HEWLETT® PACKARD

Digital Video Test Systems

E6285A MPEG-2 Digital Video Encoder Stress Test Patterns Application Note

Version: 1.00

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Introduction

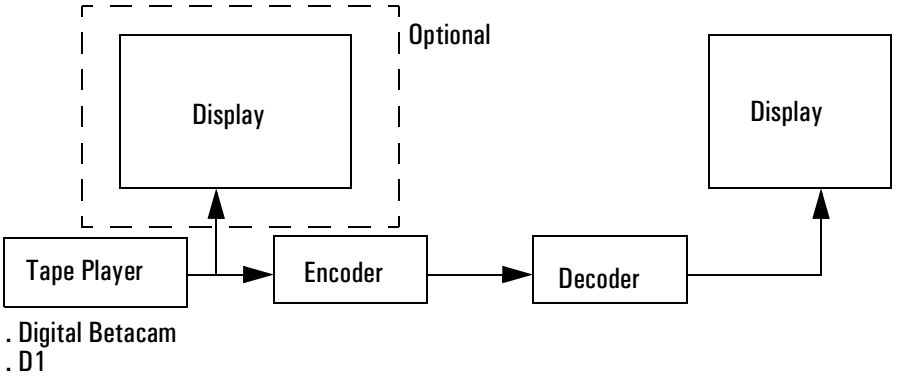
The encoder is one of the most critical components in a digital video system. While decoding follows well defined standards, digital video encoding can vary significantly as different encoder manufacturers attempt to develop proprietary algorithms that deliver optimal video quality with minimal bandwidth usage.

The HP E6285A MPEG-2 Digital Video Encoder Stress Test Patterns is a series of synthetically-generated test patterns designed to test various aspects of the encoding process in MPEG-2 video. They provide a standardized and objective test methodology for digital video encoding. The reliable, deterministic testing methodology offered by the Stress Test Patterns are valuable for a variety of applications.

- Optimization of encoder algorithms in systems under development
- Stress testing of digital video systems
- Comparative evaluation of competitive products
- Assessment and monitoring of relative digital video output quality

Using the Encoder Stress Test Patterns

The figure below illustrates how the encoder stress test patterns can be used to test encoders.



Video Format and Test Categories

The E6285A is available in several four formats.

- Progressive NTSC
- Interlaced NTSC
- Progressive PAL
- Interlaced PAL

The parameters for each test pattern have been defined to create different stress level for the encoding process. There are three categories of test level: low, medium and high stress. These three categories of stress level are available in all four video formats.

Description of Test Patterns

Feature	Test Feature
Luminance rendition	As in chrominance rendition except that the bars are of varying grey scale.
Chrominance rendition	Chrominance rendition tests consist of colored bars that move. Color representation can be examined for possible color clipping.
Edge rendition	By examining the influence of quantization and "mosquito noise", the edge rendition test looks at edge rendition as a function of orientation. The test sequence presents images of a rotating square. The object changes color over time and its contours are antialiased.
Blocking rendition	The blocking effect test sequence feature a series of squares whose dimensions decrease with time. Each square is filled with a slowly varying function of luminance that favors the appearance of blocking effect due to the use of block DCT.
Isotropy Test	The zone plate pattern is used to test the isotropy of displays and encoders. White noise is added to the zone plate to analyze encoder isotropy in the presence of noise.
Noise Test	The noise test examines the influence of increasing noise on the system. Noise is added as a function of time on a still picture.
Abrupt scene changes	The abrupt scene change test determines how well the system copes with difficult scene changes.This test is available in the high stress category only.
Time Aliasing	The time aliasing test pattern consists of a rotating wheel on a complex background. The wheel is accelerating and its motion goes beyond the Nyquist frequency and noise is added with time. This makes the motion estimation harder and tests the robustness of the motion estimation algorithm.
Texture rendition	The texture rendition test presents a time varying texture to the encoder.
Text rendition	The text rendition test determines how well the system copes with text of various font sizes. Block DCT tends to have a disastrous effect on small text fonts.
Zooming and Panning	These test patterns (Zone Plate and Moving Wheel) contain both linear and nonlinear motion at various speeds. They also simulate zooming and panning and they are used to test for artifacts arising from poor motion estimation and compensation.

