ISO/IEC 30193:2016-06 (E)

Information technology - Digitally recorded media for information interchange and storage - 120 mm Triple Layer (100,0 Gbytes per disk) BD Rewritable disk

Contents

Page

1 Scope 1

2 Conformance 1
2.1 Optical Disk 1
2.2 Generating system 1
2.3 Receiving system 1
2.4 Compatibility statement 2

3 Normative references 2

4 Terms and definitions 2

5 Conventions and notations 7
5.1 Terminology: 7
5.1.1 Meaning of words 7
5.1.2 Levels of grouping 7
5.2 Representation of numbers 7
5.3 Integer calculus 8
5.4 Names 8

6 List of acronyms 9

7 General description of disk 11

8 General requirements 12
8.1 Environments 12
8.1.1 Test environment 12
8.1.2 Operating environment 12
8.1.3 Storage environment 13
8.1.4 Transportation 14
8.2 Safety requirements 14
8.3 Flammability 14

9 Reference drive 14
9.1 General 14
9.2 Measurement conditions 14
9.3 Optical system 14
9.4 Optical beam 15
9.5 HF read channel 16
9.6 Radial PP read channel 16
9.7 Disk Clamping 16
9.8 Rotation of disk and Measurement Velocity 17
9.9 Normalized servo transfer function 17
9.10 Measurement Velocities and Reference servos for axial tracking 18
9.10.1 General 18
9.10.2 Reference servo for axial tracking 18
9.11 Measurement Velocities and Reference servos for radial tracking 19
9.11.1 General 19
9.11.2 Reference servo for radial tracking 19

10 Dimensional characteristics 20

10.1 General 20
10.2 Disk reference planes and reference axis 21
10.3 Overall dimensions 22
10.4 First transition Area 23
10.5 Protection ring 23
10.6 Clamping Zone 23
10.7 Second transition Area 23
10.8 Information Area 24
10.8.1 General 24
10.8.2 Subdivision of Information Zone on TL disk 24
10.9 Rim Area 25

11 Mechanical characteristics 26
11.1 Mass 26
11.2 Moment of inertia 26
11.3 Dynamic imbalance 26
11.4 Axial runout 26
11.4.1 General 26
11.4.2 Residual axial tracking error 26
11.5 Radial runout 26
11.5.1 General 26
11.5.2 Residual radial tracking error 27
11.6 Durability of Cover Layer 27
11.6.1 Impact resistance of Cover Layer 27
11.6.2 Scratch resistance of Cover Layer 27
11.6.3 Repulsion of fingerprints by Cover Layer 27

12 Optical characteristics in Information Area 27
12.1 General 27
12.2 Refractive index of Transmission Stacks (TS) 27
12.3 Thickness of Transmission Stacks (TS) 27
12.4 Example of target thickness of Spacer Layers for TL disks 28
12.5 Reflectivity of Recording Layers 30
12.6 Birefringence 31
12.7 Angular deviation 31

13 Data Format 32
13.1 General 32
13.2 Data Frame 35
13.3 Error-Detection Code (EDC) 35
13.4 Scrambled Data Frame 35
13.5 Data Block 36
13.6 LDC Block 37
13.7 LDC code-words 37
13.8 LDC Cluster 38
13.8.1 General 38
13.8.2 First interleaving step 38
13.8.3 Second interleaving step 38
13.9 Addressing and Control Data 41
13.9.1 General 41
13.9.2 Address Units 41
13.9.3 User-Control Data 45
13.9.4 Byte/Bit assignment for User-Control Data 45
13.10 Access Block 47
13.11 BIS Block 47
13.12 BIS code-words 48
13.13 BIS Cluster 49
13.14 ECC Cluster 52
13.15 Recording Frames 53
13.16 Physical Cluster 54
13.17 17PP Modulation for Recordable data 54
13.17.1 General 54

13.17.2 Bit conversion rules 54
13.17.3 dc-control procedure 55
13.17.4 Frame Sync 55
13.18 Modulation and NRZI conversion 57

