

# HD HQV BENCHMARK

## TESTING & SCORING GUIDE

HDTV'S  
BLU-RAY AND HD-DVD PLAYERS  
VIDEO PROCESSORS



This manual provides details on how to use the HQV Benchmark DVD and develop an objective composite score for the video processor being tested.

VERSION 1 – Blu-ray & HD DVD  
[www.hqv.com](http://www.hqv.com)

# HD HQV BENCHMARK

## INTRODUCTION

You hold in your hands the HD HQV Benchmark, a very powerful evaluation tool that has been developed with the help of some of the premier home theater publications. It's designed to put your HD display, HD DVD player, Blu-ray player, or video scaler through a video obstacle course; one that will reveal a lot about the quality of the video signal processing in these components.

## BEFORE YOU BEGIN

**Important:** Since video processors can be found in both televisions and Blu-ray/HDDVD players, it is important to avoid duplicate processing of the signal. When evaluating the HDTV make sure to put the HD DVD player into 1080i output mode. When testing the Blu-ray or HD DVD player turn the setting to either 1080p or 720p output (720p still requires proper video processing of a 1080i source as the 720p image is created by scaling down from the 1080i to 1080p conversion).

## HIGH-DEFINITION TESTING \*

I want to test...	HD DVD/Blu-ray player should be set to...
The video processor in the TV	1080i Noise Reduction Off
The Blu-ray or HD DVD player	1080p Noise Reduction On

### ATTENTION

You **MUST** use the HD-DVD/Blu-ray HQV HD benchmark disc to test high-definition performance. Using the standard DVD Benchmark with an “upsampling DVD player” set at 1080i/1080p provides **NO** meaningful information about HD video processing performance as the disc is authored in 480i60.

- \* As of this writing the Sony Playstation 3, Toshiba HD-A1, HD-XA1, or HD-A2 will not de-interlace 1080i material to 1080p. These players can only be used to evaluate the capabilities of your video processor or display, not the onboard video processing of the player.

# HD HQV BENCHMARK

## HD NOISE REDUCTION

### Significance

Noise is a problem that continues to affect high-definition video sources. While analog noise is typically introduced during the duplication and editing process, noise in HD sources represents film grain and CCD noise introduced at the time of recording (particularly in the darker areas of a scene), noise introduced during the compositing and post-processing stage due to color and exposure correction, as well as during the compression process itself. Noise affects all HD sources. It doesn't matter if you're watching *Lost* on ABC at 720p, *CSI* on CBS at 1080i, or an HD DVD or Blu-ray movie. The challenge is removing the spurious noise while preserving the detail in the scene.

The most basic approach to noise reduction is blurring the image (spatial filtering). While this removes noise, it also can blur the actual detail of the image. A more sophisticated approach is recursive temporal filtering. Since digital noise is random, these algorithms filter out noise by averaging out the pixels over time. While temporal noise filters can provide a near perfect reconstruction of the original data (with non-moving images), they can also produce "smearing" or "ghosting" effects when the "changing pixels" of a motion in object is confused for the "changing pixels" of random noise.

### Procedure

Turn on any noise reduction on the device being tested to the highest setting. Since both HDTV's and Blu-ray/HD DVD players can incorporate noise reduction, be sure you have disabled noise reduction on the product you are not testing. High quality noise reduction will minimize noise while preserving image detail. Look for detailed objects in the scene and see what impact turning off and on noise reduction has on them. Try different setting levels of noise reduction and see its impact on the image.



Score of 0



Score of 25

### HD NOISE REDUCTION (SCORE ANYWHERE BETWEEN 25 AND 0)



- 25 The level of noise is noticeably reduced without loss of detail
- 15 The level of noise is reduced somewhat and detail is preserved
- 7 The level of noise is reduced but detail is lost
- 0 There is no apparent reduction in noise and/or image detail is significantly reduced or artifacts are introduced

# HD HQV BENCHMARK

## HD VIDEO RESOLUTION LOSS TEST

### Significance

The odd and even fields of interlaced video are recorded a fraction of a second apart (1/60s or 1/50s). This presents several problems to the video processor. When the video contains non-moving objects, it is possible to recover the full resolution of the original scene. On the other hand, if the video contains moving objects, resolution is necessarily lost; it was lost at the time of the recording.

