

# Disc Checks - 10<sup>th</sup> May 2004

Performed at CD-ROM Services, North Sydney, Australia on behalf of the International Disc Duplicating Association.

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# Types of Errors

Four discs were recorded on four different drives, and tested using a Clover CD Analyzer. The tests are not intended to be comprehensive, but cover only Block Error Rates. This is nonetheless a good indicator of whether or not the disc is good.

## WHAT ARE ERRORS?

Block errors on a disc are not a physical thing. They are a manifestation of how a disc interacts with a player. So different players can produce different error-rates from the same disc. Although there are rigid specifications that define what a CD should be, there are no such specifications for players. Therefore, to ensure wide compatibility, discs should have low errors. Additionally, a disc that is unreadable on one player, may seem to perform well on another.

The CIRC error correction used in CD players uses two stages of error correction called C1 and C2, with de-interleaving of the data between the stages. The error correction chip can correct two bad symbols per block in the first stage and up to four bad symbols in the second stage.

## BLER

BLER, or Block Error Rate, is the number of data blocks per second that contain detectable errors at the input of the C1 decoder. The "Red Book" specification allows BLER up to 220 per second averaged over 10 seconds. These days, with high speed readers commonplace, the generally accepted maximum is 50, with peaks below 20 being desirable. Average BLER should be below 5, and an average less than 1 is desirable.

## E11, E21, E31

An E11 error means one bad symbol was corrected at the C1 stage. An E21 error means two bad symbols corrected at the C1 stage. E31 means three or more bad symbols at the C1 stage, and is uncorrectable at C1 and so is passed on to the C2 stage.

Because the data is de-interleaved between the stages, each of the bad symbols is now in separate blocks, and so they can be handled by the C2 stage. As a result of the interleaving, one uncorrectable symbol at C1 can become up to 28 bad symbols at C2, which is why E12 is often much higher than E31.

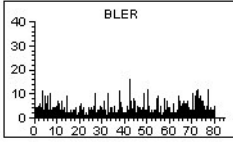
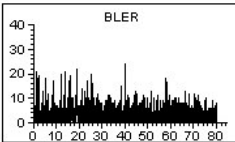
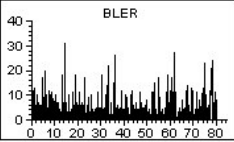
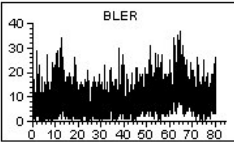
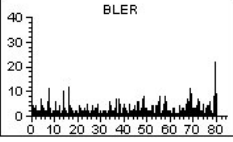
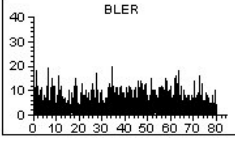
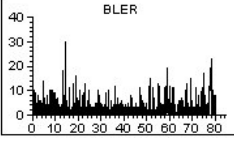
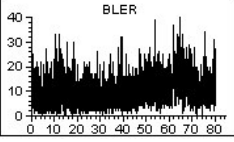
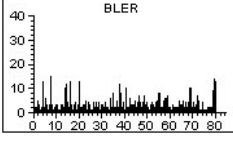
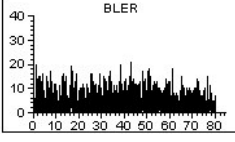
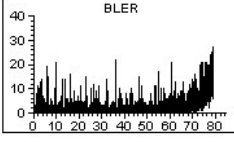
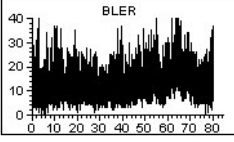
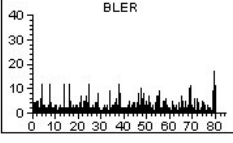
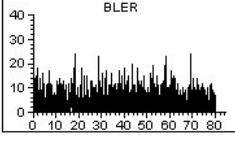
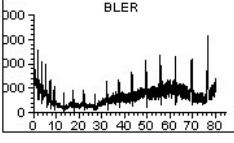
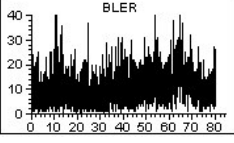
## E12, E22, E32

An E12 error means that one bad symbol was corrected at the C2 stage. E22 is two bad symbols, and E32 is three or more bad symbols at C2 and therefore cannot be corrected. It is theoretically possible for C2 to correct four bad symbols, but not all players can do so. To allow for high compatibility, we consider E32 to be uncorrectable, even though some drives may be able to correct it.

