User Manual

Tektronix

STRM100 Series
Sarnoff MPEG Video Compliance Bitstreams

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This document supports STRM100 version 1.1c,
STRM101 version 1.0, and STRM102 version 1.0.

Sarnoff Corporation
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MPEG Video Compliance Bitstreams
User Manual
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Preface

This is the user manual for the STRM100 Series of Sarnoff MPEG Video Compliance Bitstreams. It contains information about the bitstreams in STRM100 version 1.1c, STRM101 version 1.0, and STRM102 version 1.0.

The following topics are covered in this manual:

- *Using the Bitstreams* explains how to use the bitstreams with a Tektronix MTS100 MPEG Test System, to concatenate multiple bitstreams, and to receive product support.
- *Operating Concepts* explains the basic application for the bitstreams and provides general information about the tests.
- *Test Reference* defines the terms used in the test descriptions and lists the technical references for the manual.
- *MPEG-1 and MPEG-2 Tests* describes bitstreams on the CD-ROM that can be used to test MPEG-1 and MPEG-2 systems.
- *MPEG-2 Specific Tests* describes bitstreams on the CD-ROM that can be used to test MPEG-2 systems.
- *MPEG-2 Display Modes Tests* on the CD-ROM that can be used to test MPEG-2 display modes.
- *CD-ROM File Directory* provides a complete list of files on the CD-ROM.

Using the Bitstreams

The STRM100 Sarnoff MPEG Video Compliance Bitstreams CD-ROM contains a collection of MPEG-1 and MPEG-2 compatible bitstreams. You can use the bitstreams to test decoders by visually inspecting the decoded image, which is displayed on a monitor. Detailed descriptions of each bitstream appear later in this manual.

This section explains how to use the bitstreams with a Tektronix MTS100 MPEG Test System, to concatenate multiple bitstreams, and to receive product support.

NOTE. *STRM100 bitstreams are compatible only with 525-line systems; STRM101 bitstreams are compatible only with 625-line systems. The STRM102 provides bitstreams for both 525- and 625-line systems.*

Using the MTS100 with the Bitstreams

Using the MTS100 Multiplexer application, you can make transport stream files that use one or more bitstreams from the CD-ROM. Perform the following steps to create a transport stream file that contains one bitstream from the CD-ROM:

NOTE. *To multiplex more than one bitstream from the CD-ROM, add multiple program icons to the transport stream configuration file, or add multiple Video icons to the program icon.*

1. Load the CD-ROM into the MTS100 CD-ROM drive.
2. Start the MTS100 Multiplexer application and create a new transport stream configuration file.
3. Choose the Program 1 icon.
4. To add a video icon to Program 1, choose Add (+) from the Button Bar and choose OK to exit the Stream To Add dialog box.
5. Double-click on the video icon and select “Browse” from the Video Stream dialog box. This allows you to select a bitstream from the CD-ROM.

6. Select a file from the CD-ROM drive (drive D). For example, use the pathname

   `d:\525\acscan.mpg`

   to select the CCIR601 MPEG-2 Alternate Scan Pattern bitstream.

7. Choose OK to load the file. Choose OK again to return to the hierarchical display of the configuration file.

8. To create the transport stream file, choose Go from the Button Bar and choose OK.

Concatenating Multiple Bitstreams

You can concatenate bitstreams from the CD-ROM using the DOS "copy" command to create transport stream files that contain multiple tests.

For example, after saving the file z720x480.mpg to your C:\ drive, use the DOS "copy" command as follows.

```
copy/B z720x480.mpg + z720x480.mpg + z720x480.mpg C:\cat3.mpg
```

to produce a once-through elementary stream (cat3.mpg) that consists of three consecutive iterations of the CCIR601 720x480 MPEG-1 Zone Plates file. Refer to the Windows NT manual for other ways to concatenate bitstreams using the "copy" command.

NOTE. *The MTS100 MPEG Test System can use concatenated bitstreams only if the bitstreams have a common bit rate. Refer to to the* CD-ROM File Directory *section to determine the bit rate of each bitstream before concatenating bitstreams for use with the MTS100 MPEG Test System.*

Additional Support

Tektronix provides comprehensive product support for the STRM100 Sarnoff MPEG Video Compliance Bitstreams. Use the following resources to receive support in your area:

- In North America, call 1-800-TEK-WIDE (1-800-835-9433) and ask for STRM100 support
- Outside North America, call 1-503-627-2400 and ask for STRM100 support

- Send FAX messages to 1-503-627-5695
- On the Internet, send email to our support engineers at the following address: *tm_app_supp@tek.com*

Operating Concepts

These bitstreams were designed to test a decoder's compliance with various aspects of MPEG-1 Video [1] and MPEG-2 Video [2], the video compression standards developed by the Moving Pictures Experts Group. These tests were designed so that no access to the internal data in the decoder would be required. The MPEG decoder is treated as a "black box," with the results of the tests obtained by visual inspection of the decoded image.

To test the basic functionality of the decoder, run the Restricted Parameter Tests first. If these basic tests pass, proceed to the MPEG-1, MPEG-2, and MPEG-2 Display Modes tests as shown in Table 1:

***NOTE**. Run tests within the MPEG-1 Tests, MPEG-2 Tests, and MPEG-2 Display Modes Tests groups in any order.*

Table 1: Recommended test order

Order in Sequence	Test Group
1 (run first)	Restricted Parameter Test
2	MPEG-1 Tests: AC Run / Level (MPEG-1), Bit Rate (MPEG-1), Coded Block Pattern, Downloadable Quantiser Matrices, Dynamic GOP, Dynamic Picture Size, Dynamic Slice Size, Intra DC Coefficients, Macroblock Address Increment, Macroblock Stuffing, Macroblock Type, Motion Vector (MPEG-1), Postprocessing Functions, Zero Stuffing
3	MPEG-2 Tests: 16x8 Motion Compensation, AC Run / Level (MPEG-2), Alternate Scan Pattern, Bit Rate (MPEG-2), Dual Prime Motion Vector, Field DCT, Field Motion Vector, Linear Quantiser Scale, Motion Vector (MPEG-2), MPEG-1 / MPEG-2 Sequences, Nonlinear Quantiser Scale, Picture Structure, VBV Buffer Size
4 (run last)	MPEG-2 Display Modes Tests: Pan and Scan, Three-Two Pulldown

Error Propagation: Bitstreams with a Gray "VERIFY" Screen

This method of testing MPEG decoders as black boxes depends on the frame memories used in MPEG decoders to remember the results from decoding previous frames and to incorporate those results into the reconstruction of new frames. Thus if an error occurs just once in a certain frame, that error will be incorporated into all subsequent frames if the bitstream is properly designed. The highly-simplified diagram of an MPEG decoder shown in Figure 1 may help to reveal why errors can be made to propagate.

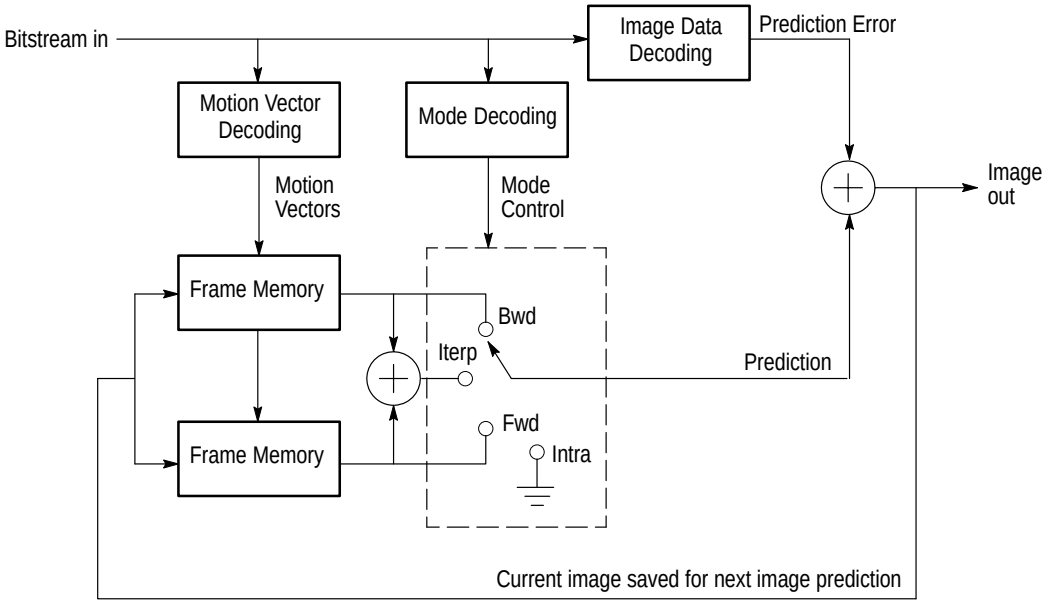
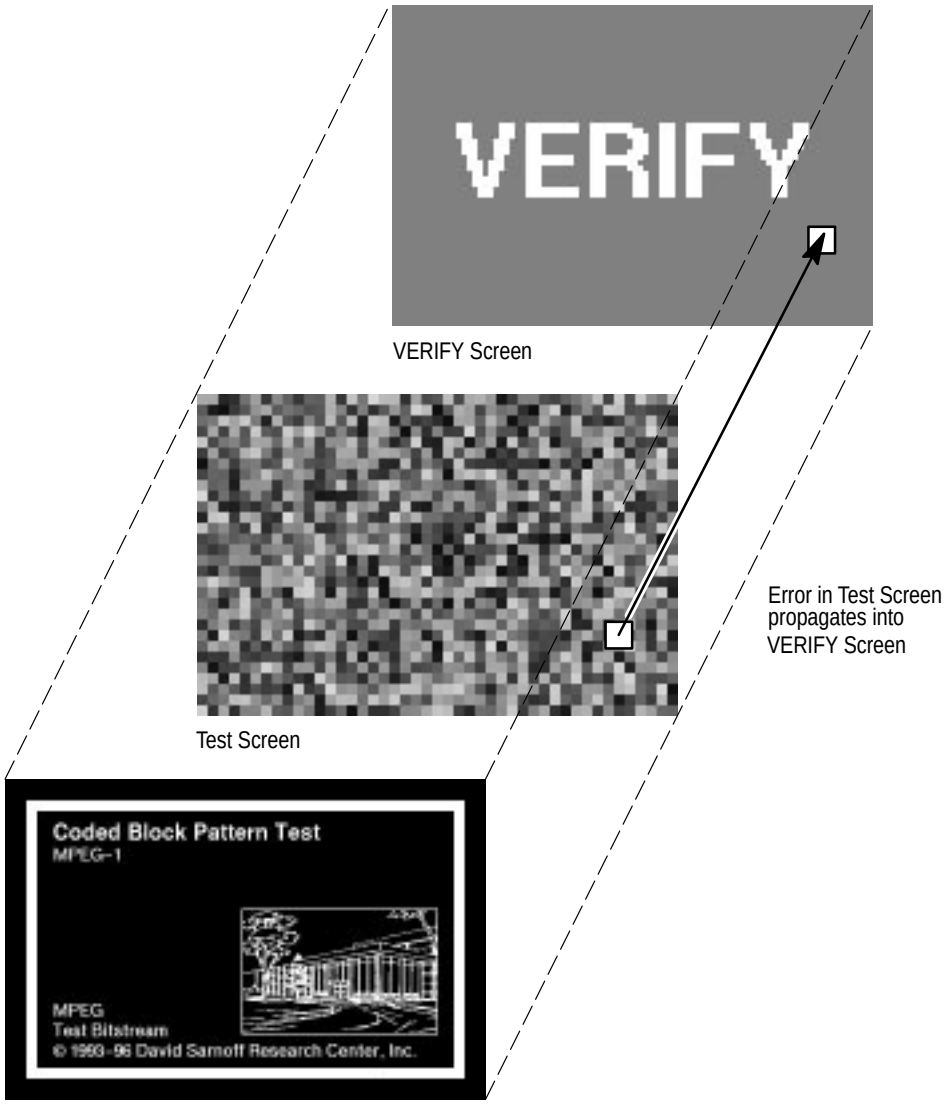


