysis stage, described in the following sections.

The process of capturing new AVI file should be finished and file closed before the "open" ("input") function of the VQMA program is performed. It is possible to give the AVI file any name of user choice and store it in any folder on any *local* hard drive.

 It is *not recommended* to use *network drives* because of the high bandwidth required for normal operation of the software.

VQMA remembers the location of the folder with last opened file, so "File Open" dialog defaults to this location.

Manual or automatic update of captured video data and corresponding update of test results are possible at the rate of about 2-3 seconds – this is typical capture-plus-analysis time interval for medium speed PC.

The update of captured *.AVI data file, renaming, appending and/or overwriting of the relevant files, as well as systematic logging of the test results in DOS mode should be organized by the user, e.g. in form of script or batch file.

VQMA tool is also capable to process other video file formats and test patterns, as described in the "Supported File Formats" section, but some analysis functions will be not available or disabled.

For example, VQMA noise measurement algorithm requires access to *multiple* frames of matrix test pattern, but it can also be done by processing *single* frame of uniform *grey field*.

Quite often, for calibration and debugging purposes, user needs just a valid display of Y waveform plus UV vector graph. In such case, it is enough to provide .YUV file containing single frame of VQMA matrix or any other .YUV file containing standard 75% color bars pattern, e.g. SMPTE bars or EBU bars on red.

4   Running VQMA in Windows GUI mode

Click on the VQMA executable icon, or launch VQMA.EXE with no parameters specified in the command line, to open GUI with standard Windows menus and dialog boxes.

4.1 Menu - File

This menu should be used first - after launch of VQMA.EXE:
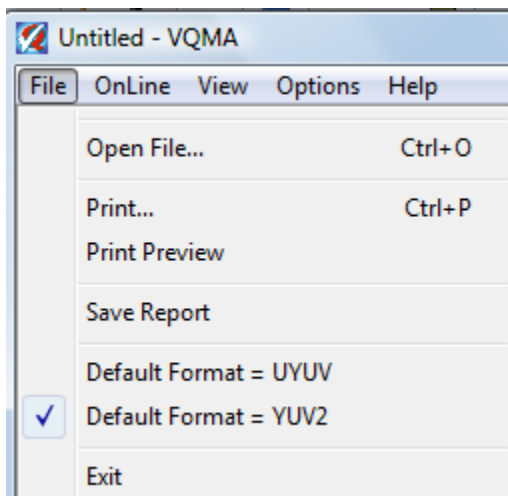
User can perform standard Windows functions, - Open File, Print, Print Preview and Exit.

Sub-menu "Open File" invokes standard "File/Open" Windows dialog box. User can browse folders to find and open pre-captured video file. Default file type is **.avi**. Sub-dialog "Files of type:" allows opening files of other types: single frame **.yuv** files or multi-frame .**nts** /**.pal**.

In "Print Preview" sub-menu each of eight on-screen pages of VQMA test results can be previewed and printed separately.
VQMA.EXE automatically set printer page orientation to "**Landscape**". *Manually switching printer into "Portrait" mode may result in unreadable print-out.*
It is advisable to use PDF writer, e.g. "PDF Factory" to create electronic reports of VQMA test results; paper copies can also be printed if necessary. Default name for VQMA PDF Report file is suggested by printer and typically include drive letter, folder name and .AVI file name.

Menu "File" also includes two VQMA specific functions:

- "Default Format"
     this allows to toggle between two alternative formats of .YUV/.NTS/.PAL files to be opened,
     but does not affect the processing of .AVI files, which is controlled by FOURCC code read from AVI file header

- "Save Report"
     this allows user to browse folders and save short text report in .TXT or .CSV format.

User can select any folder and file name for this report. Format of saved report is similar to DOS mode output, described in the correspondent section of this manual, but in Windows mode there

is one extra line showing full name of input file.

4.2 K-rating, Y/C Gain and Y/C Delay page

This page displays *averaged* waveforms of Y , U and V signals selected from the 5th band of VQMA matrix test pattern.

It also shows the measurements results for three parameters related to this 5th band:

1. **K-rating**, in %, measured on 2T pulse (white needle pulse)

2. **C vs. Y Gain**, in dB, measured on 20T composite pulse

3. **C vs. Y Delay**, in ns, measured on 20T composite pulse
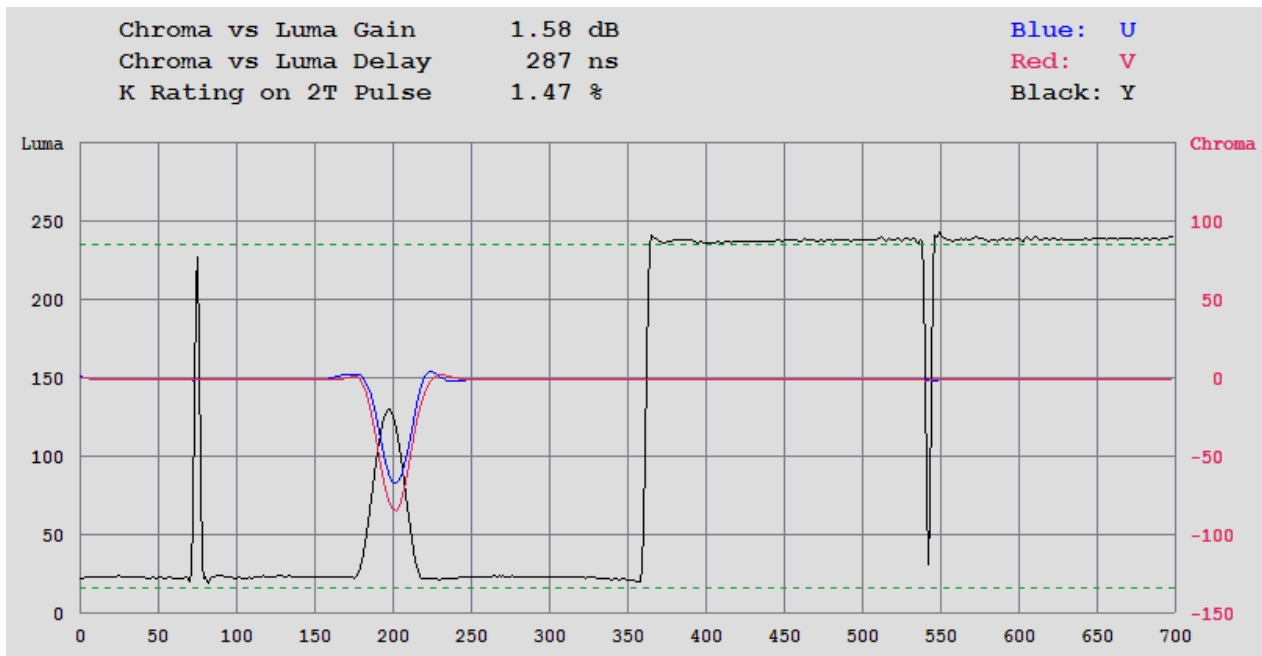
Vertical scale is D1 8 bit, Reference Black = 16, Reference White =235.
Horizontal co-ordinate: Y pixel count from 0 to 719.

