ClearView

Video Quality Analyzers
8K • 4K • HD • SD

Video Clarity

Tools for Video Analysis

ClearView is highly advanced test & measurement analyzer for audio and video quality, subjective viewing, recording and comparatively playing up to two 8K ultra high definition uncompressed sequences*. The product line provides a wide choice of quality analysis features and measurements that effectively quantify the human subjective experience.

With the convergence of voice, TV and data there is a need for multiple resolutions and processing methods to all screens - TV, PC and mobile. Therefore, the requirements of digital content distribution have increased dramatically. Evolving compression schemes from MPEG-2 to MPEG-4 AVC and now HEVC and JPEG 2000 have increased the need for tools that can properly analyze and track results.

Digital media can be reproduced at any resolution, assuming that one has the storage space and the bandwidth (the number of bits per second that can be sent through a given medium, such as fiber optic cable or the air). At some point, the level of resolution achieved by digitizing a signal will become so good that it is indistinguishable, given the limitations of our perception, from the source.

The most decisive task for product developers and broadcasters is to create a product or service that can fit as many programs as possible into the available bandwidth before the quality becomes objectionable.

To this end, human perceptual video and audio quality analysis must be done.

Two ways exist to do this analysis:
- Perform in-depth analysis on problematic/difficult streams and judge the perceived A/V quality
- Perform long-duration tests searching for drops/degradation in A/V quality over a 24/48 hour test run

In depth A/V quality analysis is a subjective notion. The most precise way to measure quality is to collect human observers and to ask them to judge the quality. This is an expensive and potentially inconsistent approach as human observers need to be judged to make sure that they can be trusted - i.e. their sight is good, they are not too tired or they are not color blind, etc. In the end, a mean opinion score (MOS) is computed for each test. Details for setting up a subjective test can be found in Recommendation ITU-R BT.500-12 - Methodology for the subjective assessment of the quality of television pictures.

A number of algorithms have been developed to estimate perceived quality in a precise way. The results of these algorithms are then correlated against correctly produced subjective data under ITU-R BT.500.12. The result is a perceptual measure of subjective quality.

The algorithms are divided into three general types:
- Full reference algorithms compare the processed and reference sequences
- No reference algorithms analyze only the processed
- Reduced reference algorithms extract specific information from the reference stream and use it when analyzing the processed stream

The ClearView Analyzer product line features four full reference scoring methods or scales:
- MOVIE: MOtion-based Video Integrity Evaluation index which is able to provide one of the most accurate perceptual video quality measurements
- MS-SSIM/DMOS: Multi-Scale Structural Similarity Image Quality Assessment on both MS-SSIM and DMOS scales, where DMOS is the difference between the mean opinion scores of the reference and processed video
- JND: The number of human observers that must be gathered to end up with at least one person who believes that the processed video is at least as good as the reference (just noticeable differences)
- PEAQ: Perceptual Evaluation of Audio Quality with two scales produced from a computerized model of the human ear, BS.1387 and BS.1118
- aFreq: Audio performance metric for finding gross errors versus each reference audio channel. aFreq includes an audio-video offset measurement or lip sync value for a selected channel in program.

The ClearView Analyzer product line includes four no-reference scoring methods:
- aPEAK: True-peak audio measurement per channel according to ITU-R BS.1770-3
- LKFS: Audio loudness measurement per program according to ITU-R BS.1770-3
- Spatial: Calculates the activity power of a video frame, a higher number indicates more changes in the frame
- Temporal: Calculates the changes between successive video frames, a zero indicates a frozen frame

*Sequences in ClearView are video, audio, VANC & timecode of any duration.

The best way to subjectively analyze and compare two different sequences is to look at them on the same video display. Using two different displays, even of the same type, requires vigilant calibration.
- Therefore, ClearView has many viewing modes that show the two sequences using its built-in, full resolution video output *or in a separate playback window on the desktop**.
- In side-by-side and split-mirror modes the sequences can be panned as only half of the image is showing.
- In seamless split mode part of the image is from the reference and the rest of the image is from a processed version of the video content.
- ClearView allows the split point to be moved interactively.

ClearView can also output the two sequences to two different displays. This is done using the multiple output viewing mode command.

Side-By-Side Viewing

Split Mirror Viewing

Seamless Split Viewing

Video sequences can be further analyzed as follows:
- Zooming into any picture area up to 16x
- Panning within the picture during zoom or split screen
- Identifying pixel values via mouse click
- Playing individual fields

Using the included command line interface play lists can be created to allow any view mode to be executed in a series.

ClearView A-B: An easy way to view pixel intensity differences between two images.
- Below a straight subtraction shows one pixel level intensity which may not be possible with some displays.
- Therefore, ClearView systems include A minus B with a Threshold and Addback command allowing users to see differences that are greater or less than a specific pixel intensity threshold as a selectable color.
- This also allows edge differences to stand out.

A minus B with Threshold = 20 View Mode
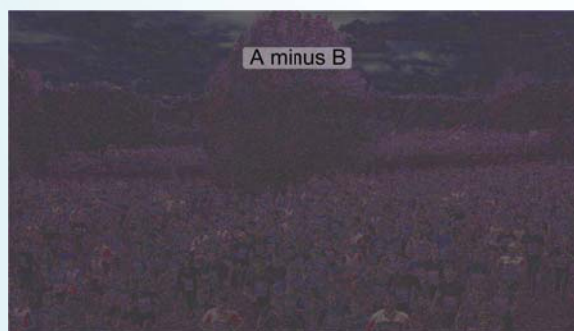

Colors green A>B; yellow B>A
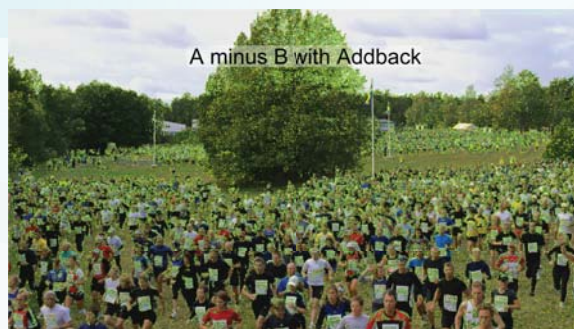
These views are all simultaneously fed to the ClearView graphical user interface and to each of ClearView's full resolution video outputs or, selectably, to a separate desktop window.

The separate desktop playback window is a feature offered in ClearView starting with version 8.4.

PSNR: The most widely used metrics are PSNR (Peak Signal-to-Noise Ratio) or MSE (Mean Squared Error). Both measure the mean error between input and output. PSNR expresses its result as a ratio of the peak signal expressed in dB. PSNR and MSE, while not performing a human perceptual video quality prediction, do serve an important role. PSNR is the objective metric included in all ClearView systems. It measures the absolute difference between two signals, which is completely quantifiable. This is very important in QA and device performance testing where the perceived quality has already been measured in the laboratory environment and what is needed is a PASS/FAIL indicator.

Video Perceptual Quality Measurements

MOVIE: The ClearView 8.2 version system provides a new video quality measurement, MOVIE, the MOtion-based Video Integrity Evaluation index which is able to provide an improved perceptual video quality prediction as an addition to others offered in ClearView systems up to this point. Additionally, MOVIE provides an incrementally accurate correlation to standards-based human subjective quality assessments versus other measurements by implementing an advanced method of defining and measuring spatial and temporal motion distortion in a localized multiscale framework. Therefore, MOVIE provides a leap forward by defining the time-space element and its effects on human perception of video quality as it applies to a full-reference measurement method. In ClearView the selections for Temporal MOVIE or Spatial MOVIE indices are included and overall MOVIE is a product calculation.
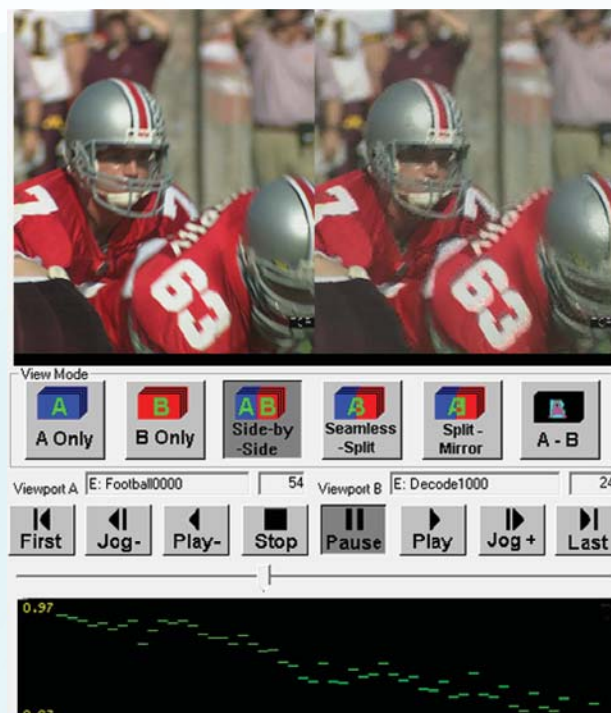
MS-SSIM and DMOS: The structural similarity approach provides an alternative and complementary way to accurately measure human perceptual video quality. It is based on a top-down assumption that the HVS is highly adapted for extracting structural information from a scene, and therefore a measure of structural similarity is an excellent approximation of perceived image quality. The idea is that the eye can recognize a shape even if part of it is missing. It has been shown that a simple implementation of structural similarity (SSIM) outperforms other perceptual image quality metrics. However, the SSIM index achieves the best performance when applied at an appropriate scale (i.e. viewer distance/screen height). Therefore, multi-scale structure similarity (MS-SSIM) has been defined. In MS-SSIM, the picture is evaluated at various resolutions and the result is an average of these calibrated steps and MS-SSIM out-performs simple SSIM even when the SSIM is correctly calibrated to the environment and data set.