Feature	Test Feature
Motion Rendition	The motion rendition test fully test the motion estimation/compensation engine of the encoder. It is a combination of non a moving zone plate, followed by a zooming and panning of it. After this, a rotating wheel appears which is later animated by zooming and panning.

Length of the Test Patterns

The number of frames for each of the test patterns is as shown in the tables below. Still frames are inserted at the beginning of the low and medium stress categories. This is done to ensure that encoder is at a reasonably stable mode at the time of encoding. Similarly, five complex texture frame are inserted into the high stress category of test patterns to stress the buffer/bit allocation algorithm further. The frame numbers shown in the tables include these additional frames and the two sync frames that are inserted at the beginning of the test patterns.

Table 1: Number of Frames - Low Stress

Test Pattern	Prog. NTSC	Inter. NTSC	Prog. PAL	Inter. PAL
Luminance Rendition	45	45	45	45
Chrominance Rendition	131	131	131	131
Edge Rendition	83	83	83	83
Blockiness Rendition	73	73	73	73
Isotropy Test	93	93	93	93
Noise	163	163	163	163
Time Aliasing Test	63	63	63	63
Texture Rendition	113	113	113	113
Text Rendition	63	63	63	63
Zoom and Pan (Wheel)	83	83	83	83
Zoom and Pan (Zone Plate)	83	83	83	83
Motion Rendition	296	296	296	296

Table 2: Number of Frames - Medium Stress

Test Pattern	Prog. NTSC	Inter. NTSC	Prog. PAL	Inter. PAL
Luminance Rendition	39	39	39	39
Chrominance Rendition	113	113	113	113
Edge Rendition	77	77	77	77
Blockiness Rendition	57	57	57	57
Isotropy Test	77	77	77	77
Noise	107	107	107	107
Time Aliasing Test	57	57	57	57
Texture Rendition	107	107	107	107
Text Rendition	57	57	57	57
Zoom and Pan (Wheel)	77	77	77	77
Zoom and Pan (Zone Plate)	77	77	77	77
Motion Rendition	272	272	272	272

Table 3: Number of Frames - High Stress

Test Pattern	Prog. NTSC	Inter. NTSC	Prog. PAL	Inter. PAL
Luminance Rendition	39	39	39	39
Chrominance Rendition[a]	73	73	73	73
Edge Rendition	77	77	77	77
Blockiness Rendition	47	47	47	47
Isotropy Test	67	67	67	67

Table 3: Number of Frames - High Stress

Test Pattern	Prog. NTSC	Inter. NTSC	Prog. PAL	Inter. PAL
Noise	57	57	57	57
Abrupt Scene Change Test	18	18	18	18
Time Aliasing Test	57	57	57	57
Texture Rendition	107	107	107	107
Text Rendition	57	57	57	57
Zoom and Pan (Wheel)	77	77	77	77
Zoom and Pan (Zone Plate)	77	77	77	77
Motion Rendition	257	257	257	257

a. The number of frames of 113 reported in the title frames of the high stress chrominance rendition test pattern is incorrect. The correct number of frames for this test is 73.

Time Code of the Tapes

Table 4: Time Code of NTSC Tape

Test Pattern	Time Code (inpoint)
1. NTSC calibration color bars and black screen	0:58:30:00
1.1 Black screen	0:59:30:00
1.2. Low Stress - Progressive NTSC luminance rendition test	1:00:00:00
1.3. Low Stress - Progressive NTSC chrominance rendition test	1:00:07:14
1.4. Low Stress - Progressive NTSC edge rendition test	1:00:23:16
1.5. Low Stress - Progressive NTSC blockiness rendition test	1:00:34:24
1.6. Low Stress - Progressive NTSC isotropy test	1:00:45:02
1.7. Low Stress - Progressive NTSC Noise test	1:00:57:10
1.8. Low Stress - Progressive NTSC Time Aliasing test	1:01:16:18
1.9. Low Stress - Progressive NTSC Zoom and Pan (Wheel)	1:01:25:26
1.10. Low Stress - Progressive NTSC Zoom and Pan (Zone Plate)	1:01:37:04
1.11. Low Stress - Progressive NTSC Texture rendition test	1:01:48:12
1.12. Low Stress - Progressive NTSC text rendition test	1:02:02:20
1.13. Low Stress - Progressive NTSC Motion rendition	1:02:11:26
2.1. Medium Stress - Progressive NTSC luminance rendition test	1:02:44:11
2.2. Medium Stress - Progressive NTSC chrominance rendition test	1:02:51:05
2.3. Medium Stress - Progressive NTSC edge rendition test	1:03:05:11
2.4. Medium Stress - Progressive NTSC blockiness rendition test	1:03:15:29
2.5. Medium Stress - Progressive NTSC isotropy test	1:03:24:17