For more information on testing discs, check the Web site for [Media Sciences](#).

## Disc Information

	<b><i>Taiyo Yuden</i></b>	<b><i>Ritek</i></b>	<b><i>E-Top Mediatek</i></b>	<b><i>Prodisc</i></b>
Australian Distributor	Years Well & Co	U-tech Media Australia	American Supply Company	Capax
ATIP Code	97m24s01f	97m15s17f	97m28s22f	97m32s19f
Dye	Cyanine	Phthylocyanine type 7	Phthylocyanine type 2	Phthylocyanine type 9
Disc Capacity	79.59.17	79.59.70	79.59.67	79.59.72

<i>Drive</i>	<i>Taiyo Yuden</i>	<i>Ritek</i>	<i>E-Top Mediatek</i>	<i>Prodisc</i>
Lite-On 40x12x48x (16x)				
Pioneer A-07 (16x)				
PlexWriter 8/20 (8x)				
Teac 58-S (6x)				

Lite-On 40x12x48x (16x)

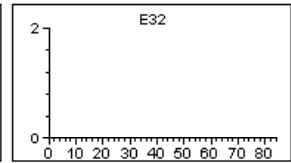
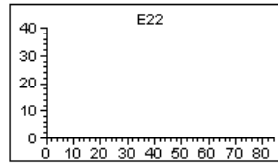
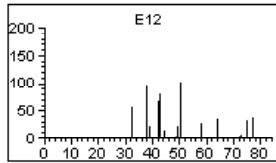
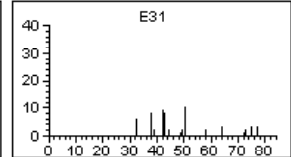
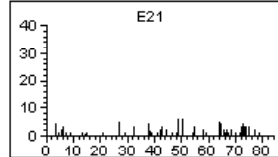
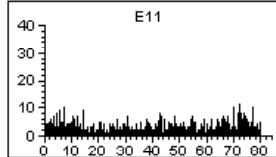
**Taiyo Yuden**

Serial Number UH315U0620380

CIRC Test Results:

Av BLER = 0.8	Pk BLER = 16.0	10Pk BLER = 8.7
Av E11 = 0.7	Pk E11 = 11.0	10Pk E11 = 5.6
Av E21 = 0.0	Pk E21 = 6.0	10Pk E21 = 1.9
Av E31 = 0.0	Pk E31 = 10.0	10Pk E31 = 4.5
Av E12 = 0.3	Pk E12 = 102.0	10Pk E12 = 31.9
Av E22 = 0.0	Pk E22 = 0.0	10Pk E22 = 0.0
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
Tot E22 = 0	Tot E32 = 0	

Grade = A



Lite-On 40x12x48x (16x)

**Ritek**

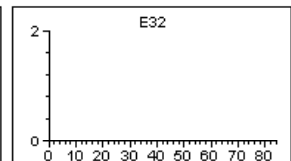
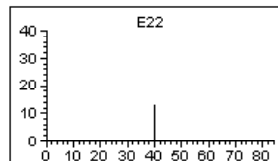
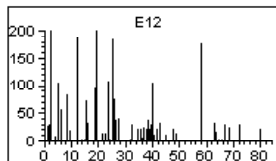
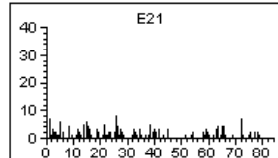
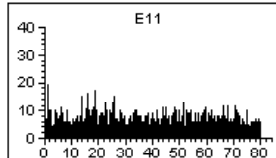
Serial Number J312J5212202057C21

CIRC Test Results:

Av BLER = 2.3	Pk BLER = 24.0	10Pk BLER = 12.4
Av E11 = 2.1	Pk E11 = 19.0	10Pk E11 = 6.9
Av E21 = 0.1	Pk E21 = 8.0	10Pk E21 = 2.3
Av E31 = 0.1	Pk E31 = 18.0	10Pk E31 = 8.5
Av E12 = 1.6	Pk E12 = 237.0	10Pk E12 = 102.5
Av E22 = 0.0	Pk E22 = 13.0	10Pk E22 = 1.3
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
Tot E22 = 13	Tot E32 = 0	

