ISO/IEC 30193:2013-07 (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

Foreword x

Introduction x

1 Scope 1

2 Conformance 1
2.1 Optical Disk 1
2.2 Generating system 1
2.3 Receiving system 2
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 22
10.5 Protection ring 22
10.6 Clamping Zone 23
10.7 Second transition Area 23
10.8 Information Area 23
10.8.1 General 23
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) 28
12.4 Example of target thickness of Spacer Layers for TL disks 29
12.5 Reflectivity of Recording Layers 31
12.6 Birefringence 31
12.7 Angular deviation 31

13 Data Format 33
13.1 General 33
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 39
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 48
13.14 ECC Cluster 51

13.15 Recording Frames 51
13.16 Physical Cluster 52
13.17 17PP Modulation for Recordable data 52
13.17.1 General 52
13.17.2 Bit conversion rules 52
13.17.3 dc-control procedure 53
13.17.4 Frame Sync 53
13.18 Modulation and NRZI conversion 55

14 Physical Data Allocating and Linking 55
14.1 General 55
14.2 Recording-Unit Block (RUB) 55
14.2.1 General 55
14.2.2 Data Run-in 56
14.2.3 Data Run-out 57
14.2.4 Guard_3 field 58
14.3 Locating data relative to wobble addresses 58
14.3.1 General 58
14.3.2 Start-Position Shift (SPS) 58

15 Track format 60
15.1 General 60
15.2 Track shape 60
15.3 Track path 62
15.4 Track Pitch 62
15.4.1 Track Pitch in BCA Zone 62
15.4.2 Track Pitch in Embossed HFM Areas 62
15.4.3 Track Pitch in Rewritable Areas 62
15.4.4 Track Pitch between Embossed HFM Area and Rewritable Area 63
15.5 Track layout of HFM Grooves 63
15.5.1 General 63
15.5.2 Data Format 63
15.5.3 Addressing and Control Data 64
15.5.4 Recording Frames 67
15.6 Track layout of Wobbled Grooves 69
15.6.1 General 69
15.6.2 Modulation of wobbles 69
15.6.3 Wobble polarity 70
15.7 ADIP information 71
15.7.1 General 71
15.7.2 ADIP-Unit Types 71
15.7.3 ADIP word structure 72
15.7.4 ADIP data structure 73
15.7.5 ADIP error correction 76
15.8 Disk Information in ADIP Aux Frame 78
15.8.1 General 78
15.8.2 Error protection for Disk Information Aux Frames 78
15.8.3 Disk-Information data structure 79

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 133
18.3.3 INFO 2 / Reserved 8 133
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 INFO2 / PAC 2 134
18.3.8 INFO2 / Reserved 134
18.3.9 INFO2 / DMA 2 134
18.3.10 INFO2 / Control Data 2 134
18.3.11 INFO2 / Buffer 2 134
18.3.12 OPC / Test Zone 134
18.3.13 Reserved 134
18.3.14 INFO1 / Buffer 1 135
18.3.15 INFO1 / Drive Area (optional) 135
18.3.16 INFO1 / Reserved 3 136
18.3.17 INFO1 / Reserved 2 136
18.3.18 INFO1 / Reserved 1 136
18.3.19 INFO1 / DMA 1 136
18.3.20 INFO1 / Control Data 1 136
18.3.21 INFO1 / PAC 1 136
18.3.22 INFO1 / Reserved 137

19 Data Zone 137

20 Outer Zone(s) 137
20.1 General 137
20.2 INFO3 / Buffer 3 138
20.3 INFO3 / DMA 3 138
20.4 INFO3 / Control Data 3 138
20.5 Angular buffer 138
20.6 INFO4 / DMA 4 138
20.7 INFO4 / Control Data 4 138
20.8 INFO4 / Buffer 4 138
20.9 DCZ0 / Test Zone, DCZ1 / Test Zone and DCZ2 / Test Zone 138
20.10 Protection-Zone 3 138

