



DVD-R

Video Format Recorder

TEST SPECIFICATION

Version 1.3
May 2005

Amendment for DVD-R Video Format Recorder TS Version 1.3 (May 2005)

The following pages were amended without changing the version number of the TS.

- **Minor amendment (July 15, 2009)**

Page	Location	Amendment
Pages 22 to 23	Annex A	<ul style="list-style-type: none">• Class-A Lab information of "Industrial Technology Research Institute", "Matsushita Electric Industrial Co., Ltd. (company name)", "PIONEER CORPORATION", "Sony Corporation (addition)" and "Victor Company of Japan, Limited" was updated.
Pages 26 to 27	Annex D	<ul style="list-style-type: none">• A note regarding Class-A Lab information was added.• Class-A Lab information of "PIONEER CORPORATION" and "Matsushita Electric Industrial Co., Ltd. (company name)" was updated.• The supplier of the Test Discs LVP00.06 and LVP08.01 was changed from "Royal Philips Electronics" to "OM&T B.V.".

- **Minor amendment (January 2010)**

Page	Location	Amendment
Pages 22 to 23	Annex A	<ul style="list-style-type: none">• Class-A Lab information of "Panasonic Corporation", "PIONEER CORPORATION" and "Victor Company of Japan, Limited" were updated.
Pages 26 to 27	Annex D	<ul style="list-style-type: none">• Class-A Lab information of "Panasonic Corporation" and "PIONEER CORPORATION" were updated.

- **Amendment 1 (January 2012)**

Page	Location	Amendment
Pages 22 to 23	Annex A	<ul style="list-style-type: none">• "Toshiba Corporation" was deleted from the Class-A Lab list.• The company name "Victor Company of Japan, Limited" was changed to "JVC KENWOOD Corporation".
Pages 26 to 27	Annex D	<ul style="list-style-type: none">• The supplier of the Test Stream Disc (IDL-0002) was changed from "Toshiba Corporation" to "ALMEDIO INC.".• DVD File System Verifier (TFSV03) from Toshiba was discontinued.

- **Amendment 2 (June 2012)**

Page	Location	Amendment
Page 22	Annex A	<ul style="list-style-type: none">• "Industrial Technology Research Institute" was deleted from the Class-A Lab list.• Class-A Lab information of "Sony Corporation" was updated.

Conditions for Publication

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Revision History

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DVD-R Video Format Recorder Test Specification Version 1.0 was distributed to SG-10 members.
- April 26, 2001
VTF members approved DVD-R Video Format Recorder Test Specification Version 1.0.
- June 22, 2001
VTF members agreed to add Note sentence in **1.1 Scope**.
- February 2002
DVD-R Video Format Recorder Test Specification Version 1.1(draft) to add test specification for 625/50 TV system was distributed to SG-10 members.
- March 29, 2002
DVD-R Video Format Recorder Test Specification Version 1.1 was approved by VTF members.
- January 2003
Version 1.2 draft to add test specification for 4x-speed Recorder was distributed to SG-10 members.
- March 14, 2003
DVD-R Video Format Recorder Test Specification Version 1.2 was approved by VTF members.
- April 11, 2005
Version 1.3 was approved by VTF.
The version 1.3 added Test Specifications for higher speed SL Disc up to 16x-speed and for DL Disc based on DVD-R for DL Book Part 1: Ver. 3.0.
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Forms for DVD Format verification

Form 1U

Preliminary Information for DVD Format Verification F1

Form 2U

Test Information of DVD Format Verification F2

Form 3U

Test result of 1x-speed Recording characteristics for SL disc F3

Form 4U

Test result of 1x-speed Linking characteristics for SL disc F5

Form 5U

Test result of 1x-speed Information data in Lead-in and RMA for SL disc F6

Form 6U

Test result of Reading characteristics for SL disc F8

Form 7U

Test result of 4x-speed Recording characteristics for SL disc F9

Form 8U

Test result of 4x-speed Linking characteristics for SL disc F11

Form 9U

Test result of 4x-speed Information data in Lead-in and RMA for SL disc F12

Form 10U

Test result of 6x-speed Recording characteristics for SL disc F14

Form 11U

Test result of 6x-speed Linking characteristics for SL disc F16

Form 12U

Test result of 6x-speed Information data in Lead-in and RMA for SL disc F17

Form 13U

Test result of 8x-speed Recording characteristics for SL disc F19

Form 14U

Test result of 8x-speed Linking characteristics for SL disc F21

Form 15U

Test result of 8x-speed Information data in Lead-in and RMA for SL disc F22

Form 16U

Test result of 12x-speed Recording characteristics for SL disc F24

Form 17U

Test result of 12x-speed Linking characteristics for SL disc F26

Form 18U

Test result of 12x-speed Information data in Lead-in and RMA for SL disc F27

Form 19U

Test result of 16x-speed Recording characteristics for SL disc F29

Form 20U

Test result of 16x-speed Linking characteristics for SL disc F30

Form 21U

Test result of 16x-speed Information data in Lead-in and RMA for SL disc F31

Form 22U

Test result of 2x-speed Recording characteristics for DL disc F33

Form 23U

Test result of 2x-speed Linking characteristics for DL disc F37

Form 24U

Test result of 2x-speed Information data in Lead-in and RMA for DL disc F38

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Test result of Reading characteristics for DL disc F40

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Form 34U

Test result of PAL Multichannel Test Disc F64

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Form 36U

Test result of PAL Navigation Files Test Disc Vol. 2 F70

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Test result of ADP_TY and ADP_ID check F73

Form 38U

Confirmation of DVD Format Verification F74

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1. General

1.1 Scope

The scope of this Test Specification is the testing DVD-R Video Format Recorders for compliance with **DVD Specifications listed in 1.2**. The products shall be able to record on DVD-R Disc for General (hereinafter called **SL disc**) and/or DVD-R Disc for Dual Layer (hereinafter called **DL disc**).

The test procedure described herein could be used by Class-A Verification Labs, Class-B Verification Labs and Quality Assurance Departments of DVD-R Video Format Recorder manufactures.

The scope of this Test Specification is limited to product's compliance to DVD Specifications and not to evaluate performance of products.

Note: This product is regarded as an associated product conforming to the plural DVD Specifications (e.g. DVD-R for General, DVD-R for Dual Layer and DVD-Video Book). Therefore this Test Specification involves at least two kinds of test group which may link to the verification fee.