Image data from the bitstream is combined with previous and/or future images to create the new image.

Figure 1: Simplified MPEG decoder

The bitstream provides image data which, when combined with data from a previously-received image (according to mode and motion vector instructions in the bitstream), will produce the new image. This new image may be stored in one of the two Frame Memories for use in reconstructing the next image in the bitstream.

This testing method basically involves creating a bitstream that contains syntactical elements to be tested, followed by data that when combined (by the decoder) with the result of the syntactical test (stored by the decoder) should result in a known image. An example of this is a bitstream that begins with a sequence of television frames that contains an image that describes the test, followed by one or more test frames that contain syntactical elements to be tested, followed by frames containing instructions and data to create a known image from the result of the test frames (see Figure 2).



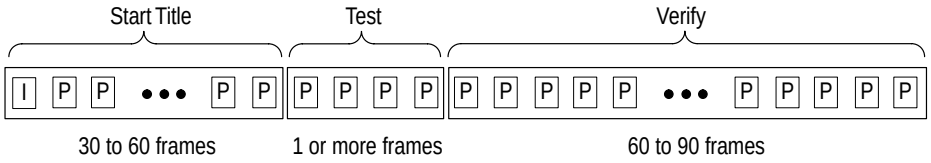
A typical test bitstream contains a sequence of frames starting with a “Title” screen which holds for one or two seconds, followed by one or more frames containing the syntax elements under test, followed by a nearly flat-gray screen with the word “VERIFY”.

Figure 2: Propagation of Errors

A typical test bitstream begins with one or two seconds of a stationary “Title” screen that contains the title of the test and some other information relating to that particular test. This is followed by one or more frames that contain the syntax elements under test, finally followed by a nearly flat-gray screen containing the word “VERIFY”. The word “verify” means that the viewer should *verify* that these

frames look as they should. The flat-gray nature of this screen was chosen to enhance the visibility of errors that are small.

The structure of this test may be represented schematically as a sequence of frames, as shown in Figure 3.



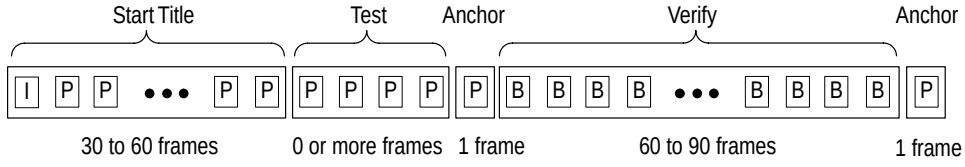
The test begins with an Intra (I) frame, and from one to two seconds of “Start Title”, which is a still frame which describes the particular test. The Start Title is for operator convenience only, and does not affect the operation of the test. The “Test” portion consists of one or more frames that contain syntactical elements to be tested. The first frame of the Test frames may be Intra, but to ensure that errors are not masked by subsequent intra coding, all subsequent pictures must be coded as “P” frames, with Intra mode disabled. Finally, the “Verify” portion of the test contains data coded to create a known picture from the preceding frame. If this known picture is seen on the output of the decoder, the decoder is probably working properly for the syntax element under test.

Figure 3: Basic Test Frame Sequence

Testing B Pictures

In MPEG, the reconstructed image data is saved in the decoder’s frame memory only for “intra” and “predictive” picture types. When a “bi-directional” image is reconstructed by the decoder, the image data is discarded immediately after it is displayed, thus B pictures are never used to reconstruct subsequent frames. Thus, any errors the decoder might make while reconstructing a B picture will not propagate to subsequent frames. Where possible, B pictures are *not* used as the test frames.

However, certain syntactical elements occur *only* in B pictures. In order to test these elements (for example, backward motion vector codes) the test frames must also contain instructions to create the VERIFY frames from the previous one or two anchor (I or P) frames. The “Test” portion and the “Verify” portion thus occur simultaneously (see Figure 4).



Errors made in reconstructing B pictures do not propagate since B pictures are always discarded after reconstruction. In order to test syntax elements that are unique to B pictures, the “test” and “verify” portions are combined.

Figure 4: Test Frame Sequence with B Pictures

Note that this test structure requires an anchor frame that is displayed last, after the Test and Verify section. The viewer can ignore this frame at the end of the sequence.

Bitstreams without a Gray “VERIFY” Screen

Some bitstreams do not use the gray VERIFY screen because they require multiple I pictures, and errors do not propagate across I pictures. For other tests, the syntax elements being tested do not directly affect the image content, so the expected failure mode would not be a corrupted image but instead no image at all.

Note that some tests require a `sequence_end_code`. Failing such a test does not make a decoder non-compliant because MPEG does not specify what a decoder should do after receiving a `sequence_end_code`. Most likely a decoder would continue decoding, possibly dropping some pictures while it re-configures itself to respond to any changes in the sequence header. The number of frames dropped would vary depending on the decoder implementation. The section “Test Reference” indicates which bitstreams require a `sequence_end_code.`

Common Verification Procedures and Key Frames

This section shows key frames that are used in more than one bitstream. Key frames that are unique to a particular bitstream are included with that bitstream’s documentation.

The “VERIFY Screen” Verification Procedure

The VERIFY screen should be free from errors (Figures 5 and 6). The VERIFY screen should appear as a light-gray word “VERIFY” on a smooth, medium-gray background (as shown above). Note that the word “VERIFY has blocky edges for simpler coding. A non-smooth background, with variations in brightness or color, may indicate failure of the test. See the section “Notes on Accuracy of IDCT” for additional information.

Figure 5: VERIFY screen for SIF (352 X 240)

Figure 6: VERIFY screen for CCIR601 (720 X 480)

The "Motion Sequence" Verification Procedure

White squares fill the black rectangle in raster-scan fashion as shown in Figure 7 (the rows are filled in from left to right, starting with the top row). The motion should be smooth and free from errors.

Figure 7: Motion sequence verification procedure screen

The "Thermometer" Verification Procedure

The "Thermometer" verification procedure (Figure 8) is similar to the "Motion Sequence" verification procedure except that the white squares should change to red to indicate the percentage of the buffer size used by the preceding picture (25%, 50%, 75%, and 100%).

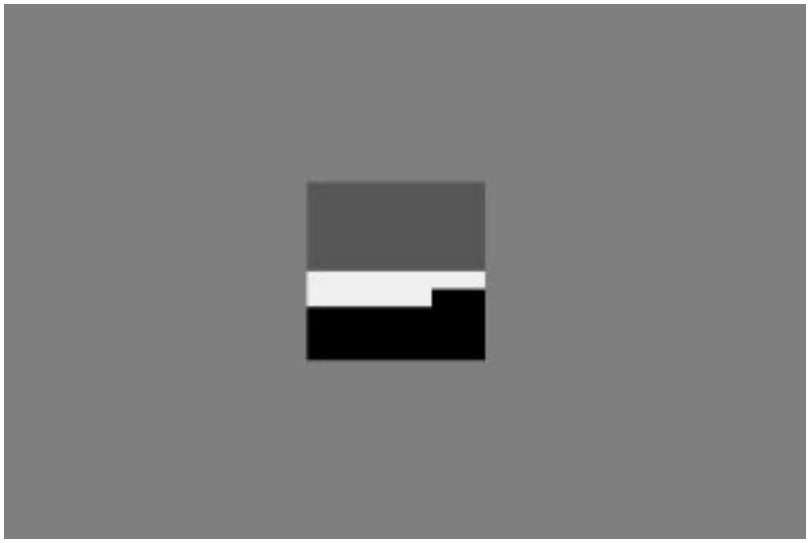


Figure 8: Thermometer verification procedure screen

Notes on Accuracy of IDCT

Both MPEG-1 Video [1] and MPEG-2 Video [2] require that the IDCT conforms to the IEEE Standard Specification for the Implementations of 8 by 8 Inverse Discrete Cosine Transform [3].

NOTE. *Certain artifacts that are not caused by failure of the syntax elements specifically under test may appear in VERIFY screens. Section 1.1, "Purpose", of [3] says:*

> *In a circumstance where IDCTs of different implementations are used in the encoder and the decoder, the IDCT outputs may be slightly different due to different numerical accuracies. These differences will accumulate in the loop and appear as additional noises in the reconstructed pictures.*

To eliminate one possible cause of visible mismatches, the process that generated these bitstreams followed the suggestion in Note 2 of Section 7.4.4, "Mismatch control", of [2], which says:

> Small non-zero inputs to the IDCT may result in zero output for compliant IDCTs. If this occurs in an encoder, mismatch may occur in some pictures in a decoder that uses a different compliant IDCT. An encoder should avoid this problem and may do so by checking the output of its own IDCT. It should ensure that it never inserts any non-zero coefficients into the bitstream when the block in question reconstructs to zero through its own IDCT function. If this action is not taken by the encoder, situations can arise where large and very visible mismatches between the state of the encoder and decoder occur.