Table 4: Time Code of NTSC Tape

Test Pattern	Time Code (inpoint)
2.6. Medium Stress - Progressive NTSC Noise test	1:03:35:05
2.7. Medium Stress - Progressive NTSC Time Aliasing test	1:03:48:23
2.8. Medium Stress - Progressive NTSC Zoom and Pan (Wheel)	1:03:57:11
2.9. Medium Stress - Progressive NTSC Zoom and Pan (Zone Plate)	1:04:07:29
2.10. Medium Stress - Progressive NTSC Texture rendition test	1:04:18:17
2.11. Medium Stress - Progressive NTSC text rendition test	1:04:32:05
2.12. Medium Stress - Progressive NTSC Motion rendition	1:04:40:23
3.1. High Stress - Progressive NTSC luminance rendition test	1:05:10:26
3.2. High Stress - Progressive NTSC chrominance rendition test	1:05:17:20
3.3. High Stress - Progressive NTSC edge rendition test	1:05:27:26
3.4. High Stress - Progressive NTSC blockiness rendition test	1:05:38:14
3.5. High Stress - Progressive NTSC isotropy test	1:05:46:02
3.6. High Stress - Progressive NTSC Noise test	1:05:55:20
3.7. High Stress - Progressive NTSC Scene change test	1:06:04:08
3.8. High Stress - Progressive NTSC Time Aliasing test	1:06:08:29
3.9. High Stress - Progressive NTSC Zoom and Pan (Wheel)	1:06:17:17
3.10. High Stress - Progressive NTSC Zoom and Pan (Zone Plate)	1:06:28:05
3.11. High Stress - Progressive NTSC Texture rendition test	1:06:38:23
3.12. High Stress - Progressive NTSC text rendition test	1:06:52:14
3.13. High Stress - Progressive NTSC Motion rendition	1:07:01:02
4.1. Low Stress - Interlaced NTSC luminance rendition test	1:07:29:20
4.2. Low Stress - Interlaced NTSC chrominance rendition test	1:07:37:02

Table 4: Time Code of NTSC Tape

Test Pattern	Time Code (inpoint)
4.3. Low Stress - Interlaced NTSC edge rendition test	1:07:53:02
4.4. Low Stress - Interlaced NTSC blockiness rendition test	1:08:04:08
4.5. Low Stress - Interlaced NTSC isotropy test	1:08:14:14
4.6. Low Stress - Interlaced NTSC Noise test	1:08:26:20
4.7. Low Stress - Interlaced NTSC Time Aliasing test	1:08:45:26
4.8. Low Stress - Interlaced NTSC Zoom and Pan (Wheel)	1:08:55:02
4.9. Low Stress - Interlaced NTSC Zoom and Pan (Zone Plate)	1:09:06:08
4.10. Low Stress - Interlaced NTSC Texture rendition test	1:09:17:14
4.11. Low Stress -Interlaced NTSC text rendition test	1:09:31:20
4.12. Low Stress - Interlaced NTSC Motion rendition Interlaced	1:09:40:26
5.1. Medium Stress - Interlaced NTSC luminance rendition test	1:10:13:11
5.2. Medium Stress - Interlaced NTSC chrominance rendition test	1:10:20:05
5.3. Medium Stress - Interlaced NTSC edge rendition test	1:10:34:11
5.4. Medium Stress - Interlaced NTSC blockiness rendition test	1:10:44:29
5.5. Medium Stress - Interlaced NTSC isotropy test	1:10:53:17
5.6. Medium Stress - Interlaced NTSC Noise test	1:11:04:05
5.7. Medium Stress - Interlaced NTSC Time Aliasing test	1:11:17:23
5.8. Medium Stress - Interlaced NTSC Zoom and Pan (Wheel)	1:11:26:11
5.9. Medium Stress - Interlaced NTSC Zoom and Pan (Zone Plate)	1:11:36:29
5.10. Medium Stress - Interlaced NTSC Texture rendition test	1:11:47:17
5.11. Medium Stress - Interlaced NTSC text rendition test	1:12:01:05
5.12. Medium Stress - Interlaced NTSC Motion rendition	1:12:09:23