1.2 Normative References

DVD Specifications for Recordable Disc for General (DVD-R for General)

Part 1: Physical Specifications Version 2.1

Optional Specifications 4x-speed DVD-R Revision 1.0

Optional Specifications 6x-speed DVD-R Revision 2.0

Optional Specifications 8x-speed DVD-R Revision 3.0

Optional Specifications 2x-speed DVD-R Revision 4.0

Optional Specifications 12x-speed DVD-R Revision 5.0

Optional Specifications 16x-speed DVD-R Revision 6.0

DVD Specifications for Recordable Disc for Dual Layer (DVD-R for DL)

Part 1: Physical Specifications Version 3.0

Optional Specifications 4x-speed DVD-R for DL Revision 1.0

DVD Specifications for Recordable Disc for General (DVD-R for General)

Part 2: File System Specification Version 2.1

DVD Specifications for Read-Only Disc

Part 3: Video Specifications Version 1.1

1.3 Scope of Products Covered

Recorder for SL disc

- Class 0 DVD-R Video Format Recorder for SL (1x only) for 525/60 and/or 625/50 TV system
- Class 0 DVD-R Video Format Recorder for SL (4x max.) for 525/60 and/or 625/50 TV system
- Class 0 DVD-R Video Format Recorder for SL (6x max.) for 525/60 and/or 625/50 TV system
- Class 0 DVD-R Video Format Recorder for SL (8x max.) for 525/60 and/or 625/50 TV system
- Class 0 DVD-R Video Format Recorder for SL (12x max.) for 525/60 and/or 625/50 TV system
- Class 0 DVD-R Video Format Recorder for SL (16x max.) for 525/60 and/or 625/50 TV system

Recorder for DL disc

- Class 0 DVD-R Video Format Recorder for DL (2x only) for 525/60 and/or 625/50 TV system
- Class 0 DVD-R Video Format Recorder for DL (4x max.) for 525/60 and/or 625/50 TV system

Notes:

- The Class 0 Recorder for SL (1x only) means that it is adaptable to the DVD-R discs for General having Class 0 and the recording speed is 1x-speed only.
- The Class 0 Recorder for SL (**N**x max.) means that it is adaptable to the DVD-R discs for General having Class 0 and the maximum recording speed for Class 0 disc is **N**x-speed.
- The Class 0 Recorder for DL (2x only) means that it is adaptable to the DVD-R discs for DL having Class 0 and the recording speed is 2x-speed only.
- The Class 0 Recorder for DL (4x max.) means that it is adaptable to the DVD-R discs for DL having Class 0 and the maximum recording speed for Class 0 disc is 4x-speed.

2. DVD Logo

DVD Format/Logo Licensing Corporation owns the rights to license the DVD Logo. To be able to use the DVD Logo, DVD manufacturer must have:

- a. License to use the Logo and
- b. DVD Specification compliance of the product for logo consideration must be validated by the test specifications as defined in this document.

Licensing terms for the DVD Logo are available from the DVD Format/Logo Licensing Corporation.

This chapter describes the mechanism to be used for product compliance testing.

2.1 Definition of Terms Used

First Production Model- The **First Production Model** must be tested and approved by any of the appropriate Class-A Verification Labs (see definition of Class-A Labs below) for compliance with DVD Specifications. Class-A labs will use the test specifications described in this document for compliance verification.

The following parameters must be used to determine a **First Production Model** *for each of the "Recorder for SL disc" and the "Recorder for DL disc" independently:*

- DVD Specifications Version n.x changing to $n \pm 1.x$
- Initial or the latest production model at the start of Logo Program for each licensee
- Production model that is adaptable to additional Class disc

Example of first production model

Recorder for SL disc: Class 0 DVD-R Video Format Recorder (1x only)
or Class 0 DVD-R Video Format Recorder (4x max.)
or Class 0 DVD-R Video Format Recorder (6x max.)
or Class 0 DVD-R Video Format Recorder (8x max.)
or Class 0 DVD-R Video Format Recorder (12x max.)
or Class 0 DVD-R Video Format Recorder (16x max.)

and

Recorder for DL disc: Class 0 DVD-R Video Format Recorder for DL (2x only)
or Class 0 DVD-R Video Format Recorder for DL (4x max.)

Next Production Model - A **Next Production Model** does not require compliance verification from a Class-A Verification Lab, but must be tested by licensee in its QA department for compliance with DVD Specifications. Licensee's QA department must have the test tools required to perform the tests specified in this document and must, at minimum, use the test procedure referred to in this document (licensee is free to have its own QA procedure, equipment and tools as long as it is a superset of the specification described in this document). A Licensee without its own QA department can get the product tested by a certified Third Party Class-B Verification Lab (see definition of Class-B Labs below).

The following parameters must be used to determine a **Next Production Model**:

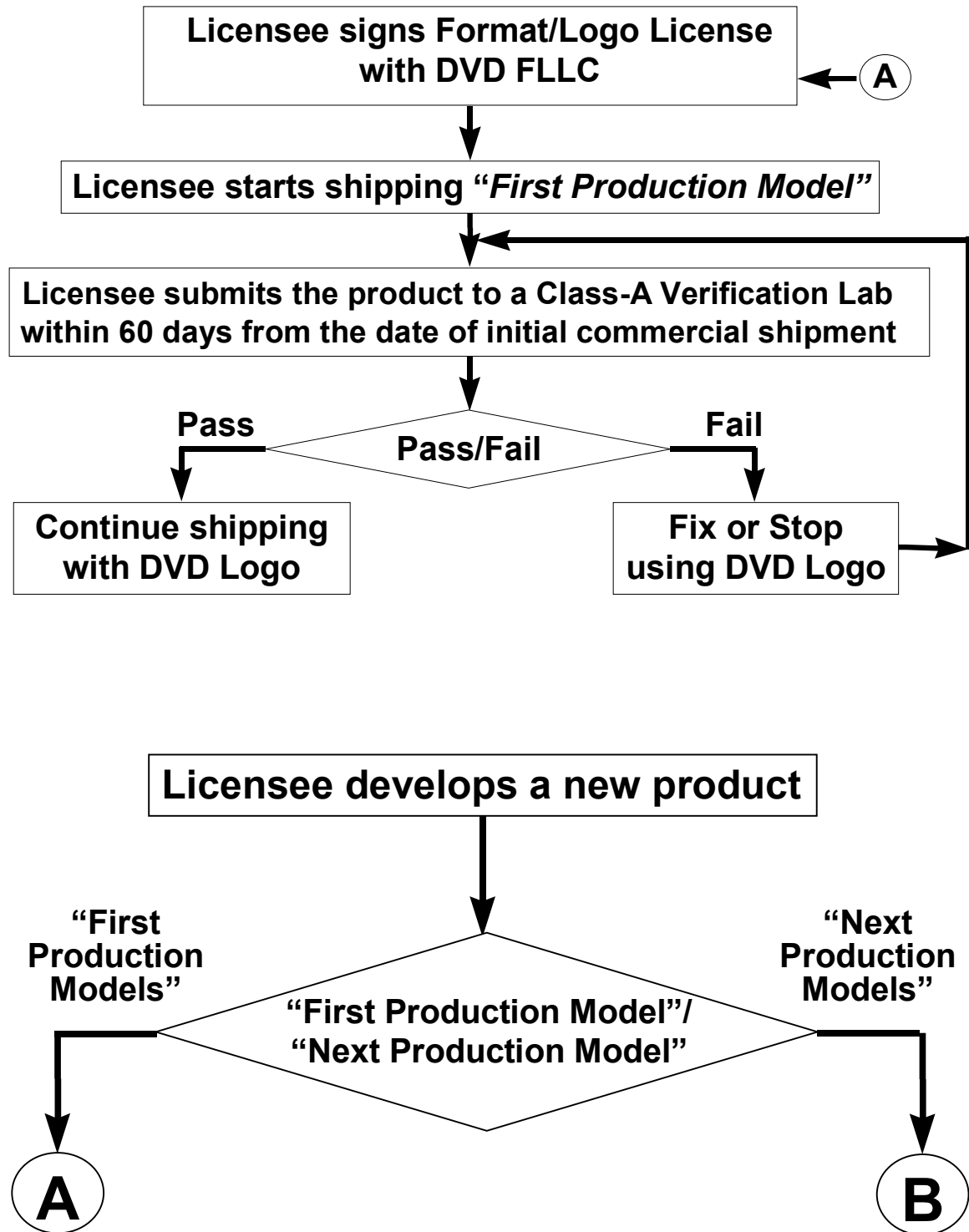
- DVD Specifications Version n.x changing to n.x+1
- Change to add or reduce applicable recording speed(s) without adding Class (i.e. Basic recording speed)
- Significant changes at Licensees discretion to Pickup head, LSI and/or firmware related to DVD format

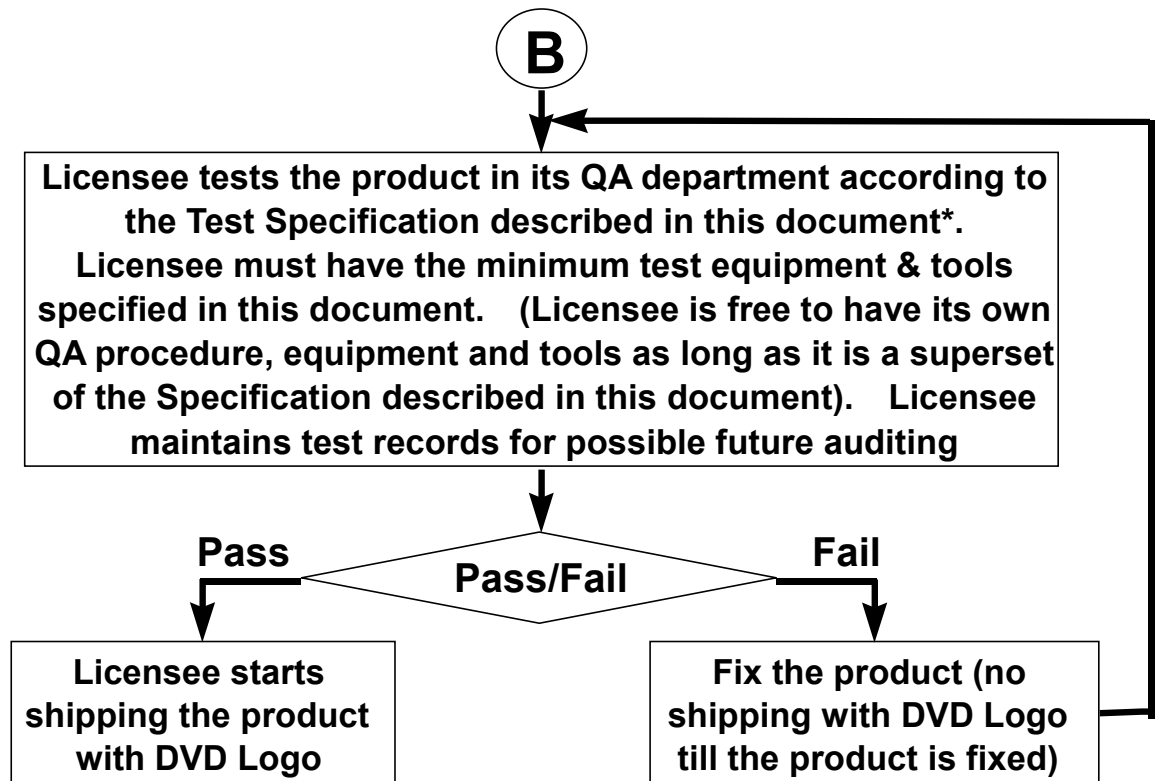
Class-A Verification Labs - Class-A Verification Labs are experts in DVD technology and provide independent expert assessment of Licensee's product compliance with DVD Specifications. Class-A labs also provide additional services such as interpretation of DVD Specifications, Test Tool development, Class-B Lab and Licensee auditing, etc.

Class-B Verification Labs - DVD-R Video Format Recorder Class-B Verification Labs provide DVD-R Video Format Recorder testing strictly according to the **DVD-R Video Format Recorder Test Specification** (They can not interpret the specifications).

2.2 DVD Logo Mechanism

The DVD Logo mechanism is described in the following flow chart:





*: Licensee without own QA department can get the product tested by a **DVD-R Video Format Recorder Class-B Verification Lab**.

3. Test Tools and Test Specifications

This chapter covers the test specifications and tool requirements for the physical and logical compliance testing.

3.1 Test Tools

The following tools are required to perform the tests specified and shall be available before executing the test procedures.

3.1.1 Test Discs

The following test discs are used for this verification activity. As for acquisition, refer to **Annex D**.