Black needle pulse is present on the display, but its distortions are not included in the K-rating calculation. However, this particular test signal component is useful for estimation of quadrature and other non-linear distortions. If its shape correlates well with the shape of its counterpart of opposite polarity (white needle pulse), then the distortions are rather linear. In case of strong non-linearity, caused, for example, by protective black or white level limiter, the overshoots of two needle pulses will look quite different.

Display of U (blue) and V (red) components of demodulated 20T composite pulse allows to distinguish between linear and non-linear causes of Y/C delay errors. From the plot above it could be seen that there are both types of distortions present. Both U and V are delayed wrt Y, but V delay is much higher, probably because of the chroma bandwidth asymmetry. The most probable reason - bad design, lack of tuning or malfunction of the tuner. Less probable reason - wrong settings of the composite decoder controls.

4.3 Menu - OnLine

This menu item is reserved for future use - to control video capture devices installed and recognized by Windows.
Current version does not support "Live Capture" mode, so this menu is shown in grey.
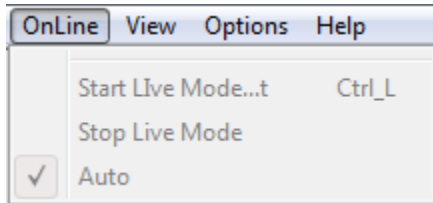
Menu contains three commands:

- "Start Live Mode" (Start Capture)

- "Stop Live Mode" (Stop Capture)

- "Auto"

Default is "Auto", in this mode the on-line capture process is repeated indefinitely; video data refreshment rate is controlled by VQMA program. This allows video data capture process to re-start immediately after the end of current cycle of measurements.

4.4 Menu - View

This menu allows selection of Test Summary page or partial test result pages as described in the following sub-sections.
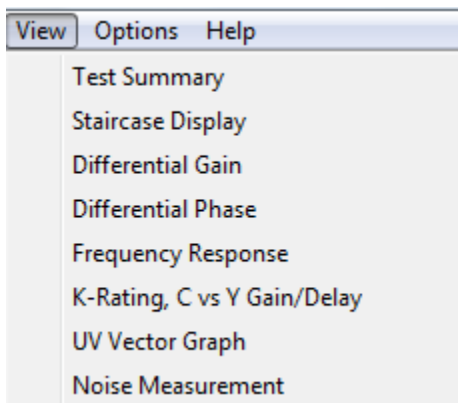
Default page selection is "Test Summary".

Test Date and Time are shown at the top and Video File Name (full path) is shown at the bottom. This information is always presented on all VQMA pages.

Choice of selected page is persistent, same page will be shown after analysis of any new file, until the selection by user of some other page.

4.4.1 Viewing Test Result Pages

VQMA produces several result presentation pages which are displayed one at a time, each page containing detailed report about the particular type of video distortions:

- Test Summary table
  shows all results, plus partial and global "Pass/Fail" flags

- Staircase display
  shows waveform, Black and White levels

- Differential Gain
  also contains DG profile display

- Differential Phase
  also contains DP profile display

- Frequency Response
  also contains multi-burst waveforms display

- K-rating, Y/C Gain and Delay
  also contains 2T/20T pulse waveforms display

- UV Vectorscope Display

- Noise Measurement
  shows weighted and unweighted SNR for Y and UV channels , Noise Spectrum Display, Noise Pattern Display

User can select any page from "View" menu. At the first run of VQMA.EXE the "Summary" page is selected; it also can be selected by user at any time later.

At any time moment only one of these pages is displayed. If the user selects another video file, VQMA stays on the previously opened page, allowing fast performance comparison of different devices or even complete systems, e.g. made by different manufacturers. This feature is also useful for adjustment or comparison of different configurations or modes, e.g. comparing the tuner performance with CVBS input, or CVBS input performance vs. YPbPr input.

For example, user may open file "Device_1.AVI", select "Noise Measurement" page, review it, then open another video file, e.g. "Device_2.AVI". In this case VQMA stays on "Noise Measurement" page, thus allowing quick (nearly instantaneous) visual comparison of interference levels and noise performances of two capture devices.

Even after print-out of noise spectra and noise patterns VQMA will stay on "Noise Measurement" page until the selection by user of some other page, e.g. "Frequency Response".

Test results vary depending on type of averaging filter selected in the "Options" menu. Switching the averaging filters allows to estimate the influence of noise on the actual results. Current status of averaging is shown in the upper right corner of every page.

4.4.2 Test Summary page

The table shows the results of all partial tests, whilst the most important "global" result is displayed in the upper left corner. This is shown as one word, which can be either "Passed" in green or "Failed" in red; it is produced by logical AND function of partial test result flags of the table.