ClearView includes the algorithm developed by the University of Texas known as MS-SSIM and provides it on both DMOS (Differential Mean Opinion Score) and MS-SSIM scales. The measurements may be performed on luma (Y) and a combined score is provided for color difference channels (Cb, Cr).

ClearView System Option - Sarnoff JND: A well accepted perceptual video quality index method which simulates the functionality of the human visual system (HVS) components.

The method involves video/audio alignment, low pass filtering (to simulate the eye – video only), calculating the differences that affect the human eye/ear, blockiness, blurriness, noise, lack of dynamic range, loss of high frequencies, classifying the types of distortions, and generating a perceived quality number per frame. ClearView analyzers are optionally licensed with the algorithm developed by Sarnoff Corporation known as Picture Quality Ratio (PQR) and place it on the JND (Just Noticeable Differences) scale.

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Audio Performance Measurements - Included In All ClearView Models

Audio Frequency Metric - **aFREQ** - A comparison of audio versus a reference to find gross audio errors.
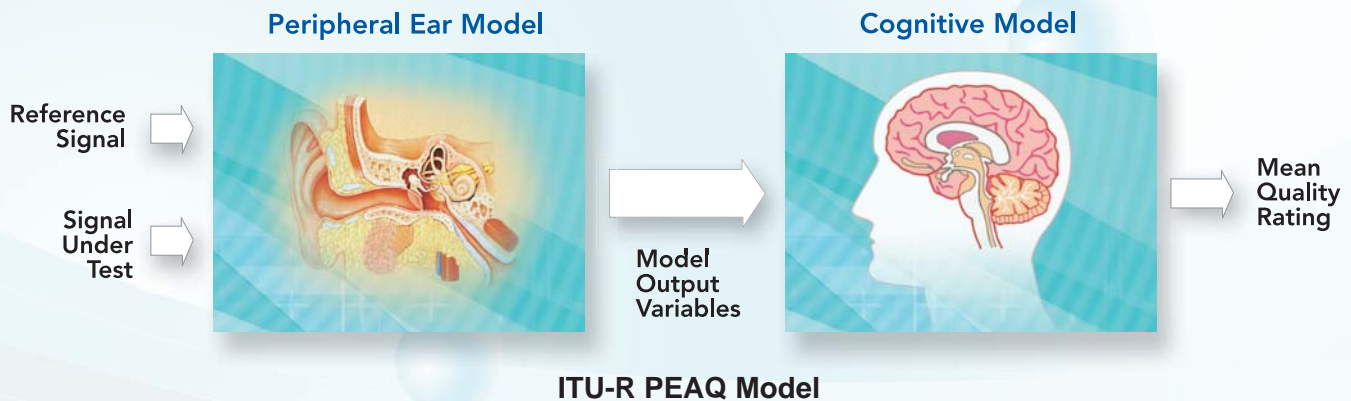- Audio Alignment (lip-sync), a millisecond accurate measurement, is included in aFREQ.

Audio Peak Metric and Loudness Measurement - **aPEAK** measures the true-peak amplitude and gives a value for each frame and separate value for each channel. Within the aPEAK there is a Selection for **LKFS**, Loudness Quoted relative to Full Scale. LKFS metric gives a measurement that will take the peak loudness over a one second period over all audio channels in a given program and Respond with one value over that period. The values returned are based on a logarithmic scale with 0 Being the maximum value and -60 being close to silence.
- The LKFS measurement in ClearView follows recommendation **ITU-R BS.1770-3** exactly.

Audio Perceptual Quality Measurement - Option

The ITU-R **PEAQ** (Perceptual Evaluation of Audio Quality) model is an "electronic ear" which performs an objective measurement of perceived quality of wide band (up to 20 kHz) audio signals using a computerized model of the human ear. This well accepted perceptual audio quality measurement method was developed jointly by experts from eight leading research laboratories and is an international ITU-R standard. It is ITU-R Recommendation BS.1387, "Method for objective measurement of perceived audio quality".
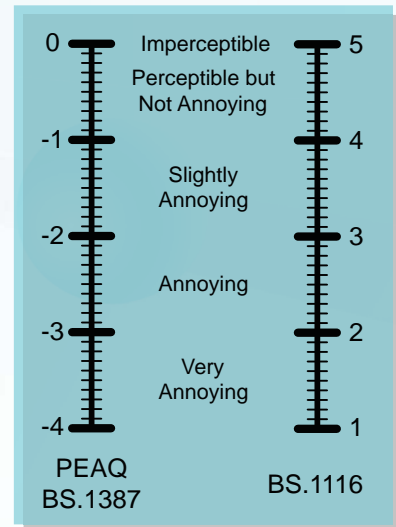
The PEAQ model processes two audio signals to be compared (namely the original reference signal and the test version to be evaluated) and calculates a quality score similar to the mean opinion score that would be obtained from a formal subjective test. In this sense, the PEAQ model is considered as an "average listener".

Peripheral Ear Model

Reference Signal

Signal Under Test

Model Output Variables

Cognitive Model

Mean Quality Rating

ITU-R PEAQ Model

The perceptual rating generated by the PEAQ model represents the overall severity of the impairments in the test signal as compared to the reference. The ClearView system provides the user with two rating scales as shown on the right.

The ClearView analyzer features a full implementation of the ITU-R PEAQ model which has been certified by the Communications Research Centre Canada, one of the laboratories that developed the ITU-R PEAQ method.

The PEAQ measurement is an option for all ClearView system models. Option item CV-PEAQ.

0	Imperceptible — 5
	Perceptible but Not Annoying
-1	4
	Slightly Annoying
-2	3
	Annoying
-3	2
	Very Annoying
-4	1

PEAQ BS.1387   BS.1116

PEAQ Impairment Scales

Equipment Manufacturers want to accelerate the development of their processing algorithms. ClearView allows developers to compare performance of algorithms, quantitatively or subjectively judge them, and get detailed reports.

ClearView
- Imports many compressed or uncompressed file formats (video and audio file types listed on page 10)
- Records video and audio using standard baseband inputs like HD/SD/3G SDI, HDMI, Component, Composite or S-Video as well as digital or analog audio on XLR and embedded SDI
- Captures live from an IP network and demultiplexes the targeted stream for decoding and testing

Regardless of whether the sequence is imported as a file or recorded, a file is stored as YUV 4:2:2 or RGB 4:4:4.
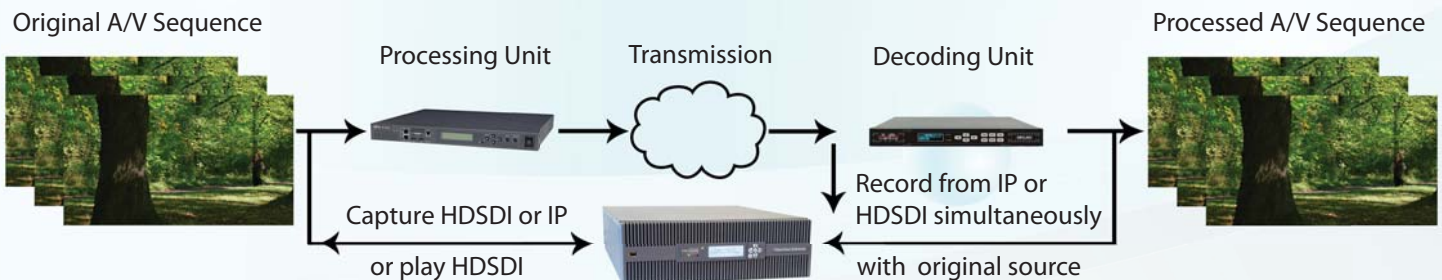
ClearView can then:
- Automatically align the two sequences spatially and temporally
- Provide a subjective comparison of the two sequences using any of the viewing modes previously shown
- Score the video and audio quality on a perceptual scale using the MOVIE, DMOS, JND and PEAQ methods
- Objectively measure using PSNR

The perceptual scores and objective measurements can be saved to a log file, which contains all of the information about the sequences. The log file can be imported into Excel so as to be combined with other data and it can be dropped onto the ClearView GUI (shown on page 10) to restore the test session.

Ways to use ClearView:
1) Send a sequence via HDSDI or IP to ClearView or from ClearView to the processing unit. Simultaneously record the transmitted output from a hardware decoder or from an IP network directly.

Original A/V Sequence   Processing Unit   Transmission   Decoding Unit   Processed A/V Sequence

Capture HDSDI or IP or play HDSDI

Record from IP or HDSDI simultaneously with original source

2) Send a known sequence via SDI to the processing unit, record the output from a hardware decoder and compare this to a pre-recorded result - generating pass fail to a ClearView log file or CLI script.