(For 525/60 TV system and 625/50 TV system)

- 1x-speed DVD-R for General Standard Blank Test Disc : Type 1 GRBTD-001
- 4x/1x-speed DVD-R Standard Blank Test Disc : GRBTD-021
- 8x/1x-speed DVD-R Standard Blank Test Disc : GRBTD-031
- 16x/1x-speed DVD-R Standard Blank Test Disc : GRBTD-041
- 4x/2x-speed DVD-R for DL Standard Blank Test Disc : GRBTD-001-DL

(For 525/60 TV system)

- DVD-R for General Standard Signal Test Disc : Type 1 GRSTD-101
- DVD-R for DL Standard Signal Test Disc : GRSTD-101-DL
- Test Stream Disc : TDL-0002
- Navigation Files Test Disc Vol. 1 : DVD-NF002
- Navigation Files Test Disc Vol. 2 : DVD-NF100 (Dual layer, Parallel Track Path) or
DVD-NF150 (Dual layer, Opposite Track Path)

(For 625/50 TV system)

- DVD-R for General Standard Signal Test Disc : Type 1 GRSTD-101P
- DVD-R for DL Standard Signal Test Disc : GRSTD-101P-DL
- PAL Test Stream Disc : LVP00.06
- PAL Multi-channel Test Disc : LVP08.01
- PAL Navigation Files Test Disc Vol. 1 : DVD-NF200
- PAL Navigation Files Test Disc Vol. 2 : DVD-NF250 (Dual layer, Parallel Track Path)

3.1.2 Verifiers

To be able to check the discs recorded by DVD-R Video Format Recorder, the following verifiers are necessary. As for acquisition, refer to **Annex D**.

Verifier for information data in Lead-in area and RMA is:

- Information Area Verifier (RMAV-001)

DVD Video Verifier is:

- DVD Audio/Video Verifier (DVD-AV02 Ver. 1.2)

File System Verifier is:

- DVD File System Verifier (DVD-FV20AV) or
- DVD File System Verifier (TFSV03)

ADP_TY & ADP_ID Verifier is:

- ADP_TY & ID Verifier (ADPV-001)

3.1.3 DVD-R measuring system (Playback)

DVD-R measuring system (Playback) shall have functions at least for executing the tests defined in **3.2.1.1 to 3.2.8.3**. Its reading beam condition shall be as defined in 2.1.3.2 of DVD Specifications for Recordable Disc for General Part 1: Ver. 2.1 and its scanning velocity shall be 3.49 m/s (1x-speed). In case of DVD-R for DL, its reading beam condition shall be as defined in 2.1.3.2 of DVD Specifications for Recordable Disc for Dual Layer Part 1: Ver. 3.0 and its scanning velocity shall be 3.84 m/s (1x-speed). This system is to be equipped by each Lab and applicant individually.

3.2 Test Specifications

The following sections describe the test procedures required for verification of the DVD products specified in 1.3.

• Test procedure

The discs recorded with DVD-R Recorder have to be in compliance with the physical DVD requirements as indicated in the corresponding DVD Specifications listed in 1.2. Test will be carried out according to the nomination of "Class" and "Maximum recording speed" applied in **Form 2U**.

Test procedure of each recording speed is described respectively in the following sections from 3.2.1 to 3.2.8.

Table 3.2-1 and **Table 3.2-2** show the relation between Recorder type and Test Discs to be used.

When "✓" is marked in the column, the test at the measuring points shall be carried out.

Table 3.2-1 : Recorder type, Test recording speeds and Test Discs to be used (for SL disc)

Recorder type Class/ Recording speed	Measuring points R (mm)	Test recording speed/ Test Discs					
		1x	4x	6x	8x	12x	16x
		GRBTD-001	GRBTD-021	GRBTD-031	GRBTD-031	GRBTD-041	GRBTD-041
Class 0 (1x only)	25	✓					
	40	✓					
	55	✓					
Class 0 (4x max.)	25	✓	✓				
	40	✓	✓				
	55	✓	✓				
Class 0 (6x max.)	25	✓	---	✓			
	40	✓	---	✓			
	55	✓	---	✓			
Class 0 (8x max.)	25	✓	---	---	---		
	40	✓	---	---	✓		
	55	✓	---	---	✓		
Class 0 (12x max.)	25	✓	---	---	---	---	
	40	✓	---	---	---	✓	
	55	✓	---	---	---	✓	
Class 0 (16x max.)	25	✓	---	---	---	---	---
	40	✓	---	---	---	---	---
	55	✓	---	---	---	---	✓

Table 3.2-2 : Recorder type and Test Discs to be used (for DL disc)

Recorder type Class/ Recording speed	Measuring points R (mm)	Test recording speed/ Test Discs			
		2x		4x	
		GRBTD-001-DL		GRBTD-001-DL	
		L0	L1	L0	L1
Class 0 (2x only)	25	✓	✓		
	40	✓	✓		
	55	✓	✓		
Class 0 (4x only)	25	✓	✓	✓	✓
	40	✓	*	*	✓
	55	✓	*	*	✓

*: Licensee submits these data. Class-A Lab will not measure these parameters in general.

• **Forms to be submitted**

An applicant is requested to submit the test sample with the test results, which may be obtained by self-verification or verification conducted by Class-B Lab.

Table 3.2-3 and **Table 3.2-4** shows the relation between "Recorder type" and "Form No." to be submitted.

When "✓" is marked in the column for each product of "A-N" and "O-R", the correspondent Forms shall be submitted.

Table 3.2-3 : Recorder type and Forms to be submitted (for SL)

Recorder type			Forms No. to be submitted										
	TV system	Adaptable recording speed	3U, 5U, 6U	4U	7U to 9U	10U to 12U	13U to 15U	16U to 18U	19U to 21U	29U	30U to 32U	33U to 36U	37U
A	525/60	1x only	✓	✓						✓	✓		✓
B		4x max.	✓		✓					✓	✓		✓
C		6x max.	✓			✓				✓	✓		✓
D		8x max.	✓				✓			✓	✓		✓
E		12x max.	✓					✓		✓	✓		✓
F		16x max.	✓						✓	✓	✓		✓
I	625/50	1x only	✓	✓						✓		✓	✓
J		4x max.	✓		✓					✓		✓	✓
K		6x max.	✓			✓				✓		✓	✓
L		8x max.	✓				✓			✓		✓	✓
M		12x max.	✓					✓		✓		✓	✓
N		16x max.	✓						✓	✓		✓	✓

Table 3.2-4 : Recorder type and Forms to be submitted (for DL)

Recorder type			Forms No. to be submitted						
	TV system	Adaptable recording speed	22U, 24U, 25U	23U	26U to 28U	29U	30U to 32U	33U to 36U	37U
O	525/60	2x only	✓	✓		✓	✓		✓
P		4x max.	✓		✓	✓	✓		✓
Q	625/50	2x only	✓	✓		✓		✓	✓
R		4x max.	✓		✓	✓		✓	✓

3.2.1 Physical Specification Test for Class 0 Recorder for SL (1x only or higher speeds)

3.2.1.1 1x-speed Recording characteristics for SL disc

- 100% Full Color Bar signal shall be written in the user area of a 1x-speed Standard Blank Test Disc (Type 1 GRBTD-001) by the DVD-R Video Format Recorder.

