Exhibit 2029
Zynga, Inc. v. Personalized Media Communications, LLC
Case IPR2013-00164 (SCM)

P20

CD-R Interchangeability Test Report

A. Inoue[1], J.G.F. Kablau, J.P.J. Heemskerk[2], H. Ogawa, H. Yamauchi[3]
1.Pioneer Elec. Corp.,Tokorozawa Plant, Hanazono 4-2610, Tokorozawa,Saitama,Japan
2.Philips Consumer Elec. B.V., P.O. Box 80002 5600 JB Eindhoven, The Netherlands
3. Sony Corp., Atsugi Technology Center, 4-16-1 Okata, Atsugi, Kanagawa, Japan

1. Introduction

The "Orange Book part II[(1)]", which describes technical specifications of CD-WO (Compact Disc Write Once,so-called CD-R), was released by Philips and Sony in November 1990. The CD-R (CD recordable)User Group was formed in August 1991 by 18 companies, both from disc manufacturers and hardware manufacturers, whose aim is to confirm interchangeability between discs and devices and eventually extract problems if any. This report introduces the activities of Test Group A in which 8 disc suppliers and 9 disc evaluators participated. The characteristics of CD-R discs and the interchangeability will be discussed.

2. Outline of CD-R(CD-WO) Characteristics

The CD-R has the following characteristics:

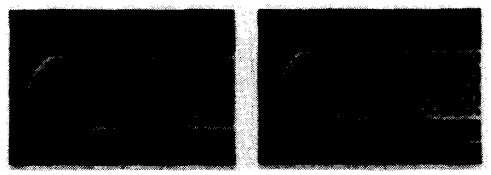
a. A reflection decreases due to recording material after recording.
b. The CD-R disc satisfies specifications as written in the chapter DISC SPECIFICATION of the Red Book[(2)] after recording.
c. The information Area of a blank disc has a wobbled pregroove for tracking , CLV speed and timing purposes.
d. Recording takes place in the groove.

Table 1 shows the measured values of CD-R with spec. of CD and CD-R. Eye patterns are shown in Figure 1 for both CD and CD-R discs using a commercial CD player. The CD-R discs resulted in equivalent characteristics to those of CDs. However, some combination between the discs and recorders have peculiarities which are described in chapter 3.

			CD	CD-R		
item	Red-Book	Orange-Book	Philips-5B	A	B	C
Reflective (%)	>70	-	84	-	-	-
Rtop (%)	-	>65	76	67.3	65.9	67.6
11T Mod. (%)	>60	>60	75	84	81	76
3T Mod. (%)	30 - 70	30 - 70	48	56	55	55
Push Pull - Amplitude	0.04 - 0.07	0.04 - (0.09)	0.065	0.108	0.09	0.124
Write Power (mW)	-	4.0 - 8.0	-	7.9	7.7	7.9
3T Jitter (nS) Pit	<30	<30	18.5	18.5	17	14.5
Land	<30	<30	20.5	21.5	20	19.5
R.C (%)	-	>5	-	9.1	10	15.2

Test Condition NA:0.45
λ :786nm

Table.1 The specifications and the relevant measured value.



(1)CD-R (2)CD

Fig.1 Eye patterns of CD and CD-R

3. Peculiarities of CD-R

a. Jitter of CD-R pits

As shown in the Fig. 2, in CD-R recording, the average pit length corresponding to each of the recorded 3T~11T signals may differ from a reference length represented by nT (n=3~11). In the figures the solid lines show the pit distribution and the dotted lines show the land. It shows the write strategy doesn't fit in the media characteristics. The phenomenon can not be perceived by solely evaluating 3T signal's jitter values specified before.

b.Wavelength dependency of CD-R

Recording layer is made of an organic dye material.[(3)(4)(5)] The changes in the refractive index ñ= n-ik of an organic dye and

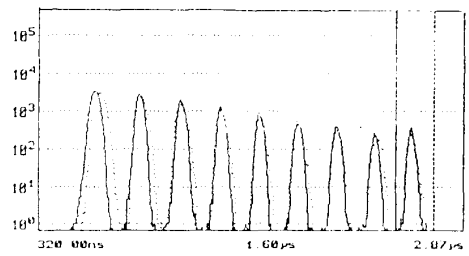


Fig.2 Time Interval Analysis

the Push-Pull signals of a CD-R disc are shown in Figure 3 as a function of the read wavelength. Push-Pull signal in the vicinity of 790 nm deviates from the specification.

4. Evaluation results

It is of an ultimate importance that a recorded CD-R is compatible with Red Book specified CDs or playable on any existing CD player without causing problems.

After the improvement of the media peculiarities and recorders, we did the playability check.

At the CD-R User Group, discs made by 8 disc suppliers, after 9 disc evaluator companies had recorded them, were tested to see if they were playable on their own or stock (other manufacturers') CD players. Tested operations were:

a. Reading of a T.O.C.
b. Play mode
c. Search mode

A set of the three operations were conducted five times and the numbers of success were taken as the evaluating parameter. An example of the evaluation results are shown in Table 2. The results are promising in playability.

In the meantime we identified some types of CD player which still shows sometimes on some discs unreliable playability.

We decided to arrange a new test with a new definition describing jitter of CD-R in order to improve a compatibility with an extra fine tuning on media characteristics , which will enlarge margins for 63 min. discs and will ensure good playability of 74 min. discs of all brands.

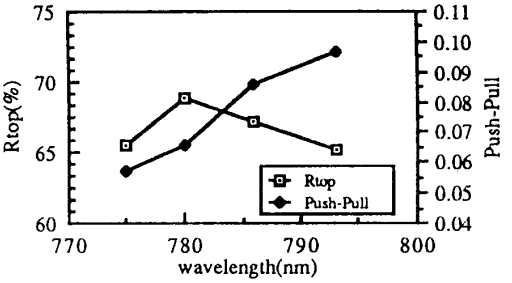


Fig.3 Wavelength dependency of Rtop & Push-Pull

Disc \ Recorder	A	B	C	D	E	F	G	H	I
a	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
b	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
c	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
d	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
e	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
f	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
g	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
h	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕

⊕ means complete success

Table.2 The evaluation results of playability

5. Conclusions

A cross evaluation has been conducted among 18 member companies, both from disc suppliers and disc evaluators. CD-R discs and the characteristics of the recorders have been assessed. Phenomena such as a read wavelength dependency specific to CD-R were also discussed. It is very promising that the playability on the existing CD players have been confirmed without causing a major problem in terms of future applications of a CD-R system.

6. Acknowledgment

The authors would like to thank the all participants in the test Group A for disc supply and evaluation.

7. References

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