Reference File & Processed Sequence

Failed ✗
Passed ✓
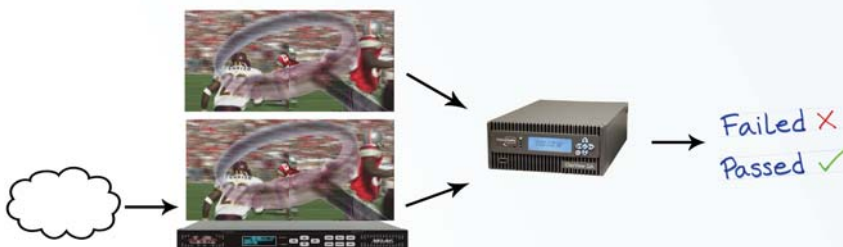
Content originators and entertainment service providers want to determine the optimal parameters to fit as many channels or streams into the delivery network as possible and reach an acceptable quality level. They also want to check the quality of the material after it has been compressed and packaged in a transport or program stream. To do this the ClearView analyzer will play a reference sequence to the processing unit and simultaneously record the decoder output.

ClearView then provides multiple comparison measurements of the processor output to the original content.
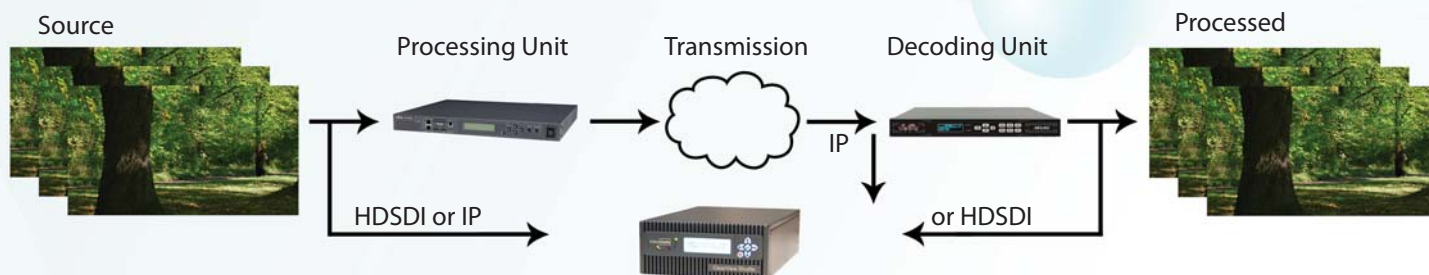
ClearView
- Plays an uncompressed sequence through HD/SD/3G SDI, HDMI or analog outputs to the processing unit
- Records, simultaneously, from the IP network or from a decoder through HD/SD/3G SDI, HDMI or analog inputs
- Aligns spatially & temporally as well as a complete frame for frame Exhaustive Alignment routine
- Judges the quality using MOVIE, DMOS, JND, and PEAQ
- Produces log files with the results (log files are text that can be examined as is or automatically exported to Excel)
- Drag and drop logs for recalling any test along with its synchronized side by side audio/video comparison

Encoder/Processor   Transmission   Decoder
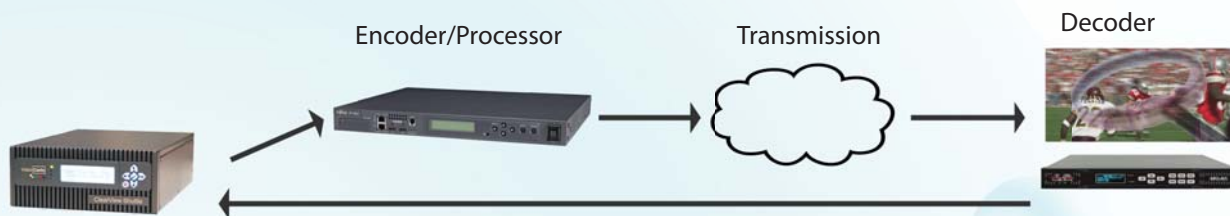
Another application for manufacturers, broadcasters or any entertainment service provider is using RTM to monitor quality and record performance faults in on-air or IP network quality of service from a long duration test. The RTM system can detect content specific, continuous or intermittent effects on audio or video quality.
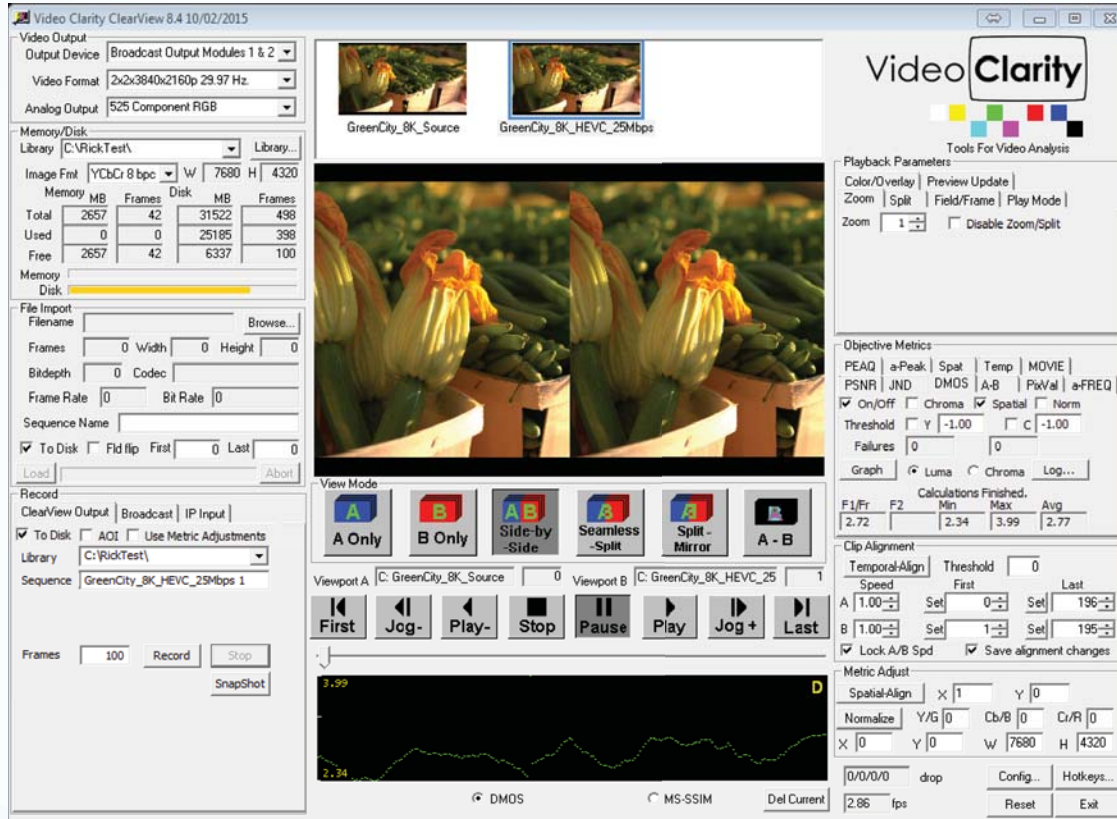
RTM and RTM 4K - full reference audio/video quality monitor with error segment recording*
- Inputs source "reference" and downstream "processed" A/V through HDSDI up to 4K or via IP up to 1080i
- Measures the audio and video quality as PSNR or DMOS in real-time on live sources
- Measures the audio and video delay (lip-sync) in real-time
- Measures the audio loudness according to ITU-R BS.1770-3
- Measures each VANC line's data line integrity with each line individually selectable
- Continuously reports min, max and average A/V quality and A/V delay to log files
- Records the failed portions of the A/V sequences, and alarms via audio beep tone if any of the above have fallen below a user set degradation threshold
- RTM is optionally combined with ClearView in the same system to provide both test applications

Source   Processing Unit   Transmission   Decoding Unit   Processed

HDSDI or IP   IP   or HDSDI

*See RTM data sheet for full feature description

Video Clarity — Tools for Video Analysis

ClearView Graphical User Interface

Control
ClearView GUI
Play list commands
Load list commands
Batch file commands
- Using Command Line

Operation
Record from AV inputs
- 3G HDSDI, HDMI or analog
Input From IP Network
- Both a source and test stream
- Real-time demux/decode
Import Files
- Demulitplex MPTS files
- Scale/Crop
- Decode many file types
Play to HDSDI, HDMI, Desktop
- Side-by-side
- Over-under
- Split mirror
- A-B with addback/threshold
- Field-only play
- Zoom & pan
- Pixel values
Perceptual Metrics
- MOVIE
- MS-SSIM with DMOS scale
- JND (option)
- PEAQ (option)
Other
- APEAK true-peak amplitude
- LKFS loudness test
- AFREQ audio impairment test
- Lip-sync +/- measurement
- PSNR
- Spatial (Activity)
- Temporal (Change)

Test Score Analysis
Log files contain the quality scores and information about each test's setup
- Metric Log Grapher creates multiple test comparisons
- Drag & drop log files back to ClearView to recall previous tests and comparison views

Subjective Viewing Modes Now On Desktop or Broadcast Output
- In addition to playback on HDMI & HDSDI outputs, a separate desktop function is here
- Play sequences to a separate window on the desktop or to an external video monitor
- Apply side-by-side or any subjective viewing modes to assess quality at full resolution
- Use all interactive play modes, zoom, pan, and pixel value tools on either output type

Perceptual Quality Metrics
- MOVIE: MOtion-based Video Integrity Evaluation index with separately selectable Temporal MOVIE and Spatial MOVIE indices
- MS-SSIM: Provided on DMOS and MS-SSIM scales
- Sarnoff JND*: On the Just Noticable Differences scale
- PEAQ*: ITU-R BS.1387 method on BS.1387 or BS.1116 scales for audio quality

Objective Metrics
- PSNR: Peak Signal to Noise differences in video
- aFREQ: Audio Frequency conformance measurement to find gross errors in audio performance versus a reference, provides lip-sync measurement in milliseconds

No Reference (Reduced Reference) Metrics
- aPEAK: True-peak audio measurement per channel according to ITU-R BS.1770-3
- LKFS: Audio loudness measurement per program according to ITU-R BS.1770-3
- Spatial: Calculates the activity power of a frame within the frame
- Temporal: Calculates the changes between successive frames

* JND and PEAQ metric licenses are options on all ClearView models, items CV-JND and CV-PEAQ.