14 Physical Data Allocating and Linking 57
14.1 General 57
14.2 Recording-Unit Block (RUB) 57
14.2.1 General 57
14.2.2 Data Run-in 58
14.2.3 Data Run-out 59
14.2.4 Guard_3 field 60
14.3 Locating data relative to wobble addresses 60
14.3.1 General 60
14.3.2 Start-Position Shift (SPS) 60

15 Track format 62
15.1 General 62
15.2 Track shape 62
15.3 Track path 64
15.4 Track Pitch 64
15.4.1 Track Pitch in BCA Zone 64
15.4.2 Track Pitch in Embossed HFM Areas 64
15.4.3 Track Pitch in Rewritable Areas 64
15.4.4 Track Pitch between Embossed HFM Area and Rewritable Area 64
15.5 Track layout of HFM Grooves 65
15.5.1 General 65
15.5.2 Data Format 65
15.5.3 Addressing and Control Data 66
15.5.4 Recording Frames 69
15.6 Track layout of Wobbled Grooves 71
15.6.1 General 71
15.6.2 Modulation of wobbles 71
15.6.3 Wobble polarity 73
15.7 ADIP information 73
15.7.1 General 73
15.7.2 ADIP-Unit Types 73
15.7.3 ADIP word structure 74
15.7.4 ADIP data structure 75
15.7.5 ADIP error correction 78
15.8 Disk Information in ADIP Aux Frame 80
15.8.1 General 80
15.8.2 Error protection for Disk Information Aux Frames 81
15.8.3 Disk-Information data structure 82

16 General description of Information Zone 122
16.1 General 122
16.2 Format of Information Zone 122

17 Layout of Rewritable Area of Information Zone 122

18 Inner Zone 127
18.1 General 127
18.2 Permanent Information & Control data (PIC) Zone 130
18.2.1 General 130
18.2.2 Content of PIC Zone 131
18.2.3 Emergency Brake 132
18.3 Rewritable Area of Inner Zone(s) 133
18.3.1 Protection-Zone 2 133
18.3.2 Buffer 134
18.3.3 INFO 2/Reserved 8 134
18.3.4 INFO 2/Reserved 7 134

18.3.5 INFO 2/Reserved 6 134
18.3.6 INFO 2/Reserved 5 134
18.3.7 INFO 2/PAC 2 134
18.3.8 INFO 2/Reserved 134
18.3.9 INFO 2/DMA 2 134
18.3.10 INFO 2/Control Data 2 134
18.3.11 INFO 2/Buffer 2 134
18.3.12 OPC/Test Zone 135
18.3.13 Reserved 135
18.3.14 INFO 1/Buffer 1 135
18.3.15 INFO 1/Drive Area (optional) 135
18.3.16 INFO 1/Reserved 3 136
18.3.17 INFO 1/Reserved 2 136
18.3.18 INFO 1/Reserved 1 136
18.3.19 INFO 1/DMA 1 136
18.3.20 INFO 1/Control Data 1 136
18.3.21 INFO 1/PAC 1 137
18.3.22 INFO 1/Reserved 137

19 Data Zone 137

20 Outer Zone(s) 137
20.1 General 137
20.2 INFO 3/Buffer 3 138
20.3 INFO 3/DMA 3 138
20.4 INFO 3/Control Data 3 138
20.5 Angular buffer 138
20.6 INFO 4/DMA 4 138
20.7 INFO 4/Control Data 4 138
20.8 INFO 4/Buffer 4 138
20.9 DCZ0/Test Zone, DCZ1/Test Zone and DCZ2/Test Zone 138
20.10 Protection-Zone 3 139

21 Physical-Access Control Clusters 139
21.1 General 139
21.2 Layout of PAC Zones 139
21.3 General structure of PAC Clusters 140
21.4 Primary PAC Cluster (mandatory) 144
21.5 Disk Write-Protect PAC Cluster (optional) 147
21.6 IS1 and IS2 PAC Clusters 151