Write Strategy variations (refer to Annex K of DVD Specifications for Recordable Disc for General Part 1 Ver. 2.1) can be used for this recording.

For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 25$ mm, 40 mm and 55 mm.

- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 3U**.

3.2.1.2 1x-speed Linking characteristics for SL disc

- This test is only for the Recorder for SL (1x only). Other Recorder for SL ($\geq 4x$ max) need not execute this test.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc (Type 1 GRBTD-001) by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than 7T (260 ns) in any place of around Linked area.

If the linking is done properly, mark OK in **Form 4U**.

3.2.1.3 1x-speed Information data in Lead-in and RMA for SL disc

- The DVD-R for General Standard Blank Test Disc recorded in the test of **3.2.1.1** shall be used for this check.
- Using DVD-R measuring system or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded DVD-R for General Standard Blank Test Disc. The applicant shall describe in **Form 5U** the values recorded in each area, and Class-A Lab will check them.

3.2.1.4 Reading characteristics for SL disc for 525/60 and/or 625/50 TV system

A DVD-R for General Standard Signal Test Disc (GRSTD-101 for 525/60 TV system and/or GRSTD-101P for 625/50 TV system) shall be read by the DVD-R Video Format Recorder.

If the 30 minutes of video with music is played back seamlessly, mark OK in **Form 6U**.

3.2.2 Physical Specification Test for Class 0 Recorder for SL (4x max.)

3.2.2.1 4x-speed Recording characteristics for SL disc

- 100% Full Color Bar signal shall be written with 4x-speed* in the user area of a 4x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-021) by the DVD-R Video Format Recorder.

Write Strategy variations (refer to 2.1.5, Annex B and C of Optional Specifications 4x-speed DVD-R Revision 1.0) can be used for this recording.

For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 25$ mm, 40 mm and 55 mm.

- Measure the characteristics of the recorded layer with 1x-speed using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 7U**.

*Note: DVD Recorder may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for SL (4x max.)" may possibly select 4x-speed recording for all user area or outer radius area of the 4x/1x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 4x-speed in the designated area in **Form 7U**.

3.2.2.2 4x-speed Linking characteristics for SL disc

- This test shall be performed under the condition keeping 4x-speed recording.
- 100% Full Color Bar signal shall be written with 4x-speed in the user area of a 4x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-021) by the DVD-R Video Format Recorder. And append the random or equivalent signal in the incremental mode according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than 7T (260ns) in any place of around Linked area.

If the linking is done properly, mark OK in **Form 8U**.

3.2.2.3 4x-speed Information data in Lead-in and RMA for SL disc

- The 4x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-021) recorded in the test of **3.2.2.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 4x/1x-speed DVD-R Standard Blank Test Disc. The applicant shall fill out each column of **Form 9U**, and Class-A Lab will check them.

3.2.3 Physical Specification Test for Class 0 Recorder for SL (6x max.)

3.2.3.1 6x-speed Recording characteristics for SL disc

- 100% Full Color Bar signal shall be written with 6x-speed* in the user area of a 8x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-031) by the DVD-R Video Format Recorder.

Write Strategy specified in 2.1.5.1 of Optional Specifications 6x-speed DVD-R Rev. 2.0 can be used for this recording. For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 25\text{ mm}$, 40 mm and 55 mm .

- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 10U**.

*Note: DVD Recorder may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for SL (6x max.)" may possibly select 6x-speed recording for all user area or outer radius area of the 8x/1x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 6x-speed in the designated area in **Form 10U**.

3.2.3.2 6x-speed Linking characteristics for SL disc

- This test shall be performed under the condition keeping 6x-speed recording.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than $7T$ (260 ns) in any place of around Linked area. If the linking is done properly, mark OK in **Form 11U**.

3.2.3.3 6x-speed Information data in Lead-in and RMA for SL disc

- The 8x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-031) recorded in the test of **3.2.3.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 8x/1x-speed DVD-R Standard Blank Test Disc. The applicant shall fill out each column of **Form 12U**, and Class-A Lab will check them.

3.2.4 Physical Specification Test for Class 0 Recorder for SL (8x max.)

3.2.4.1 8x-speed Recording characteristics for SL disc

- 100% Full Color Bar signal shall be written with 8x-speed* in the user area of a 8x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-031) by the DVD-R Video Format Recorder.

Write Strategy specified in 2.1.5.1 of Optional Specifications 8x-speed DVD-R Rev. 3.0 can be used for this recording. For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 40$ mm and 55 mm.

- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 13U**.

*Note: DVD Recorder may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for SL (8x max.)" may possibly select 8x-speed recording for all user area or outer radius area of the 8x/1x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 8x-speed in the designated area in **Form 13U**.

3.2.4.2 8x-speed Linking characteristics for SL disc

- This test shall be performed under the condition keeping 8x-speed recording.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than 7T (260 ns) in any place of around Linked area.
If the linking is done properly, mark OK in **Form 14U**.

3.2.4.3 8x-speed Information data in Lead-in and RMA for SL disc

- The 8x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-031) recorded in the test of **3.2.4.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 8x/1x-speed DVD-R Standard Blank Test Disc. The applicant shall fill out each column of **Form 15U**, and Class-A Lab will check them.

3.2.5 Physical Specification Test for Class 0 Recorder for SL (12x max.)

3.2.5.1 12x-speed Recording characteristics for SL disc

- 100% Full Color Bar signal shall be written with 12x-speed* in the user area of a 16x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-041) by the DVD-R Video Format Recorder.

Write Strategy specified in 2.1.5.1 of Optional Specifications 12x-speed DVD-R Rev. 5.0 can be used for this recording. For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 40$ mm and 55 mm.

- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 16U**.

*Note: DVD Recorder may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for SL (12x max.)" may possibly select 12x-speed recording for all user area or outer radius area of the 16x/1x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 12x-speed in the designated area in **Form 16U**.

3.2.5.2 12x-speed Linking characteristics for SL disc

- This test shall be performed under the condition keeping 12x-speed recording.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than 7T (260 ns) in any place of around Linked area.
If the linking is done properly, mark OK in **Form 17U**.

3.2.5.3 12x-speed Information data in Lead-in and RMA for SL disc

- The 16x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-041) recorded in the test of **3.2.5.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 16x/1x-speed DVD-R Standard Blank Test Disc. The applicant shall fill out each column of **Form 18U**, and Class-A Lab will check them.

3.2.6 Physical Specification Test for Class 0 Recorder for SL (16x max.)

3.2.6.1 16x-speed Recording characteristics for SL disc

- 100% Full Color Bar signal shall be written with 16x-speed* in the user area of a 16x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-041) by the DVD-R Video Format Recorder.

Write Strategy specified in 2.1.5.1 of Optional Specifications 16x-speed DVD-R Rev. 6.0 can be used for this recording. For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 55$ mm.

- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 19U**.

*Note: DVD Recorder may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for SL (16x max.)" may possibly select 16x-speed recording for all user area or outer radius area of the 16x/1x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 16x-speed in the designated area in **Form 19U**.

3.2.6.2 16x-speed Linking characteristics for SL disc

- This test shall be performed under the condition keeping 16x-speed recording.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than 7T (260 ns) in any place of around Linked area.
If the linking is done properly, mark OK in **Form 20U**.

3.2.6.3 16x-speed Information data in Lead-in and RMA for SL disc

- The 16x/1x-speed DVD-R Standard Blank Test Disc (GRBTD-041) recorded in the test of **3.2.6.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 16x/1x-speed DVD-R Standard Blank Test Disc. The applicant shall fill out each column of **Form 21U**, and Class-A Lab will check them.

3.2.7 Physical Specification Test for Class 0 Recorder for DL (2x only or 4x max.)

3.2.7.1 2x-speed Recording characteristics for DL disc

- 100% Full Color Bar signal shall be written with 2x-speed* in the user area of a 4x/2x-speed DVD-R for DL Standard Blank Test Disc (GRBTD-001-DL) by the DVD-R Video Format Recorder.
Write Strategy specified in 2.2.3.8 of DVD Specifications for Recordable Disc for Dual layer Part 1: Ver.3.0 can be used for this recording. For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of R = 25 mm, 40 mm and 55 mm.
- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 22U**.

*Note: DVD Recorder (4x max) may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for DL (4x max.)" may possibly select 4x-speed recording for all user area or outer radius area of the 4x/2x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 2x-speed in the designated area in **Form 22U**.

3.2.7.2 2x-speed Linking characteristics for DL disc

- This test is only for the Recorder for DL (2x only). The Recorder for DL (4x max) need not execute this test.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than 7T (260 ns) in any place of around Linked area.
If the linking is done properly, mark OK in **Form 23U**.

3.2.7.3 2x-speed Information data in Lead-in and RMA for DL disc

- The 4x/2x-speed DVD-R for DL Standard Blank Test Disc (GRBTD-001-DL) recorded in the test of **3.2.7.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 4x/2x-speed DVD-R for DL Standard Blank Test Disc. The applicant shall fill out each column of **Form 24U**, and Class-A Lab will check them.

3.2.7.4 Reading characteristics for DL disc for 525/60 and/or 625/50 TV system

A DVD-R for DL Standard Signal Test Disc (GRSTD-101-DL for 525/60 TV system and/or GRSTD-101P-DL for 625/50 TV system) shall be read by the DVD-R Video Format Recorder.

If the entire video with music is played back properly, mark OK in **Form 25U**.

3.2.8 Physical Specification Test for Class 0 Recorder for DL (4x max.)

3.2.8.1 4x-speed Recording characteristics for DL disc

- 100% Full Color Bar signal shall be written with 4x-speed* in the user area of a 4x/2x-speed DVD-R for DL Standard Blank Test Disc (GRBTD-001-DL) by the DVD-R Video Format Recorder.
Write Strategy specified in 2.1.5.1 of Optional Specifications 4x-speed DVD-R for DL Rev. 1.0 can be used for this recording. For the items that the evaluation radius is specified, the writing zones shall be at least 5 mm band in radius including the measuring points of $R = 25\text{ mm}$, 40 mm and 55 mm .
- Measure the characteristics of the Recorded layer using DVD-R measuring system (Playback) or equivalent and enter the measured values in accordance with **Form 26U**.

*Note: DVD Recorder may automatically select the recording speed according to the type of the inserted disc and the recording speed may not be set by user operation. "Class 0 Recorder for DL (4x max.)" may possibly select 4x-speed recording for all user area or outer radius area of the 4x/2x-speed Blank Test Disc. In such case, describe the condition that the Recorder uses 4x-speed in the designated area in **Form 26U**.

3.2.8.2 4x-speed Linking characteristics for DL disc

- This test shall be performed under the condition keeping 4x-speed recording.
- 100% Full Color Bar signal shall be written in the user area of the Blank Test Disc by the DVD-R Video Format Recorder. And append the same signal according to the linking scheme that is adopted to the DVD-R Video Format Recorder.
- Using DVD-R Disc measuring system (Playback), check whether the time difference between "the peak of LPP" and "center of 14T" is smaller than $7T$ (260 ns) in any place of around Linked area.
If the linking is done properly, mark OK in **Form 27U**.

3.2.8.3 4x-speed Information data in Lead-in and RMA for DL disc

- The 4x/2x-speed DVD-R for DL Standard Blank Test Disc (GRBTD-001-DL) recorded in the test of **3.2.8.1** shall be used for this check.
- Using DVD-R Disc measuring system (Playback) or Information Area Verifier, check the recorded information data in Lead-in and RMA of the recorded 4x/2x-speed DVD-R for DL Standard Blank Test Disc. The applicant shall fill out each column of **Form 28U**, and Class-A Lab will check them.

3.2.9 Video Format Specification Test for 525/60 TV system

The following sections describe the procedures of logical test required for the DVD-R Video Format Recorder for 525/60 TV system.

