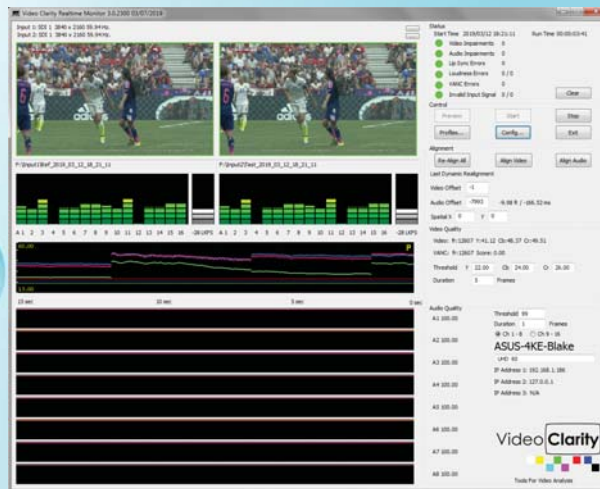
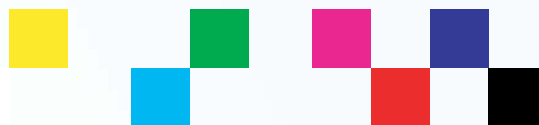


RTM

Video and Audio Quality Testing Software



Video **Clarity**

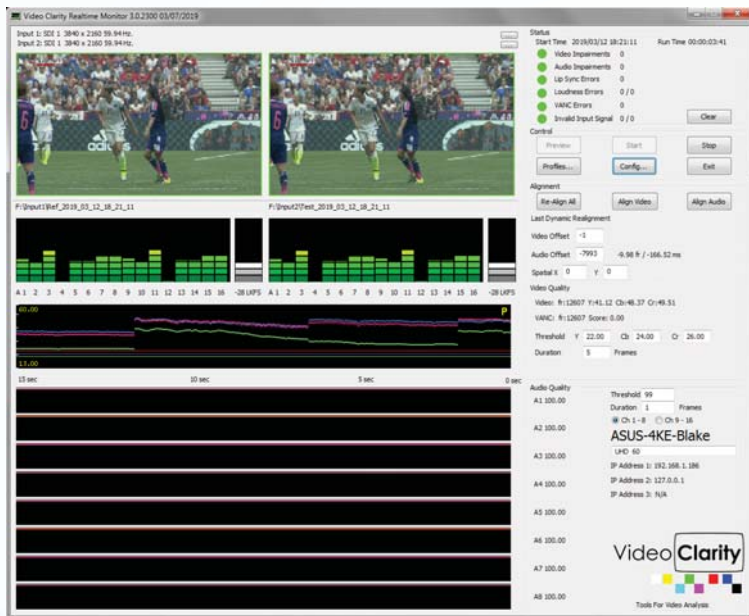


Tools for Video Analysis

RTM Video and Audio Quality Testing Software allows the user to automatically test original version video input streams or files against encoded and processed IP media content via multi-stream tests or file batches.

It features perceptual quality video scoring with audio metrics for quality, loudness, and lip sync.

Each test can be automatically or manually set via the desktop GUI, the RTM Manager web browser controller, command line interface, or REST API.

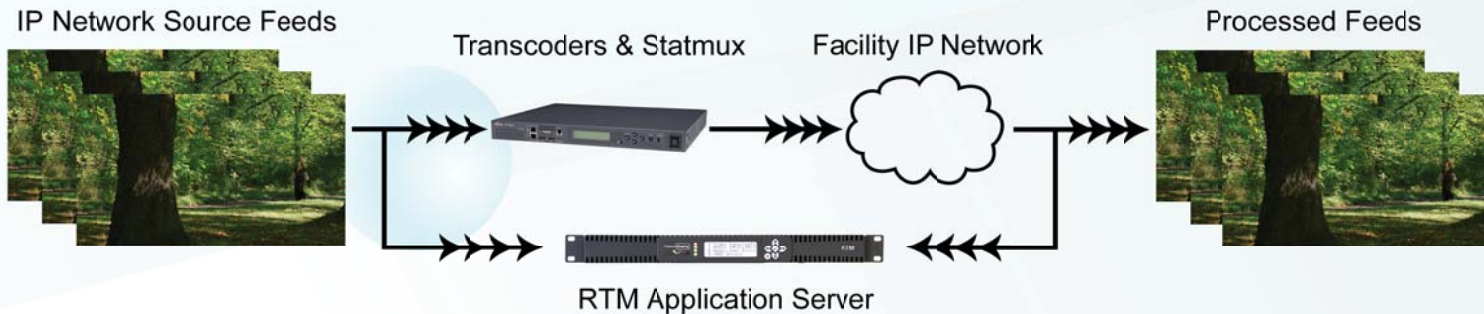


RTM GUI and main user interface

- Picture quality testing includes either a PSNR or MS-SSIM quality measurement in real-time.
- AFREQ is the audio performance metric for up to 16 channels of audio per program tested.
- Audio offset versus video is accurately measured to the millisecond.
- Full program audio loudness is calculated according to the latest ITU standards.
- End to end video delay is continuously monitored and displayed on each user interface.
- IP network packet loss is monitored for correlation to media errors affecting any test.
- MPEG transport streams may be recorded for further analysis.