In addition, these bitstreams conform to Section 1, "Corrections to the IDCT specification and requirements" of reference [4].

Specific Limitations

These bitstreams are designed to reveal first-order problems that can be noticed by a trained observer. However, visual comparison of the decoded video with a reference may not uncover subtle differences that can be detected only by extensive computer analysis.

These bitstreams are designed to test the entire range of a single parameter of interest. Some decoders may have problems with specific combinations of parameter values, and these problems may not be revealed with these bitstreams.

Test Reference

This section defines the terms used in the test descriptions, and lists the technical references for the manual.

Terms

The following pages document the tests. Tests are described by the following sections: Type, Purpose, Verification Procedure, Filename(s), Notes, and Key Frame(s).

The Type section indicates whether the test is MPEG-1 or MPEG-2.

The Purpose section describes the goal of the test. In many cases it simply lists the specific syntax elements being tested.

The Verification Procedure section describes how to evaluate the test. In many cases it refers to one of the common verification procedures described in the introduction. For tests that have unique verification procedures, a detailed description is provided in this section.

The Filename(s) section lists the base file names of the bitstreams. Not all bitstreams exist in all directories. The base file names are up to 8 characters long, and all lower case. This nomenclature is compatible with DOS, UNIX, and Macintosh file systems.

The Notes section elaborates on the test. This section is optional.

The Key Frame(s) section includes sample pictures from the decoded bitstream. This section is optional.

Technical References

1. ISO/IEC 11172–2 (1993), “Information technology - Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s - Part 2: Video”
2. ISO/IEC 13818–2, “Information technology - Generic coding of moving pictures and associated audio - Part 2: Video”, January 1995.
3. IEEE Std 1180–1990, “IEEE Standard Specification for the Implementations of 8 by 8 Inverse Discrete Cosine Transform”
4. ISO/IEC N1121, “Technical Corrigendum 2 for ISO/IEC 13818–2”, November 1995.

MPEG-1 and MPEG-2 Tests

This section describes bitstreams on the CD-ROM that can be used to test MPEG-1 and MPEG-2 systems. Refer to the following list:

AC Run / Level, MPEG-1

Type MPEG-1

Purpose To test the following syntax element(s):

```
dct_coeff_first
dct_coeff_next
```

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `acrlc1`

Notes This test exercises all entries in the following table(s) of reference [1]:

```
B.5c   Variable length codes for dct_coeff_first and
       dct_coeff_next

B.5d   Variable length codes for dct_coeff_first and
       dct_coeff_next

B.5e   Variable length codes for dct_coeff_first and
       dct_coeff_next

B.5f   Encoding of run and level following an escape code
```

Bit Rate

Type MPEG-1 for bit rates less than 500,000 bits per second.

MPEG-2 for bit rates greater than or equal to 500,000 bits per second.

Purpose To test the following MPEG-1 syntax element(s):

`bit_rate`

To test the following MPEG-2 syntax element(s):

`bit_rate_value`

Verification Procedure Use the “Motion Sequence” verification procedure.

Filename(s)

```
br047200 br060000 br100000 br100400 br100800 br101200 br101600
br102000 br00500k br01000k br01500k br01856k br02000k br02500k
br03000k br03500k br04000k br04500k br05000k br05500k br06000k
br06500k br07000k br07500k br08000k br08500k br09000k br09500k
br10000k br11000k br12000k br13000k br14000k br15000k
```

***NOTE**. Not all filenames apply to all formats. Refer to Table 2 or Table 3 as appropriate to determine the files for that format.*

Notes The `bit_rate` is specified in the bitstream in units of 400 bits / second, rounded upwards. The maximum bitrate for MPEG-2 Main Profile at Main Level is 15 Mb/s.

Coded Block Pattern

Type MPEG-1

Purpose To test the following syntax element(s):

`coded_block_pattern`

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `cbp`

Notes This test exercises all entries in the following table(s) of reference [1]:

`B.3 Variable length codes for coded_block_pattern`

Downloadable Quantiser Matrices

Type MPEG-1

Purpose To test the following syntax element(s):

```
load_intra_quantiser_matrix
intra_quantiser_matrix
load_non_intra_quantiser_matrix
non_intra_quantiser_matrix
```

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `dlquant`

Notes Asymmetric quantiser matrices are used so that decoders that use the transpose of the matrices will fail this test.

Dynamic GOP

Type MPEG-1

Purpose To test the proper decoding of different arrangements of I, P, and B pictures.

Verification Procedure Use the “Motion Sequence” verification procedure.

Filename(s) `dyngop`

Notes Certain groups of pictures can be described by N and M, where N is the number of pictures in the GOP, and M is the distance between anchor pictures. For example, the GOP for N=15 and M=3 is IBBPBBPBBPBBPBB in bitstream order, and BBIBBPBBPBBPBBP in display order. The parameters N and M are not part of the MPEG specifications. Some groups of pictures cannot be described by N and M, for example: IBPBBPBBB.

This bitstream changes N and M for each Group of Pictures (GOP).

The N and M pairs used in the bitstream are listed below.

N	M	Picture Types (in bitstream order)
15	3	IBBPBBPBBPBBPBB
15	5	IBBBBPBBBBPBBBB
15	15	IBBBBBBBBBBBBBB
14	7	IBBBBBBPBBBBBB
1	1	I
13	13	IBBBBBBBBBBBB
2	2	IB
12	6	IBBBBBPBBBBB
3	3	IBB
11	11	IBBBBBBBBBB
4	2	IBPB
10	5	IBBBBPBBBB
5	5	IBBBB
9	3	IBBPBBPBB
6	3	IBBPBB
8	4	IBBBPBBB
7	7	IBBBBBB
1	1	I
15	3	IBBPBBPBBPBBPBB

Dynamic Picture Size

Type MPEG-1

Purpose To test the following syntax element(s):

```
horizontal_size
vertical_size
sequence_end_code
```

Verification Procedure The motion of the block in the title screen should be smooth and free from errors.

The image should fill the screen.

There is no VERIFY screen in this sequence.

Important: The “dynpicts” bitstream requires a `sequence_end_code`, and therefore a compliant decoder is not required to pass this test.

Filename(s)

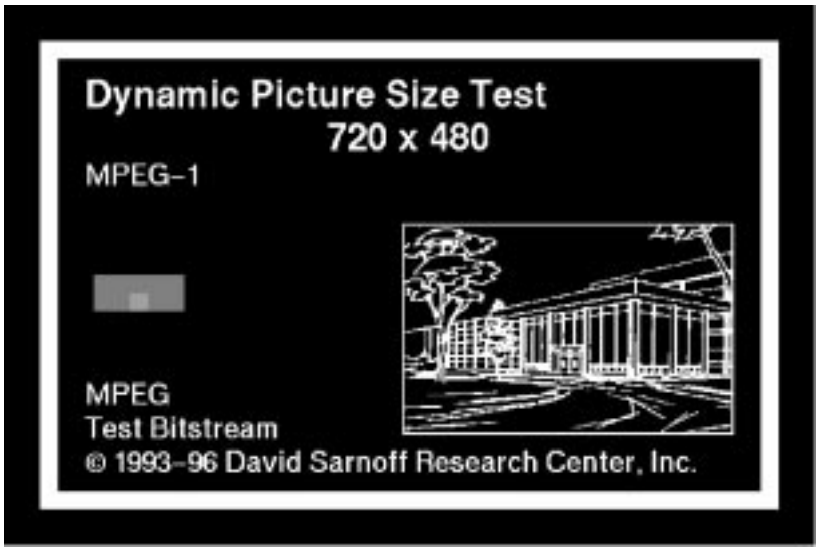
525 line	625 line
dynpicts	
h352x240	h352x288
h352x480	h352x576
h480x480	h528x576
h544x480	h576x576
h704x480	h704x576
h720x480	h720x576

NOTE. *Not all filenames apply to all formats. Refer to Table 2 or Table 3 as appropriate to determine the files for that format.*

Notes The motion in the sequence can help to determine how many frames it takes a decoder to make a transition.

Separate bitstreams of the different picture sizes are also included.

Key Frames


Dynamic Picture Size Test
720 x 480
MPEG–1
MPEG
Test Bitstream
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Dynamic Slice Size

Type MPEG-1

Purpose To test the proper decoding of slices of different sizes.

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `dynslice`

Notes There is no syntax element that explicitly states the slice size; a `slice_start_code` starts a new slice and ends the previous slice. This bitstream tests typical slice sizes and the extreme slice sizes (one macroblock per slice and one slice per picture).

Note that this bitstream does not follow the restrictions described in section 6.1.2.2, “Restricted slice structure”, of [2].

Intra DC Coefficients

Type MPEG-1

Purpose To test the following syntax element(s):

```
dct_dc_size_luminance
dct_dc_size_chrominance
dct_dc_differential
```

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `dcdiff`

Notes This test exercises all entries in the following table(s) of reference [1]:

```
B.5a  Variable length codes for dct_dc_size_luminance
B.5b  Variable length codes for dct_dc_size_chrominance
```

Linear Quantiser Scale

Type MPEG-2

Purpose To test the following syntax element(s):

```
q_scale_type
quantiser_scale_code
```

The particular value of interest of `q_scale_type` for this test is “0”: linear quantiser scale.

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `lquant`

Notes This test exercises all entries in the following table(s) of reference [2]:

```
7-6    Relation between quantiser_scale and
       quantiser_scale_code
```

Macroblock Address Increment

Type MPEG-1

Purpose To test the following syntax element(s):

```
macroblock_escape
macroblock_address_increment
```

Verification Procedure Use the “VERIFY Screen” verification procedure.

This test must be viewed on a monitor capable of underscan in order to see the extreme upper left and lower right corners (first and last macroblocks) used to test `macroblock_escape`.

