

# ISO/IEC 30190:2021 (E)

## Information technology — Digitally recorded media for information interchange and storage — 120 mm Single Layer (25,0 Gbytes per disk) and Dual Layer (50,0 Gbytes per disk) BD Recordable disk

---

### Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
4	Symbol and abbreviated terms
5	Conformance
5.1	Optical disk
5.2	Generating system
5.3	Receiving system
5.4	Compatibility statement
6	Conventions and notations
6.1	Levels of grouping
6.2	Representation of numbers
6.3	Integer calculus
7	General description of disk
8	General requirements
8.1	Environments
8.1.1	Test environment
8.1.1.1	General
8.1.1.2	Test conditions for sudden change in operating environment
8.1.2	Operating environment
8.1.3	Storage environment
8.1.3.1	General
8.1.3.2	Climate storage tests
8.1.4	Transportation
8.1.4.1	General
8.1.4.2	Packaging
8.1.4.2.1	General
8.1.4.2.2	Temperature and humidity
8.1.4.2.3	Impact loads and vibrations
8.2	Safety requirements
8.3	Flammability
9	Reference drive
9.1	General
9.2	Measurement conditions
9.3	Optical system
9.4	Optical beam
9.5	HF read channel
9.6	Radial PP read channel
9.7	Disk clamping
9.8	Rotation of disk and measurement velocity

- 9.9 Normalized servo transfer function
- 9.10 Measurement velocities and reference servos for axial tracking
  - 9.10.1 General
  - 9.10.2 Reference servo for axial tracking for 1x measurement velocity
  - 9.10.3 Reference servo for axial tracking for 2x measurement velocity and 3x measurement velocity
- 9.11 Measurement velocities and reference servos for radial tracking
  - 9.11.1 General
  - 9.11.2 Reference servo for radial tracking for 1x measurement velocity
  - 9.11.3 Reference servo for radial tracking for 2x measurement velocity and 3x measurement velocity
- 10 Dimensional characteristics
  - 10.1 General
  - 10.2 Disk reference planes and reference axis
  - 10.3 Overall dimensions
  - 10.4 First transition area
  - 10.5 Protection ring
  - 10.6 Clamping zone
  - 10.7 Second transition area
  - 10.8 Information area
    - 10.8.1 General
    - 10.8.2 Subdivision of information zone on SL disks
    - 10.8.3 Subdivision of information zone on DL disks
  - 10.9 Rim area
- 11 Mechanical characteristics
  - 11.1 Mass
  - 11.2 Moment of inertia
  - 11.3 Dynamic imbalance
  - 11.4 Axial run-out
    - 11.4.1 General
    - 11.4.2 Residual axial tracking error for 1x measurement velocity
    - 11.4.3 Residual axial tracking error for 2x measurement velocity
    - 11.4.4 Residual axial tracking error for 3x measurement velocity
  - 11.5 Radial run-out
    - 11.5.1 General
    - 11.5.2 Residual radial tracking error for 1x measurement velocity on SL disks
    - 11.5.3 Residual radial tracking error for 1x measurement velocity on DL disks
    - 11.5.4 Residual radial tracking error for 2x measurement velocity on SL and DL disks
    - 11.5.5 Residual radial tracking error for 3x measurement velocity on SL and DL disks
  - 11.6 Durability of cover layer
    - 11.6.1 Impact resistance of cover layer
    - 11.6.2 Scratch resistance of cover layer
    - 11.6.3 Repulsion of fingerprints by cover layer
- 12 Optical characteristics in information area
  - 12.1 General
  - 12.2 Refractive index of transmission stacks (TS)
  - 12.3 Thickness of transmission stacks (TS)
    - 12.3.1 Thickness of transmission stack of SL disks
    - 12.3.2 Thickness of transmission stacks of DL disks
  - 12.4 Reflectivity
    - 12.4.1 Reflectivity of recording layer of SL disks
    - 12.4.2 Reflectivity of recording layers of DL disks
  - 12.5 Birefringence
  - 12.6 Angular deviation
- 13 Data format
  - 13.1 General
  - 13.2 Data frame
  - 13.3 Error detection code (EDC)
  - 13.4 Scrambled data frame
  - 13.5 Data block