There are several ways to record live A/V sequences into ClearView. All ClearView systems provide a combination of digital video/audio inputs as well as IP input capabilities. Digital input interfaces are HDSDI with embedded audio and IP network inputs. IP inputs provide several options for capturing one or two IP streams as outlined below. ClearView also provides the very useful ability to record a side by side sequence from the system's output into a file for export as standard file formats.

Broadcast Inputs

ClearView systems hold several options for HDSDI, HDMI or analog source recording. The broadcast record tab allows a selection of single input, dual input or input/output modes and the configuration menu options are tailored to the input interfaces installed in your ClearView model.

ClearView systems automatically detect the input format for record operations. Sequences are stored as unmodified, fully uncompressed audio and video which is saved for instant recall and playback operations from a user designated ClearView library file folder and sequence name.

## IP Input - Stream Decoding and Recording

Record 1 IP Input - A single input mode that records a video sequence as sensed at the IP multicast address and port specified within the IP configuration menu as pictured to the right. *IP Input is for decoding up to 1080i (excludes 4K, 8K).*

Record 2 Inputs - Dual IP or IP with SDI input modes record sequences from two separate inputs or mix of inputs. Each input selection is provided with individual menus to set up SDI or IP input parameters. Each IP menu contains transformation settings for scale, crop, de-interlace, rate change and position for matching of source content to the IP network delivered sequence format for testing.

Record While Playing - In this mode the HDSDI output will play a sequence loaded into Viewport A for processing by the IP network processor or device under test with IP output. The ClearView IP input can then simultaneously record from an IP stream.

From ClearView

The ClearView Output tab provides the unique ability to record any sequence or combination of two sequences that are set into any View Mode. As an example a side by side view of two synchronized sequences, each with an identifying overlay window is created as a single file in a ClearView library. This AV sequence can then be exported in YUV, AVI or QuickTime format for delivery and playback review by most of today's computer desktop graphics outputs. This mode also allows a snapshot recording so that representative stills can be inserted as reference material to presentations.

Video Clarity
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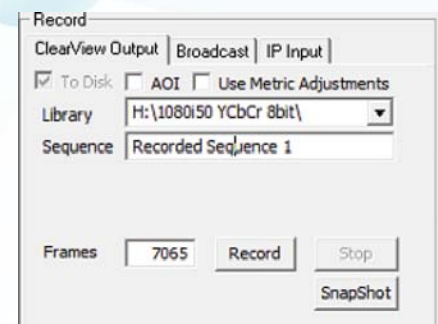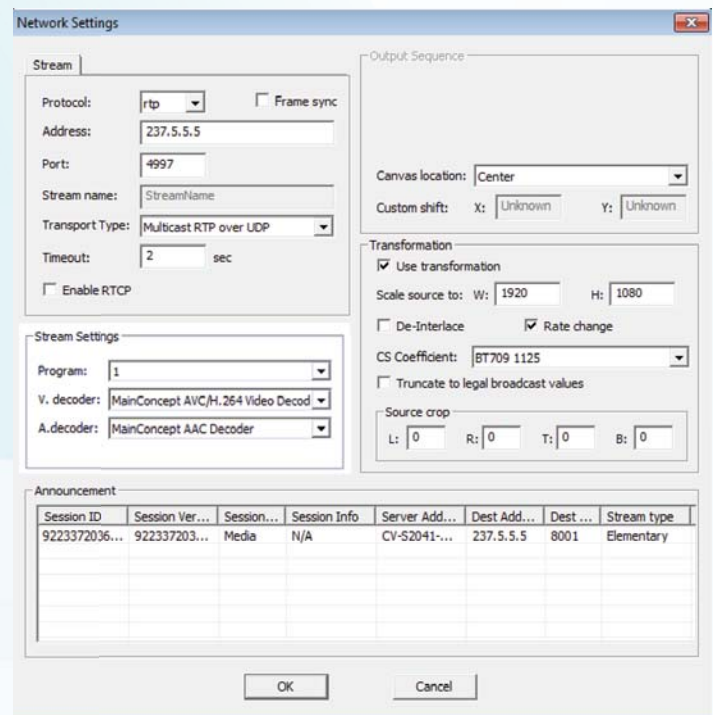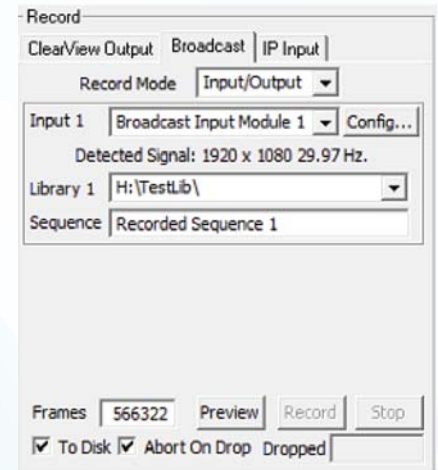
ClearView File Importer is a comprehensive solution for importing files into ClearView. It is a Stand-alone application provided with ClearView systems allowing complete control and thumbnail viewing of imported uncompressed sequences that are automatically inserted into a ClearView library for use within a ClearView test routine.

ClearView File Importer GUI
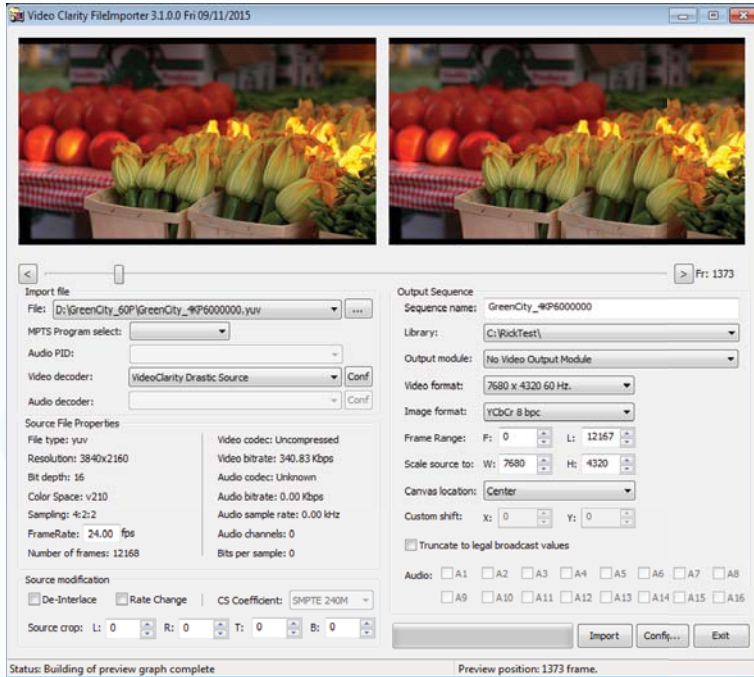
ClearView File Importer Highlights

- Wide range of supported video and audio formats
- MPTS demultiplexer - decoder
- Easy source length import modification
- Detailed per pixel source cropping
- Image quality, size and positioning adjustment
- Up to 16 channels of audio decoding
- Fast AV decoding speed
- Detailed file import source information
- Variety of video and image formats for output media
- Command Line and GUI user interface

User confirmable file adjustments:

- Color space convert YUV to/from RGB in BT.2020 color
- Decoded or imported frame size, rate
- First/last frames to import
- 3:2 pull down insertion or removal
- Bit depth conversion (8 to 10 or 10 to 8)
- Crop source with input values or interactive box
- Scale video resolution up or down to x, y / w, h
- Variable image and canvas resolution
- Truncate to legal broadcast values (yes/no)
- Import audio