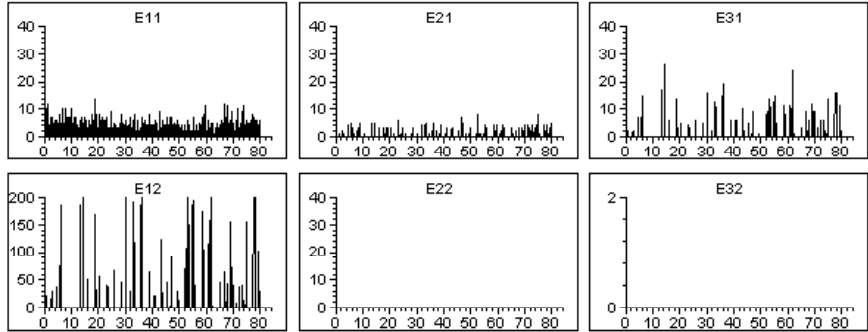
Grade = C

CIRC Test \*\*\* FAILED \*\*\*



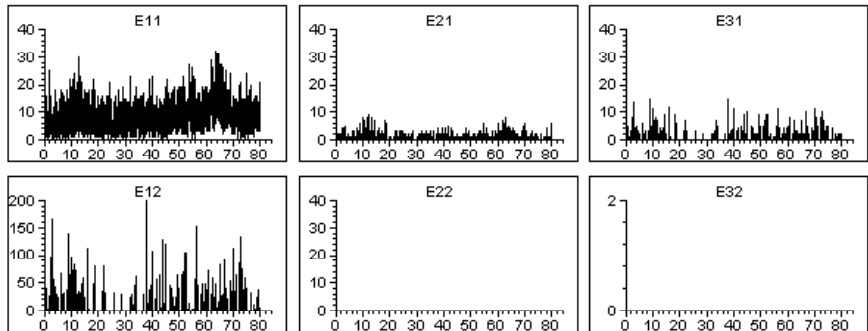
Lite-On 40x12x48x (16x)  
**E-Top Mediatek**  
 Serial Number 410708B202B3 14437

CIRC Test Results:  
 Av BLER = 1.8 Pk BLER = 31.0 10Pk BLER = 17.2  
 Av E11 = 1.1 Pk E11 = 14.0 10Pk E11 = 6.5  
 Av E21 = 0.1 Pk E21 = 8.0 10Pk E21 = 2.0  
 Av E31 = 0.6 Pk E31 = 26.0 10Pk E31 = 12.6  
 Av E12 = 6.3 Pk E12 = 307.0 **10Pk E12 = 221.0**  
 Av E22 = 0.0 Pk E22 = 0.0 10Pk E22 = 0.0  
 Av E32 = 0.0 Pk E32 = 0.0 10Pk E32 = 0.0  
 Tot E22 = 0 Tot E32 = 0  
 Grade = A



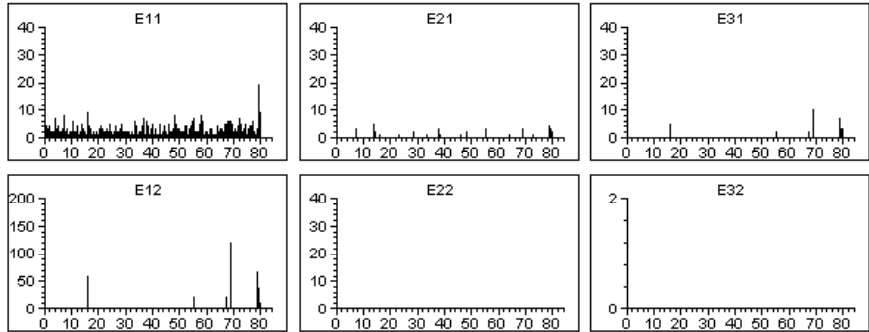
Lite-On 40x12x48x (16x)  
**Prodisc**  
 Serial Number 22409711 18214 01

CIRC Test Results:  
 Av BLER = 8.6 Pk BLER = 37.0 10Pk BLER = 27.2  
 Av E11 = 8.0 Pk E11 = 32.0 10Pk E11 = 25.4  
 Av E21 = 0.3 Pk E21 = 9.0 10Pk E21 = 4.4  
 Av E31 = 0.3 Pk E31 = 15.0 10Pk E31 = 11.6  
 Av E12 = 2.8 Pk E12 = 220.0 **10Pk E12 = 148.6**  
 Av E22 = 0.0 Pk E22 = 0.0 10Pk E22 = 0.0  
 Av E32 = 0.0 Pk E32 = 0.0 10Pk E32 = 0.0  
 Tot E22 = 0 Tot E32 = 0  
 Grade = B  
**CIRC Test \*\*\* FAILED \*\*\***