Filename(s) `mba`

Notes This test exercises all entries in the following table(s) of reference [1]:

```
B.1   Variable length codes for macroblock_address_increment
```

Following the title screen there is one frame coded as a single slice with only the first and last macroblocks coded, so that the last macroblock contains the largest possible number of `macroblock_escape` codes. The number of `macroblock_escape` codes depends on the picture size. Following that frame is one or more frames that collectively contain every `macroblock_address_increment` code at least once. The sequence ends with the VERIFY screen.

Note that this bitstream does not follow the restrictions described in section 6.1.2.2, “Restricted slice structure”, of [2].

Macroblock Stuffing

Type MPEG-1

Purpose To test the following syntax element(s):

`macroblock_stuffing`

Verification Procedure Use the “Thermometer” verification procedure.

Filename(s) `stuffmb`

Notes This bitstream tests typical and extreme amounts of `macroblock_stuffing`.

The `macroblock_stuffing` is inserted in a single macroblock of selected pictures.

Macroblock Type

Type MPEG-1

Purpose To test the following syntax element(s):

`macroblock_type`

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `mbt`

Notes This test exercises all entries in the following table(s) of reference [1]:

`B.2a` `Variable length codes for macroblock_type in intra-coded pictures (I-pictures)`

`B.2b` `Variable length codes for macroblock_type in predictive-coded pictures (P-pictures)`

`B.2c` `Variable length codes for macroblock_type in bidirectionally predictive-coded pictures (B-pictures)`

The semantics of `macroblock_type` depends on `picture_coding_type` of the current picture. There are an I-Frame and a P-Frame that precede the VERIFY sequence and contain test syntax elements for `macroblock_type` for those picture types. To test `macroblock_type` for B-Frames (which are not saved by the decoder) the VERIFY sequence is coded as a sequence of B-Frames containing the `macroblock_type` values to test.

Because this test checks syntax elements found only in B pictures, and B pictures are not saved by the decoder, the VERIFY pictures also contain the syntax elements under test. The B pictures require two anchor pictures, and one of the two anchor pictures is displayed after the B pictures, so the careful observer may notice this picture flash after the VERIFY pictures.

Motion Vector, MPEG-1

Type MPEG-1

Purpose To test the following syntax element(s):

```
forward_f_code
backward_f_code
motion_horizontal_forward_code
motion_horizontal_forward_r
motion_vertical_forward_code
motion_vertical_forward_r
motion_horizontal_backward_code
motion_horizontal_backward_r
motion_vertical_backward_code
motion_vertical_backward_r
```

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s)

```
mvs1_1
mvs1_2
mvs1_3
mvs1_4
mvs1_5
mvs1_6
mvs1_7
```

Notes This test exercises all entries in the following table(s) of reference [1]:

```
B.4   Variable length codes for
      motion_horizontal_forward_code,
      motion_vertical_forward_code,
      motion_horizontal_backward_code, and
      motion_vertical_backward_code
```

This test is comprised of a set of bitstreams, one for each `f_code` value from 1 through 7. The `forward_f_code` and `backward_f_code` values are identical and constant in each bitstream.

Because this test checks syntax elements found only in B pictures, and B pictures are not saved by the decoder, the VERIFY pictures also contain the syntax elements under test. The B pictures require two anchor pictures, and one of the two anchor pictures is displayed after the B pictures, so the careful observer may notice this picture flash after the VERIFY pictures.

Postprocessing Functions

Type MPEG-1

Purpose To test important video postprocessing functions of an MPEG decoder. These functions occur after the MPEG video decoding process and are therefore not part of the MPEG standard.

Verification Procedure The verification procedure depends on the type of test being performed.

Zone Plate Tests. Zone plates are linear frequency sweeps in both spatial dimensions. They are used to measure the magnitude of the horizontal and vertical frequency response of the decoder or decoder/monitor combination.

In the zone plates supplied for this test, DC is at the center and the horizontal and vertical Nyquist limits (half the sampling rate) are at the edges of the picture. Zone plates are displayed sequentially in the following sequence: Y, U and V.

The output frequency of the decoder at the extreme right and left edges of the image is:

Max_Freq = Pixel_Rate / (2 * Upsampling_Rate)

where Max_Freq is the maximum output frequency in MHz, Pixel_Rate is the pixel sampling rate in Msamples/sec, and Upsampling_Rate is the upsampling factor. Assuming a luminance pixel rate of 13.5 Msamples/sec, the following table shows the maximum output frequency as a function of Upsampling_Rate:

Upsampling_Rate	Max_Freq (MHz)
1:1	6.75
4:3	5.06
3:2	4.50
2:1	3.38

These maximum frequencies will be used for eyeballing the horizontal frequency cutoff of the video subsystem in the decoder/monitor combination. More precise frequency measurements of the decoder can, of course, be obtained with an oscilloscope or waveform monitor.

Luma — RF Output (525-line format)

The RF output of the decoder should limit luma bandwidth to about 4.2 MHz. This means that for all sampling rates other than 2:1, the left and right panels of the luma zone plate should go to mid-gray (no response) at

about 4.2 MHz on the scales. Note that all frequencies are in-band for the 2:1 upsampling case, so no gray panels should appear at the left or right edges.

On most monitors, color artifacts will be noticed when viewing the luma zone plate. This is normal, since the high luma frequencies are misinterpreted as color in most consumer NTSC decoders. In receivers with **notch filters**, a vertical strip of color centered at ±3.58 MHz should be seen. In receivers with **line combs**, four balls of color horizontally centered at ±3.58 MHz, and centered midway on the scales vertically should be seen. In receivers with **frame combs**, such as adaptive IDTV receivers, you may see a brief flash of color that eventually disappears, leaving a clean luma-only screen. While these color artifacts may be annoying, they serve as a useful calibration point — the point at which the center of the color balls intersects the horizontal axis is 3.58 MHz.

Luma — RF Output (625-line format)

The RF output of a PAL/I decoder should limit luma bandwidth to about 5.5 MHz. This means that for the 1:1 upsampling rate, the left and right panels of the luma zone plate should go to mid-gray (no response) at about 5.5 MHz on the scales. Note that all frequencies are in-band for the other upsampling cases, so no gray panels should appear at the left or right edges.

On most monitors, color artifacts will be noticed when viewing the luma zone plate. This is normal, since the high luma frequencies are misinterpreted as color in most consumer PAL/I decoders. In receivers with **notch filters**, a vertical strip of color centered at ±4.43 MHz should be seen. In receivers with **line combs**, four balls of color horizontally centered at ±4.43 MHz, and centered midway on the scales vertically should be seen. In receivers with **frame combs**, such as adaptive IDTV receivers, you may see a brief flash of color that eventually disappears, leaving a clean luma-only screen. While these color artifacts may be annoying, they serve as a useful calibration point—the point at which the center of the color balls intersects the horizontal axis is ±4.43 MHz.

Luma — Video Output

The video output of the decoder, like the RF output, is a *composite* NTSC or PAL/I signal. However, the luma bandwidth may be wider (check the specifications for the NTSC or PAL/I encoder). With the exception of the wider luma bandwidth, all comments in the RF output section apply here as well.

Luma — S-Video Output

This output has separate luma and chroma signals, and the luminance bandwidth may be greater than the RF output. bandwidth After checking the manufacturer’s specifications, the same procedure applies: note the frequency limit on the scales, and the left and right panels should go to mid-gray near these points. If the number is off the scale, then all frequencies should appear with more or less the same contrast. Since luma and chroma are kept separate, no color artifacts should appear when viewing the luma zone plate.

Luma — Vertical Response

Only the smallest image size (352x240 in the 525-line format; 352x288 in the 625-line format) has upsampling vertically for luma. The most likely vertical upsampling is field repeat, which lends a slight "jagged-edge" appearance to the upsampled image. However, wild fluctuations in contrast should not appear.

Chroma Response

Because chroma is transmitted as 4:2:0, the decoder will upsample chroma by an additional factor of two in both spatial dimensions, relative to luma. All straightforward upsampling methods should preserve the contrast of the chroma zone plates out to the top and bottom edges of the picture. Horizontal gray panels should appear in chroma in the RF output, but it is difficult to say exactly where, as the roll-off tends to be quite soft. (In 625-line systems, the the U and V color difference signals are bandlimited to approximately 1.3 MHz; in 525-line systems, U and V are transformed to I and Q, which are bandlimited to approximately 1.5 MHz and 0.5 MHz respectively.)

Wild fluctuations in contrast **on the video monitor** may indicate poor filtering by either the decoder or TV set. To eliminate the frequency distortions produced by peaking, black stretch or other processes in the TV set, check the decoder output with an oscilloscope or waveform monitor.

Wild fluctuations in contrast **at the decoder NTSC / PAL/I output**, even for 1:1 upsampling, may inicate that a filtering problem exists in the built-in NTSC / PAL/I encoder.

Wild fluctuations in contrast **at the S-Video output at 1:1 upsampling** may result from an analog filtering problem at the D/A output.

Wild fluctuations in contrast **only at upsampling rates other than 1:1** may be caused by a filtering problem with the upsampling circuitry or algorithm.

Ramps Test. Three ramps are provided on this test: one in each transmitted component. This test is useful in that it displays Y, U and V simultaneously but in separate patches on the screen. If a component is missing, that ramp will not appear on the screen. This is a useful check that all three components are present.

These ramps also check performance of the D/A's. When viewed on an oscilloscope in field mode, the ramps should appear smooth and linear, free from curve-like distortions or "staircasing." Staircasing or other periodic artifacts can occur if one or more bits are "stuck" in the D/A conversion. Depending on the decoder implementation, these artifacts can occur in only one, or in all three, ramps.

If an entire ramp is missing, then that component has been lost somewhere in the processing chain. If YUV is first converted to analog, then color-space converted to RGB, a broken wire could explain this. It is highly unlikely that an entire

ramp would be missing if the conversion to RGB happens in the digital domain, since this would mean that 8 wires would be missing.

If the ramps look like staircases, are highly non-linear, or exhibit large amplitude fluctuations, then the D/A's are suspect. If the D/A conversion is performed separately on Y, U and V, then any artifacts in the luma (Y) ramp should not appear in the chroma ramps. However, if the signals are first transformed to RGB and then D/A converted, then a defect in, say, the G channel would cause artifacts to appear in all the ramps.

Color Bars Test. In the color bars test, each bar has its name associated with it. On a color monitor, the bars should clearly look like the named color (magenta is purplish-pink, cyan is greenish-blue).