A good video processor needs to distinguish between objects in motion or objects that are not in motion. Doing so ensures that all of the resolution is preserved. If a video processor assumes that a non-moving object is, in fact, moving, as much as half of the useful resolution is being discarded. Likewise, if a video processor assumes that a moving object is, in fact, not moving, then “feathering artifacts” can be seen.

### Procedure

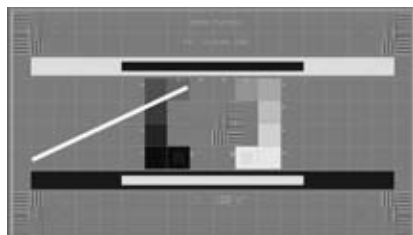
In this test, a 1080i SMPTE 133 test pattern is played off the disc. Look in the corners and to the right of the middle of the image are boxes with alternating horizontal black and white lines. The white lines (odd numbered 1,3, 5 etc.) are sent in the first field and the black lines (even numbered 2,4,6 etc.) are contained in field number two. To add a motion component (properly deinterlacing of still frames doesn't count since we are dealing with “motion” pictures, not a slide show), a clockwise rotating white line is positioned on the left side of the pattern. If a given display is properly processing all the lines, the pattern's alternating horizontal lines should remain intact. If the display is only displaying single 540 line fields, (all odd or all even numbered lines) and upconverting to the TV's native resolution, the boxes will strobe all black and then all white. If this occurs at any time, the display is listed as “fail”, because the display will only be working with half of the available information as it strobes.

An ideal video processor will be able to detect motion at the per-pixel level. It will recognize the bar as an object in motion and the striped box in the corner as a non-moving object.

Look at the boxes in the corners of the pattern. If the video processor evaluates motion at the frame/field level, all of the single-pixel height stripped regions will flicker. These video processors are discarding as much as half of the usable resolution.

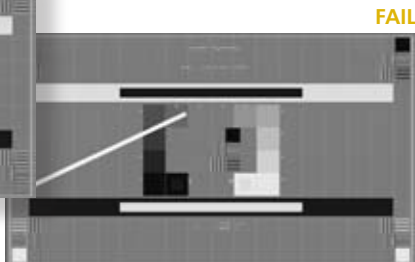
### Additional Testing Notes

You should not have to change the default setting to get the device to pass. Most likely the device will be set to "Auto," "Smart," "Mixed," or "Adaptive" mode. The goal of this test is to evaluate if a processor can appropriately identify objects in motion or not. For example, you should not have to put the device's video processor to the "Film" mode or "Video" mode for it to pass these tests. The device should automatically determine if it's film or video based content.



Score of 20

PASS



Score of 0

FAIL

### HD VIDEO RESOLUTION LOSS (SCORE ANYWHERE BETWEEN 20 AND 0)



- 20 You can see fine horizontal black and white lines in the corner boxes
- 0 The boxes in the corners strobe – half resolution processing

# HD HQV BENCHMARK

## VIDEO RECONSTRUCTION TESTS

### Significance

In these tests, we will evaluate the quality of the video reconstruction. Recall that with interlaced video, resolution in moving areas has been lost at the time of the recording. In order to replace the missing data, most video processors compute the average of the pixel above and below the area of interest. This loss of resolution causes jagged edges to form, most prominent on diagonal lines. High-quality video processors can reduce the appearance of these “jaggies” by implementing more advanced reconstruction methods such as a diagonal interpolation (also called diagonal filtering).

The only method for dealing with motion is to throw away some of the pixels that would cause feathering. So, the difference between a good and bad video processor is how selective it is at throwing away data. If you only throw away the pixels that would cause feathering, you maximize as much detail as possible.