Leftmost column contains the partial test name (name of the measured parameter).

Next two columns shows measured value of the particular parameter and unit of measurement.

The "Target" column shows actual test tolerance values read from .INI file.

The rightmost column of the table shows partial test results. These are displayed as green ticks, if partial test passed, or red crosses, if partial test failed.

C:_Work_VQMA 2v4 CD Release 26 April 2009\Samples\AVIs\Tuner Input NTSC YUY2 format.avi - VQMA

File   OnLine   View   Options   Help

VQM Test **Failed**   Wed May 13 00:15:12 2009   *Video Quality Test Summary*   *Mean values for 50 x 24 lines over 24 frames*

Parameter	Measurement	Unit	Target	Pass
Black Level	-0.2 %, (15.5)	%, (8 bits)	-5.0 -- +5.0 %	✔
White Level	103.3 %, (242.1)	%, (8 bits)	95.0 -- 105.0 %	✔
Unfiltered Y SNR	46.94	dB	> 40 dB	✔
K Rating on 2T Pulse	1.92	%	< 3 %	✔
Chroma vs Luma Gain	0.60	dB	-1.00 -- +1.00 dB	✔
Chroma vs Luma Delay	74	ns	-40 -- +40 ns	✘
Differential Gain	1.04	%	< 5 %	✔
Differential Phase	3.3	degree	< 5 degree	✔
Freq. Response @ 1.00 MHz	-0.84	dB	-1.0 -- +1.0 dB	✔
Freq. Response @ 2.00 MHz	-1.04	dB	-1.0 -- +1.0 dB	✘
Freq. Response @ 3.00 MHz	-1.99	dB	-1.0 -- +1.0 dB	✘
Freq. Response @ 3.58 MHz	-2.16	dB	-1.0 -- +1.0 dB	✘
Freq. Response @ 4.20 MHz	-13.09	dB	-1.0 -- +1.0 dB	✘
Freq. Response @ 5.80 MHz	-39.07	dB	-3.0 -- +1.0 dB	✘

Reference   *Test*

C:_Work_VQMA 2v4 CD Release 26 April 2009\Samples\AVIs\Tuner Input NTSC YUY2 format.avi

Left picture represents reference (undistorted) test pattern.

Picture on the right shows *first TV frame,* extracted from the captured video clip under test.

4.4.3 Staircase Display page

This page displays Black Level and White Level measured on ***averaged*** VQMA matrix pattern. They are presented above the plot in % of nominal range and also as D1 8 bit levels (in brackets).

Actual staircase signal waveform, averaged by the filter selected in "Options" menu, is shown on the diagram superimposed over Reference Black and White levels - designated by green dotted lines.
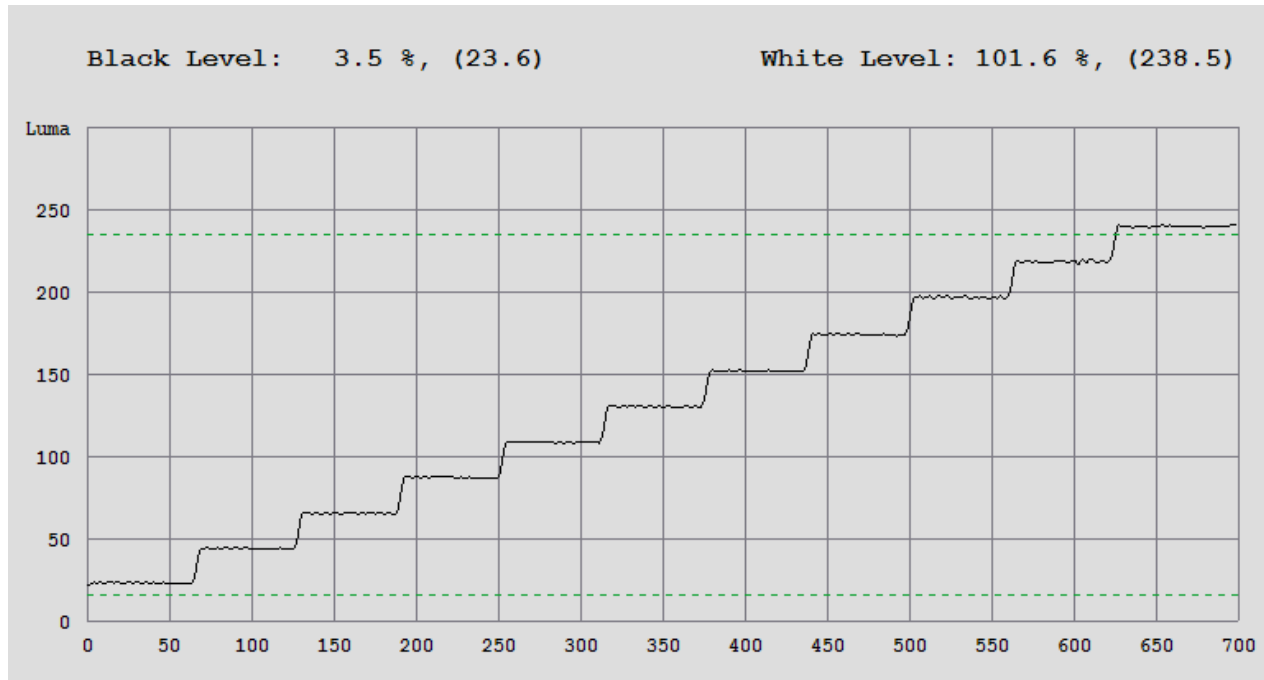
Vertical scale is D1 8 bit, Reference Black = 16, Reference White =235.
Horizontal co-ordinate: Y pixel count from 0 to 719.

Note that VQMA measures black and white levels ***not*** on porches of staircase signal (4th band - grey scale), but on larger black and white bars available within ***5th band*** of the test pattern (pulse and bar). This makes measurement more accurate, but actual vertical position of black or white porch of staircase waveform display may occasionally look slightly different from measured levels.