- 13.6 LDC block
  - 13.7 LDC code words
  - 13.8 LDC cluster
    - 13.8.1 General
    - 13.8.2 First interleaving step
    - 13.8.3 Second interleaving step
  - 13.9 Addressing and control data
    - 13.9.1 General
    - 13.9.2 Address units
      - 13.9.2.1 General
      - 13.9.2.2 Byte assignment for address fields
      - 13.9.2.3 Address unit numbers
      - 13.9.2.4 Assignments for flag bits
      - 13.9.2.5 Usage of status bits Sai,j
    - 13.9.3 User control data
    - 13.9.4 Byte/bit assignment for user control data
  - 13.10 Access block
  - 13.11 BIS block
  - 13.12 BIS code words
  - 13.13 BIS cluster
  - 13.14 ECC cluster
  - 13.15 Recording frames
  - 13.16 Physical cluster
  - 13.17 17PP modulation for recordable data
    - 13.17.1 General
    - 13.17.2 Bit conversion rules
    - 13.17.3 dc-control procedure
    - 13.17.4 Frame sync
  - 13.18 Modulation and NRZI conversion
- 14 Physical data allocating and linking
- 14.1 General
  - 14.2 Recording unit block (RUB)
    - 14.2.1 General
    - 14.2.2 Data run-in
      - 14.2.2.1 General
      - 14.2.2.2 Content of Guard\_1 fields
      - 14.2.2.3 Automatic power control (APC)
      - 14.2.2.4 Content of PrA fields
    - 14.2.3 Data run-out
      - 14.2.3.1 General
      - 14.2.3.2 Content of PoA fields
      - 14.2.3.3 Content of Guard\_2 fields
    - 14.2.4 Guard\_3 field
      - 14.2.4.1 General
      - 14.2.4.2 Automatic power control (APC)
      - 14.2.4.3 Linking requirements
  - 14.3 Locating data relative to wobble addresses
- 15 Track format
- 15.1 General
  - 15.2 Track shape
  - 15.3 Track path
  - 15.4 Track pitch
    - 15.4.1 Track pitch in BCA zone
    - 15.4.2 Track pitch in embossed HFM area
    - 15.4.3 Track pitch in recordable area(s)
    - 15.4.4 Track pitch between embossed HFM area and recordable area
  - 15.5 Track layout of HFM groove
    - 15.5.1 General
    - 15.5.2 Data format
      - 15.5.2.1 Data frame
      - 15.5.2.2 Scrambled data frame
      - 15.5.2.3 Data block

- 15.5.2.4 LDC block
- 15.5.2.5 Interleaving
- 15.5.3 Addressing and control data
  - 15.5.3.1 General
  - 15.5.3.2 Address fields
  - 15.5.3.3 User control data
  - 15.5.3.4 BIS code words
  - 15.5.3.5 BIS cluster
- 15.5.4 Recording frames
  - 15.5.4.1 General
  - 15.5.4.2 Modulation
  - 15.5.4.3 Frame sync
- 15.6 Track layout of wobbled groove(s)
  - 15.6.1 General
  - 15.6.2 Modulation of wobbles
    - 15.6.2.1 General
    - 15.6.2.2 MSK-cos modulation
    - 15.6.2.3 HMW modulation
  - 15.6.3 Wobble polarity
- 15.7 ADIP information
  - 15.7.1 General
  - 15.7.2 ADIP unit types
  - 15.7.3 ADIP word structure
  - 15.7.4 ADIP data structure
    - 15.7.4.1 General
    - 15.7.4.2 ADIP information bit assignments
    - 15.7.4.3 Relation between physical ADIP addresses on layer L0 and layer L1
  - 15.7.5 ADIP error correction
- 15.8 Disk information in ADIP frame
  - 15.8.1 General
  - 15.8.2 Error protection for disk information aux frames
  - 15.8.3 Disk information data structure
    - 15.8.3.1 General
    - 15.8.3.2 General definitions for DI unit
    - 15.8.3.3 Definitions for DI format 1 (N-1 write strategy)
    - 15.8.3.4 Definitions for DI format 2 (N/2 write strategy)
    - 15.8.3.5 Definition for DI format 3 (Castle write strategy)
    - 15.8.3.6 Write strategy requirements
    - 15.8.3.7 Usage of DI units for write strategy
- 16 General description of information zone
  - 16.1 General
  - 16.2 Format of information zone on single-layer disk
  - 16.3 Format of information zone on dual-layer disk
- 17 Layout of recordable area of information zone
- 18 Inner zone
  - 18.1 General
  - 18.2 Permanent information and control data (PIC) zone
    - 18.2.1 General
    - 18.2.2 Content of PIC zone
    - 18.2.3 Emergency brake
  - 18.3 Recordable area of inner zone 0
    - 18.3.1 Protection zone 2
    - 18.3.2 INFO 2/Reserved 8
    - 18.3.3 INFO 2/Reserved 7
    - 18.3.4 INFO 2/Reserved 6
    - 18.3.5 INFO 2/Reserved 5
    - 18.3.6 INFO 2/PAC 2
    - 18.3.7 INFO 2/DMA 2
    - 18.3.8 INFO 2/Control data 2
    - 18.3.9 INFO 2/Buffer 2
    - 18.3.10 OPC 0/Test zone