3.2.9.1 Recording capability

- Nominate the "Operation Nomination" in **Form 29U** and record arbitrary contents on a DVD-R for General Standard Blank Test Disc equivalent DVD-R disc and finalize the disc. Next, play back the presentation data and navigation data. Finally, check the recorded disc using the DVD Video Verifier and the File System Verifier at some items in accordance with **Form 29U**.
- When the function corresponding to the Check Item has not been supported by the DVD-R Video Format Recorder, i.e. "Operation Nomination" is described with hyphen '-', the Check Item can be skipped.
- If the DVD-R Video Format Recorder has any operations regarding recording other than the nominated Check Items in **Form 29U**, nominate "Check Items" and "Operation Nomination" for the operation in blank rows in **Form 29U**. Then, execute the operations on the recorded disc and play back the presentation data and navigation data and check the recorded disc using the DVD Video Verifier and the File System Verifier at some items, which are nominated, in accordance with **Form 29U**.

NOTE 1: All operations regarding recording shall be nominated by the applicant. If blank rows to nominate the operations are insufficient, blank rows shall be made and nominated.

NOTE 2: All Check Items are basically optional functions, but it should be done as much as the Recorder supports the corresponding function.

NOTE 3: The nominated Check Items are judged from the results based on the DVD Video Verifier. Therefore, after verified, the judgment is written in **Form 29U**.

NOTE 4: If the DVD Video Verifier put out message of incompatibility besides the nominated "Operation Nomination", the applicable function shall be nominated in **Form 29U**.

3.2.9.2 Playback capability

a. Presentation data

- Playback the Test Stream Disc: TDL-0002 and check the presentation data of Audio, Video, Sub-pictures, Max. bit-rate, Slide show and general presentation in accordance with **Form 30U**.

b. Navigation data structure

- Playback the Navigation Files Test Disc Vol. 1: DVD-NF002 and check the Sub-picture & highlights, Pan-scan, Sub-pictures, Audio selections, Simple seamless, Seamless multi-angle, Non-seamless multi-angle, Parental control, Still pictures, Linear Title play, Chapter search, Time search, Part of Title access, PGC playback control, Navigation between PG's, Cell still, Highlight, Linear Title control, Non-linear Title control, Title with branch structure, GPRM in register mode, Navi-commands & GPRM, Navigation timer and Command execution in accordance with **Form 31U**.
- Playback the Navigation Files Test Disc Vol. 2: DVD-NF100 or DVD-NF150 and check the UOP blocking, Highlight, Cell playback, Angle blocks, E-STD boundary, Parental, Navigation commands, Random/Shuffle and Domain transitions in accordance with **Form 32U**.

3.2.10 Video Format Specification Test for 625/50 TV system

The following sections describe the procedures of logical test required for the DVD-R for General Video Format Recorder for 625/50 TV system.

3.2.10.1 Recording capability

- Nominate the "Operation Nomination" in **Form 29U** and record arbitrary contents on a DVD-R for General Standard Blank Test Disc equivalent DVD-R disc and finalize the disc. Next, play back the presentation data and navigation data. Finally, check the recorded disc using the DVD Video Verifier and the File System Verifier at some items in accordance with **Form 29U**.
- When the function corresponding to the Check Item has not been supported by the DVD-R Video Format Recorder, i.e. "Operation Nomination" is described with hyphen '-', the Check Item can be skipped.
- If the DVD-R Video Format Recorder has any operations regarding recording other than the nominated Check Items in **Form 29U**, nominate "Check Items" and "Operation Nomination" for the operation in blank rows in **Form 29U**. Then, execute the operations on the recorded disc and play back the presentation data and navigation data and check the recorded disc using the DVD Video Verifier and the File System Verifier at some items, which are nominated, in accordance with **Form 29U**.

NOTE 1: All operations regarding recording shall be nominated by the applicant. If blank rows to nominate the operations are insufficient, blank rows shall be made and nominated.

NOTE 2: All Check Items are basically optional functions, but it should be done as much as the Recorder supports the corresponding function.

NOTE 3: The nominated Check Items are judged from the results based on the DVD Video Verifier. Therefore, after verified, the judgment is written in **Form 29U**.

NOTE 4: If the DVD Video Verifier put out message of incompatibility besides the nominated "Operation Nomination", the applicable function shall be nominated in **Form 29U**.

3.2.10.2 Playback capability

a. Presentation data

- Playback the PAL Test Stream Disc: LVP00.06 and check the presentation data of MPEG1 Audio (low, medium and high average VBR, CBR, combined with AC-3), MPEG2 Audio (base, base & extension, 7channel extension, low & high VBR, CBR), MPEG2 Video (low, medium and high VBR, CBR, 352×576, 704×576, Pan-scan, gaps, stills) and Audio LPCM syntax in accordance with **Form 33U**.
- Playback the PAL Multi-channel Test Disc: LVP08.01 and check the Stereo configuration, Configuration for 6 channel and 8 channels, CBR, VBR, Small extension frames, Extreme VBR, De-matrix procedures, Dynamic range control, High bit-rate 1 audio stream (7.1ch), High bit-rate audio 8 streams (7.1ch) and A/V synchronization in accordance with **Form 34U**.

b. Navigation data structure

- Playback the PAL Navigation Files Test Disc Vol. 1: DVD-NF200 and check the Sub-picture & highlights, Pan-scan, Sub-pictures, Audio selections, Simple seamless, Seamless multi-angle, Non-seamless multi-angle, Parental control, Still pictures, Linear Title play, Chapter search, Time search, Part of Title access, PGC playback control, Navigation between PG's, Cell still, Highlight, Linear Title control, Non-linear Title control, Title with branch structure, GPRM in register mode, Navi-commands & GPRM, Navigation timer and Command execution in accordance with **Form 35U**.
- Playback the PAL Navigation Files Test Disc Vol. 2: DVD-NF250 and check the UOP blocking, Highlight, Cell playback, Angle blocks, E-STD boundary, Parental, Navigation commands, Random/Shuffle and Domain transitions in accordance with **Form 36U**.

3.2.11 ADP_TY and ADP_ID check for 525/60 TV system and/or 625/50 TV system

The recorded disc described in **3.2.9.1** or **3.2.10.1** shall be used for the check of ADP_TY and ADP_ID.

- Check the ADP_TY in CPR_MAI in Data area using the ADP_TY & ID Verifier in accordance with **Form 37U**.
- Check the ADP_ID in VMGI_MAT and VOBU_ADP_ID in every DSI_GI using the ADP_TY & ID Verifier in accordance with **Form 37U**.