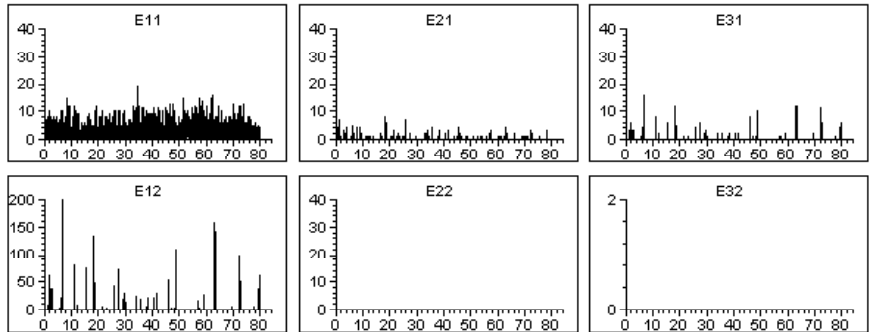
Pioneer A-07 (16x)  
**Taiyo Yuden**  
 Serial Number HH34010925780

CIRC Test Results:  
 Av BLER = 0.6 Pk BLER = 22.0 10Pk BLER = 9.6  
 Av E11 = 0.5 Pk E11 = 19.0 10Pk E11 = 8.5  
 Av E21 = 0.0 Pk E21 = 5.0 10Pk E21 = 1.1  
 Av E31 = 0.0 Pk E31 = 10.0 10Pk E31 = 7.2  
 Av E12 = 0.2 Pk E12 = 119.0 **10Pk E12 = 75.5**  
 Av E22 = 0.0 Pk E22 = 0.0 10Pk E22 = 0.0  
 Av E32 = 0.0 Pk E32 = 0.0 10Pk E32 = 0.0  
 Tot E22 = 0 Tot E32 = 0  
 Grade = A



Pioneer A-07 (16x)  
**Ritek**  
 Serial Number J312J5212202050A21

CIRC Test Results:  
 Av BLER = 2.4 Pk BLER = 20.0 10Pk BLER = 10.9  
 Av E11 = 2.2 Pk E11 = 19.0 10Pk E11 = 6.7  
 Av E21 = 0.1 Pk E21 = 8.0 10Pk E21 = 2.4  
 Av E31 = 0.1 Pk E31 = 16.0 10Pk E31 = 7.6  
 Av E12 = 0.8 Pk E12 = 204.0 **10Pk E12 = 90.9**  
 Av E22 = 0.0 Pk E22 = 0.0 10Pk E22 = 0.0  
 Av E32 = 0.0 Pk E32 = 0.0 10Pk E32 = 0.0  
 Tot E22 = 0 Tot E32 = 0  
 Grade = A



Pioneer A-07 (16x)

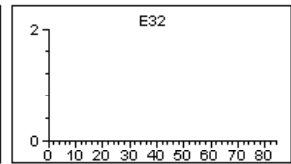
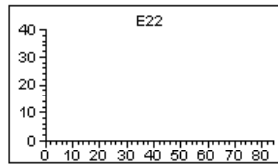
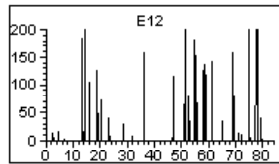
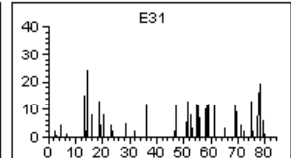
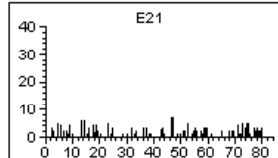
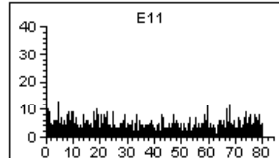
# E-Top Mediatek

Serial Number 410708B202B1 14439

## CIRC Test Results:

Av BLER = 1.5	Pk BLER = 30.0	10Pk BLER = 15.8
Av E11 = 1.0	Pk E11 = 13.0	10Pk E11 = 5.0
Av E21 = 0.1	Pk E21 = 7.0	10Pk E21 = 2.0
Av E31 = 0.4	Pk E31 = 24.0	10Pk E31 = 12.4
Av E12 = 4.3	Pk E12 = 282.0	<b>10Pk E12 = 205.2</b>
Av E22 = 0.0	Pk E22 = 0.0	10Pk E22 = 0.0
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
Tot E22 = 0	Tot E32 = 0	

