



DVD-RAM Disc (4.7/1.46 Gbytes)

TEST SPECIFICATION

Version 2.3
February 2007

Amendment for DVD-RAM Disc (4.7/1.46 Gbytes) TS Version 2.3 (Feb. 2007)

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

- **Minor amendment (March 26, 2009)**

Page	Location	Amendment
Page 28	Annex A	<ul style="list-style-type: none">• Class-A Lab information of "Industrial Technology Research Institute" and "Matsushita Electric Industrial Co., Ltd. (company name)" was updated.
Page 32	Annex D	<ul style="list-style-type: none">• The company name "Matsushita Electric Industrial Co., Ltd." was changed to "Panasonic Corporation".

- **Minor amendment (January 2010)**

Page	Location	Amendment
Page 28	Annex A	<ul style="list-style-type: none">• Class-A Lab information of "Hitachi Ltd. (company name)", "Panasonic Corporation" and "SAMSUNG ELECTRONICS CO., LTD" were updated.
Page 32	Annex D	<ul style="list-style-type: none">• Class-A Lab information of "Panasonic Corporation" was updated.

- **Amendment 1 (January 2012)**

Page	Location	Amendment
Page 28	Annex A	<ul style="list-style-type: none">• "Toshiba Corporation" was deleted from the Class-A Lab list.
Page 32	Annex D	<ul style="list-style-type: none">• DVD-RAM File System Verifier (TFSV01) from Toshiba was discontinued.

- **Amendment 2 (June 2012)**

Page	Location	Amendment
Page 28	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 "SAMSUNG ELECTRONICS CO., LTD" was updated.

Conditions for Publication

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Revision History

- April 2000
Test Specification, 2x-speed DVD-RAM Disc Version 2.0 was approved by Steering Committee of DVD Forum.
- June 2000
Version 2.1 which supports DVD Specifications for Rewritable Disc Version 2.1 for 8 cm size disc was approved by Steering Committee of DVD Forum.
- February 2003
Test Specification, 3x-speed DVD-RAM Disc Version 1.0 was approved by Steering Committee of DVD Forum.
- January 2004
Test Specification, 5x-speed DVD-RAM Disc Version 1.0 was approved by Steering Committee of DVD Forum.
- June 2005
Test Specification, DVD-RAM Disc Version 2.11 updated Class-A Lab List and Normative Reference*, and was edited as electronic files.
*: To update the version number of Part 1 (from Version 2.1 to 2.2).
- November 2005
Test Specification, DVD-RAM Disc Version 2.2 (Draft) was developed to combine with 2x-speed, 3x-speed and 5x-speed disc test specification and to add 6x-speed, 8x-speed and 12x-speed disc test specification at SG7, and approved by VTF of DVD Forum.
(The Version 2.2 was issued in December 2005.)
- January 2007
Test Specification, DVD-RAM Disc Version 2.3 (Draft) was updated to add empty case for product covered and editorial amendment, and approved by TSTF of DVD Forum.
(The Version 2.3 was issued in February 2007.)

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Forms for DVD Format verification

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Form 2N

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Form 3N

Test result of the Mechanical parameter F4

Form 4N

Test result of the Optical parameter F5

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Form 6N

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Form 11N

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Form 12N

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1. General

1.1 Scope

The scope of this Test Specification is for the purpose of testing DVD-RAM Disc for compliance with DVD Specifications for Rewritable Disc mentioned in 1.2. The test procedure described herein could be used by Class-A Verification Labs, Class-B Verification Labs and Quality Assurance Departments of DVD-RAM Disc manufacturers.

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

1.2 Normative References

DVD Specifications for Rewritable Disc:

- Part 1: Physical Specifications Version 2.2
- Part 2: File System Specifications Version 2.0
- Optional Specifications 3x-speed DVD-RAM Revision 1.0
- Optional Specifications 5x-speed DVD-RAM Revision 2.0
- Optional Specifications 6x-speed DVD-RAM Revision 3.0
- Optional Specifications 8x-speed DVD-RAM Revision 4.0
- Optional Specifications 12x-speed DVD-RAM Revision 5.0

1.3 Scope of Products Covered

12cm Disc (4.7 Gbytes type)

- 2x-speed DVD-RAM Disc (Class 0)
- 2x/3x-speed DVD-RAM Disc (Class 0)
- 2x/3x/5x-speed DVD-RAM Disc (Class 0)
- 6x-speed DVD-RAM Disc (Class 1)
- 6x/8x-speed DVD-RAM Disc (Class 1)
- 6x/8x/12x-speed DVD-RAM Disc (Class 1)
- 2x/3x/5x/6x/8x/12x-speed DVD-RAM Disc (Class 0&1) . . . declaration of possibility

8cm Disc (1.46 Gbytes type)

- 2x-speed DVD-RAM Disc (Class 0)
- 2x/3x-speed DVD-RAM Disc (Class 0)
- 2x/3x/5x-speed DVD-RAM Disc (Class 0)
- 6x-speed DVD-RAM Disc (Class 1)
- 6x/8x-speed DVD-RAM Disc (Class 1)
- 2x/3x/5x/6x/8x-speed DVD-RAM Disc (Class 0&1) . . . declaration of possibility

Empty case for DVD-RAM 12cm disc

- Case Type 3 (single-sided case)
- Case Type 5 (double-sided case)

Empty case for DVD-RAM 8cm disc

- Case Type 8 (double-sided case)
- Case Type 9 (single-sided case)

Notes:

- 1) When the 6x/8x/12x/16x-speed DVD-RAM Disc (Class 1) is being manufactured, Optional Specifications 16x-speed DVD-RAM Revision 6.0 will be added to **1.2**, and 12x-speed DVD-RAM disc Test Specification will be expanded to 16x-speed.
- 2) There are many kinds of production models for Class 0&1. The above type is just for example. Production model for Class 0&1 is possible in the future. This Test Specification just declares possibility, but doesn't specify for Class 0&1. When the Class 0&1 is manufactured, Test Specification will be revised to apply it.

1.4 Notes on the Logo and Mark for the product

The followings are the basic statements for the DVD-RAM disc products.

- (1) The Logo and Mark specified by Licensor (DVD FLLC) may be marked on the label surface of DVD-RAM disc, case which contains DVD-RAM disc, package and catalog, etc.
- (2) In the event that the product is DVD-RAM empty case only, the Logo and Mark dedicated to this empty case product may be used on the case independently from DVD-RAM disc itself.

For details on the Logo and Mark usage, refer to the DVD Logo Manual.