4.4.4 Diff Phase and Diff Gain pages

These two pages display measured Differential Phase in degrees and Differential Gain in %. These are calculated as peak values within the whole CVBS range - from black to white.

There are also two conventional displays of DP and DG profiles - black is on the left and white is on the right. The profile displays are very useful, because they allow to estimate actual causes of the differential distortions. For example, from the plots below it is clear that there is no problem with DP, whilst relatively high (out of specs) values of DG correlate with high signal levels - close to 100%. Such shape of the profile shows that the DG distortion can be possibly reduced by minor re-distribution of video gains thru the video processing chain.
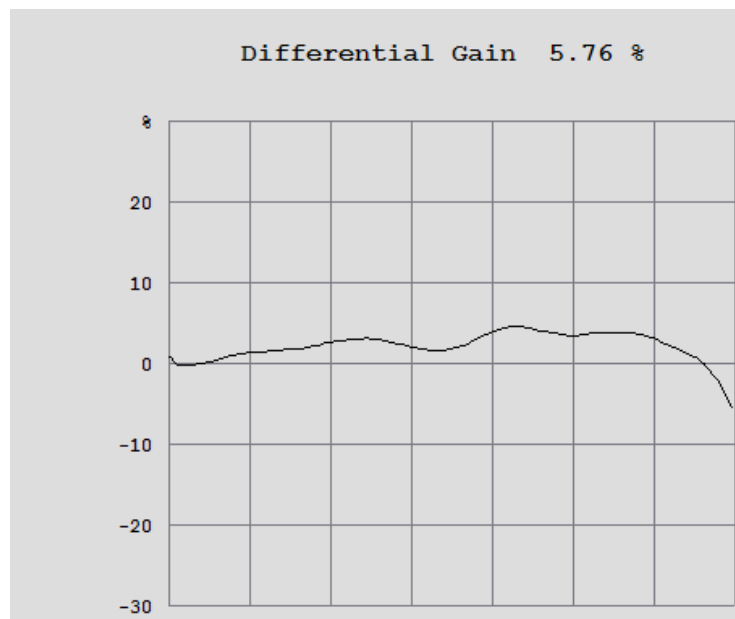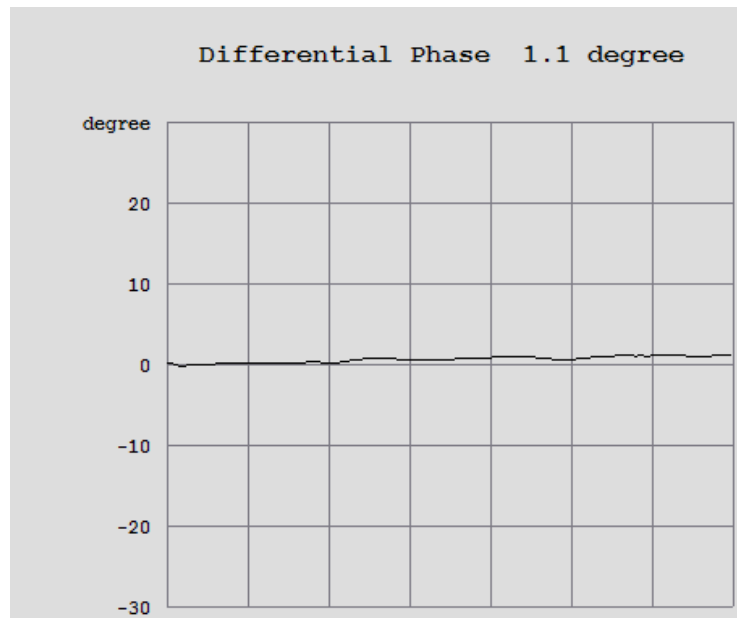
4.4.5 Frequency Response page

This page shows the measured *averaged* peak-to-peak amplitudes of six frequency bursts and displays *averaged* luminance waveform of multi-burst band of VQMA matrix pattern (3rd band).

Type of averaging filter can be selected via "Options" menu.

The burst amplitudes are expressed in dB wrt nominal (undistorted) value.

Third band of VQMA test pattern includes special reference bars with levels exactly matching the nominal burst amplitude. The measurement algorithm check these bars first, and automatically compensate for any non-standard Black Level and White Level conditions. In other words, VQMA frequency response measurement is always accurate and correct, independent of any clamping, setup or gain errors in Y channel.

The list of burst frequencies tested by VQMA is rather short, - 6 frequencies represent only few points on the frequency response plot.

However, in typical conditions frequency response shape is quite smooth. Thus, VQMA values, measured on few frequency bursts, adequately represent typical frequency response plot in total.