If the colors look distorted, then a possible explanation is cross-wiring of the YUV components (U and V may be exchanged, for instance). If the colors appear wrong, turn off the color on the monitor. If the luma bars look like they decrease in brightness from left to right, then the most likely cause is bad postprocessing in the chroma subsystem.

Filename(s)

525 line format	625 line format
z352x240	z352x288
z352x480	z352x576
z480x480	z528x576
z544x480	z576x576
z704x480	z704x576
z720x480	z720x576
colorbar	colorbar
postramp	postramp

Notes

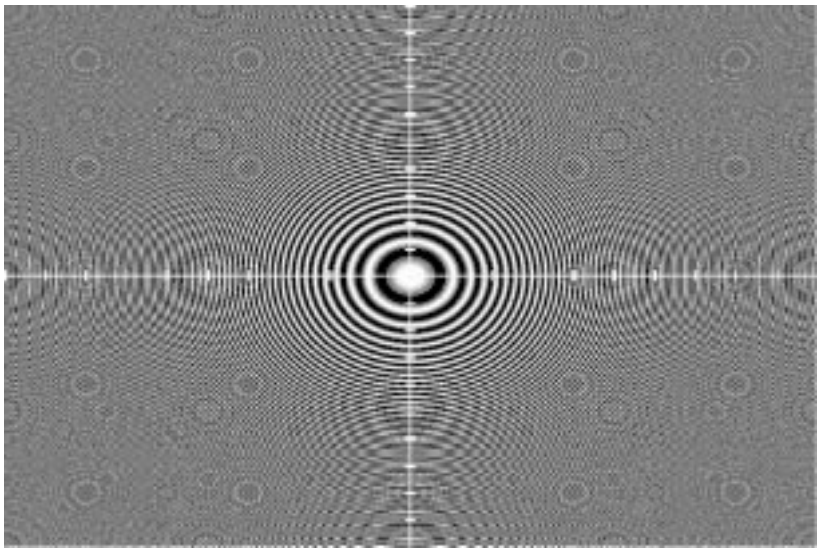
Zone Plate.
Y, U and V sequential.
DC at center.
Maximum horizontal frequency at right and left edges of active image.
Maximum vertical frequency at top and bottom edges of active image.
Linear increase in spatial frequency from center to edges of active image.

Ramps.
Ramps increase in amplitude from left to right.
The top ramp is Y.
The middle ramp is U.
The bottom ramp is V.
Y pixel range: [0, 255]

U pixel range: [0, 255]
V pixel range: [0, 255]

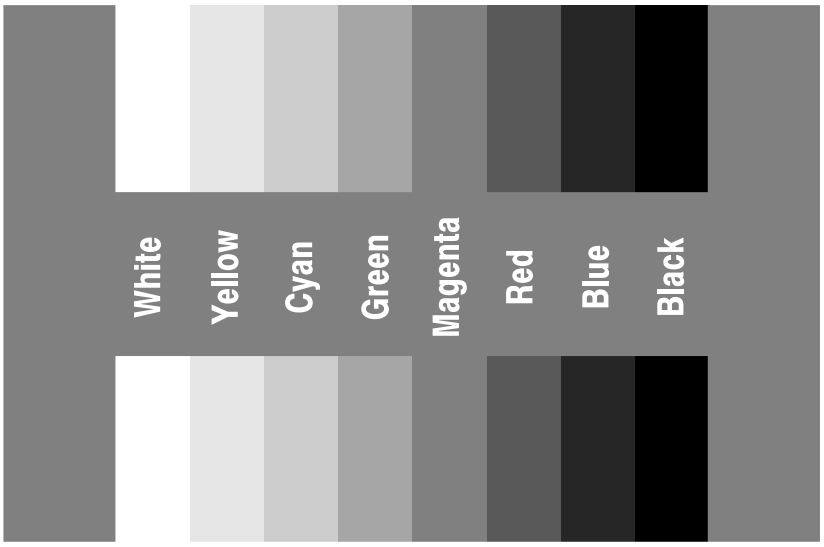
Color Bars.
White, Yellow, Cyan, Green, Magenta, Red, Blue, Black

Key Frames



Zone plate

Ramps (only the Y ramp is visible in this picture)



Color bars

Restricted Parameter

Type MPEG-1

Purpose To test a restricted range of MPEG parameters.

Verification Procedure Use the “Motion Sequence” verification procedure.

Filename(s)

```
rpt_i
rpt_ip
rpt_ipb
```

Notes These Restricted Parameter bitstreams exercise the most basic functionality of a decoder. Other Compliance Bitstreams cannot be expected to decode correctly if these tests are not passed. The bitstreams can be used in the order listed above to isolate a decoder’s ability to handle I, P, and B pictures.

The bitstream “rpt_i” contains only I pictures. This bitstream bypasses the motion compensation section of the decoder.

The bitstream “rpt_ip” contains I and P pictures.

The bitstream “rpt_ipb” contains I, P, and B pictures.

All motion vectors are zero.

Do not confuse “Restricted Parameter” with “Constrained Parameter”, which is defined in [1], or with “Restricted Slice Structure”, which is defined in [2].

VBV Buffer Size

Type MPEG-2

Purpose To test the following syntax element(s):

```
vbv_buffer_size
vbv_delay
```

Verification Procedure Use the “Thermometer” verification procedure.

Filename(s) `vbv`

Notes The SIF version of this bitstream uses a buffer size of 327,680 bits.

The CCIR601 version of this bitstream uses a buffer size of 1,835,008 bits.

Zero Stuffing

Type MPEG-1

Purpose To test zero stuffing.

Verification Procedure Use the “Thermometer” verification procedure.

Filename(s) `stuffz`

Notes This bitstream tests typical and extreme amounts of zero stuffing.

All zero stuffing bits are inserted before the first slice start code of the stuffed picture.

MPEG-2 Specific Tests

This section describes bitstreams on the CD-ROM that can be used to test MPEG-2 systems. Refer to the following list:

AC Run / Level, MPEG-2

Type MPEG-2

Purpose To test the following syntax element(s):

`intra_vlc_format"Subsequent DCT coefficients"`

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `acrlc2`

Notes This test exercises all entries in the following table(s) of reference [2]:

`B-14  DCT coefficients Table zero`

`B-15  DCT coefficients Table one`

`B-16  Encoding of run and level following an ESCAPE code`

Alternate Scan Pattern

Type MPEG-2

Purpose To test the following syntax element(s):

`alternate_scan`

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `acscan`

Notes This test exercises all entries in the following figure of reference [2]:

`Figure 7-3 Definition of scan[1][v][u]`

Dual Prime Motion Vector

Type MPEG-2

Purpose To test the following syntax element(s):

```
frame_motion_type
motion_code
dmvector
```

The particular value of interest of `frame_motion_type` for this test is “11”: Dual-Prime prediction.

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `mv_dual`

Notes This test exercises all entries in the following table(s) of reference [2]:

`B-10 Variable length codes for motion_code`

`B-11 Variable length codes for dmvector`

Unlike many of the other motion vector tests, this test does not use B-frames, because the Dual-Prime mode is allowed only in P-frames. The frame(s) that contain the syntax elements to be tested precede the VERIFY screen sequence. The VERIFY sequence is coded entirely as P-frames.

For all the pictures in this bitstream, `picture_structure` is “frame”.

For the macroblocks in the test picture(s) in this bitstream, `mv_format` is “field”; otherwise, `mv_format` is “frame”.

The `f_codes` for this test are always 1.

Field DCT

Type MPEG-2

Purpose To test the following syntax element(s):

`dct_type`

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `fielddct`

Notes For the test picture(s) in this bitstream, `dct_type` is ‘1’; otherwise, `dct_type` is ‘0’.

Field Motion Vector

Type MPEG-2

Purpose To test the following syntax element(s):

```
frame_motion_type
motion_vertical_field_select
motion_code
```

The particular value of interest of `frame_motion_type` for this test is “01”: field-based prediction.

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `fieldmv`

Notes This test exercises all entries in the following table(s) of reference [2]:

```
B-10  Variable length codes for motion_code
```

For all the pictures in this bitstream, `picture_structure` is “frame”.

For the macroblocks in the test picture(s) in this bitstream, `mv_format` is “field”; otherwise, `mv_format` is “frame”.

The `f_codes` for this test are always 1.

Motion Vector, MPEG-2

Type MPEG-2

Purpose To test the following syntax element(s):

```
f_code
motion_code
motion_residual
```

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s)

```
mvs2_1
mvs2_2
mvs2_3
mvs2_4
mvs2_5
mvs2_6
mvs2_7
mvs2_8
```

Notes This test exercises all entries in the following table(s) of reference [2]:

```
B-10  Variable length codes for motion_code
```

This test is comprised of a set of bitstreams, one for each `f_code` value from 1 through 8. All `f_code` values are identical and constant in each bitstream, except for horizontal `f_code` greater than 5 for which the vertical `f_code` are 5. This conforms to the Main Profile at Main Level restrictions.

Because this test checks syntax elements found only in B pictures, and B pictures are not saved by the decoder, the VERIFY pictures also contain the syntax elements under test. The B pictures require two anchor pictures, and one of the two anchor pictures is displayed after the B pictures, so the careful observer may notice this picture flash after the VERIFY pictures.

For all the pictures in these bitstreams, `picture_structure` is “frame”.

For all the macroblocks in these bitstreams, `mv_format` is “frame”.

MPEG-1 / MPEG-2 Sequences

Type MPEG-1 and MPEG-2

Purpose To test the following syntax element(s):

```
sequence_end_code
extension_start_code
```

To test the decoder's ability to dynamically switch between MPEG-1 and MPEG-2.

Verification Procedure The motion of the block in the title screen should be smooth and free from errors.

The viewer should see title screens for both MPEG-1 and MPEG-2.