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:

- License to use the Logo and
- 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**:

- DVD Specifications Version n.x changing to n+1.x
- Initial or the latest production model at the start of Logo Program for each licensee
- Different Class production model (Example: Company who passed A in **Table 2.1** applies to D)
- Additional Class production model (Example: Company who passed C in **Table 2.1** applies to G)
- Production model increased Maximum recording speed (Example: Company who passed A in **Table 2.1** applies to B)
- Production model decreased Maximum recording speed (Example: Company who passed C in **Table 2.1** applies to B)
- Empty case for DVD-RAM 12cm disc or 8cm disc

Table 2.1 : List of Possible Production Model

Recording speed		2x	3x	5x	6x	8x	12x
Class & Production model							
Class 0		◎	○	○			
Class 1					◎	○	○
A	2x-speed DVD-RAM Disc (Class 0)	★					
B	2x/3x-speed DVD-RAM Disc (Class 0)	★	★				
C	2x/3x/5x-speed DVD-RAM Disc (Class 0)	★	★	★			
D	6x-speed DVD-RAM Disc (Class 1)				★		
E	6x/8x-speed DVD-RAM Disc (Class 1)				★	★	
F	6x/8x/12x-speed DVD-RAM Disc (Class 1)				★	★	★
G	2x/3x/5x/6x-speed DVD-RAM Disc (Class 0&1)*	★	★	★	★		
H	2x/3x/5x/6x/8x-speed DVD-RAM Disc (Class 0&1)*	★	★	★	★	★	
I	2x/3x/5x/6x/8x/12x-speed DVD-RAM Disc (Class 0&1)*	★	★	★	★	★	★

◎ : Basic Recording Speed

○ : Optional recording speed

★ : Mandatory recording speed for a disc

*: There are many kinds of production models for Class 0&1. These types are just for example. Production model for Class 0&1 is possible in the future. This Test Specification just declares possibility, but doesn't specify for Class 0&1. When the Class 0&1 is manufactured, Test Specification will be revised to apply it.

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 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 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
- Optional Specifications 3x-speed DVD-RAM Revision 1.x changing to 1.x+1
- Optional Specifications 5x-speed DVD-RAM Revision 2.x changing to 2.x+1
- Optional Specifications 6x-speed DVD-RAM Revision 3.x changing to 3.x+1
- Optional Specifications 8x-speed DVD-RAM Revision 4.x changing to 4.x+1
- Optional Specifications 12x-speed DVD-RAM Revision 5.x changing to 5.x+1
- Significant changes to the Material and/or Manufacturing process related to DVD Format
- Single Sided or Double Sided and 12cm or 8cm (*1)
- Different type of case (*2)

(*1): If one type disc (e.g. Single Sided/12 cm disc) of these parameter combinations is produced as the First Production Model, the other type discs (e.g. Single Sided/8 cm, Double Single Sided/12 cm and Double Sided/8 cm) shall be defined as the Next Production Model and vice versa.

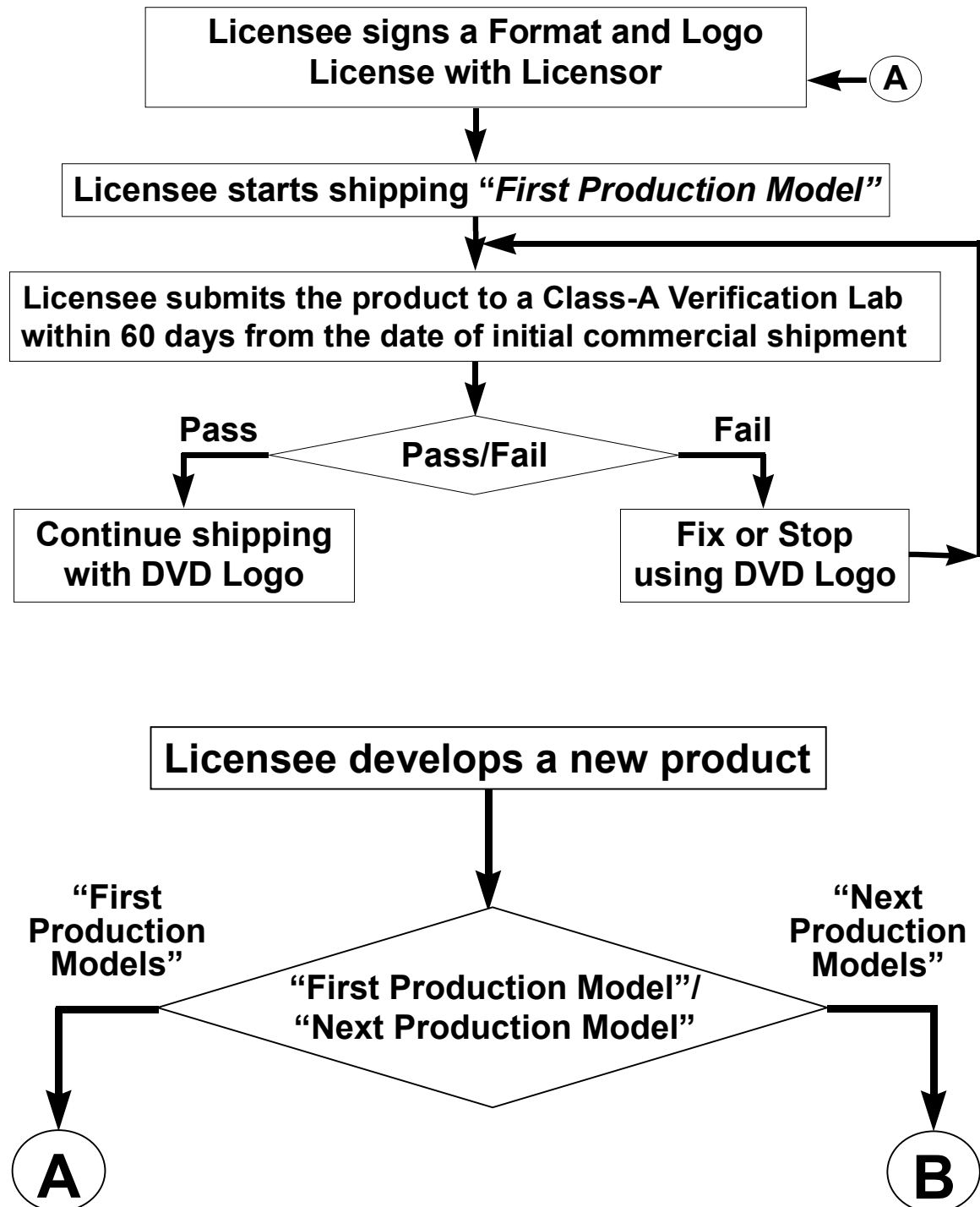
(*2): If one type of DVD-RAM disc with case is produced as a First Production Model, the empty case for DVD-RAM disc shall be defined as the Next Production Model.