Table 4: Time Code of NTSC Tape

Test Pattern	Time Code (inpoint)
6.1. High Stress - Interlaced NTSC luminance rendition test	1:12:39:26
6.2. High Stress - Interlaced NTSC chrominance rendition test	1:12:46:20
6.3. High Stress - Interlaced NTSC edge rendition test	1:12:56:26
6.4. High Stress - Interlaced NTSC blockiness rendition test	1:13:07:14
6.5. High Stress - Interlaced NTSC isotropy test	1:13:15:02
6.6. High Stress - Interlaced NTSC Noise test	1:13:24:20
6.7. High Stress - Interlaced NTSC Scene Change test	1:13:33:08
6.8. High Stress - Interlaced NTSC Time Aliasing test	1:13:37:29
6.9. High Stress - Interlaced NTSC Zoom and Pan (Wheel)	1:13:46:17
6.10. High Stress - Interlaced NTSC Zoom and Pan (Zone Plate)	1:13:57:05
6.11. High Stress - Interlaced NTSC Texture rendition test	1:14:07:26
6.12. High Stress - Interlaced NTSC text rendition test	1:14:21:17
6.13. High Stress - Interlaced NTSC Motion rendition	1:14:30:05

Table 5: Time Code of PAL Tape

Test Pattern	Time Code (inpoint)
1.1 Progressive PAL calibration colour bars	0:58:30:00
1.2 Black Screen	0:59:30:00
1.3. Low Stress - Progressive PAL luminance rendition test	1:00:00:00
1.4. Low Stress - Progressive PAL chrominance rendition test	1:00:08:10
1.5. Low Stress - Progressive PAL edge rendition test	1:00:27:03

Table 5: Time Code of PAL Tape

Test Pattern	Time Code (inpoint)
1.6. Low Stress - Progressive PAL blockiness rendition test	1:00:40:02
1.7. Low Stress - Progressive PAL isotropy test	1:00:51:21
1.8. Low Stress - Progressive PAL Noise test	1:01:06:00
1.9. Low Stress - Progressive PAL Time Aliasing test	1:01:28:14
1.10. Low Stress - Progressive PAL Zoom and Pan (Wheel)	1:01:39:03
1.11. Low Stress - Progressive PAL Zoom and Pan (Zone Plate)	1:01:52:02
1.12. Low Stress - Progressive PAL Texture rendition test	1:02:05:01
1.13. Low Stress - Progressive PAL text rendition test	1:02:21:15
1.14. Low Stress - Progressive PAL Motion rendition	1:02:32:04
2.1. Medium Stress - Progressive PAL luminance rendition test	1:03:10:17
2.2. Medium Stress - Progressive PAL chrominance rendition test	1:03:18:09
2.3. Medium Stress - Progressive PAL edge rendition test	1:03:34:23
2.4. Medium Stress - Progressive PAL blockiness rendition test	1:03:47:04
2.5. Medium Stress - Progressive PAL isotropy test	1:03:57:00
2.6. Medium Stress - Progressive PAL Noise test	1:04:09:06
2.7. Medium Stress - Progressive PAL Time Aliasing test	1:04:25:02
2.8. Medium Stress - Progressive PAL Zoom and Pan (Wheel)	1:04:34:23
2.9. Medium Stress - Progressive PAL Zoom and Pan (Zone Plate)	1:04:47:04
2.10. Medium Stress - Progressive PAL Texture rendition test	1:04:59:10
2.11. Medium Stress - Progressive PAL text rendition test	1:05:15:06
2.12. Medium Stress - Progressive PAL Motion rendition	1:05:25:02
3.1. High Stress - Progressive PAL luminance rendition test	1:06:00:18