Grade = A



Pioneer A-07 (16x)

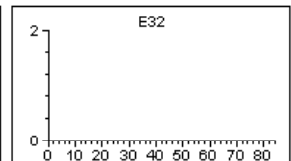
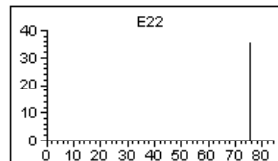
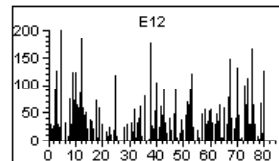
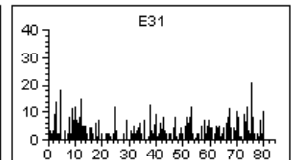
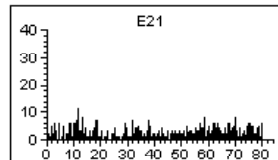
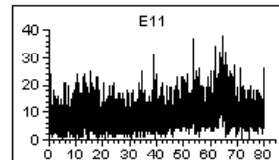
# Prodisc

Serial Number 22409712 18220 01

## CIRC Test Results:

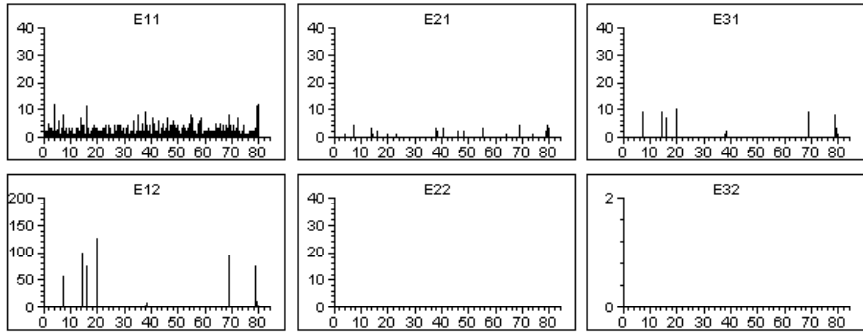
Av BLER = 10.0	Pk BLER = 40.0	10Pk BLER = 29.6
Av E11 = 9.3	Pk E11 = 38.0	10Pk E11 = 28.0
Av E21 = 0.3	Pk E21 = 11.0	10Pk E21 = 3.7
Av E31 = 0.3	Pk E31 = 21.0	10Pk E31 = 10.9
Av E12 = 3.0	Pk E12 = 204.0	<b>10Pk E12 = 126.7</b>
Av E22 = 0.0	<b>Pk E22 = 35.0</b>	<b>10Pk E22 = 7.4</b>
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
<b>Tot E22 = 116</b>	Tot E32 = 0	

Grade = C



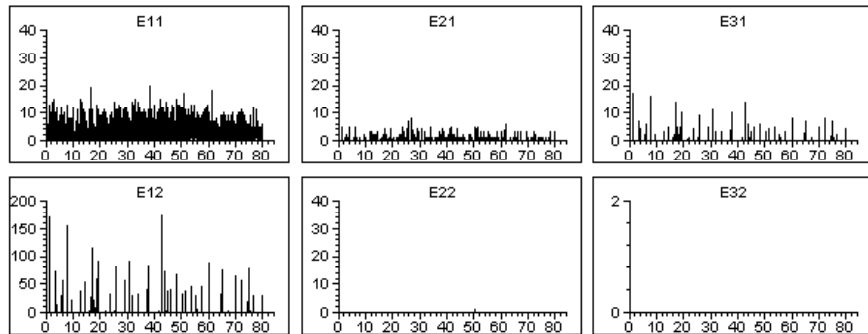
PlexWriter 8/20 (8x)  
**Taiyo Yuden**  
 Serial Number HH34010925680