21 Physical-Access Control Clusters 138
21.1 General 138
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 153
22.1 General 153
22.2 Disk-Management Structure (DMS) 154
22.2.1 General 154
22.2.2 Disk-Definition Structure (DDS) 156
22.2.3 Defect List (DFL) 160

23 Assignment of Logical-Sector Numbers (LSNs) 165

24 Characteristics of Grooved Areas 167

25 Method of testing for Grooved Area 167
25.1 General 167
25.2 Environment 167
25.3 Reference drive 167
25.3.1 General 167
25.3.2 Read power 167

25.3.3 Read channels 167
25.3.4 Tracking requirements 167
25.3.5 Scanning velocities 168
25.4 Definition of signals 168

26 Signals from HFM Grooves 169
26.1 Push-Pull polarity 169
26.2 Push-Pull signal 169
26.3 Wobble signal 169
26.4 Jitter of HFM signal 169

27 Signals from Wobbled Grooves 170
27.1 Phase depth 170
27.2 Push-Pull signal 170
27.3 Wobble signal 170
27.3.1 General 170
27.3.2 Measurement of NWS 170
27.3.3 Measurement of the wobble CNR 171
27.3.4 Measurement of harmonic distortion of wobble 171

28 Characteristics of Recording Layer 171

29 Method of testing for Recording Layer 171
29.1 General 171
29.2 Environment 171
29.3 Reference drive 171
29.3.1 General 171
29.3.2 Read power 172
29.3.3 Read channels 172
29.3.4 Tracking requirements 172
29.3.5 Scanning velocities 172
29.4 Write conditions 172
29.4.1 Write-pulse waveform 172
29.4.2 Write powers 172
29.4.3 Average power 173
29.4.4 Write conditions for i-MLSE measurement 173
29.4.5 Write conditions for cross-erase measurements 173
29.5 Definition of signals 173

30 Signals from Recorded Areas 174
30.1 HF signals 174
30.2 Modulated amplitude 174
30.3 Reflectivity-Modulation product 175
30.4 Asymmetry 176
30.5 i-MLSE@DOW(n) 176
30.6 Cross-erase @ DOW(n)XE 176
30.7 Read stability 177

31 Local defects 177

32 Characteristics of User Data 178

33 Method of testing for User Data 178
33.1 General 178
33.2 Environment 178
33.3 Reference drive 178
33.3.1 General 178
33.3.2 Read power 178
33.3.3 Read channels 178
33.3.4 Error correction 178
33.3.5 Tracking requirements 178
33.3.6 Scanning velocities 178

33.4 Definition of signals 179

34 Minimum quality of recorded information 180
34.1 General 180
34.2 Random Symbol Error Rate 180
34.3 Maximum burst errors 180
34.4 User-written Data 180

35 BCA 180

Annex A (normative) Thickness of Transmission Stacks in case of multiple layers 182

A.1 General 182
A.2 Refractive Index ni of all layers in Cover and Spacer Layers 182
A.3 Thickness variation of Transmission Stack 182
A.4 Thickness variations of Spacer Layers 182
A.5 Example of thickness calculation 183

Annex B (normative) Measurement of reflectivity 184

B.1 General 184
B.2 Calibration method 184
B.3 Measuring method 185
B.4 Procedure for compensating stray light effect from observed reflectivity 186

Annex C (normative) Measurement of scratch resistance of Cover Layer 189

C.1 General 189
C.2 Taber Abrasion test 189

Annex D (normative) Measurement of repulsion of grime by Cover Layer 191

D.1 General 191
D.2 Specifications of stamp 191
D.3 Preparation of ink 192
D.4 Preparation of ink pad 192
D.5 Using ink pad and stamp 193

Annex E (normative) Measurement of wobble amplitude 194

E.1 Measurement methods 194
E.2 Calibration of filters 197

Annex F (normative) Write-pulse waveform for testing 198

F.1 General write-pulse waveform 198
F.2 Extended N-1 write strategy 198
F.3 Extended N/2 write strategy 202
F.4 Definitions of pulse widths and rise and fall times 206

