Reduced Reference Processed (RR_PROCESSED) Software Release Version 1.2
Release Notes
September, 2010

This file contains information about the above product in the following sections:

1) Release Contents

The RR_ PROCESSED software was developed by the Institute for Telecommunication Sciences (ITS). RR_ORIGINAL and RR_PROCESSED work together to demonstrate how to process video sequences in an in-service environment (e.g., original and processed video sequences are on separate computers, at different locations). RR_ PROCESSED performs automated processing on processed video sequences (e.g., straight from the camera) and produces Video Quality Metrics (VQM) and calibration information. This program runs under the Windows operating system on a PC.

2) Package Contents

See CVQM readme file.

3) System Requirements

See CVQM readme file.

4) Technical Support Information

See CVQM readme file.

5) Install/Uninstall Instructions

See CVQM readme file.

6) Operating Instructions

Open a command prompt window by selecting "Start", "Program", "Accessories", "Command Prompt". Change to the c:\CVQM installation directory in step 1 of the Installation Instructions by typing "cd c:\CVQM" at the command prompt.

To start the RR_PROCESSED software, type "rr_processed" at the command prompt.

Execute RR_PROCESSED with no arguments for syntax and brief operating instructions. See also #10 below for details.

7) Product Release Notes

RR_ORIGINAL and RR_PROCESSED are presented her in the exact form submitted to VQEG for validation. Therefore, this code contains some assumptions and limitations inherent to VQEG's RRNR-TV Test Plan. The models and calibration routines contained herein do not (generally speaking) require these constraints. The constraints on the processed video sequences are as follows, where all calibration values are relative to the original:

- Processed video sequences must be contained in big-YUV formatted video files.
- Processed video sequences must be either NTSC (720x486, 30fps, interlaced) or PAL (720x576, 25fps, interlaced).
- Processed video sequences must be exactly 8 seconds duration.
- Valid video region assumed to be exactly
  525-line/NTSC: top=21, left=31, bottom=466, right=690
  625-line/PAL: top=21, left=31, bottom=556, right=690
  Thus, this region must contain valid video.
- Delay (between original and processed) must be within +/- two frames from "first frames in the files align."
- Video cannot contain spatial scaling.
- Horizontal and vertical shift must be within +/- 1 pixel
- Luma gain must be between 0.97 and 1.03
- Luma offset must be within -10 to +10

The last five (5) constraints are isolated to the code within function RR_PROCESSED, and can be modified without making changes to RR_ORIGINAL.

Additionally, this implementation presumes "downstream" monitoring (i.e., the original video information is sent to the processed video, and there exists no mechanism by which information about the processed video can be sent back to the computer that is examining the original video). Thus, the valid region must be constant and cannot be influenced by the processed video sequence's actual valid region. Upstream monitoring (i.e., processed video information sent to the original video location) will require a slightly different implementation. Dual monitoring (i.e., dual direction communication available) allows for greater flexibility.

8) Usage, Copyright, and Patent Information

See CVQM readme file.

9) Use of VQM Numbers in Outside Reporting

See CVQM readme file.

10) Input and Output Arguments

RR_PROCESSED takes processed test sequences in uncompressed big-YUV file format.

```
RR_PROCESSED calculate NTIA low-bandwidth model (or NTIA fast low-bandwidth
model) and calibration.

SYNTAX
  rr_processed file_list video_standard model results_log

DESCRIPTION
  'file_list' is a text file containing original and processed file names in
                pairs, one pair on each line.  Paths are okay.  Each file
                must be in big-YUV format.  After the second file name, optional
                (i.e., manual) calibration values may be listed. See "EXAMPLE
                LIST".
            -->  When an original-processed file pair list includes calibration
                values, then automated calibration will be skipped, and manual
                values used instead.
                Optional calibration values are listed in the following order:
       luma_gain luma_offset horiz_shift vert_shift delay
              luma_gain is luminance gain, double precision
              luma_offset is luminance offset, double precision
              horiz_shift is horizontal shift, integer; positive means
                       processed has been moved right with respect to original
              vert_shift is vertical shift, integer; positive means
                       processed has been moved down with respect to original
                       Odd values mean that the processed video has been reframed
                       (i.e., 1st field in time of original, aligns with 2nd
                       field in time of processed -- i.e., +0.5 frame delay)
              delay is time delay in frames, integer; this value adjusts the
                       start frame used by RR_PROCESSED -- it adds "delay" to
                       the 0.8sec starting frame for the processed segment used.

  'video_standard' indicates the frame rate and video size:
    '525'          525-line, 30fps video (720 pixels by 486 rows), "NTSC"
                   Interlaced fields, lower field presented earlier in time
    '625'          625-line, 25fps video (720 pixels by 576 rows), "PAL"
                   Interlaced fields, upper field presented earlier in time

  'model'          The name of the video quality model desired.  Must
                   be one of the following:
    'lowbw'        Low Bandwidth Model
    'fastlowbw'    Fast Low Bandwidth Model, ITU-T Recommendation J.244.
    'general'      General Model (FR-TV Phase II), ITU-T Recommendation J.144.

    'developers'   Developers Model (approximates the FR-TV Phase II model)

  'results_log' is the prefix (with path) for text files, where results will be
                  written.  If results_log is 'c:\temp\525log', then
                  VQM results will be appended to 'c:\temp\525log_vqm.txt'
                  Errors will be appended to 'c:\temp\525log_error.txt'
                  Calibration values will be appended to
                  'c:\temp\525log_calibration.txt' (Note: Cb and Cr gain &
                  offset are calculated but not removed.)  Calibration limit
                  exceeded warnings append to 'c:\temp\525log_limitwarnings.txt'
                  Model Parameters append to 'c:\temp\525log_parameters.txt'

Compressed reduced reference calibration and model features will be read from
files named after the original video sequence.  The calibration features must
have "_calibration.mat" appended, in the directory that contains that original
```

video sequence. The model features must have "_features.dat" appended, in the directory that contains the original video sequence.

EXAMPLE CALL:

```
  rr_processed 'list_525.txt' '525' 'lowbw' 'log525'
  rr_processed 'list_625.txt' '625' 'fastlowbw' 'log625'
```

EXAMPLE LIST:

```
  c:\v525\SRC_08__525.yuv  c:\v525\SRC_08_MPEG2_m2@1000_525.yuv
  c:\v525\SRC_15__525.yuv  c:\v525\SRC_15_v1@3000_525.yuv
  c:\v525\SRC_16__525.yuv  c:\v525\SRC_16_H264_h4@6000_525.yuv 1.01 -3.2 +1 -1 2
```

RESTRICTIONS:

All video sequences must be exactly 8-seconds in duration.

Test plan and model constraints taken together produces a maximum temporal segment of 7-seconds for VQM and calibration. The first 0.8 sec and last 0.2s of the original video sequence will be ignored. The processed segment used is the segment that best aligns with the original, within the constraints of the RRNR-TV test plan (or optionally input). This software assumes valid video for the following region:

- 525-line/NTSC: top=21, left=31, bottom=466, right=690
- 625-line/PAL: top=21, left=31, bottom=556, right=690