Annex A

List of Class-A Verification Labs

This List is correct at the time of publication. However, when the Class-A Lab information contained here differs from such information cited in our website www.dvdfllc.co.jp, the List with more current date prevails. Also, please refer to the website for the latest Verification Service of each Class-A Lab.

(Recorder for SL disc/ Recorder for DL disc)

JVC KENWOOD Corporation

DVD Verification Lab.

12, 3-chome, Moriya-cho, Kanagawa-ku, Yokohama, Kanagawa, 221-8528 Japan

Fax: +81-45-450-2425

Panasonic Corporation

Format Verification Laboratory

1-15, Matsuo-cho, Kadoma, Osaka, 571-8504 Japan

Fax: +81-6-6909-5027

E-mail: fvl-info@ml.jp.panasonic.com URL: <http://panasonic.co.jp/avc/fvl/en/index.html>

PIONEER CORPORATION

Verification Laboratory

1-1 Shin-ogura, Saiwai-ku, Kawasaki-shi, Kanagawa, 212-0031 Japan

Fax: +81-44-580-4027

SHARP CORPORATION

DVD Verification Laboratory

174, Hayakawa-cho, Yaita-city, Tochigi, 329-2193 Japan

Tel: +81-287-44-3749 Fax: +81-287-43-6680

Sony Corporation

Verification Laboratory

2-10-1 Osaki, Shinagawa-ku, Tokyo, 141-8610 Japan

Fax: +81-50-3750-6608

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Annex B

Glossary of Terms used

(May be defined in future.)

Annex C

Procedure for Class-A Verification Lab Product Submission

The procedure for submitting a product to a Class-A Verification Lab is as follows:

Preliminary Application

Applicant must complete **Form 1U** to provide preliminary information.

Self Test

Applicant must test the product in accordance with this Test Specification prior to submitting samples to a Class-A Verification Lab. Applicant must complete **Form 2U**, and **necessary Forms*** to provide test results.

* Note: The required Forms for each product are listed on the **Table 3.2-3** and/or **Table 3.2-4**.

Mutual Non-Disclosure Agreement (NDA)

Applicant, in order to maintain the confidentiality of the applicant product and Verification Lab's information, must sign a Mutual Non-Disclosure Agreement.

Application

Applicant must submit 3 product samples along with said necessary Forms and the NDA.

Test Result

Upon completion of testing, Verification Lab will complete **Form 38U** to inform the applicant and DVD Format/Logo Licensing Corporation of the test results.

Annex D

Test Tool Contact Information

The Contact Information is correct at the time of publication. However, when the Class-A Lab information (marked <*>) differs from such information cited in our website www.dvdfllc.co.jp, the List with more current date prevails.

Test Discs

(For 525/60 and 625/50 TV system)

<ul style="list-style-type: none"> 1x-speed DVD-R for General Standard Blank Test Disc Type 1; GRBTD-001 	PIONEER CORPORATION<*> Verification Laboratory 1-1 Shin-ogura, Saiwai-ku, Kawasaki-shi, Kanagawa, 212-0031 Japan Fax: +81-44-580-4027
<ul style="list-style-type: none"> 4x/1x-speed DVD-R for General Standard Blank Test Disc GRBTD-021 	
<ul style="list-style-type: none"> 8x/1x-speed DVD-R for General Standard Blank Test Disc GRBTD-031 	
<ul style="list-style-type: none"> 16x/1x-speed DVD-R for General Standard Blank Test Disc GRBTD-041 	
<ul style="list-style-type: none"> 4x/2x-speed DVD-R for DL Standard Blank Test Disc GRBTD-001-DL 	

(For 525/60 TV system)

<ul style="list-style-type: none"> DVD-R for General Standard Signal Test Disc Type 1; GRSTD-101 	PIONEER CORPORATION<*>
<ul style="list-style-type: none"> DVD-R for DL Standard Signal Test Disc GRSTD-101-DL 	
<ul style="list-style-type: none"> Test Stream Disc TDL-0002 	ALMEDIO INC. <*> Testing Laboratory 32-13, Sakae-cho 2 chome, Higashimurayama-shi, Tokyo, 189-0013 Japan Fax: +81-42-397-1919 E-mail: testlab@almedio.co.jp
<ul style="list-style-type: none"> Navigation Files Test Disc Vol. 1; DVD-NF002 Vol. 2; DVD-NF100 Vol. 2; DVD-NF150 	Panasonic Corporation<*> Format Verification Laboratory 1-15, Matsuo-cho, Kadoma, Osaka, 571-8504 Japan Fax: +81-6-6909-5027 E-mail: fvl-info@ml.jp.panasonic.com URL: http://panasonic.co.jp/avc/fvl/en/index.html

To be continued

(For 625/50 TV system)

<ul style="list-style-type: none"> DVD-R for General Standard Signal Test Disc Type 1; GRSTD-101P DVD-R for DL Standard Signal Test Disc GRSTD-101P-DL 	PIONEER CORPORATION<*>
<ul style="list-style-type: none"> PAL Test Stream Disc LVP00.06 PAL Multi-channel Test Disc LVP08.01 	OM&T B.V. Global Sales Order Desk Building SFH, Glaslaan 2, 5616 LW Eindhoven, The Netherlands Fax: +31-40-2171-435 E-mail: orderdesk.td@om-t.net URL: http://www.om-t.net
<ul style="list-style-type: none"> PAL Navigation Files Test Disc Vol. 1; DVD-NF200 Vol. 2; DVD-NF250 	Panasonic Corporation<*>

Verifiers

<ul style="list-style-type: none"> Information Area Verifier RMAV-001 ADP_TY & ID Verifier ADPV-001 	PIONEER CORPORATION<*> Verification Laboratory 1-1 Shin-ogura, Saiwai-ku, Kawasaki-shi, Kanagawa, 212-0031 Japan Fax: +81-44-580-4027
<ul style="list-style-type: none"> Audio/Video Verifier DVD-AV02 Ver. 1.2 DVD File System Verifier DVD-FV20AV 	Panasonic Corporation<*> Format Verification Laboratory 1-15, Matsuo-cho, Kadoma, Osaka, 571-8504 Japan Fax: +81-6-6909-5027 E-mail: fvl-info@ml.jp.panasonic.com URL: http://panasonic.co.jp/avc/fvl/en/index.html
TFSV03	<i>Discontinued</i>

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