Annex G (normative) Optimum Power Control (OPC) procedure for media 208

G.1 General 208
G.2 Mathematical model for modulation versus power function 208
G.3 Procedure for determination of OPC parameters for media 210

Annex H (normative) HF signal Pre-processing for i-MLSE(Integrated-Maximum Likelihood Sequence Error Estimation) measurements 211

H.1 General 211
H.2 General implementation of i-MLSE measurement syatem 211
H.3 Specifications of Analogue filters (HPF and LPF) 211

H.4 Specifications of A/D Converter 212
H.5 Specifications of offset canceller 212
H.6 Specifications of Auto Gain Controller (AGC) 212
H.7 Specifications of Interpolator 213
H.8 Specifiationes of Phase Locked Loop 215
H.9 Specifications of Digital Equalizer 215
H.10 Specifications of Adaptive Equalizer 216
H.11 Specifications of Viterbi detector 217
H.12 Description of i-MLSE(Integrated - Maximum Likelihood Sequence Error Estimation) 217
H.12.1 General 217
H.12.2 General implementation of i-MLSE detection units 217
H.12.3 Pattern Detector 218
H.12.4 Metric Difference Calculator 219
H.12.5 Error rate estimation 220
H.12.6 i-MLSE calculation 223

Annex I (normative) Measurement procedures 224

I.1 General 224
I.2 Initial adjustments of Reference drive 224
I.3 i-MLSE measurement 224
I.4 Modulated amplitude measurements 224
I.5 Measurements of Resolution I3pp / I8pp 225
I.6 Measurement of Modulation I8pp / I8H and I3pp / I8H 226
I.7 Asymmetry measurement 227
I.7.1 General 227
I.7.2 Sampling method 227
I.7.3 Level calculation block (Averaging method) 228
I.7.4 Asymmetry calculation 230
I.8 Measurement of light reflectivity 231
I.8.1 General 231
I.8.2 Measurement procedure of light reflectivity 231
I.9 Tracking-error signal measurements (PPnorm measurement procedure) 232
I.10 Residual error of axial tracking measurement procedure 233
I.11 Residual error of radial tracking measurement procedure 233
I.12 Random SER measurement 234

Annex J (informative) Measurement of birefringence 235

J.1 Principle of measurement 235
J.2 Measurements conditions 235
J.3 Example of measurement procedure 236
J.4 Interchangeability of measuring results 236

Annex K (informative) Measurement of thickness of Cover Layer and Spacer Layer 237

K.1 Focussing method 237
K.2 Interferometer method 237

Annex L (informative) Measurement of impact resistance of Cover Layer 240

L.1 General 240
L.2 Recommendation for drives 240
L.3 Measurements of impact resistance of Cover Layer 240

Annex M (informative) Groove deviation and wobble amplitude 241

M.1 Relation between NWS and wobble amplitude 241
M.2 Tolelance of NWS 241

Annex N (informative) Guidline for write pulse adjustment using L-SEAT edge-shift 243

N.1 General 243
N.2 General implementation of edge-shift detection system 243
N.2.1 Edge-shift evaluation unit 243
N.2.2 Analogue filters (HPF, LPF) 243
N.2.3 AD Converter 243
N.2.4 Offset canceller 243
N.2.5 Auto Gain Controller (AGC) 244
N.2.6 Interpolator 244
N.2.7 Phase Locked Loop 244
N.2.8 Digital Equalizer 244
N.2.9 Adaptive Equalizer 244
N.2.10 Viterbi detector 244
N.2.11 L-SEAT evaluation block 244
N.3 HF signal processing for L-SEAT 245
N.3.1 General 245
N.3.2 Definition of L-SEAT 245
N.3.3 Edge detection bit patterns 246
N.4 General implementation of L-SEAT evaluation block 249
N.5 General write pulse adjustment procedure 250

Bibliography 252