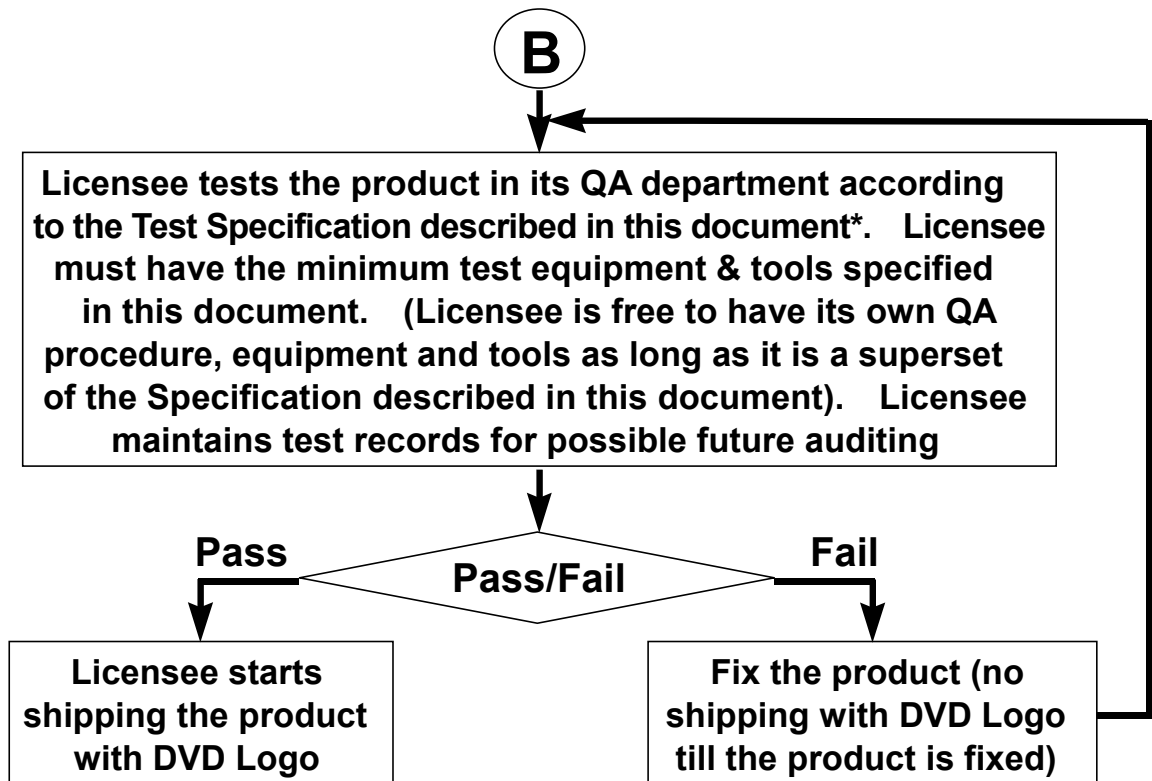
Class-A Verification Labs – Class-A Verification Labs are experts in DVD technology and provide independent expert assessment of Licensee's product compliance with respect to DVD Specifications. Class-A Labs also provide additional services such as interpretation of DVD Specifications, Test Tool development,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

Class-B Verification Labs – DVD-RAM Disc Class-B Verification Labs provide DVD-RAM Disc testing strictly according to **DVD-RAM Disc Test Specification** (They can not interpret 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 from a **DVD-RAM Disc 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 General Requirements

3.1.1 Test tools

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

- **DVD-RAM Disc Evaluation System**

This is the system owned individually by each applicant or Lab for executing the following tests.

- **Drive for measuring Address Error Ratio**

This is the drive owned individually by each applicant or lab for executing the following tests.

- **DVD-RAM File System Verifiers: DVD-FV01RAM and TFSV01**

The DVD-RAM File System Verifier: DVD-FV01RAM or TFSV01 is used for testing UDF File structure on DVD-RAM disc. As for acquisition, refer to **Annex D**.

3.1.2 Test requirement

The DVD-RAM Disc products described in **1.3 Scope of Products Covered** are required to execute the test related following sections from **3.2** to **3.11**. Please confirm which test is needed for your product in **Table 3.1.2-1**.

Table 3.1.2-1 : Test items

★ : Mandatory test

P : Partially test

Production model		Section number	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
		Reading speed	-	2x						
		Recording speed	-		2x	3x	5x	6x	8x	12x
A	2x-speed DVD-RAM Disc (Class 0)		★	★	★					
B	2x/3x-speed DVD-RAM Disc (Class 0)		★	★	★	★				
C	2x/3x/5x-speed DVD-RAM Disc (Class 0)		★	★	★	P	★			
D	6x-speed DVD-RAM Disc (Class 1)		★	★				★		
E	6x/8x-speed DVD-RAM Disc (Class 1)		★	★				★	★	
F	6x/8x/12x-speed DVD-RAM Disc (Class 1)		★	★				★	P	★
AA	Empty case		★ (3.2.6)							

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

3.2 Test Specifications of all speed discs (General parts)

The following sections describe the test procedures of all speed discs.

3.2.1 Mechanical parameters

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 3N**.
Finally judge the result with **Form 28N**.

3.2.2 Optical parameters

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 4N**.
Finally judge the result with **Form 28N**.

3.2.3 Recorded parameters

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 5N**.
Finally judge the result with **Form 28N**.

3.2.4 Information area format

Ensure that Information area format, which is specified in chapter 5 of DVD Specifications for Rewritable Disc / Part 1: Physical Specifications, is written properly using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 6N**.

If product model supports 3x-speed recording, it also needs to check that Information area format is compliant with Optional Specifications 3x-speed DVD-RAM Revision 1.0.

If product model supports 5x-speed recording, it also needs to check that Information area format is compliant with Optional Specifications 5x-speed DVD-RAM Revision 2.0.

If product model supports 6x-speed recording, it also needs to check that Information area format is compliant with Optional Specifications 6x-speed DVD-RAM Revision 3.0.

If product model supports 8x-speed recording, it also needs to check that Information area format is compliant with Optional Specifications 8x-speed DVD-RAM Revision 4.0.

If product model supports 12x-speed recording, it also needs to check that Information area format is compliant with Optional Specifications 12x-speed DVD-RAM Revision 5.0.

Finally judge the result with **Form 28N**.

3.2.5 Burst Cutting Area Code (Optional)

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 7N**.
Finally judge the result with **Form 28N**.

If production model doesn't possess Burst Cutting Area Code, this test is omitted.

3.2.6 Dimensions of the DVD-RAM Disc Case

In the case of testing 12 cm disc size case, check the measuring test results of DVD-RAM Disc case according to the specifications in sections 3.3, 3.4, 3.5, 3.6 and/or 3.7 (depending on the type of the case) of DVD Specifications for Rewritable Disc / Part 1: Physical Specifications Ver. 2.2. Finally judge the result with **Form 28N**.

In the case of testing 8 cm disc size case, check the measuring test results of DVD-RAM Disc case according to the specifications in Annex Y of DVD Specifications for Rewritable Disc / Part 1: Physical Specifications Ver. 2.2.

Finally judge the result with **Form 28N**.

If production model doesn't possess DVD-RAM Disc Case, this test is omitted.

3.2.7 File System verification (Optional)

In the case that the disc to be verified has been pre-formatted on the strength of DVD Specifications for Rewritable Disc Part2: File System Specifications Version 2.0, it is able to check the logical file system format using DVD-RAM File System Verifier.

- The test is done in accordance with user's manual of the DVD-RAM File System Verifier:
DVD-FV01RAM or TFSV01.
- The file system format is verified in conformity with UDF 2.0 by the Verifier.
- If no error is detected in the above verification, mark OK in **Form 28N**.

If production model is unformatted with File system, this test is omitted.

3.3 Test Specifications for 2x-speed reading

The following sections describe the test procedures for 2x-speed reading.

3.3.1 Signals from Embossed data zone

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 8N**. Finally judge the result with **Form 28N**.

3.3.2 Signals from groove and land in the unwritten recording field

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 9N**. Finally judge the result with **Form 28N**.

3.3.3 Signals from Header field in Rewritable data zone

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 10N** to **13N**. Finally judge the result with **Form 28N**.

3.3.4 Error ratio of CAPA

Measure the item using Standard Drive for measuring Address Error Ratio (AER), or equivalent system in accordance with **Form 14N**. Finally judge the result with **Form 28N**.