- 18.3.11 Usage of OPC areas
  - 18.3.11.1 OPC procedure order
  - 18.3.11.2 OPC physical cluster usage
  - 18.3.11.3 OPC update in TDMA
- 18.3.12 OPC 0/OPC 0 Buffer
- 18.3.13 TDMA 0
- 18.3.14 INFO 1/Pre-write area
- 18.3.15 INFO 1/Drive area
  - 18.3.15.1 General
  - 18.3.15.2 Format of drive-specific information
- 18.3.16 INFO 1/DMA 1
- 18.3.17 INFO 1/Control data 1
- 18.3.18 INFO 1/PAC 1
- 18.4 Recordable area of inner zone 1
  - 18.4.1 Buffer
  - 18.4.2 OPC 1
  - 18.4.3 Buffer
  - 18.4.4 INFO 2/Reserved 8
  - 18.4.5 INFO 2/Reserved 7
  - 18.4.6 INFO 2/Reserved 6
  - 18.4.7 INFO 2/Reserved 5
  - 18.4.8 INFO 2/PAC 2
  - 18.4.9 INFO 2/DMA 2
  - 18.4.10 INFO 2/Control data 2
  - 18.4.11 INFO 2/Buffer 2
  - 18.4.12 TDMA 1
  - 18.4.13 Reserved
  - 18.4.14 INFO 1/Pre-write area
  - 18.4.15 INFO 1/Drive area
  - 18.4.16 INFO 1/DMA 1
  - 18.4.17 INFO 1/Control data 1
  - 18.4.18 INFO 1/PAC 1
- 19 Data zone
- 20 Outer zone(s)
  - 20.1 General
  - 20.2 Recordable area of outer zone(s)
    - 20.2.1 INFO 3/Buffer 4
    - 20.2.2 INFO 3/DMA 3
    - 20.2.3 INFO 3/Control data 3
    - 20.2.4 Angular buffer
    - 20.2.5 INFO 4/DMA 4
    - 20.2.6 INFO 4/Control data 4
    - 20.2.7 INFO 4/Buffer 6
    - 20.2.8 DCZ 0/Test zone and DCZ 1 / Test zone
    - 20.2.9 Usage of DCZ area
      - 20.2.9.1 DCZ procedure order
      - 20.2.9.2 DCZ physical cluster usage
      - 20.2.9.3 Update of TDMA
    - 20.2.10 Protection zone 3
- 21 Physical access control clusters
  - 21.1 General
  - 21.2 Layout of PAC zones
  - 21.3 General structure of PAC clusters
  - 21.4 IS1 and IS2 PAC clusters
- 22 Disk management
  - 22.1 General
  - 22.2 Recording management
    - 22.2.1 General
    - 22.2.2 Sequential recording mode (SRM)
    - 22.2.3 Recording user data in SRR

22.2.4	SRR status
22.2.5	Closing SRR
22.3	Temporary disk management areas (TDMA)
22.3.1	General
22.3.2	TDMA access indicators
22.4	Disk management structure (DMS)
22.4.1	General
22.4.2	Temporary disk management structure (TDMS)
22.4.3	TDMS in sequential recording mode
22.4.4	Temporary disk definition structure (TDDS)
22.4.5	Temporary defect list (TDFL)
22.4.5.1	General
22.4.5.2	TDFL data structure
22.4.5.3	Defect list header
22.4.5.4	Defect list terminator
22.4.6	Sequential recording range information (SRRI)
22.4.6.1	General
22.4.6.2	SRRI data structure
22.4.6.3	SRRI header
22.4.6.4	SRR entry
22.4.6.5	SRRI terminator
22.5	Unrecorded (blank) disk structure
22.5.1	General
22.5.2	Pre-recorded areas on unrecorded disk
22.5.3	Pre-recorded BCA
22.5.4	Pre-recorded INFO 2/Reserved 5, Reserved 8 and Pre-recorded INFO 1/Pre-write area
22.5.5	Pre-recorded INFO 1/PAC 1 and Pre-recorded INFO 2/PAC 2
22.5.6	OPC 0/Test zone and OPC 1/Test zone
22.5.7	TDMA 0
22.5.8	Initialization of disk
22.6	Recorded (closed) disk structure
22.6.1	General
22.6.2	DMA zones
22.6.3	Disk management structures (DMS)
22.6.3.1	General
22.6.3.2	Disk management structure (DMS) on SL disk
22.6.3.3	Disk management structure (DMS) on DL disk
23	Assignment of logical sector numbers (LSNs)
24	Characteristics of grooved areas
25	Method of testing for grooved area
25.1	General
25.2	Environment
25.3	Reference drive
25.3.1	General
25.3.2	Read power
25.3.3	Read channels
25.3.4	Tracking requirements
25.3.5	Scanning velocities
25.4	Definition of signals
26	Signals from HFM groove
26.1	Push-pull polarity
26.2	Push-pull signal
26.3	Wobble signal
26.4	Jitter of HFM signal
27	Signals from wobbled groove(s)
27.1	Phase depth
27.2	Push-pull signal
27.3	Wobble signal
27.3.1	General