CIRC Test Results:  
 Av BLER = 0.6 Pk BLER = 15.0 10Pk BLER = 9.7  
 Av E11 = 0.5 Pk E11 = 12.0 10Pk E11 = 7.8  
 Av E21 = 0.0 Pk E21 = 4.0 10Pk E21 = 1.1  
 Av E31 = 0.0 Pk E31 = 10.0 10Pk E31 = 6.9  
 Av E12 = 0.4 Pk E12 = 125.0 **10Pk E12 = 75.5**  
 Av E22 = 0.0 Pk E22 = 0.0 10Pk E22 = 0.0  
 Av E32 = 0.0 Pk E32 = 0.0 10Pk E32 = 0.0  
 Tot E22 = 0 Tot E32 = 0  
 Grade = A



PlexWriter 8/20 (8x)  
**Ritek**  
 Serial Number J312J5212202054B21

CIRC Test Results:  
 Av BLER = 3.1 Pk BLER = 21.0 10Pk BLER = 10.6  
 Av E11 = 2.9 Pk E11 = 20.0 10Pk E11 = 8.5  
 Av E21 = 0.1 Pk E21 = 8.0 10Pk E21 = 1.9  
 Av E31 = 0.1 Pk E31 = 17.0 10Pk E31 = 6.8  
 Av E12 = 1.0 Pk E12 = 173.0 **10Pk E12 = 87.9**  
 Av E22 = 0.0 **Pk E22 = 1.0** **10Pk E22 = 0.1**  
 Av E32 = 0.0 Pk E32 = 0.0 10Pk E32 = 0.0  
**Tot E22 = 1** Tot E32 = 0  
 Grade = C



PlexWriter 8/20 (8x)

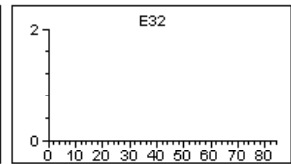
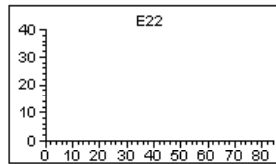
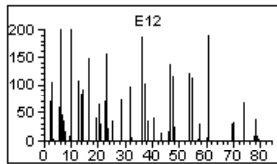
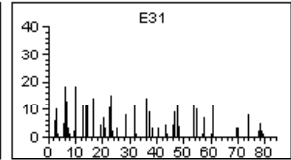
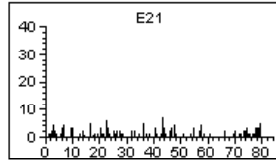
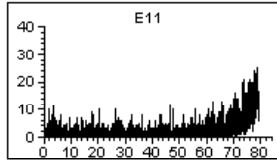
# E-Top Mediatek

Serial Number 410708A202B4 14436

## CIRC Test Results:

Av BLER = 2.4	Pk BLER = 27.0	10Pk BLER = 18.1
Av E11 = 2.1	Pk E11 = 25.0	10Pk E11 = 17.7
Av E21 = 0.1	Pk E21 = 7.0	10Pk E21 = 1.3
Av E31 = 0.2	Pk E31 = 18.0	10Pk E31 = 9.7
Av E12 = 1.5	Pk E12 = 258.0	<b>10Pk E12 = 79.4</b>
Av E22 = 0.0	Pk E22 = 0.0	10Pk E22 = 0.0
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
Tot E22 = 0	Tot E32 = 0	

Grade = A



PlexWriter 8/20 (8x)

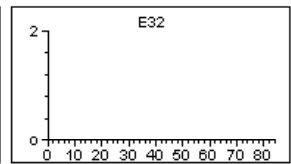
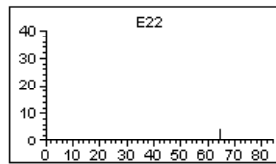
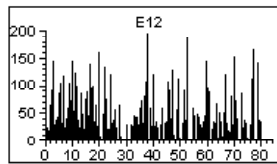
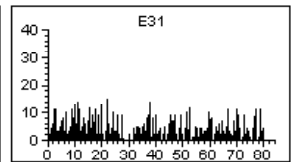
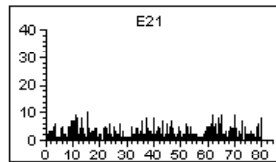
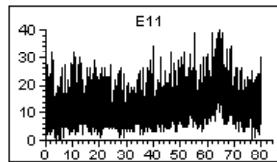
# Prodisc