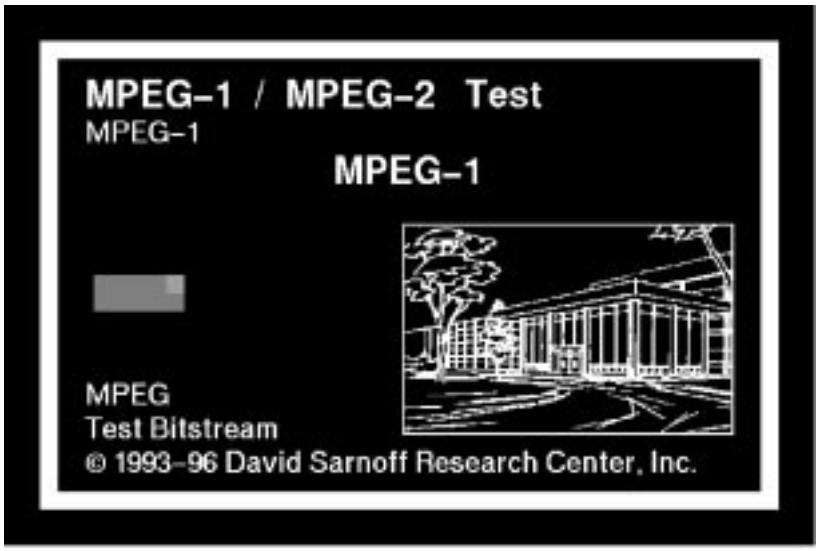
There is no VERIFY screen in this sequence.

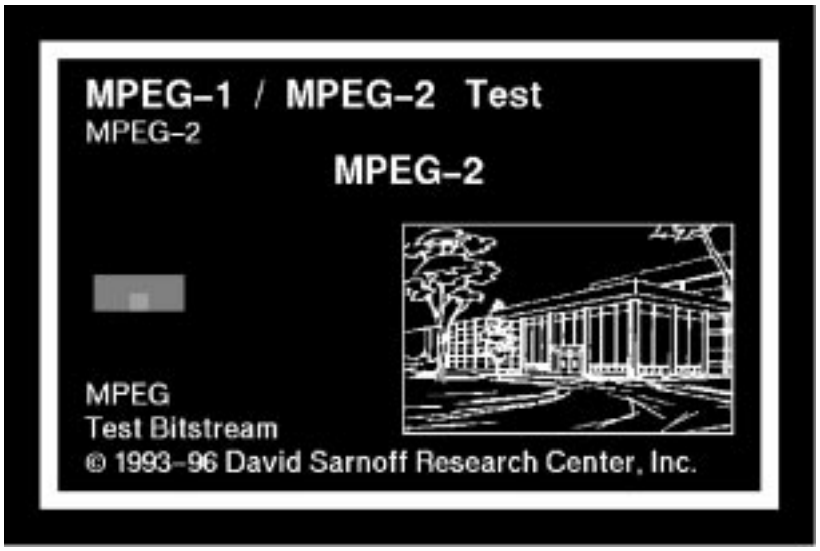
Important: This test requires a `sequence_end_code`, and therefore a compliant decoder is not required to pass this test.

Filename(s) `mpeg12`

Notes The motion in the sequence can help to determine how many frames it takes a decoder to make a transition.

Key Frames


MPEG–1 / MPEG–2 Test
MPEG–1
MPEG–1
MPEG
Test Bitstream
© 1993–96 David Sarnoff Research Center, Inc.


MPEG–1 / MPEG–2 Test
MPEG–2
MPEG–2
MPEG
Test Bitstream
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Nonlinear Quantiser Scale

Type MPEG-2

Purpose To test the following syntax element(s):

```
q_scale_type
quantiser_scale_code
```

The particular value of interest of `q_scale_type` for this test is “1”: nonlinear quantiser scale.

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `nlquant`

Notes This test exercises all entries in the following table(s) of reference [2]:

```
7-6    Relation between quantiser_scale and
       quantiser_scale_code
```

Picture Structure

Type MPEG-2

Purpose To test the following syntax element(s):

`picture_structure`

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `fieldps`

Notes For the test picture(s) in this bitstream, `picture_structure` is “field”; otherwise, `picture_structure` is “frame”.

16x8 Motion Compensation

Type MPEG-2

Purpose To test the following syntax element(s):

```
field_motion_type
motion_vertical_field_select
motion_code
```

The particular value of interest of `field_motion_type` for this test is “10”: 16x8 motion compensation.

Verification Procedure Use the “VERIFY Screen” verification procedure.

Filename(s) `mv16x8`

Notes This test exercises all entries in the following table(s) of reference [2]:

```
B-10  Variable length codes for motion_code
```

Because 16x8 motion compensation is a mode that is only allowed in field-structure pictures, the test frame(s) are actually pairs of field-structure pictures, top field and bottom field. The VERIFY screen is coded as P-frame frame-pictures

For the test picture(s) in this bitstream, `picture_structure` is “field”; otherwise, `picture_structure` is “frame”.

For the macroblocks in the test picture(s) in this bitstream, `mv_format` is “field”; otherwise, `mv_format` is “frame”.

The `f_codes` for this test are always 1.

MPEG-2 Display Modes Tests

This section describes bitstreams on the CD-ROM that can be used to test MPEG-2. Refer to the following list:

Pan and Scan

Type MPEG-2

Purpose To test the following syntax element(s):

```
aspect_ratio_information
display_horizontal_size
display_vertical_size
frame_centre_horizontal_offset
frame_centre_vertical_offset
```

Verification Procedure There is no VERIFY screen in this sequence. Instead, the sequence consists of a title screen followed by an image with two “boxes” on it. The upper box, labeled “16:9”, should **always** be centered in a 16:9 display. The lower box, labeled “4:3”, should **always** be centered in a 4:3 display.

It is not necessary to have a 16:9 display to perform this test. A 4:3 monitor will show a 16:9 image if the decoder is set to 16:9 mode.

Notice that the specification of the display process is system specific. MPEG does not specify the method of displaying decoded images (including pan and scan information).

Verification of Operation in 4:3 Mode. Perform the following steps to verify operation in 4:3 mode:

1. Set the decoder to operate in 4:3 mode.
2. Run the sequence.

The lower box should fill the width of the screen. It may be slightly wider than the screen, but it should not be either much narrower than the screen or much wider.

The upper box will appear to jump across the screen.

The lower box should appear stationary in the image.

A decoder which does not follow MPEG-2 specifications for pictures which do not have a `picture_display_extension()` as specified in section 6.3.12, may have a “jump” in the 4:3 block in the second second following the title screen, before the “pan” section of the test.

A decoder which displays the wrong field first will have a “doubled” line on the pan portion of the test.

A decoder which does not support at least quarter-pixel shifts will not cause the upper box to shake, but the lower box will shake in the final second of the sequence.

If the 4:3 box does not fill the screen, the decoder has not interpreted `aspect_ratio_information` correctly.

Verification of Operation in 16:9 Mode. Perform the following steps to verify operation in 16:9 mode:

1. Set the decoder to display in 16:9 mode.
2. Run the sequence.

The upper box should stay stationary while the lower box moves smoothly from right to left. It then shakes slightly at the center of the image and concludes with a brief split field.

The vertical edges of the upper box occur where the diagonals meet the horizontal lines. These edges should be near the edge of the displayed image, but they may be slightly off the screen. If they are a considerable distance off the screen (if the image looks like a line, an x, and another line), and if the 4:3 box nearly fills the screen width, then the decoder’s 16:9 mode is not correct.

If the upper box moves, pan-and-scan is not disabled properly. This is a system specified display mode.

If the 16:9 image does not fill the screen, the decoder has not detected `aspect_ratio_information` correctly.

Filename(s)

`pan2hor`
`pan2vert`

Notes

The bitstream “pan2hor” has all zero `frame_centre_vertical_offset` values.

The bitstream “pan2vert” has non-zero `frame_centre_vertical_offset` values. However, this bitstream does not provide a way to verify that the

frame_centre_vertical_offset values are properly decoded. This bitstream can be used to indicate whether or not a decoder ignores the frame_centre_vertical_offset values. If a decoder ignores the frame_centre_vertical_offset values, then “pan2vert” will behave the same as “pan2hor”.

There is no known use for vertical panning in MPEG-2. The vertical offset syntax element was included to provide functionality *if* someone found a use for it at some point in the future.

After the title screen, the image sequence consists of images which pan, first on a picture-by-picture basis, then on a field-by-field basis, and finally on a picture-by-picture basis, but with only a fraction of a pixel shift.

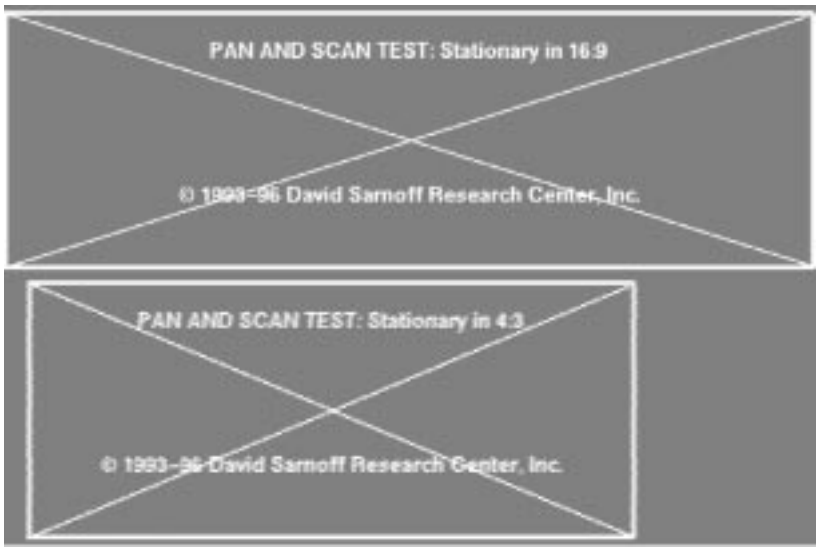
The first portion appears as a jump to one side, which will be followed in 4:3 mode, but not in 16:9 mode. The second portion is a smooth pan, and the third is a “shake test” in the center of the image. The fourth portion is a brief split field.

Section 6.3.12 specifies that two offsets be sent for non-progressive images, so even when the offset is a fixed number for several frames (as in the first second of the test), two codes are included in each picture display extension.

In the second test second of the sequence, this bitstream exercises section 6.3.12’s specification of display for pictures without picture_display_extension(). A twenty-seven frame period follows a three frame period which specifies an “extreme” picture shift to one side. An MPEG-2 decoder should “hold” this “extreme” value of frame_centre_horizontal_offset for those twenty-seven frames.

The sequence includes pictures with frame_centre_horizontal_offset codes. Proper operation when frame_centre_horizontal_offset is not transmitted is also tested.