- 27.3.2 Measurement of INWS
- 27.3.3 Measurement of wobble CNR
- 27.3.4 Measurement of harmonic distortion of wobble
- 27.4 HFM and wobbled groove transition requirements for LTH disks
- 28 Characteristics of recording layer
- 29 Method of testing for recording layer
  - 29.1 General
  - 29.2 Environment
  - 29.3 Reference drive
    - 29.3.1 General
    - 29.3.2 Read power
    - 29.3.3 Read channels
    - 29.3.4 Tracking requirements
    - 29.3.5 Scanning velocities
  - 29.4 Write conditions
    - 29.4.1 Write pulse waveform
    - 29.4.2 Write powers
    - 29.4.3 Write conditions for jitter measurement
  - 29.5 Definition of signals
- 30 Signals from recorded areas
  - 30.1 HF signals
  - 30.2 Modulated amplitude
  - 30.3 Reflectivity modulation product
  - 30.4 Asymmetry
  - 30.5 Jitter
  - 30.6 Read stability
- 31 Local defects
- 32 Characteristics of user data
- 33 Method of testing for user data
  - 33.1 General
  - 33.2 Environment
  - 33.3 Reference drive
    - 33.3.1 General
    - 33.3.2 Read power
    - 33.3.3 Read channels
    - 33.3.4 Error correction
    - 33.3.5 Tracking requirements
    - 33.3.6 Scanning velocities
  - 33.4 Error signals
- 34 Minimum quality of recorded information
  - 34.1 Symbol error rate
  - 34.2 Maximum burst errors
  - 34.3 User-written data
- 35 BCA
- Annex A (normative) Thickness of transmission stacks in case of multiple layers
  - A.1 General
  - A.2 Refractive index  $n_i$  of all layers in cover layer and spacer layer
  - A.3 Thickness variation of transmission stack
  - A.4 Example of thickness calculation for SL
- Annex B (normative) Measurement of reflectivity
  - B.1 General
  - B.2 Calibration method
  - B.3 Measuring method

**Annex C (normative) Measurement of scratch resistance of cover layer**

- C.1 General
- C.2 Taber abrasion test

**Annex D (normative) Measurement of repulsion of grime by cover layer**

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

**Annex E (normative) Measurement of wobble amplitude**

- E.1 Measurement methods
- E.2 Calibration of filters

**Annex F (normative) Write pulse waveform for testing**

- F.1 General write pulse waveform
- F.2 N-1 write strategy
- F.3 N/2 write strategy
- F.4 Castle write strategy
- F.5 Definition of pulse widths and rise and fall times

**Annex G (normative) Optimum power control (OPC) procedure for disk**

- G.1 General
- G.2 Mathematical model for modulation versus power function
- G.3 Procedure for determination of OPC parameters for disk
- G.4 Procedure to determine beta value

**Annex H (normative) HF signal pre-processing for jitter measurements**

- H.1 General
- H.2 General implementation of equalizer
- H.3 Conventional equalizer circuit
- H.4 Limit equalizer circuit
- H.5 Specifications of supporting circuits
  - H.5.1 Amplifiers and filters
  - H.5.2 Open-loop transfer function for PLL
  - H.5.3 Slicer
- H.6 Condition for measurement
- H.7 Jitter measurement

**Annex I (normative) Measurement procedure**

- I.1 General
- I.2 Initial adjustments of reference drive
- I.3 Jitter measurement
- I.4 Modulated amplitude measurements
- I.5 Measurements of resolution I2pp/I8pp and I3pp/I8pp
  - I.5.1 Method for measuring I2pp and I8pp
  - I.5.2 I3pp/I8pp, I8pp/I8H and asymmetry measurement procedure
- I.6 Tracking error signal measurements (VPPnorm measurement procedure)
- I.7 Residual error of axial tracking measurement procedure
- I.8 Residual error of radial tracking measurement procedure
- I.9 Random SER measurement

**Annex J (informative) Measurement of birefringence**

- J.1 Principle of measurement
- J.2 Measurements conditions
- J.3 Example of measurement procedure

**Annex K (informative) Measurement of thickness of cover layer and spacer layer**

- K.1 Focusing method
- K.2 Interferometer method

**Annex L (informative) Measurement of impact resistance of cover layer**

- L.1        General**
- L.2        Recommendation for drives**
- L.3        Measurements of impact resistance of cover layer**

**Annex M   (informative) Groove deviation and wobble amplitude**

- M.1        Relation between normalized wobble signal and wobble amplitude**
- M.2        Tolerance of normalized wobble signal**

**Page count: 231**