Imported File Formats (partial list):
Accom YUV CCIR 601 8-bit
ARI Raw Bayer Pattern
Avid AVR, DS HD/SD, DV (*.gen)
Avid Meridian, Y'CbCr, OMFI (*.omf, *.omfi)
AVR, JFIF, JPED, Meridian, RGB, Y'CbCr
Cineon (*.cin), CineWave
DPX RGB 8, RGB 10, Y'CbCr 4:2:2
DV (*.dv, *.dif), Digital Negative (*.dng)
DVS Direct File Format (*.dvs)
DVSD, DV25, DV50, MPEG-I, mJPEG, DigiSuite
H.261, H.263, H.264, H.265, HDV
Headerless/Raw (*.hdr, *.yuv, *.rgb, *.raw)
HiCon SLB32 RFB format (*.slb)
Image (*.gif, *.jpg, *.png), Jaleo Direct Format (*.js)
JPEG, JPEG2000, Media 100 MJPEG
Microsoft AVI (*.avi), BMP, DIB Files (*.dps)
MJPEG, MPEG 1 4:2:0 (*.mpg, *.mpeg)
MPEG-2 Elem. Stream, (4:2:0/4:2:2), MPEG2 (*.m2v)
MPEG-2 Program Stream, (4:2:0/4:2:2)
MPEG-2/4 in Transport Stream, (4:2:0/4:2:2)
MPEG-2.4 in MPTS (4:2:0, 4:2:2), MPEG4 (*.m4v)
MPEG-4 AVC Elementary Stream 4:2:0/4:2:2, (*.h264)
MPEG-H HEVC/H.265 4:2:0 Main Profile (*.h265)
MXF Format (DV, DVCPro50, MPEG, IMX)
Newtek Video Toaster (*.rtv)
Phantom Support (*.cine), PhotoShop FilmStrip (*.flm)
Photo CD PCD, Photoshop PSD, Portable anymap PNM
Portable Bitmap Fomat PBM DPS
Portable graymap PGM
Portable pixmap PPM
Profile GXF Format/SMPTE-360 (*.gxf)
QuickTime Movies (*.mov)
QuickTime formats w/proper codec, ProRes, etc...
RealVideo (*.ra, *.rm, *.ram), Red Camera Stream (*.r3d)
Run-Length encoding (rle)
SGI Movie Format (*.mv), SGI RGB
Silicon Image Bayer (*.siv), Sun Raster (*.ras)
Targa TGA, ICB, VDA, VST, Targa 3000, TIFF, TIF
v210 Y'CbCr 10 Bit, VC-1 Pro, Viewstore (*.vsr)
vcap, vacap10, Windows Media (*.asf, *.wmf, *.wmv)
Y'CbCr 8/10, Y'CbCr, RGB, YCrCb 8/RGBA

Audio Import Formats:
Dolby® Digital Plus Professional Decoder (option)
MPEG-2 Layer 1 (*.mp1)
MPEG-2 Layer 3 (*.mp3)
Waveform Audio (*.wav)
Adaptive Multi-rate (*.amr)
Audio Interchange File Format (*.aiff)
Windows Media Audio (*.wma)
Advanced Audio Coding (*.aac)

Exported File Formats:
QuickTime with up to 16 audio channels
Microsoft AVI (*.avi), BMP
Headerless/Raw (*.yuv, *.rgb, *.raw)

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Product Feature Matrix

Products Features	ClearView Extreme 8K	ClearView Extreme 4K	CV-Extreme w/RTM 4K	ClearView Shuttle 4K	CV-Shuttle HD + RTM	ClearView QA
PSNR, aFreq, aPeak, Lip-sync metrics	X	X	X	X	X	X
Perceptual Video and Audio Metrics	JND,PEAQ optional	JND,PEAQ optional	JND,PEAQ optional	JND,PEAQ optional	JND,PEAQ optional	All optional
Subjective Viewing Modes	X	X	X	X	X	X
Subjective Side-By-Side Max Play Rate	7680X4320p30	3840X2016p60	3840X2160p60	3840X2160p30	1920X1080i60	1920X1080i60
Max Video Rec. Rate w-16 Audio chs.	7680X4320p60	3840X2016p60	3840X2160p60	3840X2160p60	1920X1080p60	1920X1080p60
Max Video Play Rate w-16 Audio chs.	7680X4320p60	3840X2016p60	3840X2160p60	3840X2160p60	1920X1080p60	1920X1080p60
Max Simultaneous Play & Record Rate	3840X2160p60	3840X2016p60	3840X2160p60	1920X1080p60	1920X1080i60	1920X1080i60
Real-Time Measurement Input Rate	Optional	Optional	2160p 50/60	Optional	1080i 50/60	NA
Disk Storage Capacity Examples - In Minutes	46, 82 or 126 7680X4320p 60Hz YUV10	67 or 132 3840X2160p 60Hz YUV10	67 or 132 3840X2160p 60Hz YUV10	28 min of 3840X2160p 60Hz YUV10	173 min of 1080i 60Hz YUV8	173 min of 1080i 60Hz YUV8
Metric Log Grapher, RTM Log Grapher	X	X	X,X	X	X,X	X
WaveformMonitor/Vectorscope - WFM	X	X	X	X	X	Option
ClearView File Import Features	X	X	X	X	X	Option
HDSDI Input, including 8 and 10 bit	X	X	X	X	X	X
Y'PbPr, S-Video, Composite Input						X
HDMI AV Input (Recording YUV 4:2:2)	Ext. Option	Ext. Option	Ext. Option	Ext. Option	Ext. Option	X
HDSDI Output (See Interfaces Specs)	X	X	X	X	X	X
Y'PbPr, S-Video, Composite Output		X	X	X		X
HDMI AV Output - Max Rate		2160p60,4:2:0	2160p60,4:2:0	2160p60,4:2:0		1080p60,4:2:2
IP Record - Max Decode / Record Rate	1080i60 (2)	1080i60 (2)	1080i60 (2)	1080i60 (2)	1080i60 (2)	Option
Timecode record and play	X	X	X	X	X	X
USB Ports - 3.0, 2.0	10,2	10,2	10,2	4,4	4,4	4,4
Giga-Bit Ethernet Ports	2	2	2	2 (1 via USB)	2	2
Chassis and Rack Mount Type	3RU Kit	3RU Kit	3RU Kit	2RU Ears	2RU Ears	2RU Ears

WFM - Waveform Monitor / Vectorscope*

ClearView systems now include WFM, a comprehensive signal tool for input and playback specification display.

Waveform Monitor - Displays the levels of the Y, Cb and Cr from the left of the picture to the right of the picture with all the lines summed into one graph.

Vectorscope - Depicts a traditional Cb by Cr X-Y display with overlaid reference graticule. Color accurate graticules automatically switch between SD, HD and UHD color spaces.

Chromaticity Scope - Provides a visual representation of the color in a video across all the colors of visible light. For a particular Y'CbCr range (BT.2020, Rec.709,CCIR-601) a triangle can be super imposed.

Histogram - Provides an overview of the tonal range of each color in the picture.

Picture View - Shows the video signal, to confirm the source is correct and to display time code location.

Data View - Allows access to the raw pixel values being monitored on the HDMI or SDI input.

Signal Compare - Used to freeze a complete frame of video (two fields in interlaced), every second line (field) or at a 50/50 dissolve to compare two signals or cameras.

Time Code - Reads multiple timecode types simultaneously and displays them in the lower third data area.

Audio - Up to 16 channels of audio are supported for metering.

* WFM is included in new systems shipped with v8.4 starting in April 2016

ClearView Extreme 4K and 8K Systems

Storage on 4K Models: 5 TB or 10 TB
Storage on 8K Models: 14, 25 or 38 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect, 700 Watts Max
GUI Output: HDMI, DVI and VGA

Physical Specifications:
Dim. of 4K: 17" W x 5.25" H x 20.15" D
43 cm x 13.5 cm x 51.4 cm
Dim. of 8K: 17" x 5.25" x 31.5" (80 cm) D
Weight: 4K: 40 lbs, 18 Kg ; 8K: 50 lbs, 22.7 Kg

Temperature:
Operating: +5 - +25 Celsius
Storage: -20 - +50 Celsius
Rel Humid: 5-95%, noncondens

Options:
-CV-JND - JND metric
-CV-PEAQ - PEAQ metric
-VC-DDP - Dolby® Digital Plus
  Professional Input Decoder

ClearView Extreme 4K: Model #s CV-S8084-4K or -10

A/V Interfaces: CV-SDI-IO-4K2 (2)
Accessories: 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, A/V cable kits (2), HDMI to VGA conv. cable

Play/Record Duration Examples (10 TB):

Video Standard	Duration
3840x2160@60p, 10-bit, 4:2:2	132 min.
1920x1080@60p, 10-bit, 4:2:2	528 min.

ClearView Extreme 8K: Model #s CV-S8088-8K, or -25, or -38

A/V Interfaces: CV-SDI-IO-8 (2)
Accessories: 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, sync generator w/BNC cables

Play/Record Duration Examples (25 TB):

Video Standard	Duration
7680x4320@60p, 10-bit, 4:2:2	82 min.
3840x2160@60p, 10-bit, 4:2:2	330 min.

ClearView Extreme 4K Systems with RTM 3G or RTM 4K

CV-S8084-4K-RTM   - with RTM 3G
CV-S8084-4K-10-RTM - with RTM 3G
CV-S8084-RTM-4K   - with RTM 4K
CV-S8084-RTM-4K-10 - with RTM 4K

A/V Interfaces: CV-SDI-IO-4K2 (2)
Accessories: 3 RU rack kit, keyboard, mouse, mirror boot drive, manual, A/V cable kits (2), HDMI to VGA conv. cable

ClearView Extreme 8K Systems with RTM 3G or RTM 4K

CV-S8088-8K-RTM   - with RTM 3G   CV-S8088-8K-RTM-4K   - with RTM 4K
CV-S8088-8K-25-RTM - with RTM 3G   CV-S8088-8K-25-RTM-4K - with RTM 4K
CV-S8088-8K-38-RTM - with RTM 3G   CV-S8088-8K-38-RTM-4K - with RTM 4K
A/V Interfaces and Accessories: Same as model CV-S8088-8K

ClearView Shuttle 4K and HD Systems

Storage: 4K - 2.1 TB, HD - 1.2 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect, 300 Watts Max
GUI Output: VGA, DVI or HDMI

Physical Specifications:
Dimensions: 8.6" W x 3.5" H x 13.75" D
22.0 cm x 9.0 cm x 35.0 cm
Weight: 11.5 lbs, 5.4 Kg

Temperature:
Operating: +5 - +25 Celsius
Storage: -20 - +50 Celsius
Rel Humid: 5-95%, noncndnsng

Options:
-CV-JND - JND metric
-CV-PEAQ - PEAQ metric
-VC-DDP - Dolby® Digital Plus
  Professional Input Decoder

ClearView Shuttle 4K: Model # CV-S2044

A/V Interface: CV-SDI-IO-4K2 (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed manual, cable kit, rack ears

Play/Record Duration Examples:

Video Standard	Duration
3840x2160@60p, 10-bit, 4:2:2	28 min.
1920x1080@60p, 10-bit, 4:2:2	113 min.