RTM - Applications

- Automatic video quality analysis of IP stream content in multiple bit rates
- IP network delivery processor product and deployment testing
- Multiple encoded program quality comparison testing
- Batch processing of audio/video quality testing for all types of media file content

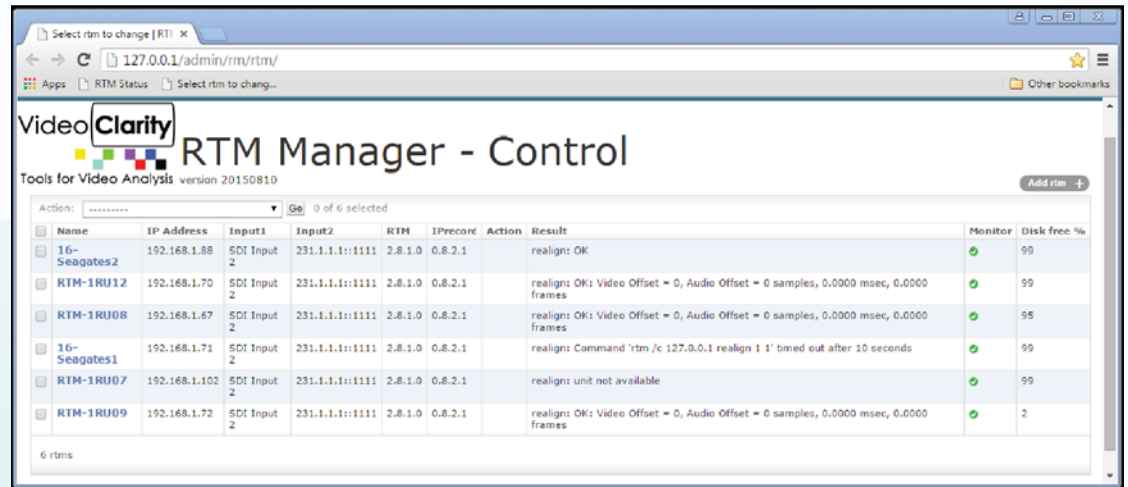


RTM Signal Flow Example of Four IP Streams Being Tested

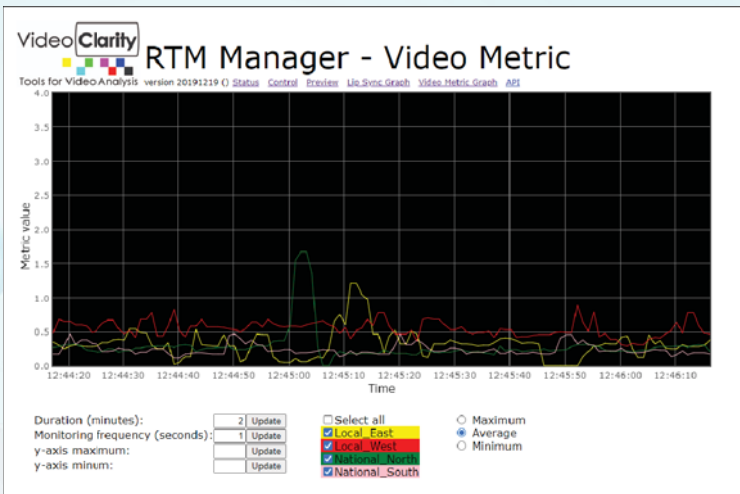
RTM features an automated alignment procedure that insures sources are continually matched to the downstream signal or processed test file for completion.

RTM - Manager Provides Full Control From A Browser

RTM Manager provides full control of the RTM application from any browser. Test status, thumbnail video previews, and administrative page are created for the user to set up and monitor tests as needed.



RTM Manager Video Quality Graph



RTM Manager generates video quality graphs from each test instance so that scores can be viewed in real-time from any browser. Scores may also be viewed via the included RTM Log Grapher, native text file, or output to standard spreadsheet tools.

Score logs of each test are generated during run-time. Each log contains time of test, source content file or source, video format tested, test score min, max, and average.

Test thresholds may be entered into RTM for reliably recording errors in several key areas:

- Video fine detail - issues such as blur or blockiness
- Gross video impairments - loss of signal, freezes, tearing, and field/frame loss
- Audio silence, pops, clicks and distortions
- Lip sync, audio relative to video in milliseconds

RTM Manager Jobs

Jobs automatically tests image and sound quality of media files in a batch. Drag and drop files onto the manager to have RTM tests run automatically from any media file type.

The RTM built-in decoder processes the files to uncompressed sequences for quality testing. All tests are done in the uncompressed domain with scores compiled in delimited text files for data harvesting.