- AER is defined as follows.

$$\text{AER} = \text{Number of PID error sectors} / \text{Number of measured sectors}$$

(PID error sector is the sector which has 3 or more erroneous PIDs.)

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.4 Test Specifications for 2x-speed recording

The following sections describe the test procedures for 2x-speed recording.

3.4.1 Characteristics of the Recording layer

Applicant must determine the best write strategy (Peak power, Bias power1, 2, 3, First pulse start time, and Last pulse end time), which shall be recorded in the embossed Control data zone in Lead-in area.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 15N**.

Finally judge the result with **Form 28N**.

3.4.2 Signals from groove and land in the written recording field

Condition of write strategy shall be the same condition as used in the test defined in clause 3.4.1.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 16N**.

Finally judge the result with **Form 28N**.

3.4.3 Power margin

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 17N**.

Finally judge the result with **Form 28N**.

- Write power condition is as follows:

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause 3.4.1.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure asymmetry and the deviation between leading edge jitter and trailing edge jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.4.4 Cross Power Over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 18N**.

Finally judge the result with **Form 28N**.

- Over-write power condition is as follows.

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause 3.4.1.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.4.5 Cross erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 19N**. Finally judge the result with **Form 28N**.

- Condition of write strategy shall be the same condition as used in the test defined in clause **3.4.1**.
- Measuring method is as follows.
 - (1) Overwrite random data pattern for 10 times at each track in the following order.
 1. Track #N
 2. Track #N+2
 3. Track #N-2
 - (2) Write random data pattern repeatedly on Track #(N+1) and Track #(N-1) and measure the jitter of Track #N at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.4.6 Cyclability

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 20N**. Finally judge the result with **Form 28N**.

- Condition of write pulse shall be the same condition as used in the test defined in clause **3.4.1**.
- Write random data pattern repeatedly and measure the jitter at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.4.7 Servo margin of CAPA and written data

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 21N** and **Form 22N**. Finally judge the result with **Form 28N**.

- Condition of write power is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.4.1**.
- Write random data pattern on five adjacent tracks 10 times each and measure the jitter of CAPA and written data.
- Test condition is as follows:
 - Condition A is of moving axial tracking between $-1.0\mu\text{m}$ and $+1.0\mu\text{m}$.
 - Condition B is of moving radial tracking between $-0.1\mu\text{m}$ and $+0.1\mu\text{m}$.
 - Condition C is of moving tangential tilt between -0.5deg and $+0.5\text{deg}$.
 - Condition D is of moving radial tilt between -1.0deg and $+1.0\text{deg}$.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.5 Test Specifications for 3x-speed recording

The following sections describe the test procedures for 3x-speed recording.

In case of 2x/3x/5x-speed DVD-RAM Disc (Class 0), the test procedures of **3.5.1** Characteristics of the Recording layer and **3.5.2** Signals from groove and land in the written recording field shall be applied for the verification.

3.5.1 Characteristics of the Recording layer

Applicant must determine the best write strategy (Peak power, Bias power1, 2, 3, First pulse start time, and Last pulse end time), which shall be recorded in the embossed Control data zone in Lead-in area.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 15N**. Finally judge the result with **Form 28N**.

3.5.2 Signals from groove and land in the written recording field

Condition of write strategy shall be the same condition as used in the test defined in clause **3.5.1**.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 16N**. Finally judge the result with **Form 28N**.

3.5.3 Power margin

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 17N**. Finally judge the result with **Form 28N**.

- Write power condition is as follows:

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.5.1**.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure asymmetry and the deviation between leading edge jitter and trailing edge jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.5.4 Cross Power Over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 18N**. Finally judge the result with **Form 28N**.

- Over-write power condition is as follows.

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.5.1**.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.5.5 Cross erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 19N**. Finally judge the result with **Form 28N**.

- Condition of write strategy shall be the same condition as used in the test defined in clause **3.5.1**.
- Measuring method is as follows.
 - (1) Overwrite random data pattern for 10 times at each track in the following order.
 1. Track #N
 2. Track #N+2
 3. Track #N-2
 - (2) Write random data pattern repeatedly on Track #(N+1) and Track #(N-1) and measure the jitter of Track #N at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.5.6 Cross speed over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 23N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 2x-speed defined in clause **3.4.1** and 3x-speed defined in clause **3.5.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Overwrite random data pattern 10 times by 3x-speed and 1 time by 2x-speed on the same track, and then measure the jitter. On the contrary, write 10 times by 2x-speed and 1 time by 3x-speed on the same track, and then measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.5.7 Cross speed erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 24N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 2x-speed defined in clause **3.4.1** and 3x-speed defined in clause **3.5.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Measuring method is as follows.
 - (1) Overwrite random data pattern 10 times by 3x-speed on each track in the following order.
 1. Track #N1
 2. Track #N1+2
 3. Track #N1-2
 - (2) Write random data pattern repeatedly by 2x-speed on Track #(N1+1) and Track #(N1-1) and measure the jitter of Track #N1 at every 10, 10000 times.

- (3) Overwrite random data pattern 10 times by 2x-speed on each track in the following order.
1. Track #N2
 2. Track #N2+2
 3. Track #N2-2
- (4) Write random data pattern repeatedly by 3x-speed on Track #(N2+1) and Track #(N2-1) and measure the jitter of Track #N2 at every 10, 10000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.6 Test Specifications for 5x-speed recording

The following sections describe the test procedures for 5x-speed recording.

3.6.1 Characteristics of the Recording layer

Applicant must determine the best write strategy (Peak power, Bias power1, 2, 3, First pulse start time, and Last pulse end time), which shall be recorded in the embossed Control data zone in Lead-in area.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 15N**.

Finally judge the result with **Form 28N**.

3.6.2 Signals from groove and land in the written recording field

Condition of write strategy shall be the same condition as used in the test defined in clause **3.6.1**.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with

Form 16N. Finally judge the result with **Form 28N**.

3.6.3 Power margin

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 17N**.

Finally judge the result with **Form 28N**.

- Write power condition is as follows:

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.6.1**.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure asymmetry and the deviation between leading edge jitter and trailing edge jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.6.4 Cross Power Over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 18N**.

Finally judge the result with **Form 28N**.

- Over-write power condition is as follows.

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.6.1**.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.6.5 Cross erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 19N**. Finally judge the result with **Form 28N**.

- Condition of write strategy shall be the same condition as used in the test defined in clause **3.6.1**.
- Measuring method is as follows.
 - (1) Overwrite random data pattern for 10 times at each track in the following order.
 1. Track #N
 2. Track #N+2
 3. Track #N-2
 - (2) Write random data pattern repeatedly on Track #(N+1) and Track #(N-1) and measure the jitter of Track #N at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.6.6 Cross speed over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 23N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 2x-speed defined in clause **3.4.1** and 5x-speed defined in clause **3.6.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Overwrite random data pattern 10 times by 5x-speed and 1 time by 2x-speed on the same track, and then measure the jitter. On the contrary, write 10 times by 2x-speed and 1 time by 5x-speed on the same track, and then measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.6.7 Cross speed erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 24N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 2x-speed defined in clause **3.4.1** and 5x-speed defined in clause **3.6.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Measuring method is as follows.
 - (1) Overwrite random data pattern 10 times by 5x-speed on each track in the following order.
 1. Track #N1
 2. Track #N1+2
 3. Track #N1-2
 - (2) Write random data pattern repeatedly by 2x-speed on Track #(N1+1) and Track #(N1-1) and measure the jitter of Track #N1 at every 10, 10000 times.