On the other hand, long-distant RF echoes may produce strong ripples on frequency response, seriously damaging the validity of the multi-burst test. In such case, only genuine slow sweep signal test can reveal the true shape of frequency response.
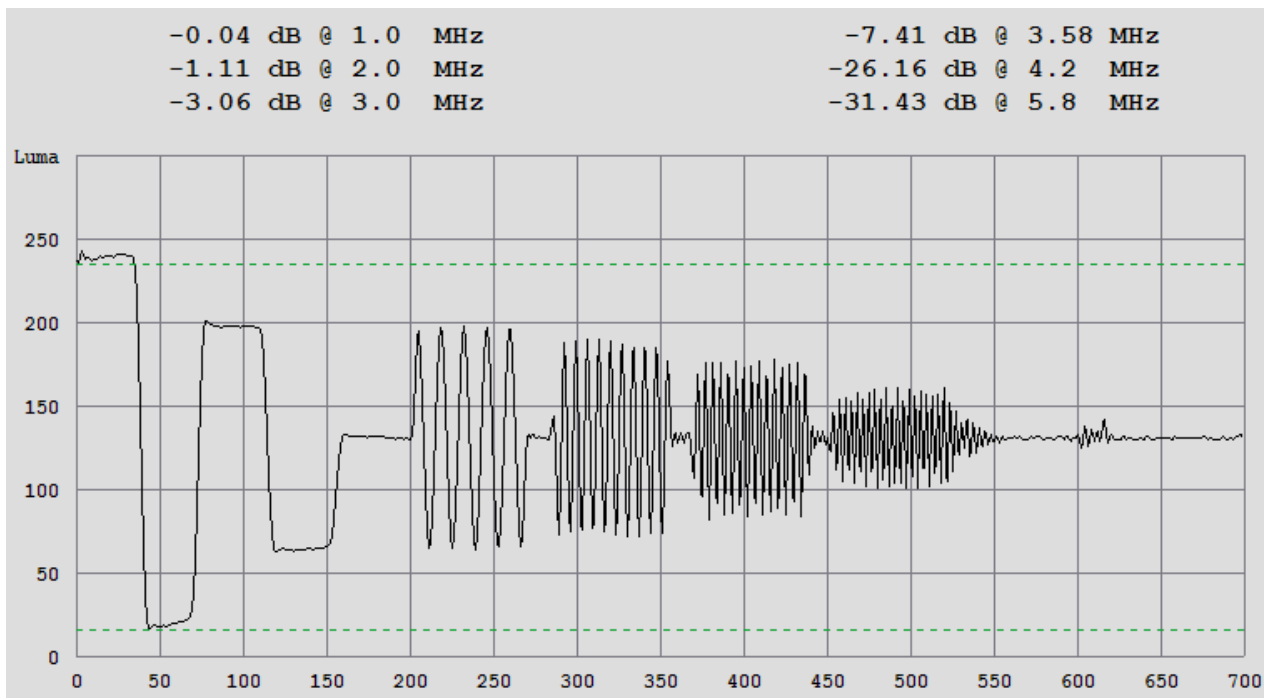

```
-0.04 dB @ 1.0   MHz          -7.41 dB @ 3.58 MHz
-1.11 dB @ 2.0   MHz         -26.16 dB @ 4.2   MHz
-3.06 dB @ 3.0   MHz         -31.43 dB @ 5.8   MHz
```

Vertical scale is D1 8 bit, Reference Black = 16, Reference White =235.
Horizontal co-ordinate: Y pixel count from 0 to 719.

4.4.6 UV Vector Graph page

This page displays *averaged* waveforms of U and V signals selected from the color bars band of VQMA matrix test pattern.Type of averaging filter can be selected via "Options" menu.

U(CR) and V(CB) levels are in D1 8 bit scale.

Seven target zones (red squares) on color bars vector display are sized to represent 5% (+/-2.5%) of nominal UV range.

Central points of these squares represents reference 75% Color Bars. UV values for both systems NTSC and PAL are the same.

This page also allows visual estimation of C channel dynamic quadrature distortions. Non-distorted chrominance transitions are mapped as straight lines, but distorted transitions appear bended. The curvature of lines on the display is usually affected by tuner performance.

Chroma(Cb, Cr) Vectors in Percent of full D1 Range
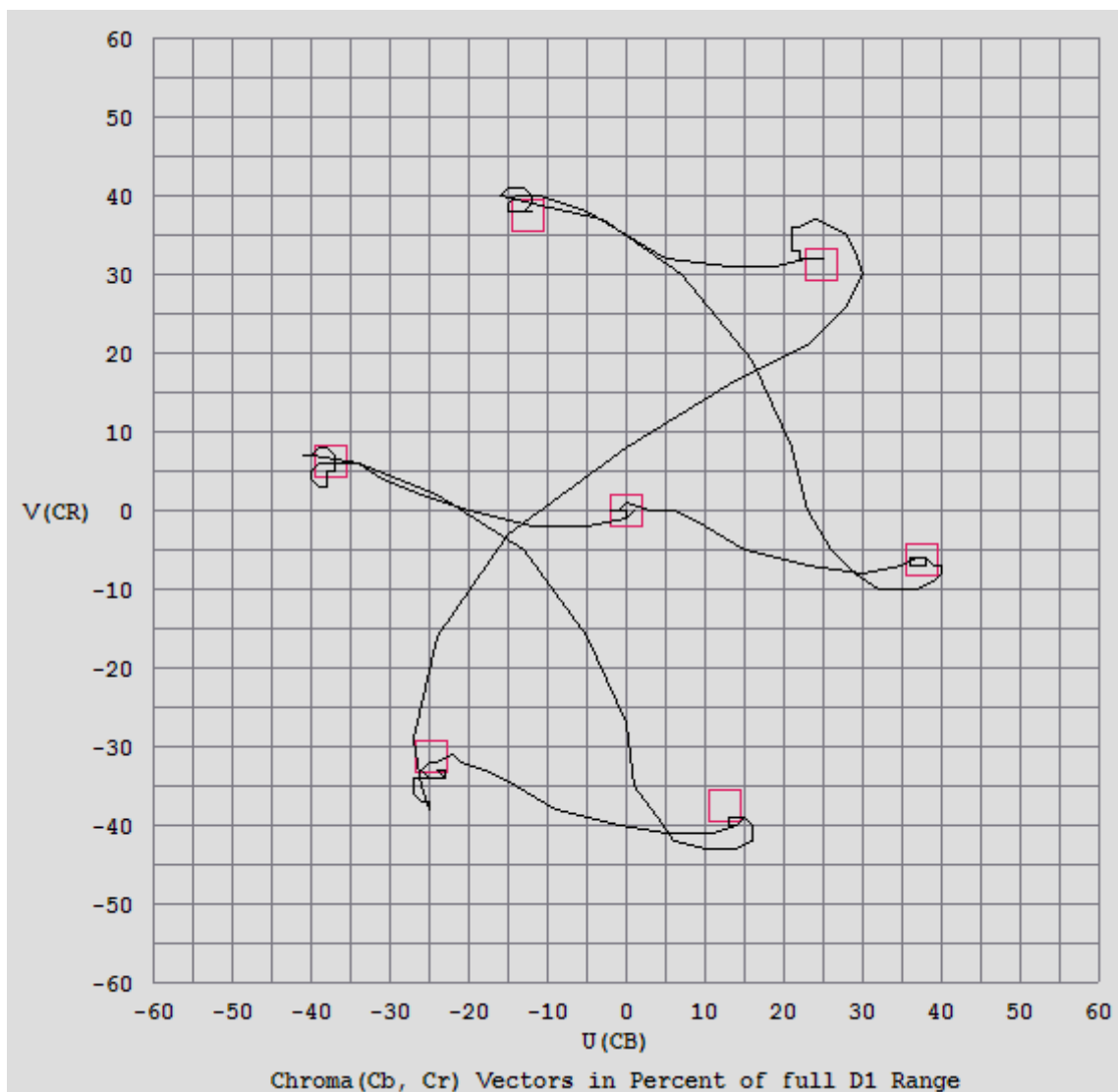
4.4.7 Noise Measurement page