ClearView Shuttle HD: Model # CV-S2042

A/V Interface: CV-SDI-IO-CVD22 (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed manual, BNC kit, rack ears

Play/Record Duration Examples:

Video Standard	Duration
1280x720@60p, 8-bit, 4:2:2	194 min.
1920x1080@60i, 8-bit, 4:2:2	173 min.

ClearView Shuttle 4K+RTM: Model # CV-S2044-RTM

A/V Interface and Accessories:
- Same as CV-S2044 model

ClearView and RTM Combination System:
- RTM license with RTM 3G function included

ClearView Shuttle HD+RTM: Model # CV-S2042-RTM

A/V Interface and Accessories:
- Same as CV-S2042 model

ClearView and RTM Combination System:
- RTM license with RTM (1080i) function incl.

ClearView QA

Model # CV-S2041-QA

Storage: 1.2 TB
Power: 100 - 240 VAC, 47-63 Hz, Autodetect, 300 Watts Max
GUI Output: VGA, DVI or HDMI
Options: - CV-WFM - Waveform/Vectorscope
         - CV-FileImporter - ClearView File Importer
         - CV-DMOS - DMOS measurement license
         - CV-JND - JND measurement license
         - CV-PEAQ - PEAQ measurement license
         - VC-DDP - Dolby® Digital Plus Input Decoder

Physical Specifications:
Dimensions: 8.6" W x 3.5" H x 13.75" D
22.0 cm x 9.0 cm x 35.0 cm
Weight: 11.5 lbs, 5.4 Kg

Temperature:
Operating: +5 - +25 Celsius
Storage: -20 - +50 Celsius
Relative Humidity: 5-95%, noncondensing

A/V Interface: CV-SDI-IO-LHI (1)
Accessories: Hard travel case, keyboard, mouse, OS recovery disk, printed manual, cable kit, rack ears

Play/Record Duration Examples:

Video Standard	Duration
1280x720@60p, 8-bit, 4:2:2	194 min.
1920x1080@60i, 8-bit, 4:2:2	173 min.

ClearView Product A/V Interface Specifications

CV-SDI-IO-8:
The two interfaces applied on all CV-S8088-8K models include*:
- 16 BNC connections
- 1 sync generator, with cables

Digital Video: 8 BNC input/output (16 per system) - 3G HD-SDI or SD-SDI compliant
- Supports 8 or 10 bits ITU-601, SMPTE 259, 292, 296, 424, 425a/b, two 4K/QuadHD
Digital Embedded Audio: 16 channels - SDI embedded input or output
Reference Input: 1 BNC - Tri-level HD sync (two per system)
Timecode: SMPTE-12M on HDSDI   **Digital Audio Format:** 24bit, 48KHz PCM, or DD+

Digital Video Formats: 525i @ 59.94Hz, 625i @ 50Hz, 720p @ 60, 59.94, 50Hz, 1080i @ 60, 59.94 & 50Hz, 1080p @ 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz, 3840X2160p @ 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz
*7680X4320p @ 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz

CV-SDI-IO-4K2:
CV-Extreme-4K applies two
CV-Shuttle-4K applies one
Each interface module includes:
- Quad SMB to BNC cable
- Analog breakout cable
- Mini HDMI to HDMI cable

Digital Video: 4 BNC input/output programmable - 3G HD-SDI or SD-SDI compliant
- Supports 8 or 10 bits ITU-601, SMPTE 259, 292, 296, 424, 425a/b and 4K/QuadHD
Digital Embedded Audio: 16 channels - SDI embedded input and output
Digital AES/EBU Audio: 8 channels on 4 BNC input, 8 channels on 4 BNC output
HDMI 2.0B: 1 output, up to 3840X2160p60Hz 4:2:0 (Mini HDMI to HDMI cable supplied)
Analog Video: 3 BNC out - Component (Y, Pr, Pb), Composite or S-Video
Reference Input: 1 BNC - Tri-level HD sync (on analog A/V breakout cable supplied)

Digital Video Formats: 525i @ 59.94Hz, 625i @ 50Hz, 720p @ 60, 59.94, 50Hz, 1080i @ 60, 59.94 & 50Hz, 1080p @ 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz, 3840X2160p @ 60, 59.94, 50, 30, 29.97, 25, 24, 23.98Hz
Digital Audio Format: 24bit, 48KHz PCM, or DD+
Timecode: SMPTE-12M on HDSDI, LTC on analog breakout

CV-SDI-IO-CVD22:

Includes:
- 5 SMB to BNC cables (6")

Digital Video: 2 BNC input, 2 BNC output - One 3G SMPTE-424 or Two SMPTE-292
- Supports 8 or 10 bits ITU-601, SMPTE 259, 292, 296, 424, 425 (Level A or B)
Digital Audio I/O and Format: 16 ch. - SDI embedded, 24bit, 48KHz PCM, or DD+
Reference Input: 1 BNC - Tri-level HD sync

Digital Video Formats: 525i @ 59.94Hz, 625i @ 50Hz, 720p @ 60, 59.94, 50Hz, 1080i @ 60, 59.94 & 50 Hz, 1080p @ 60, 59.94, 50, 30, 29.97, 25, 24 & 23.98Hz
Timecode: SMPTE-12M on HDSDI

CV-SDI-IO-LHI:

Includes:
- Analog breakout cable
- 2 Mini HDMI to HDMI cables

Digital Video: 1 BNC input, 1 BNC output - 3G HD-SDI or SD-SDI compliant
- Supports 8 or 10 bits ITU-601, SMPTE 259, 292, 296, 424, 425 (Level A or B)
Digital Audio I/O: 16 channels - SDI embedded or 2 channels - AES/EBU on 1 XLR
HDMI 1.3a: 1 input, 1 output on HDMI mini connectors (2 converter cables supplied)
Analog Video: 3 BNC in, 3 BNC out - Component (Y, Pr, Pb), Composite or S-Video
Analog Audio I/O: 2 channels on 2 XLR (Analog A/V cable breakout supplied)
Reference Input: 1 BNC - Tri-level HD sync

Digital Video Formats: 525i @ 59.94Hz, 625i @ 50Hz, 720p @ 60, 59.94, 50Hz, 1080i @ 60, 59.94 & 50Hz, 1080p @ 60, 59.94, 50, 30, 29.97, 25, 24 & 23.98Hz
Digital Audio Format:
24bit, 48KHz PCM, or DD+
Timecode: SMPTE-12M on HDSDI, LTC on analog breakout

RTM
Real-Time A/V Quality Monitor/Recorders

Video Errors   0
Audio Errors   0
VANC Errors   0
Lip-Sync 0.00 msec

RTM

Video Clarity, Inc.
Real-Time Monitor

RTM

Video Clarity, Inc.
RTM-3G

RTM 3G

Video Clarity

Tools for Video Analysis

Today's multi-device delivery scenario - to TV, PC and handheld devices - puts high demands on broadcasters and multi-channel operators.

Digital media transmission now requires most live or stored assets to be prepared in different formats and delivered through a diverse set of network paths to the consumer.

Advertisers and program providers demand high quality. The technology required to deliver multiple formats and versions of the same asset is now highly complex which can lead to errors that affect quality. Therefore, a high priority should be placed on constantly testing at each step in the delivery chain so that the desired user experience is achieved.

Testing digital assets and delivery methods for quality has also led to new challenges. While experienced analog engineers could detect and classify errors by predictable means, new digital technologies have created a dynamic environment. Minor imperfections generally have no notice-able effect on quality in a digital transmission until the degra-dation hits a threshold. This unpredictable "digital cliff" drops quality to unacceptable levels.

At the processing layer, problems arise when down-converting HD to SD, changing formats and compressing the signal into the available bandwidth. Also the separate processing of audio, video and data can lead to synchroniza-tion problems.

At the transmission layer, broadcasters encounter familiar RF problems with a new challenge - coverage and interfer-ence problems caused by more channels at lower powers.

For multi-channel distribution, operators are relying on a multiplicity of distribution steps in the network and therefore latency, packet loss and synchronization add additional concerns.

Errors in one layer can cause errors in the next. For example blockiness caused by compression looks similar to packet loss/bit errors hidden by the set-top box (receiver).

For this reason, the quality must be assessed at multiple points across the network including a continuous test through an end point device (IRD or set top box) or end point IP stream sample.