- (3) Overwrite random data pattern 10 times by 2x-speed on each track in the following order.
1. Track #N2
 2. Track #N2+2
 3. Track #N2-2
- (4) Write random data pattern repeatedly by 5x-speed on Track #(N2+1) and Track #(N2-1) and measure the jitter of Track #N2 at every 10, 10000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.6.8 Characteristics of the Recording layer of CAV Operation (Recommended Specification)

This section describes the test procedures for CAV recording required for verification of 5x-speed DVD-RAM Disc products.

For write condition, 3x-speed recording parameter shall be calculated from 2x and 5x write parameters given in physical format information. Method of calculation is specified in Annex of Optional Specifications 5x-speed DVD-RAM Revision 2.0.

Applicant should declare the calculated 3x-speed write strategy Peak power, Bias power1, 2, 3, First pulse end time, Last pulse start time, Multipulse duration, Bias power2 duration, First pulse start time and Last pulse end time. Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 25N** and **Form 26N**. Finally judge the result with **Form 28N**.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.7 Test Specifications for 6x-speed recording

The following sections describe the test procedures for 6x-speed recording.

3.7.1 Characteristics of the Recording layer

Applicant must determine the best write strategy (Peak power, Bias power1, 2, 3, First pulse start time, and Last pulse end time), which shall be recorded in the embossed Control data zone in Lead-in area.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 15N**.

Finally judge the result with **Form 28N**.

3.7.2 Signals from groove and land in the written recording field

Condition of write strategy shall be the same condition as used in the test defined in clause 3.7.1.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 16N**.

Finally judge the result with **Form 28N**.

3.7.3 Power margin

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 17N**.

Finally judge the result with **Form 28N**.

- Write power condition is as follows:

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause 3.7.1.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure asymmetry and the deviation between leading edge jitter and trailing edge jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.7.4 Cross Power Over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 18N**.

Finally judge the result with **Form 28N**.

- Over-write power condition is as follows.

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause 3.7.1.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.7.5 Cross erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 19N**. Finally judge the result with **Form 28N**.

- Condition of write strategy shall be the same condition as used in the test defined in clause **3.7.1**.
- Measuring method is as follows.
 - (1) Overwrite random data pattern for 10 times at each track in the following order.
 1. Track #N
 2. Track #N+2
 3. Track #N-2
 - (2) Write random data pattern repeatedly on Track #(N+1) and Track #(N-1) and measure the jitter of Track #N at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.7.6 Cyclability

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 20N**. Finally judge the result with **Form 28N**.

- Condition of write pulse shall be the same condition as used in the test defined in clause **3.7.1**.
- Write random data pattern repeatedly and measure the jitter at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.7.7 Servo margin of CAPA and written data

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 21N** and **Form 22N**. Finally judge the result with **Form 28N**.

- Condition of write power is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.7.1**.
- Write random data pattern on five adjacent tracks 10 times each and measure the jitter of CAPA and written data.
- Test condition is as follows:
 - Condition A is of moving axial tracking between $-1.0\mu\text{m}$ and $+1.0\mu\text{m}$.
 - Condition B is of moving radial tracking between $-0.1\mu\text{m}$ and $+0.1\mu\text{m}$.
 - Condition C is of moving tangential tilt between -0.5deg and $+0.5\text{deg}$.
 - Condition D is of moving radial tilt between -1.0deg and $+1.0\text{deg}$.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.7.8 Read cycles for read stability

After writing random data pattern on five adjacent tracks 10 times each with same write pulse condition as used in the test defined in clause **3.7.1**, measure the items for Read cycles for Read stability with the condition as 6x-speed recording/6x-speed reading using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 27N**. Finally judge the result with **Form 28N**.

Notes:

- Applicant should use the measurement procedure for read stability using Arrhenius plot method, compliant with Rewritable Disc/ Part 1/Optional Specifications 6x-speed DVD-RAM Revision 3.0/Annex B.
- Applicant should submit the melting point of the active-recording layer.
- Check the Read cycles specified in test condition below.
 - (1) Jitter threshold 9% with 6x-reading at Read power 2.0 mW under ambient temperature 25 °C in the User area of zone 0 and zone 34.
 - (2) Jitter threshold 12% with 6x-reading at Read power 2.0 mW under ambient temperature 60 °C in the User area of zone 34.
- Refer to **Annex E** of this Test Specification which shows example of test method for read stability.

Remarks: This data concerned on Ambient temperature 60 °C shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2/Optional Specifications 6x-speed DVD-RAM Revision 3.0.

3.8 Test Specifications for 8x-speed recording

The following sections describe the test procedures for 8x-speed recording.

In case of 6x/8x/12x-speed DVD-RAM Disc (Class 1), the test procedures of **3.8.1** Characteristics of the Recording layer and **3.8.2** Signals from groove and land in the written recording field shall be applied for the verification.

3.8.1 Characteristics of the Recording layer

Applicant must determine the best write strategy (Peak power, Bias power1, 2, 3, First pulse start time, and Last pulse end time), which shall be recorded in the embossed Control data zone in Lead-in area.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 15N**.

Finally judge the result with **Form 28N**.

3.8.2 Signals from groove and land in the written recording field

Condition of write strategy shall be the same condition as used in the test defined in clause **3.8.1**.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 16N**.

Finally judge the result with **Form 28N**.

3.8.3 Power margin

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 17N**.

Finally judge the result with **Form 28N**.

- Write power condition is as follows:

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.8.1**.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure asymmetry and the deviation between leading edge jitter and trailing edge jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.8.4 Cross Power Over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 18N**.

Finally judge the result with **Form 28N**.

- Over-write power condition is as follows.

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause **3.8.1**.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.8.5 Cross erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 19N**. Finally judge the result with **Form 28N**.

- Condition of write strategy shall be the same condition as used in the test defined in clause **3.8.1**.
- Measuring method is as follows.
 - (1) Overwrite random data pattern for 10 times at each track in the following order.
 1. Track #N
 2. Track #N+2
 3. Track #N-2
 - (2) Write random data pattern repeatedly on Track #(N+1) and Track #(N-1) and measure the jitter of Track #N at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.8.6 Cross speed over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 23N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 6x-speed defined in clause **3.7.1** and 8x-speed defined in clause **3.8.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Overwrite random data pattern 10 times by 8x-speed and 1 time by 6x-speed on the same track, and then measure the jitter. On the contrary, write 10 times by 6x-speed and 1 time by 8x-speed on the same track, and then measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.8.7 Cross speed erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 24N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 6x-speed defined in clause **3.7.1** and 8x-speed defined in clause **3.8.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Measuring method is as follows.
 - (1) Overwrite random data pattern 10 times by 8x-speed on each track in the following order.
 1. Track #N1
 2. Track #N1+2
 3. Track #N1-2
 - (2) Write random data pattern repeatedly by 6x-speed on Track #(N1+1) and Track #(N1-1) and measure the jitter of Track #N1 at every 10, 10000 times.