RMS noise level of **Y** channel in **D1 8 bit levels** is shown on the very top of the page.

The RMS value is derived directly from incoming video data, so it correlates with unfiltered SNR.

Y channel **SNR** is calculated in five variants: **unfiltered**, **band-limited A & B** (for CVBS & tuner inputs), **band-limited and weighted A & B**.

*These SNR values may be slightly affected by video calibration errors, because SNR is traditionally calculated wrt **nominal** signal range, i.e. assuming video gain = 0 dB.*

UV SNR is derived from 1.5 MHz band-limited unweighted sum of scaled U noise and V noise.

Y channel filters switch automatically depending on TV standard:

NTSC: **SMPTE Unified Weighting**,   **4.2** MHz and **6.0** MHz **Band-limiting**

PAL: **EBU Weighting**,   **5.0** MHz and **6.0** MHz **Band-limiting**

Y Noise Spectral Density plots in dB/MHz for unlimited and weighted noise spectra allows to see the effect of tuner frequency response and also to distinguish random noise from the contributions by regular textures, e.g. from those caused by RF interference or digital clock pick-up.


```
Y Noise Level RMS    3.56 (8 bit level)
Y SNR unfiltered    35.79 dB                              UV SNR 1.5 MHz   43.36 dB
Y SNR 4.2 MHz       36.13 dB                    Y SNR 4.2 MHz weighted   42.08 dB
Y SNR 6.0 MHz       36.10 dB                    Y SNR 6.0 MHz weighted   42.07 dB
```

Noise Spectrum
Noise weighted in red

8 x Noise
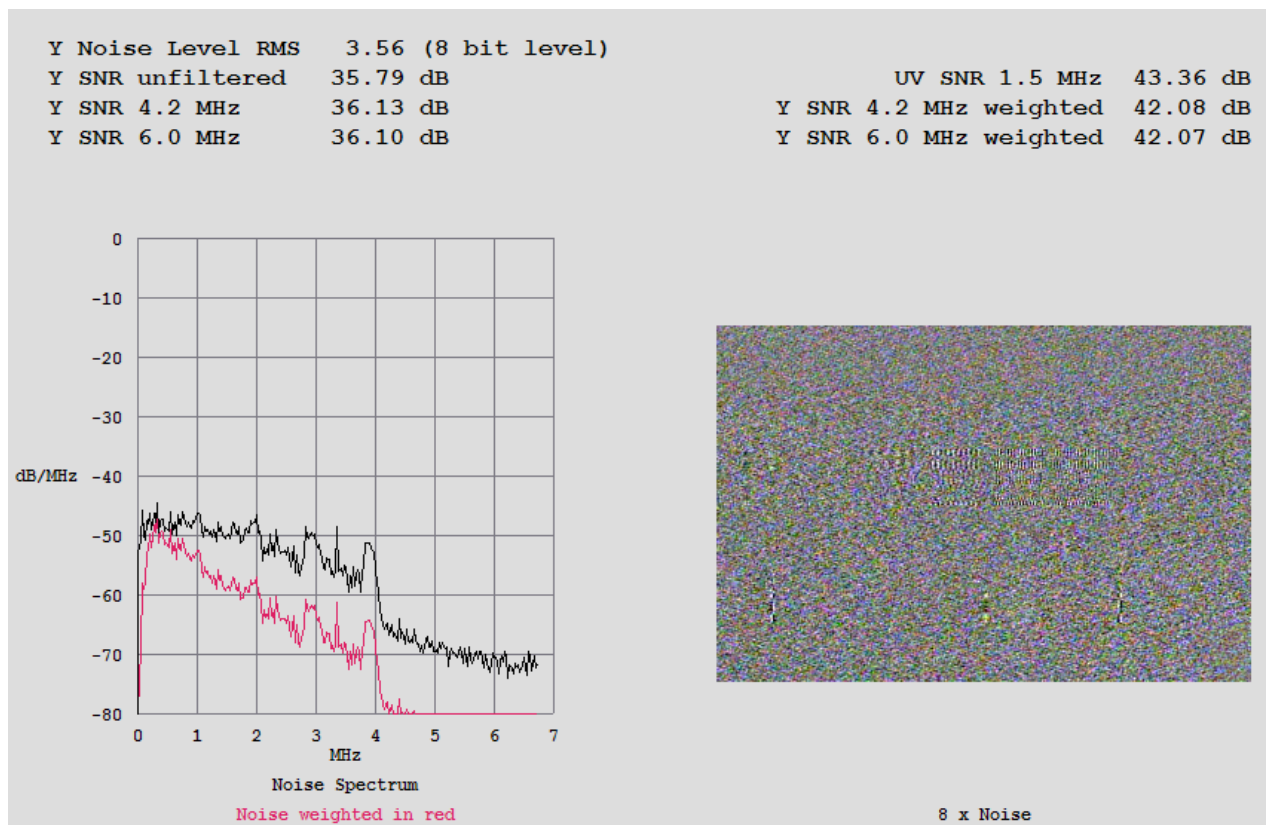
The picture at the bottom right corner of the page shows *boosted* (x8 gain) noise pattern on grey background. This also helps to differentiate true random noise from other unwanted (but more or less periodic) signals.