When you throw away data, you must replace it by averaging pixels above and below the area. The loss of resolution causes jagged edges to form, most prominently on diagonal lines. High-quality de-interlacers can reduce the appearance of these “jaggies” through intelligent reconstruction methods. The reconstruction process gets increasingly difficult as the angle becomes more oblique.

### Procedure

The “jaggies” test is a set of three bars with a waving motion (like waving your hand). This part of the benchmark challenges the video processor’s ability to appropriately construct edges of rapidly moving shapes that change direction, speed, and angle.

If all three bars appear to have jagged edges at all times, the video processor does not use any intelligent reconstruction methods. If all bars are smooth throughout the test, the video processor is doing an excellent job of reconstruction.

You should not have to change the default setting to get the device to pass. Most likely



the device will be set to "Auto," "Smart," "Mixed," or "Adaptive" mode. The goal of this test is to evaluate if a processor can appropriately identify an objects motion or not. For example, you should not have to put the device's video processor to the "Film" mode or "Video" mode for it to pass these tests. The device should automatically determine if it's film or video based

**PASS**



**Score of 20**

**FAIL**



**Score of 0**

### VIDEO RECONSTRUCTION (SCORE ANYWHERE BETWEEN 20 AND 0)



- |    |   |
|----|---|
| 20 | All three bars have smooth edges at all times                   |
| 10 | The top two bars have smooth edges, but the bottom bar does not |
| 5  | Only the top bar has a smooth edge                              |
| 0  | None of the bars have smooth edges                              |

# HD HQV BENCHMARK

## FILM RESOLUTION LOSS TEST

### Significance

1080p content exists today. In fact, the majority of today's HD content on CBS and NBC is 1080p. Virtually all major Hollywood films and the majority of "scripted" television shows broadcast over 1080i60 are originally recorded as 1080p24 (1080p resolution, 24 frames per second).

Content that has been recorded at 1080p24 is converted into 1080i60 for broadcast purposes via a telecine process. A good video processor should be able to decode the original 1080p data by recognizing the "3:2 cadence" of the repeated fields generated in this process. This process is known as "inverse telecine." With support for this feature, 100 percent of the pixels from the original 1080p source can be seen. Without proper inverse telecine, the video processor discards half of the resolution.

Popular TV shows broadcast in 1080i including CBS's *How I Met Your Mother*, *The Unit*, *CSI*, *NCIS*, *The King of Queens*, and NBC's *ER*, *Law and Order*, and more can be enjoyed in full 1080p resolution provided your video processor or display device is capable of content-based HD 2:3 inverse telecine.

This test is relevant for testing Blu-ray and HD DVD players for any content that is 1080i and was sourced from a 1080p master that underwent a telecine process. This includes some concert footage, documentaries, films, and many television shows. For example *Discovery's China Revealed* available on Blu-ray is a combination of 1080i video and 1080i 3:2 content.

### Procedure

In this test, a horizontal pan over the standardized SMPTE test pattern was recorded at 24 frames per second. The 1080p24 source was then transferred to the 1080i60 broadcast standard. If the processor properly handles the signal, the boxes with the stripped horizontal lines will remain intact. If not, either the boxes will "strobe" between all black and all white, or you will see vertical bands on the sides of the box. Any "strobing" or banding constitutes a "fail".

You should not have to change the default setting to get the device to pass. Most likely the device will be set to "Auto," "Smart," "Mixed," or "Adaptive" mode. The goal of this test is to evaluate if a processor can appropriately identify the source cadence and apply the proper inverse cadence to recreate the original 1080p image. It also tests if your video processor, player or display can properly recognize the source type and apply the right de-interlacing to achieve the full 1080p image. For example, you should not have to put the device's video processor to the "Film" mode or "Video" mode for it to pass these tests. The device should automatically determine if it's film or video based.