- (3) Overwrite random data pattern 10 times by 6x-speed on each track in the following order.
1. Track #N2
 2. Track #N2+2
 3. Track #N2-2
- (4) Write random data pattern repeatedly by 8x-speed on Track #(N2+1) and Track #(N2-1) and measure the jitter of Track #N2 at every 10, 10000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.8.8 Characteristics of the Recording layer of CAV Operation (Recommended Specification)

This section describes the test procedures for CAV recording required for verification of 8x-speed DVD-RAM Disc products.

For write condition, 7x-speed recording parameter shall be calculated from 6x and 8x recording parameters given in physical format information. Method of calculation is specified in Annex of Optional Specifications 8x-speed DVD-RAM Revision 4.0.

Applicant should declare the calculated write strategy, Peak power, Bias power1, 2, 3, First pulse end time, Last pulse start time, Multi pulse duration, Bias power2 duration, First pulse start time and Last pulse end time for 7x-speed recording parameter.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 25N** and **Form 26N**. Finally judge the result with **Form 28N**.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.8.9 Read cycles for read stability

After writing random data pattern on five adjacent tracks 10 times each with same write pulse condition as used in the test defined in clause 3.8.1, measure the items for Read cycles for Read stability with the condition as 8x-speed recording/8x-speed reading using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 27N**. Finally judge the result with **Form 28N**.

Notes:

- Applicant should use the measurement procedure for read stability using Arrhenius plot method, compliant with Rewritable Disc/ Part 1/Optional Specifications 8x-speed DVD-RAM Revision 4.0/Annex B.
- Applicant should submit the melting point of the active-recording layer.
- Check the Read cycles specified in test condition as Jitter threshold 12% with 8x-reading at Read power 2.2 mW under ambient temperature 60 °C in the User area of zone 34.
- Refer to **Annex E** of this Test Specification which shows example of test method for read stability.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2/Optional Specifications 8x-speed DVD-RAM Revision 4.0.

3.9 Test Specifications for 12x-speed recording

The following sections describe the test procedures for 12x-speed recording.

3.9.1 Characteristics of the Recording layer

Applicant must determine the best write strategy (Peak power, Bias power1, 2, 3, First pulse start time, and Last pulse end time), which shall be recorded in the embossed Control data zone in Lead-in area.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 15N**.

Finally judge the result with **Form 28N**.

3.9.2 Signals from groove and land in the written recording field

Condition of write strategy shall be the same condition as used in the test defined in clause 3.9.1.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 16N**.

Finally judge the result with **Form 28N**.

3.9.3 Power margin

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 17N**.

Finally judge the result with **Form 28N**.

- Write power condition is as follows:

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause 3.9.1.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure asymmetry and the deviation between leading edge jitter and trailing edge jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.9.4 Cross Power Over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 18N**.

Finally judge the result with **Form 28N**.

- Over-write power condition is as follows.

Condition A is the best write strategy of Peak power (Pp) and Bias power1, 2, 3 (PB1, PB2, PB3). This condition shall be the same condition as used in the test defined in clause 3.9.1.

Condition B is plus 5% of Pp, PB1, PB2 and PB3.

Condition C is minus 10% of Pp, PB1, PB2 and PB3.

- Write random data pattern on the same place by these condition's power and measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1:
Version 2.2.

3.9.5 Cross erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 19N**. Finally judge the result with **Form 28N**.

- Condition of write strategy shall be the same condition as used in the test defined in clause **3.9.1**.
- Measuring method is as follows.
 - (1) Overwrite random data pattern for 10 times at each track in the following order.
 1. Track #N
 2. Track #N+2
 3. Track #N-2
 - (2) Write random data pattern repeatedly on Track #(N+1) and Track #(N-1) and measure the jitter of Track #N at every 10, 10000, 50000 and 100000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.9.6 Cross speed over-write

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 23N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 6x-speed defined in clause **3.7.1** and 12x-speed defined in clause **3.9.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Overwrite random data pattern 10 times by 12x-speed and 1 time by 6x-speed on the same track, and then measure the jitter. On the contrary, write 10 times by 6x-speed and 1 time by 12x-speed on the same track, and then measure the jitter.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.9.7 Cross speed erasing

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 24N**. Finally judge the result with **Form 28N**.

- Each condition of write power for 6x-speed defined in clause **3.7.1** and 12x-speed defined in clause **3.9.1** is the best write strategy of Peak power (Pp) and Bias power 1, 2, 3 (PB1, PB2, PB3).
- Measuring method is as follows.
 - (1) Overwrite random data pattern 10 times by 12x-speed on each track in the following order.
 1. Track #N1
 2. Track #N1+2
 3. Track #N1-2
 - (2) Write random data pattern repeatedly by 6x-speed on Track #(N1+1) and Track #(N1-1) and measure the jitter of Track #N1 at every 10, 10000 times.

- (3) Overwrite random data pattern 10 times by 6x-speed on each track in the following order.
1. Track #N2
 2. Track #N2+2
 3. Track #N2-2
- (4) Write random data pattern repeatedly by 12x-speed on Track #(N2+1) and Track #(N2-1) and measure the jitter of Track #N2 at every 10, 10000 times.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.9.8 Characteristics of the Recording layer of CAV Operation (Recommended Specification)

This section describes the test procedures for CAV recording required for verification of 12x-speed DVD-RAM Disc products.

For write condition, 8x-speed recording parameter shall be calculated from 6x and 12x recording parameters given in physical format information. Method of calculation is specified in Annex of Optional Specifications 12x-speed DVD-RAM Revision 5.0.

Applicant should declare the calculated write strategy, Peak power, Bias power1, 2, 3, First pulse end time, Last pulse start time, Multi pulse duration, Bias power2 duration, First pulse start time and Last pulse end time for 8x-speed recording parameter.

Measure the items using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 25N** and **Form 26N**. Finally judge the result with **Form 28N**.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2.

3.9.9 Read cycles for read stability

After writing random data pattern on five adjacent tracks 10 times each with same write pulse condition as used in the test defined in clause 3.9.1, measure the items for Read cycles for Read stability with condition as 12x-speed recording/12x-speed reading using DVD-RAM Disc Evaluation System or equivalent system in accordance with **Form 27N**. Finally judge the result with **Form 28N**.

Notes:

- Applicant should use the measurement procedure for read stability using Arrhenius plot method, compliant with Rewritable Disc/ Part 1/Optional Specifications 12x-speed DVD-RAM Revision 5.0/Annex B.
- Applicant should submit the melting point of the active-recording layer.
- Check the Read cycles specified in test condition as Jitter threshold 12% with 12x-reading at Read power 2.6 mW under Ambient temperature 60 °C in the User area of zone 34.
- Refer to **Annex E** of this Test Specification which shows example of test method for read stability.

Remarks: This data shall be treated as non-specified data in DVD Specifications for Rewritable Disc/ Part 1: Version 2.2/Optional Specifications 12x-speed DVD-RAM Revision 5.0.

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.

- **2x-speed, 2x/3x-speed, 2x/3x/5x-speed, 6x-speed, 6x/8x-speed and 6x/8x/12x-speed DVD-RAM disc**

Hitachi Consumer Electronics Co., Ltd.