4.5 Menu - Options

"Options" menu allows selection of spatial/temporal averaging filters used to reduce the harmful effect of noise, which affects the accuracy of measurement.

Options	Help
Single Frame Single Line	
Single Frame Multiple Lines	
Multiple Frames Multiple Lines	
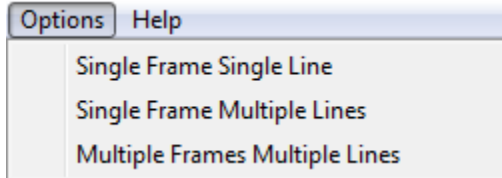
This menu is for advanced users.

Default selection is "Multiple Frames Multiple Lines", it allows maximum reduction of noise influence over the test results. This selection is *mandatory* for Summary Page and Noise Measurement Page. When user selects in "View" menu any one of these two pages the "Options" menu automatically reverts to "Multiple Frames Multiple Lines". Two other options could be used to compare the behavior and amount of noise, e.g. when viewing the "Staircase Display" page.

4.6 Menu - Help

"Help" menu contains two items:

Help
About VQMA program
Short Guide
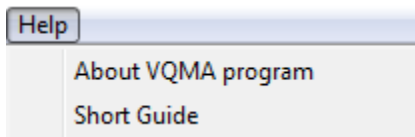
4.6.1 About VQMA program

This sub-menu shows program version, copyright and technical support information

About VQMA Program

Version 2.4.3
VideoQ, Inc. Copyright (c) 2005-2009

Technical support: support@videoq.com

OK
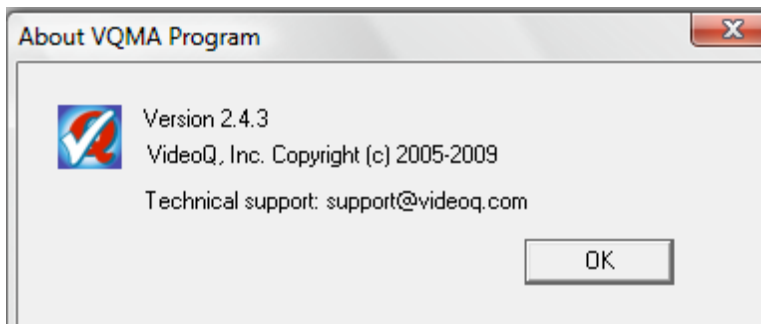
4.6.2 Short Guide

This sub-menu produces pop-up box with short description of modes of operation and supported video file formats:

Short Guide

VQMA can be launched in two modes:

1. Double click on the VQMA executable icon - to launch Windows GUI mode.

2. Open a DOS box, go to the directory containing VQMA, and type:

    vqma   – to launch Windows GUI mode
      or
    vqma -i <inF> [-y <Format>] -o <outF> – to launch command line

    <Format> = uyvy or yuv2, if -y is omitted format defaults to yuv2
    Parameters <inF> and <outF> can be absolute path, or file name,
    which defaults to the same directory where the VQMA executable resides
    Option flags -i, -y and -o should be entered as is
    The extension of <outF> could be txt or csv, defaults to txt.

Input data should be uncompressed 4:2:2, 720x480, 720x486 or 720x576.
Supported file types:

    xxx.avi   – AVI video clip
    xxx.yuv   – Single YUV frame
    xxx.nts   – Multiple NTSC YUV frames
    xxx.pal   – Multiple PAL YUV frames

Supported *.AVI types: FOURCC = UYVY or YUY2, min duration: 8 TV frames

OK

5   Running VQMA in DOS Mode

VQMA.EXE can be used in DOS window under Windows XP in unattended (robotic) mode.
Note that in previous versions the executable file name was shortened to VQM.EXE:

```
C:\WINDOWS\system32\cmd.exe                              _ □ ×
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\vq>vqm -i ntsc.avi -o vqm4ntsc.txt

C:\vq>exit_
```

5.1 Command Line Parameters

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

VQMA.exe *-i* <InFileName> [*-y* <Format>] *-o* <OutFileName>

where <InFileName> and <OutFileName> can be absolute path, or file name, which defaults to
the same directory where the VQMA executable resides.
All command line characters must be entered *lower case*.

Optional *-y* flag and following <Format> parameter allow to switch between two alternative
multiplexing formats of YUV data: UYVY and YUV2 (YUYV).
Four characters long <Format> string should be either *uyvy* or *yuv2*. If *-y* flag is not present
VQMA.EXE defaults to YUV2 format.
*This does not affect the processing of .avi files, which is controlled by FOURCC code read from
input file header.*
The *-i*, *-y* and *-o* option flags should be entered as is.

Long file names are accepted, *but the total command line string length **should not exceed 256
byte***.

Multi-frame **.nts** and **.pal** formats are supported.

The extension of <OutFileName> could be **.txt** or **.csv**, defaults to **.txt**.

If necessary, multiple or variable commands can be organized using standard Windows batch files
or scripts. Here is the example of such .**bat** file:

```
rem   VideoQ Inc. Copyright [c] 2005-2008
VQMA.exe  -i   example_pal.avi   -o
example_pal.csv
exit
```

5.2 Test Results Presentation

The results can be found in the <OutFile> . They are presented in three sections:

1. VideoQ copyright info (commented out by semicolons)

2. Test results in form of comma separated ASCII data

3. Copy of the .INI content (commented out by semicolons)
    this section allows to log, if necessary, the actual target values used for the test

The most important is **Section 2**.