Serial Number 22409712 18196 01

## CIRC Test Results:

Av BLER = 13.8	Pk BLER = 46.0	10Pk BLER = 33.7
Av E11 = 12.9	Pk E11 = 44.0	10Pk E11 = 31.6
Av E21 = 0.4	Pk E21 = 10.0	10Pk E21 = 4.6
Av E31 = 0.4	Pk E31 = 15.0	10Pk E31 = 11.6
Av E12 = 4.3	Pk E12 = 194.0	<b>10Pk E12 = 150.3</b>
Av E22 = 0.0	<b>Pk E22 = 4.0</b>	<b>10Pk E22 = 0.4</b>
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
<b>Tot E22 = 4</b>	Tot E32 = 0	

Grade = C



Teac 58-S (6x)

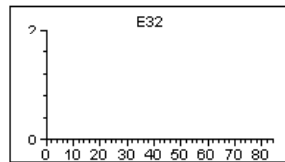
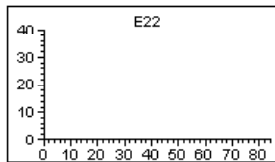
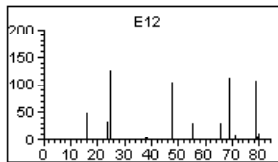
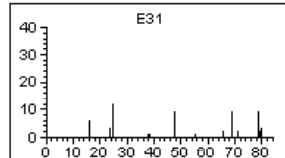
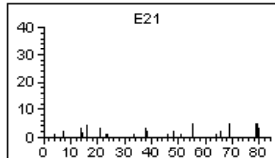
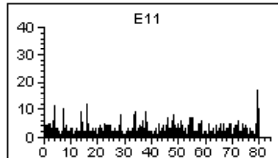
**Taiyo Yuden**

Serial Number HH34010925980

CIRC Test Results:

Av BLER = 0.6	Pk BLER = 17.0	10Pk BLER = 9.4
Av E11 = 0.5	Pk E11 = 17.0	10Pk E11 = 7.3
Av E21 = 0.0	Pk E21 = 5.0	10Pk E21 = 1.3
Av E31 = 0.0	Pk E31 = 12.0	10Pk E31 = 6.9
Av E12 = 0.3	Pk E12 = 126.0	<b>10Pk E12 = 72.2</b>
Av E22 = 0.0	Pk E22 = 0.0	10Pk E22 = 0.0
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
Tot E22 = 0	Tot E32 = 0	

Grade = A



Teac 58-S (6x)

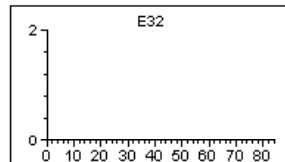
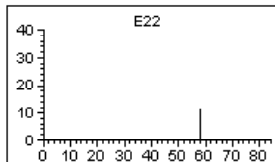
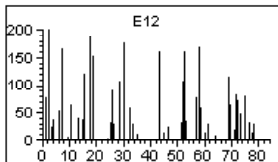
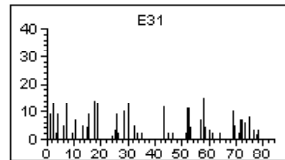
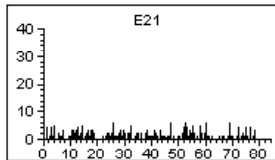
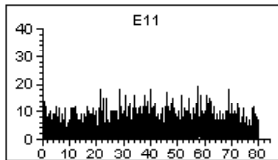
**Ritek**

Serial Number J312J5212202107B21

CIRC Test Results:

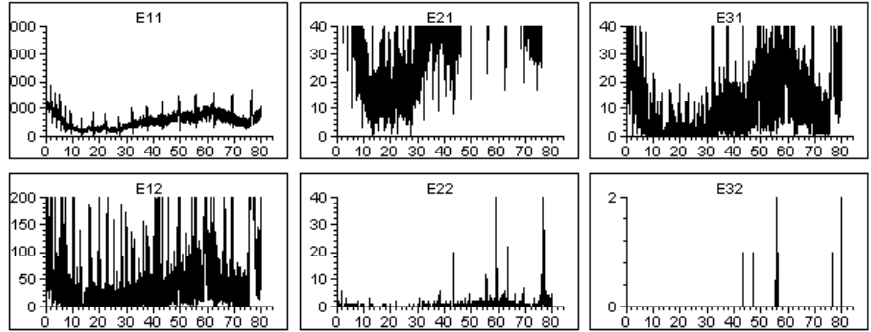
Av BLER = 3.1	Pk BLER = 24.0	10Pk BLER = 13.3
Av E11 = 2.8	Pk E11 = 19.0	10Pk E11 = 7.2
Av E21 = 0.1	Pk E21 = 6.0	10Pk E21 = 1.9
Av E31 = 0.2	Pk E31 = 15.0	10Pk E31 = 8.4
Av E12 = 1.8	Pk E12 = 209.0	<b>10Pk E12 = 84.4</b>
Av E22 = 0.0	<b>Pk E22 = 11.0</b>	<b>10Pk E22 = 1.1</b>
Av E32 = 0.0	Pk E32 = 0.0	10Pk E32 = 0.0
<b>Tot E22 = 11</b>	Tot E32 = 0	