Key Frames


PAN AND SCAN TEST: Stationary in 16:9
© 1993-96 David Sarnoff Research Center, Inc.
PAN AND SCAN TEST: Stationary in 4:3
© 1993-96 David Sarnoff Research Center, Inc.

Three-Two Pulldown (525 Lines Only)

Type MPEG-2

Purpose To test the following syntax element(s):

```
progressive_sequence
top_field_first
repeat_first_field
```

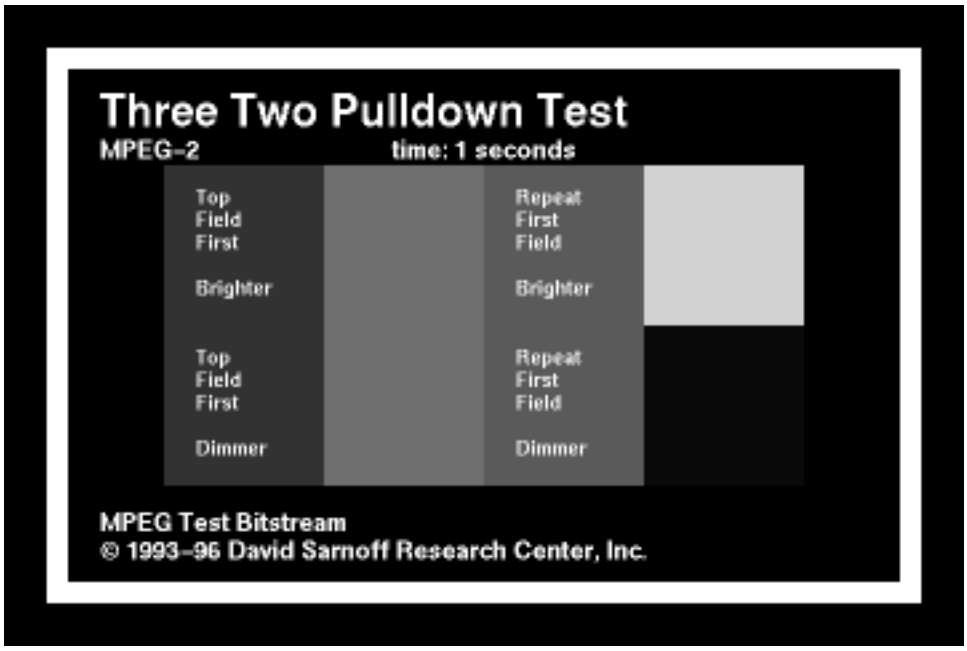
Verification Procedure The 3:2 pulldown test has two tests integrated into the title slide. On the left is the Top Field First test, which is performed by comparing the brightness of two squares. On the right is the Repeat First Field test, which is also performed by comparing the average brightness of two squares, which flash on and off.

If the decoder is operating properly, the top squares should be brighter, and they are labeled as such. If the squares labeled “dimmer” are brighter, the sense of the flag is incorrect, or being ignored. If the two squares are equally bright, then `repeat_first_field` is being ignored.

The title screen also indicates time in seconds. The number changes once every 24 frames, which is about once per second, assuming the effective decoder display rate is 23.976 frames per second. The viewer watches the decoded video, and verifies that the time changes once per second. If the decoder ignores `repeat_first_field` and displays the frames at 29.97 frames per second, then the clock will run about 20% faster, and the 5 second bitstream will be displayed in only 4 seconds.

Filename(s) `pulldown`

Key Frames


Three Two Pulldown Test
MPEG-2
time: 1 seconds
Top
Field
First
Brighter
Repeat
First
Field
Brighter
Top
Field
First
Dimmer
Repeat
First
Field
Dimmer
MPEG Test Bitstream
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CD-ROM File Directories

This section provides a complete list of the files on the STRM100 Series CD-ROMs. Table 2 lists the files in the SIF directories, and Table 3 lists the files in the CCIR601 directories.

Table 2: SIF/CIF directories

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
AC Run / Level, MPEG-1	acrlc1	MPEG-1	352x240	352x288	1.2
AC Run / Level, MPEG-2	acrlc2	MPEG-2	352x240	352x288	1.2
Alternate Scan Pattern	acscan	MPEG-2	352x240	352x288	1.2
Bit Rate					
47,200 b/s	br047200	MPEG-1	352x240	352x288	0.0472
60,000 b/s	br060000	MPEG-1	352x240	352x288	0.0600
100,000 b/s	br100000	MPEG-1	352x240	352x288	0.1000
100,400 b/s	br100400	MPEG-1	352x240	352x288	0.1004
100,800 b/s	br100800	MPEG-1	352x240	352x288	0.1008
101,200 b/s	br101200	MPEG-1	352x240	352x288	0.1012
101,600 b/s	br101600	MPEG-1	352x240	352x288	0.1016
102,000 b/s	br102000	MPEG-1	352x240	352x288	0.1020
500,000 b/s	br00500k	MPEG-2	352x240	352x288	0.5
1,000,000 b/s	br01000k	MPEG-2	352x240	352x288	1.0
1,500,000 b/s	br01500k	MPEG-2	352x240	352x288	1.5
1,856,000 b/s	br01856k	MPEG-2	352x240	352x288	1.856
2,000,000 b/s	br02000k	MPEG-2	352x240	352x288	2.0
2,500,000 b/s	br02500k	MPEG-2	352x240	352x288	2.5
3,000,000 b/s	br03000k	MPEG-2	352x240	352x288	3.0
3,500,000 b/s	br03500k	MPEG-2	352x240	352x288	3.5
4,000,000 b/s	br04000k	MPEG-2	352x240	352x288	4.0
4,500,000 b/s	br04500k	MPEG-2	352x240	352x288	4.5
5,000,000 b/s	br05000k	MPEG-2	352x240	352x288	5.0
5,500,000 b/s	br05500k	MPEG-2	352x240	352x288	5.5
6,000,000 b/s	br06000k	MPEG-2	352x240	352x288	6.0
6,500,000 b/s	br06500k	MPEG-2	352x240	352x288	6.5
7,000,000 b/s	br07000k	MPEG-2	352x240	352x288	7.0
7,500,000 b/s	br07500k	MPEG-2	352x240	352x288	7.5

Table 2: SIF/CIF directories (cont.)

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
8,000,000 b/s	br08000k	MPEG-2	352x240	352x288	8.0
8,500,000 b/s	br08500k	MPEG-2	352x240	n/a	8.5
9,000,000 b/s	br09000k	MPEG-2	352x240	n/a	9.0
9,500,000 b/s	br09500k	MPEG-2	352x240	n/a	9.5
Coded Block Pattern	cbp	MPEG-1	352x240	352x288	1.2
Downloadable Quantiser Matrices	dlquant	MPEG-1	352x240	352x288	1.2
Dynamic GOP	dyngop	MPEG-1	352x240	352x288	1.2
Dynamic Picture Size					
Dynamic	dynpicts	MPEG-1	Mixed	352x288	1.2
SIF (525 lines)	h352x240	MPEG-1	352x240	n/a	1.2
SIF (625 lines)	h352x288	MPEG-1	n/a	352x288	1.2
Small (352x480)	h352x480	MPEG-1	352x480	n/a	1.2
Medium (480x480)	h480x480	MPEG-1	480x480	n/a	1.2
Large (544x480)	h544x480	MPEG-1	544x480	n/a	1.2
Dynamic Slice Size	dynslice	MPEG-1	352x240	352x288	1.2
Intra DC Coefficients	dcdiff	MPEG-1	352x240	352x288	1.2
Linear Quantiser Scale	lquant	MPEG-2	352x240	352x288	1.2
Macroblock Address Increment	mba	MPEG-1	352x240	352x288	1.2
Macroblock Stuffing	stuffmb	MPEG-1	352x240	352x288	1.2
Macroblock Type	mbt	MPEG-1	352x240	352x288	1.2
MPEG-1 / MPEG-2 Sequences	mpeg12	Mixed	352x240	352x288	1.2
Motion Vector, MPEG-1					
forward_f_code = 1 backward_f_code = 1	mvs1_1	MPEG-1	352x240	352x288	1.2
forward_f_code = 2 backward_f_code = 2	mvs1_2	MPEG-1	352x240	352x288	1.2
forward_f_code = 3 backward_f_code = 3	mvs1_3	MPEG-1	352x240	352x288	1.2
forward_f_code = 4 backward_f_code = 4	mvs1_4	MPEG-1	352x240	352x288	1.2
forward_f_code = 5 backward_f_code = 5	mvs1_5	MPEG-1	352x240	352x288	1.2
forward_f_code = 6 backward_f_code = 6	mvs1_6	MPEG-1	352x240	352x288	1.2
forward_f_code = 7 backward_f_code = 7	mvs1_7	MPEG-1	352x240	352x288	1.2

Table 2: SIF/CIF directories (cont.)

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
Motion Vector, MPEG-2					
f_code[0][0] = 1 f_code[0][1] = 1 f_code[1][0] = 1 f_code[1][1] = 1	mvs2_1	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 2 f_code[0][1] = 2 f_code[1][0] = 2 f_code[1][1] = 2	mvs2_2	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 3 f_code[0][1] = 3 f_code[1][0] = 3 f_code[1][1] = 3	mvs2_3	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 4 f_code[0][1] = 4 f_code[1][0] = 4 f_code[1][1] = 4	mvs2_4	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 5 f_code[0][1] = 5 f_code[1][0] = 5 f_code[1][1] = 5	mvs2_5	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 6 f_code[0][1] = 5 f_code[1][0] = 6 f_code[1][1] = 5	mvs2_6	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 7 f_code[0][1] = 5 f_code[1][0] = 7 f_code[1][1] = 5	mvs2_7	MPEG-2	352x240	352x288	1.2
f_code[0][0] = 8 f_code[0][1] = 5 f_code[1][0] = 8 f_code[1][1] = 5	mvs2_8	MPEG-2	352x240	352x288	1.2
Nonlinear Quantiser Scale	nlquant	MPEG-2	352x240	352x288	1.2
Postprocessing Functions					
Color Bars	colorbar	MPEG-1	352x240	352x288	1.2
Ramp	postramp	MPEG-1	352x240	352x288	1.2
Zone Plates					
SIF (525-line)	z352x240	MPEG-1	352x240	n/a	1.2
SIF (625-line)	z352x288	MPEG-1	n/a	352x288	1.2

Table 2: SIF/CIF directories (cont.)