Table 5: Time Code of PAL Tape

Test Pattern	Time Code (inpoint)
3.2. High Stress - Progressive PAL chrominance rendition test	1:06:08:10
3.3. High Stress - Progressive PAL edge rendition test	1:06:20:04
3.4. High Stress - Progressive PAL blockiness rendition test	1:06:32:10
3.5. High Stress - Progressive PAL isotropy test	1:06:41:01
3.6. High Stress - Progressive PAL Noise test	1:06:52:02
3.7. High Stress - Progressive PAL Scene Change test	1:07:01:23
3.8. High Stress - Progressive PAL Time Aliasing test	1:07:07:02
3.9. High Stress - Progressive PAL Zoom and Pan (Wheel)	1:07:16:23
3.10. High Stress - Progressive PAL Zoom and Pan (Zone Plate)	1:07:29:04
3.11. High Stress - Progressive PAL Texture rendition test	1:07:41:10
3.12. High Stress - Progressive PAL text rendition test	1:07:57:06
3.13. High Stress - Progressive PAL Motion rendition	1:08:07:02
4.1. Low Stress - Interlaced PAL luminance rendition test	1:08:40:23
4.2. Low Stress - Interlaced PAL chrominance rendition test	1:08:49:08
4.3. Low Stress - Interlaced PAL edge rendition test	1:09:08:01
4.4. Low Stress - Interlaced PAL blockiness rendition test	1:09:21:00
4.5. Low Stress - Interlaced PAL isotropy test	1:09:32:19
4.6. Low Stress - Interlaced PAL Noise test	1:09:46:23
4.7. Low Stress - Interlaced PAL Time Aliasing test	1:10:09:12
4.8. Low Stress - Interlaced PAL Zoom and Pan (Wheel)	1:10:20:01
4.9. Low Stress - Interlaced PAL Zoom and Pan (Zone Plate)	1:10:33:00
4.10. Low Stress - Interlaced PAL Texture rendition test	1:10:45:24

Table 5: Time Code of PAL Tape

Test Pattern	Time Code (inpoint)
4.11. Low Stress -Interlaced PAL text rendition test	1:11:02:13
4.12. Low Stress - Interlaced PAL Motion rendition	1:11:13:02
5.1. Medium Stress - Interlaced PAL luminance rendition test	1:11:51:15
5.2. Medium Stress - Interlaced PAL chrominance rendition test	1:11:59:07
5.3. Medium Stress - Interlaced PAL edge rendition test	1:12:15:21
5.4. Medium Stress - Interlaced PAL blockiness rendition test	1:12:28:02
5.5. Medium Stress - Interlaced PAL isotropy test	1:12:37:23
5.6. Medium Stress - Interlaced PAL Noise test	1:12:49:00
5.7. Medium Stress - Interlaced PAL Time Aliasing test	1:13:04:21
5.8. Medium Stress - Interlaced PAL Zoom and Pan (Wheel)	1:13:14:17
5.9. Medium Stress - Interlaced PAL Zoom and Pan (Zone Plate)	1:13:26:23
5.10. Medium Stress - Interlaced PAL Texture rendition test	1:13:39:04
5.11. Medium Stress - Interlaced PAL text rendition test	1:13:55:00
5.12. Medium Stress - Interlaced PAL Motion rendition	1:14:04:21
6.1. High Stress - Interlaced PAL luminance rendition test	1:14:40:12
6.2. High Stress - Interlaced PAL chrominance rendition test	1:14:48:04
6.3. High Stress - Interlaced PAL edge rendition test	1:14:59:23
6.4. High Stress - Interlaced PAL blockiness rendition test	1:15:12:04
6.5. High Stress - Interlaced PAL isotropy test	1:15:20:20
6.6. High Stress - Interlaced PAL Noise test	1:15:31:21
6.7. High Stress - Interlaced PAL Scene Change test	1:15:41:17
6.8. High Stress - Interlaced PAL Time Aliasing test	1:15:46:21

Table 5: Time Code of PAL Tape

Test Pattern	Time Code (inpoint)
6.9. High Stress - Interlaced PAL Zoom and Pan (Wheel)	1:15:56:17
6.10. High Stress - Interlaced PAL Zoom and Pan (Zone Plate)	1:16:08:23
6.11. High Stress - Interlaced PAL Texture rendition test	1:16:21:04
6.12. High Stress - Interlaced PAL text rendition test	1:16:37:00
6.13. High Stress - Interlaced PAL Motion rendition	1:16:46:21