Format Verification Center

292, Yoshida-cho, Totsuka-ku, Yokohama-shi, Kanagawa, 244-0817 Japan

Fax: +81-45-866-5905

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>

- **2x-speed DVD-RAM disc**

SAMSUNG ELECTRONICS CO., LTD

DVD Verification Laboratory

VD Division, DM Business

416, Maetan-3Dong, Yeongtong-Gu, Suwon-City, Gyeonggi-Do, 443-742 Korea

Tel: +82-31-277-0875 Fax: +82-31-277-3398

E-mail: bd.tcenter@samsung.com

Panasonic Disc Manufacturing Corporation of America

PDMC Verification Laboratory

20608 Madrona Avenue, Torrance, CA, 90503 U.S.A.

Fax: +1-310-783-4849

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Annex B

Glossary of Terms used

DVD-RAM : DVD Rewritable Disc

DVD-ROM : DVD Read Only Disc

DVD-R : DVD Recordable Disc

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 1N** to provide preliminary information.

Self Test

Applicant must test the product in accordance with this Test Specification prior to submitting it to a Class-A Verification lab. Applicant must complete the necessary Forms according to the list of **Form 2N (2/2)** to provide test results.

Mutual Non-Disclosure Agreement (NDA)

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

Application

Applicant must submit 10 product samples along with the necessary Forms and the NDA.

Test Results

Upon completion of testing, Verification Lab will complete **Form 29N** 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.*

DVD-RAM File System Verifier (DVD-FV01RAM) shall be delivered by:

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>

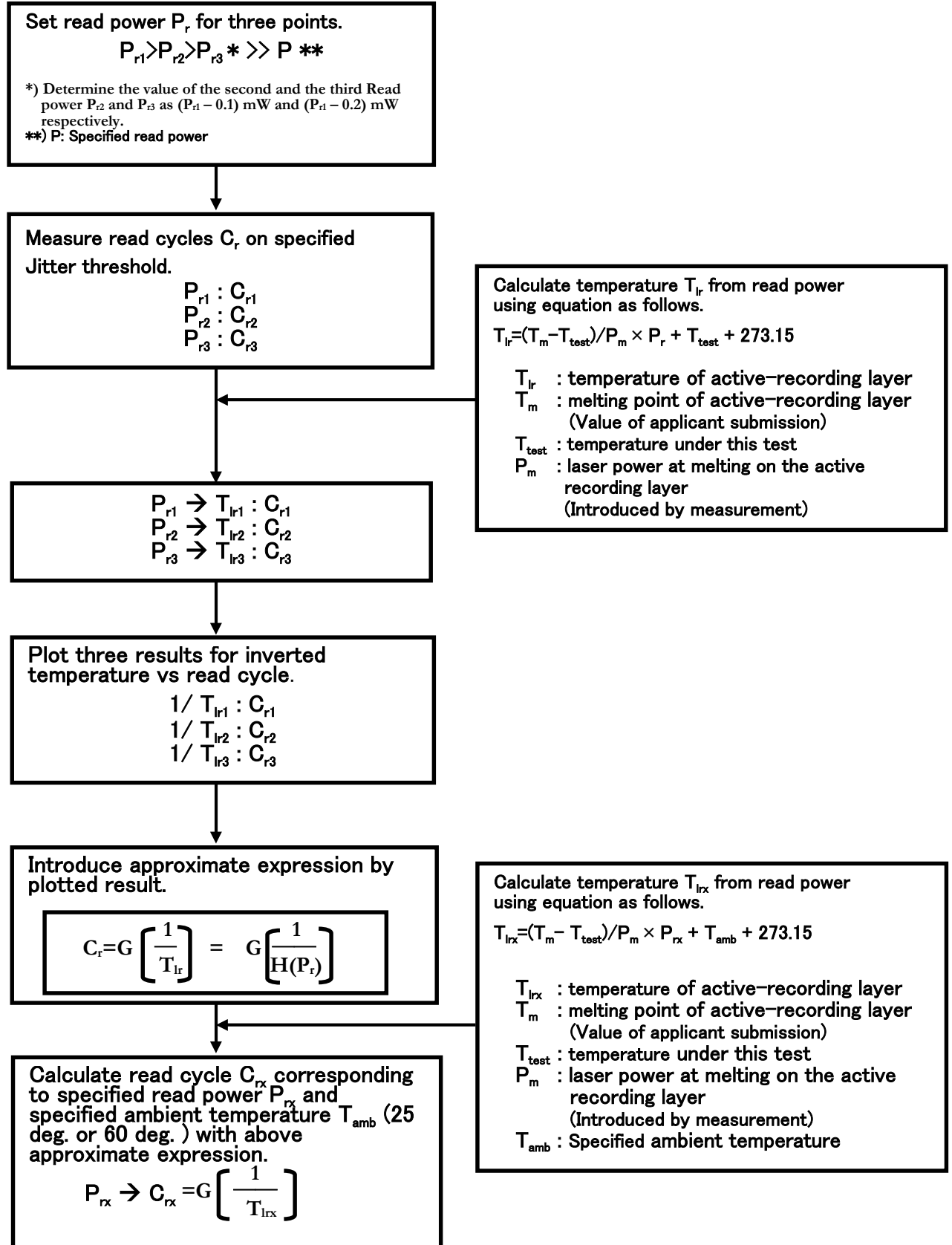
DVD-RAM File System Verifier (TFSV01):

Discontinued

Annex E

Test Measurement Procedure for Read Stability

This flow chart shows measurement procedure for read stability using Arrhenius plot method.



E-1 An example of determination of Read cycles at Jitter threshold

This clause shows a concrete example, 6x-recording and 6x-reading on groove track case, of determination of Read cycles at Jitter threshold. The relationship between the jitter value and the read cycles shown in [Figure E-1] would be obtained. Read cycles C_{r1} at Jitter threshold 9.0% and read power $P_{r1} = 2.8$ mW are calculated using the approximate equation derived in the range around the value of jitter 9.0% in [Figure E-1].

The equation is as follows : $y = 6.53889644 \times e^{0.00005885x}$

The read cycles C_{r1} at Jitter threshold 9.0% is calculated as follows :

$$C_{r1} = \text{LN}(9.0/6.53889644)/(0.00005885) = 5428 \quad (3,000 \leq C_{r1} = 5428 \leq 10,000 \text{ *})$$

*) It recommends choosing the value of the first Read power P_{r1} so that the Read cycles C_{r1} would be put in from 3,000 to 10,000.

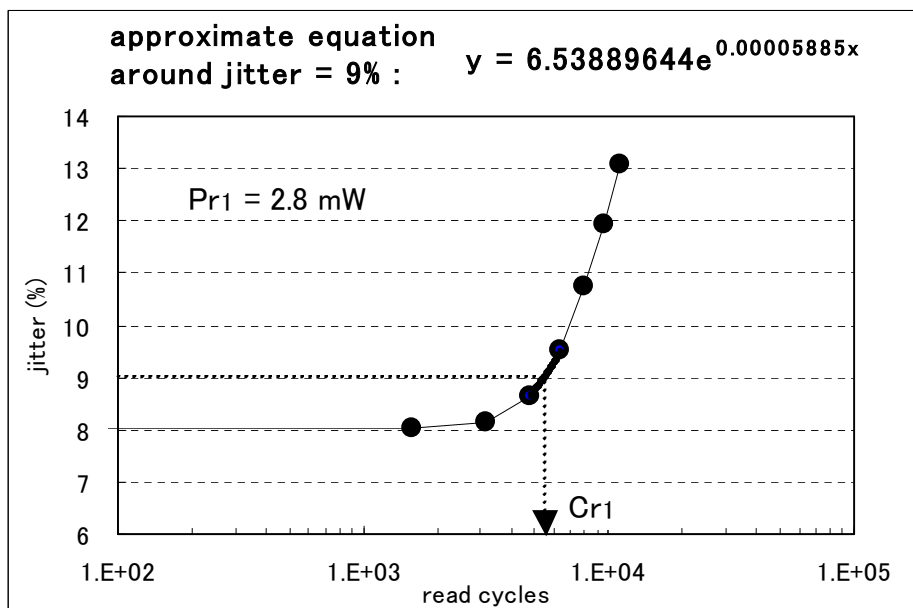
The temperature under this test T_{test2} is also checked as 26 °C.