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
Restricted Parameter					
I Pictures	rpt_i	MPEG-1	352x240	352x288	1.2
I and P Pictures	rpt_ip	MPEG-1	352x240	352x288	1.2
I, P, and B Pictures	rpt_ipb	MPEG-1	352x240	352x288	1.2
VBV Buffer Size (uses a buffer size of 327,680 bits)	vbv	MPEG-2	352x240	352x288	1.2
Zero Stuffing	stuffz	MPEG-1	352x240	352x288	1.2

Table 3: CCIR601 directories

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
AC Run / Level, MPEG-1	acrlc1	MPEG-1	720x480	720x576	4.5
AC Run / Level, MPEG-2	acrlc2	MPEG-2	720x480	720x576	4.5
Alternate Scan Pattern	acscan	MPEG-2	720x480	720x576	4.5
Bit Rate					
100,000 b/s	br100000	MPEG-1	352x240	352x288	0.1000
100,400 b/s	br100400	MPEG-1	352x240	352x288	0.1004
100,800 b/s	br100800	MPEG-1	352x240	352x288	0.1008
101,200 b/s	br101200	MPEG-1	352x240	352x288	0.1012
101,600 b/s	br101600	MPEG-1	352x240	352x288	0.1016
102,000 b/s	br102000	MPEG-1	352x240	352x288	0.1020
500,000 b/s	br00500k	MPEG-2	720x480	720x576	0.5
1,000,000 b/s	br01000k	MPEG-2	720x480	720x576	1.0
1,500,000 b/s	br01500k	MPEG-2	720x480	720x576	1.5
2,000,000 b/s	br02000k	MPEG-2	720x480	720x576	2.0
2,500,000 b/s	br02500k	MPEG-2	720x480	720x576	2.5
3,000,000 b/s	br03000k	MPEG-2	720x480	720x576	3.0
3,500,000 b/s	br03500k	MPEG-2	720x480	720x576	3.5
4,000,000 b/s	br04000k	MPEG-2	720x480	720x576	4.0
4,500,000 b/s	br04500k	MPEG-2	720x480	720x576	4.5
5,000,000 b/s	br05000k	MPEG-2	720x480	720x576	5.0
5,500,000 b/s	br05500k	MPEG-2	720x480	720x576	5.5
6,000,000 b/s	br06000k	MPEG-2	720x480	720x576	6.0
6,500,000 b/s	br06500k	MPEG-2	720x480	720x576	6.5
7,000,000 b/s	br07000k	MPEG-2	720x480	720x576	7.0
7,500,000 b/s	br07500k	MPEG-2	720x480	720x576	7.5
8,000,000 b/s	br08000k	MPEG-2	720x480	720x576	8.0
8,500,000 b/s	br08500k	MPEG-2	720x480	720x576	8.5
9,000,000 b/s	br09000k	MPEG-2	720x480	720x576	9.0
9,500,000 b/s	br09500k	MPEG-2	720x480	720x576	9.5
10,000,000 b/s	br10000k	MPEG-2	720x480	720x576	10.0
11,000,000 b/s	br11000k	MPEG-2	720x480	720x576	11.0
12,000,000 b/s	br12000k	MPEG-2	720x480	720x576	12.0
13,000,000 b/s	br13000k	MPEG-2	720x480	720x576	13.0
14,000,000 b/s	br14000k	MPEG-2	720x480	720x576	14.0

Table 3: CCIR601 directories (cont.)

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
15,000,000 b/s	br15000k	MPEG-2	720x480	720x576	15.0
Coded Block Pattern	cbp	MPEG-1	720x480	720x576	4.5
Downloadable Quantiser Matrices	dlquant	MPEG-1	720x480	720x576	4.5
Dual-Prime Motion Vector	mv_dual	MPEG-2	720x480	720x576	4.5
Dynamic GOP	dyngop	MPEG-1	720x480	720x576	4.5
Dynamic Picture Size					
SIF (525-line)	h352x240	MPEG-1	352x240	n/a	4.5
SIF (625-line)	h352x288	MPEG-1	n/a	352x288	4.5
Small (525-line)	h352x480	MPEG-1	352x480	n/a	4.5
Small (625-line)	h352x576	MPEG-1	n/a	352x576	4.5
Medium (525-line)	h480x480	MPEG-1	480x480	n/a	4.5
Medium (625-line)	h528x576	MPEG-1	n/a	528x576	4.5
Large (525-line)	h544x480	MPEG-1	544x480	n/a	4.5
Large (625-line)	h576x576	MPEG-1	n/a	576x576	4.5
CCIR–601 (525-line, 704x480)	h704x480	MPEG-1	704x480	n/a	4.5
CCIR–601 (525-line, 720x480)	h720x480	MPEG-1	720x480	n/a	4.5
CCIR–601 (625-line, 704x 576)	h704x576	MPEG-1	n/a	704x576	4.5
CCIR–601 (625-line, 720x576)	h720x576	MPEG-1	n/a	720x576	4.5
Dynamic Slice Size	dynslice	MPEG-1	720x480	720x576	4.5
Field DCT	fielddct	MPEG-2	720x480	720x576	4.5
Field Motion Vector	fieldmv	MPEG-2	720x480	720x576	4.5
Intra DC Coefficients	dcdiff	MPEG-1	720x480	720x576	4.5
Linear Quantiser Scale	lquant	MPEG-2	720x480	720x576	4.5
Macroblock Address Increment	mba	MPEG-1	720x480	720x576	4.5
Macroblock Type	mbt	MPEG-1	720x480	720x576	4.5
Macroblock Stuffing	stuffmb	MPEG-1	720x480	720x576	4.5
Motion Compensation (16x8)	mv16x8	MPEG-2	720x480	720x576	4.5
Motion Vector, MPEG-1					
forward_f_code = 1 backward_f_code = 1	mvs1_1	MPEG-1	720x480	720x576	4.5
forward_f_code = 2 backward_f_code = 2	mvs1_2	MPEG-1	720x480	720x576	4.5
forward_f_code = 3 backward_f_code = 3	mvs1_3	MPEG-1	720x480	720x576	4.5

Table 3: CCIR601 directories (cont.)

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
forward_f_code = 4 backward_f_code = 4	mvs1_4	MPEG-1	720x480	720x576	4.5
forward_f_code = 5 backward_f_code = 5	mvs1_5	MPEG-1	720x480	720x576	4.5
forward_f_code = 6 backward_f_code = 6	mvs1_6	MPEG-1	720x480	720x576	4.5
forward_f_code = 7 backward_f_code = 7	mvs1_7	MPEG-1	720x480	720x576	4.5
Motion Vector, MPEG-2					
f_code[0][0] = 1 f_code[0][1] = 1 f_code[1][0] = 1 f_code[1][1] = 1	mvs2_1	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 2 f_code[0][1] = 2 f_code[1][0] = 2 f_code[1][1] = 2	mvs2_2	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 3 f_code[0][1] = 3 f_code[1][0] = 3 f_code[1][1] = 3	mvs2_3	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 4 f_code[0][1] = 4 f_code[1][0] = 4 f_code[1][1] = 4	mvs2_4	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 5 f_code[0][1] = 5 f_code[1][0] = 5 f_code[1][1] = 5	mvs2_5	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 6 f_code[0][1] = 5 f_code[1][0] = 6 f_code[1][1] = 5	mvs2_6	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 7 f_code[0][1] = 5 f_code[1][0] = 7 f_code[1][1] = 5	mvs2_7	MPEG-2	720x480	720x576	4.5
f_code[0][0] = 8 f_code[0][1] = 5 f_code[1][0] = 8 f_code[1][1] = 5	mvs2_8	MPEG-2	720x480	720x576	4.5
MPEG-1 / MPEG-2 Sequences	mpeg12	Mixed	720x480	720x576	4.5
Nonlinear Quantiser Scale	nlquant	MPEG-2	720x480	720x576	4.5

Table 3: CCIR601 directories (cont.)

Bitstream Description	Filename	MPEG 1 or 2	Image Size (H x V) 525-line	625-line	Bit rate (Mb/s)
Pan and Scan					
Non-zero vertical offsets	pan2vert	MPEG-2	720x480	720x576	4.5
Zero vertical offsets	pan2hor	MPEG-2	720x480	720x576	4.5
Picture Structure	fieldps	MPEG-2	720x480	720x576	4.5
Postprocessing Functions					
Ramp	postramp	MPEG-1	720x480	720x576	4.5
Color Bars	colorbar	MPEG-1	720x480	720x576	4.5
Zone Plates					
SIF (525-line)	z352x240	MPEG-1	352x240	n/a	4.5
SIF (625-line)	z352x288	MPEG-1	n/a	352x288	4.5
Small (525-line)	z352x480	MPEG-1	352x480	n/a	4.5
Small (625-line)	z352x576	MPEG-1	n/a	352x576	4.5
Medium (525-line)	z480x480	MPEG-1	480x480	n/a	4.5
Medium (625-line)	z528x576	MPEG-1	n/a	528x576	4.5
Large (525-line)	z544x480	MPEG-1	544x480	n/a	4.5
Large (625-line)	z576x576	MPEG-1	n/a	576x576	4.5
CCIR–601 (525-line, 704x480)	z704x480	MPEG-1	704x480	n/a	4.5
CCIR–601 (525-line, 720x480)	z720x480	MPEG-1	720x480	n/a	4.5
CCIR–601 (625-line, 704x576)	z704x576	MPEG-1	n/a	704x576	4.5
CCIR–601 (625-line, 720x576)	z720x576	MPEG-1	n/a	720x576	4.5
Restricted Parameter					
I Pictures	rpt_i	MPEG-1	720x480	720x576	4.5
I and P Pictures	rpt_ip	MPEG-1	720x480	720x576	4.5
I, P, and B Pictures	rpt_ipb	MPEG-1	720x480	720x576	4.5
Three-Two Pulldown	pulldown	MPEG-2	720x480	n/a	4.5
VBV Buffer Size (uses a buffer size of 1,835,008 bits)	vbv	MPEG-2	720x480	720x576	4.5
Zero Stuffing	stuffz	MPEG-1	720x480	720x576	4.5

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