### **Explaining the two types of failures**

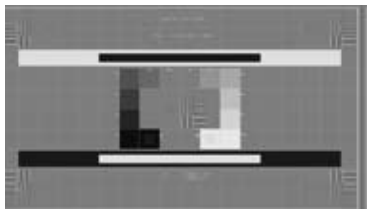
The "strobing" in the boxes indicate half-resolution (not proper inverse telecine) processing. Only one field is used to create a progressive by vertically interpolating the source field to create the synthetic. The boxes are comprised for black lines in one field and white lines in the other. Vertically interpolating white lines in the source field will yield white lines in the synthetic and generate a white box. Vertically interpolating black lines in the source field will yield black lines in the synthetic and generate a black box. So you will end up with white and black boxes alternating at 60 frames-per-second.

The strobing of vertical bands on the left and right edges of the box indicate motion adaptive processing. Since the imagery is panning horizontally and lines within the box are horizontal, then the only motion that can be detected is at the leading and trailing edges of the object (i.e. the left and right edge). Where there is no motion the fields are woven, yielding the alternating black and white lines. Where motion is detected, the source field is vertically interpolated to yield the synthetic. So instead of the entire box strobing in half-resolution processing, only the left and right edges strobe with motion adaptive processing. Motion adaptive processing is appropriate for video based content but not for film based content sourced from a telecine.

# HD HQV BENCHMARK

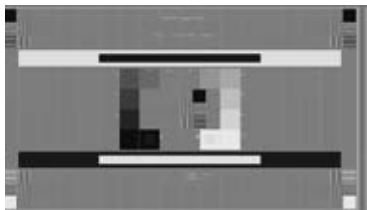
## FILM RESOLUTION LOSS TEST (CONTINUED)

PASS



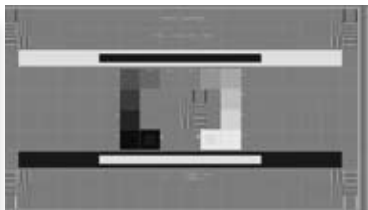
Score of 25

FAIL 1



Score of 0

FAIL 2



Score of 0

### FILM RESOLUTION LOSS (SCORE ANYWHERE BETWEEN 25 AND 0)

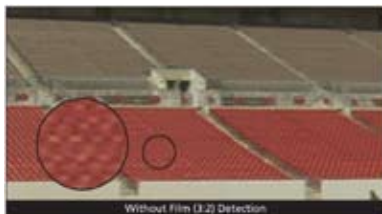


- 25 You can see fine horizontal black and white lines in the corner boxes
- 0 The boxes in the corners strobe, or the edges of the boxes have vertical bands – half resolution processing

## FILM RESOLUTION LOSS TEST – STADIUM

### Procedure

This test is a follow up test to the film resolution loss test. If you failed the previous test, you will fail this test. Pay attention to the stands. Any moiré or flickering in the upper stands indicates half resolution processing. This test provides you with a real world video that can show you how improper video processing can affect an active image. The stands in this stadium are very high in detail and a good processor, player or display should be able to reconstruct the intended 1080p image with all of its intended resolution properly.



Score of 0



Score of 10

### FILM RESOLUTION LOSS TEST - STADIUM (SCORE ANYWHERE BETWEEN 10 AND 0)



- 10 No moiré pattern or flickering in the upper stands  
 0 Moiré pattern or flickering in the upper stands



# HD HQV BENCHMARK

Introducing the HD HQV Benchmark, a powerful image quality testing tool that's designed to put your HDTV, monitor, A/V receiver or HD-DVD player through a grueling video obstacle course, one that will reveal much about the

quality of your processing. For each test, you'll find a brief description of what picture artifacts to look for and how to score the resulting images.

## TESTING INCLUDES:

### NOISE REDUCTION



Score of 0

Score of 25

### FILM TEST



Score of 0



Score of 10

HD HQV Benchmark test high definition processing

HQV Benchmark DVD (sold separately) tests standard definition processing

## THE HD HQV BENCHMARK IS USED BY TOP HOME THEATER MEDIA OUTLETS



*"It's the best way to put your TV or scaler through its paces."*

Geoff Morrison, HOME THEATER MAGAZINE



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