In this example case P_{r1} is 2.8 mW, so P_{r2} and P_{r3} is calculated as $P_{r2} = (P_{r1} - 0.1) = (2.8 - 0.1) = 2.7$ mW,

$P_{r3} = (P_{r1} - 0.2) = (2.8 - 0.2) = 2.6$ mW.

Read cycles C_{r2} at Jitter threshold 9.0% and read power $P_{r2} = 2.7$ mW and read cycles C_{r3} at Jitter threshold 9.0% and read power $P_{r3} = 2.6$ mW are also obtained in the same way as the case of read cycles C_{r1} .

◇ Figure E-1 : An example of determination of Read cycles at Jitter threshold 9% and the laser power P_{r1}



E-2 An example of determination of the laser power corresponding to the melting point of the active-recording layer at nX-reading

This clause shows a concrete example, a case of 6x-recording and 6x-reading on groove track, of determination of the laser power P_m corresponding to the melting point of the active-recording layer T_m . The relationship between the I_{otmin2}/I_{otmin1} and the laser power shown in [Figure E-2] would be obtained. P_m is the power that the I_{otmin2}/I_{otmin1} begins to decrease from 1.0. So the approximate equation is derived in the range from 0.80 to 0.95 of the I_{otmin2}/I_{otmin1} in [Figure E-2] and the equation is as follows: $y = -0.367x + 4.740$.

And P_m is calculated as follows: $(1.000 - 4.740)/(-0.367) = 10.19$ mW.

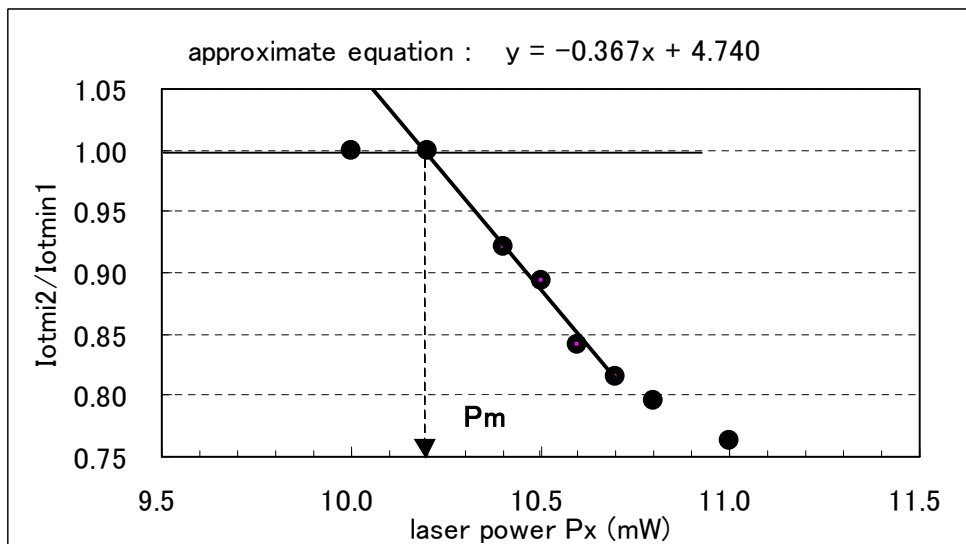
The temperature under this test T_{test1} is also checked as 26 °C.

And the melting point of the active-recording layer of this disc T_m is 700 °C.

Incidentally the temperature of the active-recording layer T_l at irradiating the reading power $P_r = 2.0$ mW and the ambient temperature $T_{amb} = 25$ °C is calculated as follows:

$$T_l = (T_m - T_{test1}) / P_m \times P_r + T_{amb} + 273.15 = (700 - 26)/(10.19) \times 2.0 + 25 + 273.15 = 430.44 \text{ K}$$

◇ Figure E-2 : An example of determination of the laser power P_m



E-3 An example of Read cycles for Read stability

This clause shows a concrete example, 6x-recording and 6x-reading on groove track case, of determination of Read cycles for Read stability. In this example case three different Read cycles are $C_{r1} = 5428$, $C_{r2} = 18635$, $C_{r3} = 50266$ at Jitter threshold 9% and at three different read power $P_{r1} = 2.8$ mW, $P_{r2} = 2.7$ mW, $P_{r3} = 2.6$ mW.

Calculate three kinds of temperature of the active-recording layer T_{lr1} , T_{lr2} , T_{lr3} , at the reading power P_{r1} , P_{r2} , P_{r3} respectively in the same way.

(e.g.)

$$T_{lr1} = (T_m - T_{test1}) / P_m \times P_r + T_{test2} + 273.15 = (700 - 26)/(10.19) \times 2.8 + 26 + 273.15 = 484.35 \text{ K}$$

$$1/T_{lr1} = 1/484.35 = 2.065 \times 10^{-3} \text{ K}^{-1}$$

The results are adjusted in **Table E-3**.

Table E-3 : Value of $1/T_{lr}$ and the cycles in this example case

Read power (mW)	2.8	2.7	2.6
$1/T_{lr} \text{ (K}^{-1}\text{)}$	2.065	2.093	2.123
Cycles on Jitter threshold 9%	5428	18635	50266

The result of Arrhenius plot using the value in **Table E-3** is shown in [Figure E-3].

The approximate equation derived from [Figure E-3] is as follows: $y = 2.5084 \times 10^{-31} \times e^{38.312}$.

The temperature of the active-recording layer T_{lm} at read power $P_r = 2.0$ mW and the ambient temperature $T_{amb} = 25^\circ\text{C}$ is calculated as follows:

$$T_{lm} = (T_m - T_{test1}) / P_m \times P_r + T_{amb} + 273.15 = (700 - 26)/(10.19) \times 2.0 + 25 + 273.15 = 430.44 \text{ K}$$

$$1/T_{lm} = 1/430.44 = 2.323 \times 10^{-3} \text{ K}^{-1}$$

The finally required value of the read cycles C_m at Jitter threshold 9%, read power $P_r = 2.0$ mW and the ambient temperature $T_{amb} = 25^\circ\text{C}$ is calculated by substituting the above $1/T_{lm}$ for the approximate equation as follows:

$$C_m = 2.5084 \times 10^{-31} \times \exp(38.312 \times 2.323) = 1.12 \times 10^8.$$

If the value of C_m is more than or equal to 1.0×10^6 then the specification is considered to be satisfied.

In this example case, $C_m = 1.12 \times 10^8 > 1.0 \times 10^6$. So the specification on the Read cycles for Read stability is satisfied.

◇ Figure E-3 : An example of determination of Read cycles for read stability