RTM compares the following:
- Reference SDI or IP input to processed SDI or IP input
- Reference file to processed SDI input of same file feed
- Reference file to processed file

RTM - features:
- Continuously reports video and audio quality
- Continuously reports audio program loudness
- Continuously reports audio/video offset (lip-sync)
- Measures VANC data integrity, line selectable
- Automatically records the degraded A/V signal and reference input during threshold break periods

Degradation thresholds may be pre-configured by your engineering staff in RTM for reliably finding errors in several key areas:
- Video fine detail - issues such as blur or blockiness
- Gross video impairments - loss of signal, freezes
- Audio silence, pops, clicks and distortions
- Audio loudness according to ITU-R BS.1770-3
- Audio/video offset (lip-sync) errors with a plus or minus measurement accurate to the millisecond

Applications:
- Broadcast quality monitoring and error recording
- Automatic quality analysis of IP streams or file assets
- Long duration product QA testing
- Television production truck to central office lip-sync and A/V quality pre-check as single ended test

Single Ended Test Operations:
RTM includes a reference test sequence that can be exported as QuickTime, RAW file or recorded to tape via RTM's HDSDI output. Once transferred, the sequence is then played from a server or from tape in a remote site and transmitted to the studio location for live input to an RTM system which can then check lip-sync and A/V quality. Several industry accepted A/V test sequences can also be used to feed RTM in this test mode.

As a full-reference monitoring device, RTM is not influ-enced by the "artistic" quality of the source.

RTM saves valuable time and money by:
- **Finding quality problems that you have missed**
- **Confirming errors that you have already observed**
- **Recording only the audio and video of each error with synced source content for off-line analysis**
- **Combining several A/V quality measurements into one solution that automatically compiles scores for any testing duration**
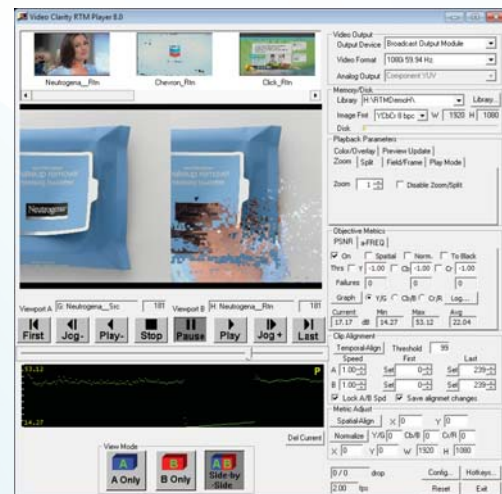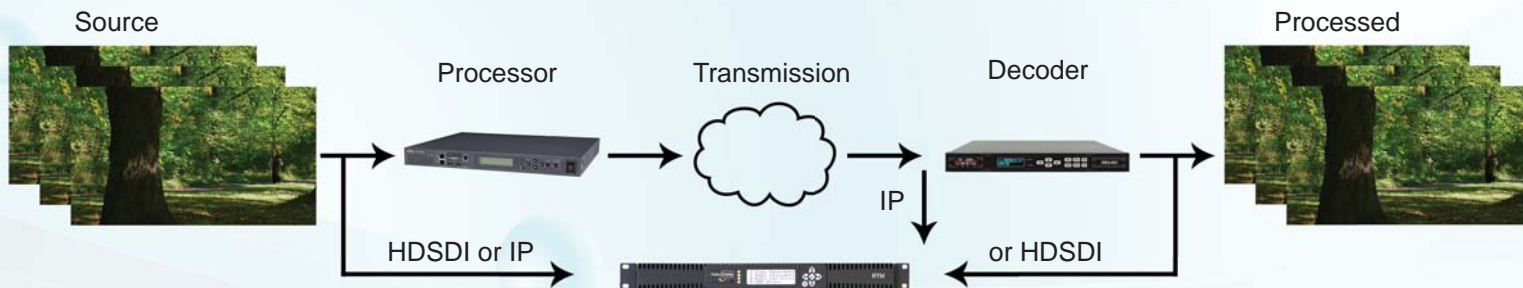
RTM - Main User Interface
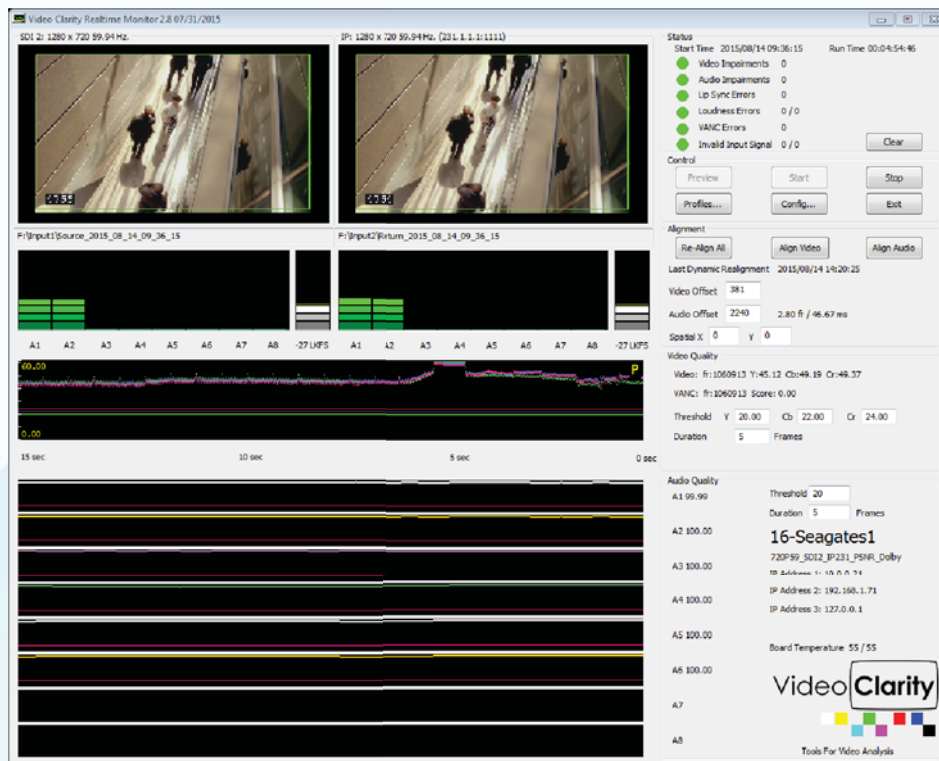
Control

RTM is controlled via graphical user interface, command line or SNMP MIB client.
- The optional RTM Manager also provides set up and control of one or multiple RTM systems

RTM Player

RTM - Signal Flow Diagram

Source

Processor   Transmission   Decoder   Processed

HDSDI or IP   IP   or HDSDI

Operation

Automatically aligns:
- Finds motion/transitions in audio/video
- Aligns video inputs spatially/temporally
- Aligns audio to the sample
- Calculates audio and video offset

Set automatic recordings based on:
- Pre-set degradation thresholds
- Frequency of error event
- Consecutive number of events

Dynamically realigns:
- Missing frames/samples
- Changes in processing or network delay

Continually reports and logs:
- Video quality with DMOS or PSNR
- Audio performance with aFreq
- Audio program group loudness
- A/V offset - non-invasively
- VANC data integrity per video line

Records upon threshold breaks in:
- Video quality
- Audio quality
- Audio/Video offset (lip sync)
- VANC data integrity per video line

Off-line Analysis

- Review RTM logs with RTM Log Grapher or easily export to Excel
- Drag and drop log files on RTM Player GUI to restore recordings
- Comparatively view as side by side the source and test video via the video output *or in a separate window on the desktop of the RTM*

RTM systems include:
- Reference test patterns
- RTM Player with file exporter
- Interactive RTM Log Grapher
- RTM Scheduler

Video Clarity
Tools for Video Analysis

RTM 1RU Model: RTM-S1082

RTM-S1082
Storage: 400 GB
Power: 100 - 240VAC, 47-63Hz, Autodetect 300 Watts Max
GUI Display Output: VGA, DVI or HDMI
Includes: Printed manual, 1 RU rack ears, USB to GNIC adapter, RTM Scheduler

Video I/O: ITU-601, SMPTE 259/292/296
- 2 HDSDI - inputs and outputs (BNC)
- Input reference & test signals up to 1080i 60Hz
Audio I/O: 24 bit, 48 KHz
- 2 HDSDI - inputs and outputs (BNC)
- 8 channels of embedded audio per BNC
- Dolby® Digital Plus (input decoder incl.) or PCM
- 1 analog stereo alarm output - stereo mini

IP Network Inputs: 2 - 1000baseT - RJ45
1 - 1000baseT - USB/RJ45
Dimensions: 17" W x 1.75" H x 10" D (1 RU)
43.2 cm x 4.5 cm x 25.4 cm
Weight: 11.7 lbs, 5.3 Kg
Operating Temperature: +5 - +25 Celsius
Storage Temperature: -20 - +50 Celsius
Relative Humidity: 5-95%, non condensing

RTM Portable Model: RTM-S2042

RTM-S2042
Storage: 1.2 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect 300 Watts Max
GUI Display Output: VGA, DVI or HDMI
Includes: Printed manual, 2 RU rack ears, keyboard, mouse, 5 SMB to BNC cable kit, USB to GNIC adapter, RTM Scheduler

Video I/O: ITU-601, SMPTE 259/292/296
- 2 HDSDI - inputs and outputs (SMB/BNC)
- Input reference & test signals up to 1080i 60Hz
Audio I/O: 24 bit, 48KHz
- 2 HDSDI - inputs and outputs (SMB/BNC)
- 8 channels of embedded audio per SMB/BNC
- Dolby® Digital Plus (input decoder incl.) or PCM
- 1 analog stereo alarm output - stereo mini