RTM Manager - Jobs

Tools for Video Analysis version 20191219 (Z460) Status Control Preview Lip-sync Graph Video Metric Graph API

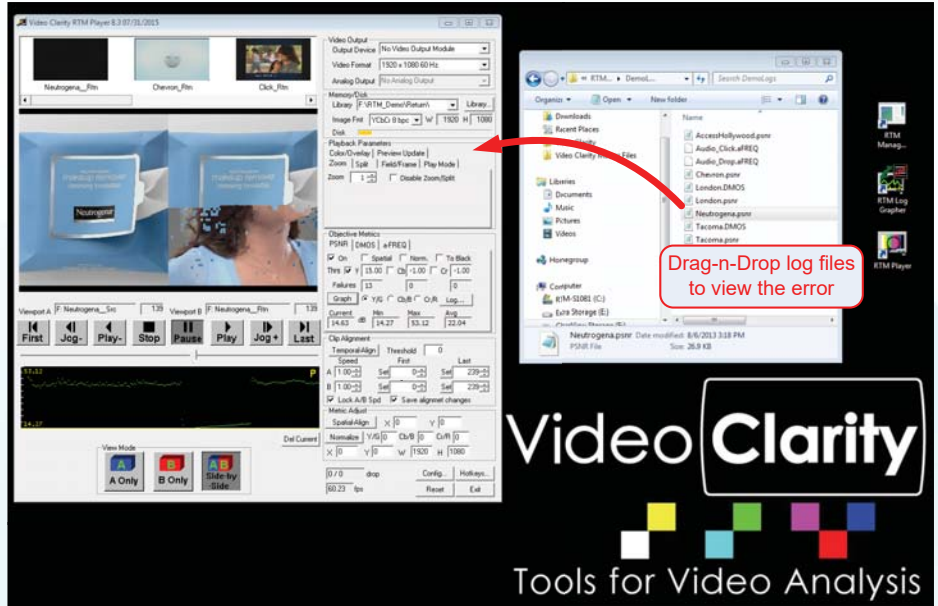
Started	Running Job	RTM	Status Time	Status
2020-09-27 11:21:58	TodayShow_AVC_HEVC6MB_PSNR	Instance_1	2020-08-27 11:22:13	Waiting for completion
Submitted	Pending Job			
2020-08-28 14:17:51	GD_19_03_DMOS			
2020-08-27 11:21:49	GD_19_14_DMOS			
2020-08-27 11:21:49	GD_19_14_PSNR			
2020-08-27 11:21:49	TodayShow_AVC_HEVC3MB_DMOS			
2020-08-27 11:21:49	TodayShow_AVC_HEVC3MB_PSNR			
2020-08-27 11:21:49	TodayShow_AVC_HEVC6MB_DMOS			

RTM Player

The included RTM Player will record and save aligned input signals or file pair segments as synchronized uncompressed video sequences for periods of any test that breached a user set threshold for quality.

Drag-n-drop the log files associated with the error segments onto the RTM player for synchronized comparison playback of each recorded segment view in a side-by-side with selectable playback of reference or test sequence. The picture can be zoomed up to 16x and panned for viewing artifacts up close.

A full resolution output to the desktop may be created with RTM Player by choosing the desktop output module. This will provide a separate window with video up to the resolution and frequency capability of the applied server's desktop display.



Desktop view of RTM Player operation

Video File or Stream Formats (partial list):

Adobe Filmstrip, Apple ProRes, AVI, AVS, DNxHD, DV video, GXF, H.261, H.263, H.264, H.265, JPEG 2000, LXF, Matroska, MJPEG, JPEG 2000, MOV/QuickTime/MP4, MPEG-1 System, MPEG-ES (elementary stream), MPEG-PS (program stream), MPEG-TS (transport stream), Material eXchange Format (MXF), MXF D-10 Mapping, RDT, RECODE R3D, VC-1

Audio Formats:

MPEG1/2, PCM, AAC, AES3, LATM, ADPCM, LPCM, WAV, MP3, BWF, WMA, DV, AC-3, Dolby Digital Plus

Network Stream Protocols:

HLS, HTTP, HTTPS, RTMP, RTMPE, RTMPS, RTMPT, RTMPTE, RTMPTS, RTP, TCP, UDP

RTM Software Models and Specifications

RTM-L4i - Permanent on-premise software
RTM-L4i-Year - One year SaaS subscription
RTM-L4i-6Mon - 6 month SaaS subscription

- SaaS may be on-premise or cloud-based
 - On-premise requires USB key shipment

On-Premise Software - Minimum System Specification:
 Intel I7 or equivalent, 16 GB memory, 3 Gb/s minimum disk throughput

On-Premise Software for ST 2110 Environment
 - Minimum Specification: Intel I7 or equivalent, 32 GB memory, 25 Gb/s throughput to storage, Mellanox ConnectX@-5 or higher network adapters

SaaS on AWS - Minimum Specification:
 T2.xlarge with 16 GB memory

SaaS on Azure - Minimum Specification:
 Standard E2s v3 - 2 vCPU(s) with 16 GB memory