22 Disk Management 152
22.1 General 152
22.2 Disk-Management Structure (DMS) 153
22.2.1 General 153
22.2.2 Disk-Definition Structure (DDS) 154
22.2.3 Defect List (DFL) 158

23 Assignment of Logical-Sector Numbers (LSNs) 164

24 Characteristics of Grooved Areas 165

25 Method of testing for Grooved Area 165
25.1 General 165
25.2 Environment 165
25.3 Reference drive 165
25.3.1 General 165
25.3.2 Read power 166
25.3.3 Read channels 166
25.3.4 Tracking requirements 166
25.3.5 Scanning velocities 166
25.4 Definition of signals 166

26 Signals from HFM Grooves 167
26.1 Push-Pull polarity 167
26.2 Push-Pull signal 167
26.3 Wobble signal 168
26.4 Jitter of HFM signal 168

27 Signals from Wobbled Grooves 168
27.1 Phase depth 168
27.2 Push-Pull signal 168
27.3 Wobble signal 169
27.3.1 General 169
27.3.2 Measurement of NWS 169
27.3.3 Measurement of the wobble CNR 169
27.3.4 Measurement of harmonic distortion of wobble 169

28 Characteristics of Recording Layer 169

29 Method of testing for Recording Layer 170
29.1 General 170
29.2 Environment 170
29.3 Reference drive 170
29.3.1 General 170
29.3.2 Read power 170
29.3.3 Read channels 170
29.3.4 Tracking requirements 170
29.3.5 Scanning velocities 170
29.4 Write conditions 170
29.4.1 Write-pulse waveform 170
29.4.2 Write powers 171
29.4.3 Average power 171
29.4.4 Write conditions for i-MLSE measurement 171
29.4.5 Write conditions for cross-erase measurements 171
29.5 Definition of signals 172

30 Signals from Recorded Areas 172
30.1 HF signals 172
30.2 Modulated amplitude 172
30.3 Reflectivity-Modulation product 173
30.4 Asymmetry 173
30.5 i-MLSE@DOW(n) 174
30.6 Cross-erase @ DOW(n)XE 174
30.7 Read stability 174

31 Local defects 175

32 Characteristics of User Data 175

33 Method of testing for User Data 175
33.1 General 175
33.2 Environment 176
33.3 Reference drive 176
33.3.1 General 176
33.3.2 Read power 176
33.3.3 Read channels 176
33.3.4 Error correction 176
33.3.5 Tracking requirements 176
33.3.6 Scanning velocities 176
33.4 Definition of signals 176

34 Minimum quality of recorded information 177
34.1 General 177

34.2 Random Symbol Error Rate 177
34.3 Maximum burst errors 178
34.4 User-written Data 178

35 BCA 178

Annex A (normative) Thickness of Transmission Stacks in case of multiple layers 179

A.1 General 179
A.2 Refractive Index ni of all layers in Cover and Spacer Layers 179
A.3 Thickness variation of Transmission Stack 179
A.4 Thickness variations of Spacer Layers 179
A.5 Example of thickness calculation 180

Annex B (normative) Measurement of reflectivity 181

B.1 General 181
B.2 Calibration method 181
B.3 Measuring method 182
B.4 Procedure for compensating stray light effect from observed reflectivity 183

Annex C (normative) Measurement of scratch resistance of Cover Layer 186

C.1 General 186
C.2 Taber Abrasion test 186

Annex D (normative) Measurement of repulsion of grime by Cover Layer 188

D.1 General 188
D.2 Specifications of stamp 188
D.3 Preparation of ink 189
D.4 Preparation of ink pad 189
D.5 Using ink pad and stamp 190

Annex E (normative) Measurement of wobble amplitude 191

E.1 Measurement methods 191
E.2 Calibration of filters 195

Annex F (normative) Write-pulse waveform for testing 196

F.1 General write-pulse waveform 196
F.2 Extended N-1 write strategy 196
F.3 Extended N/2 write strategy 199
F.4 Definitions of pulse widths and rise and fall times 203