IP Network Inputs: 2 - 1000baseT - RJ45
1 - 1000baseT - USB/RJ45
Dimensions: 8.6" W x 3.5" H x 13.75" D (2 RU)
22.0 cm x 9.0 cm x 35.0 cm
Weight: 11.5 lbs, 5.4 Kg
Operating Temperature: +5 - +25 Celsius
Storage Temperature: -20 - +50 Celsius
Relative Humidity: 5-95%, non condensing

RTM 3G Portable Model: RTM-S2043

RTM-S2043
Storage: 2.1 TB
Power: 100 - 240VAC, 47-63Hz, Autodetect 300 Watts Max
GUI Display Output: VGA, DVI or HDMI
Includes: Printed manual, 2 RU rack ears, keyboard, mouse, 4 SMB to BNC cable kit, HDMI output cable, analog breakout cable, USB to GNIC adapters (2), RTM Scheduler

Video I/O: ITU-601, SMPTE 259/292/296/424/425
- 2 3G HDSDI (SMB/BNC) - inputs and outputs
- Input reference & test signals up to 1080p 60Hz
- 1 HDMI 2.0b video & audio playback output
Audio I/O: 24 bit, 48 KHz
- 2 HDSDI - inputs and outputs (SMB/BNC)
- 8 channels of embedded per SMB/BNC
- Dolby® Digital Plus (input decoder incl.) or PCM
- 1 analog stereo alarm output - stereo mini

IP Network Inputs: 1 - 1000baseT - RJ45
2 - 1000baseT - USB/RJ45
Dimensions: 8.6" W x 3.5" H x 13.75" D (2 RU)
22.0 cm x 9.0 cm x 35.0 cm
Weight: 11.5 lbs, 5.4 Kg
Operating Temperature: +5 - +25 Celsius
Storage Temperature: -20 - +50 Celsius
Relative Humidity: 5-95%, non condensing

Video Clarity — Tools for Video Analysis

RTM 4K - The Latest Innovation In 4K Device And Network Quality Testing From Video Clarity

The real-time test of audio and video quality provides users with certain benefits including...
- The ability to perform long term quality testing on fully uncompressed video and audio for any length of time.
- A full-reference test that compares video and audio source to a return channel after processing so that highly accurate measurements and fault thresholds can be applied for automatic event recording.
- Quality measurements that are not influenced by the creative effects applied to source video material, saving valuable time and effort with no false positives for every test run.
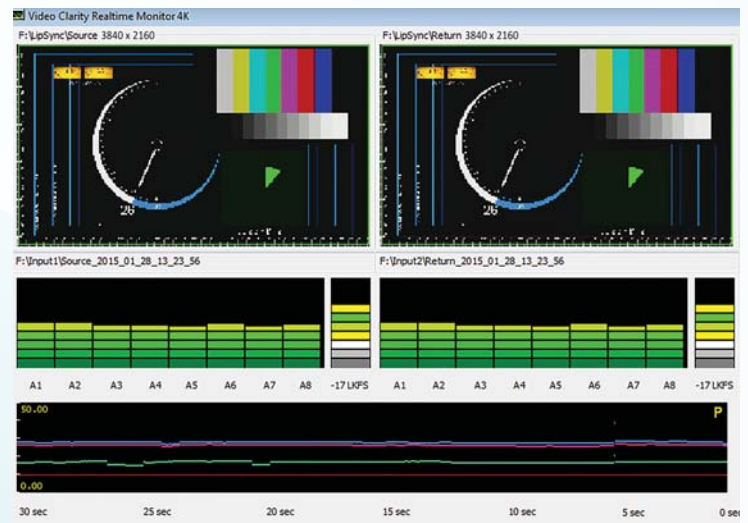
The RTM 4K presents a significant technological breakthrough by applying a fully uncompressed 4K video source with embedded audio and performing a real-time video PSNR or DMOS via comparison to a 4K encoded/decoded signal input along with audio quality, lip sync and audio program loudness measurements at the same time.
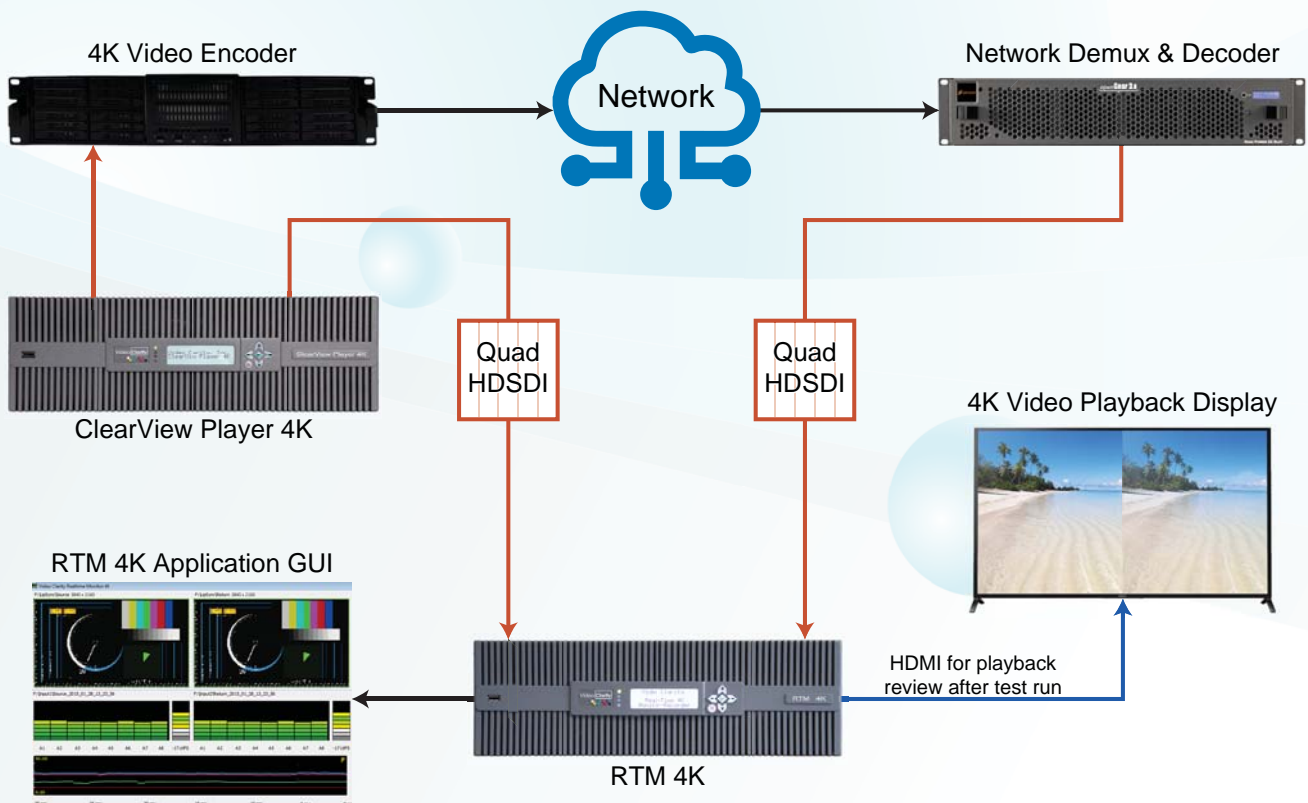
Real-Time Quality Testing for Network 4K Encoder or Transcoder

RTM 4K Features

- RTM 4K GUI provides visual thumbnail of source and test video inputs with instant test score updates.
- RTM 4K Player allows drag and drop of test logs for comparison playback of recorded error sequences.
- PSNR or DMOS (with MS-SSIM algorithm) is selectable as the video quality test in RTM 4K.
- aFreq is applied for audio performance and lip sync measurement with audio/video offset thresholds.
- aPeak is applied for LKFS audio program loudness measurement with min and max thresholds.
- VANC data check is selectable per line and is measured for data payload accuracy.
- RTM Log Grapher provides continually updated selectable measurements with timeline pan & zoom.
- RTM Scheduler runs the RTM application on a test schedule with start time and test length per job.

RTM 4K System Model: RTM-S8084

Model: RTM-S8084
Storage: 10.0 TB
Power: 100 - 240VAC, 47-63Hz, 600 W Max
GUI Display Output: VGA, DVI or HDMI
Includes: Printed manual, 3 RU rack kit, keyboard, mouse, 4 SMB to BNC cable kit (2), HDMI output cables (2), analog output cables (2), USB to GNIC adapter (1), RTM Log Grapher, RTM Scheduler

Video I/O: ITU-601, SMPTE 259/292/296/424/425
- 2 Quad 3G HDSDI (SMB/BNC) - inputs or outputs
- Input source & test signals up to 2160p 60Hz each
- 2 HDMI 2.0b 4K video & audio playback outputs
Audio I/O: 24 bit, 48 KHz
- 2 HDSDI - inputs and outputs (SMB/BNC)
- 8 channels of embedded per SMB/BNC
- Dolby® Digital Plus (input decoder incl.) or PCM
- 1 analog stereo alarm output - stereo mini

IP Inputs For HD or SD Testing and Control Use: 2 - 1000baseT - RJ45
           1 - 1000baseT - USB/RJ45
Dimensions: 17" W x 5.25" H x 20.15" D (3 RU)
        43.2 cm x 13.5 cm x 51.4 cm
Weight: 40 lbs, 18 Kg
Operating Temperature: +5 - +25 Celsius
Storage Temperature: -20 - +50 Celsius
Relative Humidity: 5-95%, non condensing