Grade = C



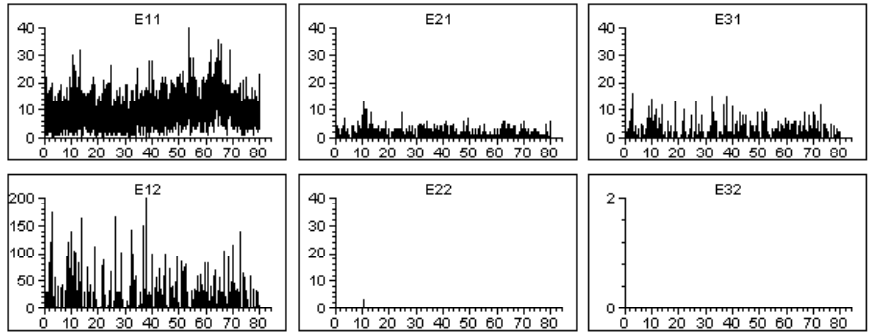
Teac 58-S (6x)  
**E-Top Mediatek**  
 Serial Number 410708A202B2 14434

CIRC Test Results:  
 Av BLER = 679.8    Pk BLER = 3144.0    10Pk BLER = 2702.6  
 Av E11 = 582.2    Pk E11 = 1848.0    10Pk E11 = 1545.1  
 Av E21 = 80.9    Pk E21 = 857.0    10Pk E21 = 703.7  
 Av E31 = 16.7    Pk E31 = 721.0    10Pk E31 = 479.6  
 Av E12 = 50.6    Pk E12 = 1325.0    10Pk E12 = 998.5  
 Av E22 = 0.4    Pk E22 = 48.0    10Pk E22 = 21.2  
 Av E32 = 0.0    Pk E32 = 2.0    10Pk E32 = 0.2  
 Tot E22 = 1882    Tot E32 = 10  
 Grade = F



Teac 58-S (6x)  
**Prodisc**  
 Serial Number 22409712 18208 01

CIRC Test Results:  
 Av BLER = 10.1    Pk BLER = 45.0    10Pk BLER = 31.0  
 Av E11 = 9.2    Pk E11 = 42.0    10Pk E11 = 28.2  
 Av E21 = 0.4    Pk E21 = 13.0    10Pk E21 = 5.5  
 Av E31 = 0.5    Pk E31 = 16.0    10Pk E31 = 12.3  
 Av E12 = 4.6    Pk E12 = 221.0    10Pk E12 = 158.7  
 Av E22 = 0.0    Pk E22 = 3.0    10Pk E22 = 0.3  
 Av E32 = 0.0    Pk E32 = 0.0    10Pk E32 = 0.0  
 Tot E22 = 3    Tot E32 = 0  
 Grade = C



## Summary

The only disc that performed well on all the tested drives was the Taiyo Yuden disc. On each drive, peak BLER was never higher than 20, and averages on all drives were below 1. There were no E22 or E32 errors.

The Ritek disc produced E22 errors on all but the Pioneer drive. E22 errors are always a bit of a concern, but in general, peaks and averages were acceptably low, and there were no E32 errors.

The disc from E-Top Mediatek performed acceptably on each drive, with the exception of the older Teac 58-S. In most cases, peak BLER was about 30, with good averages below 2, and no E22 or E32 errors, except on the Teac drive. The BLER result on the Teac was more than 10 times over specification on BLER, and had numerous E22 and E32 errors. We had to change the scale of the graph just to display the BLER, otherwise it would have been right off the scale. It is uncertain whether the problem is that the older Teac can't handle the dye of the disc, or if the disc just can't be burnt well at such a slow speed.

The Prodisc stayed within specification only on the Lite-On drive. Although the figures were roughly the same on each drive, the presence of E22 errors on the other drives is of some concern, although there were no E32 errors. Generally, peaks were around the 40 mark, with very high averages between 8 and 14.

[end]