First line of section 2 shows VQMA version, followed by actual test date and time.

Next 14 lines contain the results of partial tests, starting with the parameter code in form of two, three or four ASCII characters:

BL   Black Level in % of nominal video range, e.g. 2.8

WL   White Level in % of nominal video range, e.g. 99.3

SNR   Unweighted Luminance Channel Signal To Noise Ratio in dB, e.g. 52.23

KR   K-rating in %, e.g. 0.94

CYD   Chrominance To Luminance Delay in nanoseconds, e.g. 2

           positive values show that chrominance is delayed wrt luminance

CYG   Chrominance To Luminance Gain in dB, e.g. 0.11

           positive values show that chrominance gain is higher than luminance gain

DG   Differential Gain in %, e.g. 1.21

DP   Differential Phase in degrees, e.g. 0.8

FR1, FR2, FR3, FR36, FR42, and **FR58** are the frequency response reading in dB for the burst of corresponding MHz value

           For NTSC version the burst frequencies are 1.0, 2.0, 3.0, 3.58, 4.2 and 5.8 MHz.

           PAL version uses slightly different set of frequencies:
           FR1, FR2, FR3, FR4, FR48, and **FR58**, i.e. 1.0, 2.0, 3.0, 4.0, 4.8 and 5.8 MHz

Below is the sample of the test result presentation:

> 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
>
> CYD, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 2, ns, Success
>
> CYG, 10/19/05 2:13:14 PM, 10/19/05 2:13:14 PM, Success, 0.11, dB, 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

Each parameter code is followed by the test time interval (start and finish), first codeword "Success" or "Failure", measurement result value, unit of measurement, and the second codeword "Success" or "Failure".

The first "Success" or "Failure" shows if the test took place (independent of the actual capture device performance). This "Failure" could be caused, for example, by wrong input file name, wrong input file length, or wrong FOURCC code in the AVI header.

The second "Success" or "Failure" in each line shows the compliance of the device with the target values set in the .INI file. Thus the **global** "Success" flag is a simple logical AND function of **all partial** "Success" flags.

Next is a sample of target values presentation within VQNTSC.INI file. It contains a simple list of target values for all parameters. For each parameter the target values are defined by four consecutive lines:

1. Parameter Code [in square brackets]
2. Unit Of Measurement Name
3. Lower Limit (Minimum Value)
4. Upper Limit (Maximum Value)

```
;VQNTSC.ini - VideoQ inc. Copyright [c] 2005
; [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
; [CYD]
; CYDUNIT=ns
; CYDMIN=-40.00
; CYDMAX=40.00
; [CYG]
; CYGUNIT=dB
; CYGMIN=-1.00
; CYGMAX=1.00
; [DG]
; DGUNIT=%
; DGMAX=5.00
; [DP]
; DPUNIT=degree
; DPMAX=5.00
; [FR1]
; FR1UNIT=dB
; FR1MIN=-1.00
; FR1MAX=1.00
; [FR2]
; FR2UNIT=dB
; FR2MIN=-1.00
; FR2MAX=1.00
; [FR3]
; FR3UNIT=dB
; FR3MIN=-1.00
; FR3MAX=1.00
; [FR36]
; FR36UNIT=dB
; FR36MIN=-1.00
; FR36MAX=1.00
; [FR42]
; FR42UNIT=dB
; FR42MIN=-1.00
; FR42MAX=1.00
; [FR58]
; FR58UNIT=dB
; FR58MIN=-1.00
; FR58MAX=1.00
```

6   Customization and Editing of INI Files

VQMA.EXE checks the captured (input) video data, e.g. read from *.AVI file, against the tolerance values contained within one of the following files:

> **VQNTSC.INI**
> *or*
> **VQPAL.INI**

VQMA automatically detects NTSC or PAL video file and selects the appropriate .INI file.

The .INI files *must be present* in the program folder, they are editable, so the users can input their customized *tolerance values* for any parameter.

If these .INI files are not found in the program folder, then they are created automatically by VQMA.EXE with the default tolerance values.

VQNTSC.INI and **VQPAL.INI** file names are *reserved and cannot be modified*.

The *content* of the .INI files *can be edited* using any text editor (like Notepad) to apply the tolerance values more appropriate for the particular device under test. It should be done with caution because the *list of parameters* and *units of measurement* codes *should not be modified*.

Only actual *numerical values*, e.g. frequency response drop for some particular frequency can be amended. For example, the MIN tolerance for 3 MHz burst can be changed from -1 dB (default) to -3 dB.

It is recommended to store customized .INI files under the names which are different from the reserved ones, e.g. MY_PAL.INI. To use these customized .INI file simply rename a copy of the selected file MY_PAL.INI to **VQPAL.INI**, overwriting the default file.

It is also advisable to keep a backup copies of the original files, thus allowing to revert to the default values if necessary.

The process of replacement of the .INI files can be automated by usage of conventional batch files or scripts.

7   Terms and Abbreviations

Term	Explanation
AVI	Audio Video Interleaved (File Format)
C	Chrominance (Chroma) Video Signal
CSV	Comma Separated Values (File Format)
CVBS	Color, Video, Blanking and Sync (Composite Video Signal)
DG, DP	Differential Gain, Differential Phase (CVBS specific distortions)
DVD	Digital Video Disk (Disk Format)
EBU	European Broadcasting Union
NTSC	National Television Systems Committee (also a TV Standard name)
PAL	Phase Alternate Lines (TV Standard)
RMS	Root Mean Square (Value - noise strength estimate)
SNR	Signal To Noise Ratio
SMPTE	Society of Motion Pictures and Television Engineers
TXT	Text (File Format, for VQMA software purposes - same as CSV)
UV	Color Difference Video Signals: U (CB) & V (CR)
Y	Luminance Video Signal
YUV	Digital Component 4:2:2 Multiplex (also a File Format)

VideoQ Inc