Annex G (normative) Optimum Power Control (OPC) procedure for disk 204

G.1 General 204
G.2 Mathematical model for modulation versus power function 204
G.3 Procedure for determination of OPC parameters for disk 205

Annex H (normative) HF signal Pre-processing for i-MLSE(Integrated-Maximum Likelihood Sequence Error Estimation) measurements 207

H.1 General 207
H.2 General implementation of i-MLSE measurement syatem 207
H.3 Specifications of Analogue filters (HPF and LPF) 207
H.4 Specifications of A/D Converter 207
H.5 Specifications of offset canceller 208
H.6 Specifications of Auto Gain Controller (AGC) 208
H.7 Specifications of Interpolator 209

H.8 Specificationes of Phase Locked Loop 211
H.9 Specifications of Digital Equalizer 211
H.10 Specifications of Adaptive Equalizer 212
H.11 Specifications of Viterbi detector 213
H.12 Description of i-MLSE(Integrated - Maximum Likelihood Sequence Error Estimation) 213
H.12.1 General 213
H.12.2 General implementation of i-MLSE detection units 213
H.12.3 Pattern Detector 214
H.12.4 Metric Difference Calculator 215
H.12.5 Error rate estimation 216
H.12.6 i-MLSE calculation 219

Annex I (normative) Measurement procedures 220

I.1 General 220
I.2 Initial adjustments of Reference drive 220
I.3 i-MLSE measurement 220
I.4 Modulated amplitude measurements 220
I.5 Measurements of Resolution I3pp / I8pp 220
I.6 Measurement of Modulation I8pp / I8H and I3pp / I8H 222
I.7 Asymmetry measurement 223
I.7.1 General 223
I.7.2 Sampling method 223
I.7.3 Level calculation block (Averaging method) 224
I.7.4 Asymmetry calculation 226
I.8 Measurement of light reflectivity 227
I.8.1 General 227
I.8.2 Measurement procedure of light reflectivity 227
I.9 Tracking-error signal measurements (PPnorm measurement procedure) 227
I.10 Residual error of axial tracking measurement procedure 229
I.11 Residual error of radial tracking measurement procedure 229
I.12 Random SER measurement 230

Annex J (informative) Measurement of birefringence 231

J.1 Principle of measurement 231
J.2 Measurements conditions 231
J.3 Example of measurement procedure 231
J.4 Interchangeability of measuring results 232

Annex K (informative) Measurement of thickness of Cover Layer and Spacer Layer 233

K.1 Focussing method 233
K.2 Interferometer method 233

Annex L (informative) Measurement of impact resistance of Cover Layer 236

L.1 General 236
L.2 Recommendation for drives 236
L.3 Measurements of impact resistance of Cover Layer 236

Annex M (informative) Groove deviation and wobble amplitude 238

M.1 Relation between NWS and wobble amplitude 238
M.2 Tolelance of NWS 238

Annex N (informative) Guidline for write pulse adjustment using L-SEAT edge-shift 240

N.1 General 240
N.2 General implementation of edge-shift detection system 240
N.2.1 Edge-shift evaluation unit 240
N.2.2 Analogue filters (HPF, LPF) 240

N.2.3 AD Converter 240
N.2.4 Offset canceller 240
N.2.5 Auto Gain Controller (AGC) 241
N.2.6 Interpolator 241
N.2.7 PLL 241
N.2.8 Digital Equalizer 241
N.2.9 Adaptive Equalizer 241
N.2.10 Viterbi detector 241
N.2.11 L-SEAT evaluation block 241
N.3 HF signal processing for L-SEAT 242
N.3.1 General 242
N.3.2 Definition of L-SEAT 242
N.3.3 Edge detection bit patterns 243
N.4 General implementation of L-SEAT evaluation block 246
N.5 General write pulse adjustment procedure 247