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Information technology – Small Computer System Interface (SCSI) – Part 262: SAS Protocol Layer – 2 (SPL-2)



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FOREWORD ... 37
INTRODUCTION ... 38
General ... 38
SCSI standards family ... 39

1 Scope ... 40

2 Normative references ... 41

3 Terms, definitions, symbols, abbreviations, keywords, and conventions ... 42
3.1 Terms and definitions ... 42
3.2 Symbols and abbreviations ... 71
3.3 Keywords ... 74
3.4 Editorial conventions ... 75
3.5 UML notation conventions ... 76
3.5.1 Notation conventions overview ... 76
3.5.2 Constraint and note conventions ... 77
3.5.3 Class diagram conventions ... 77
3.5.4 Object diagram conventions ... 81
3.6 State machine conventions ... 83
3.6.1 State machine conventions overview ... 83
3.6.2 Transitions ... 84
3.6.3 Messages, requests, indications, confirmations, responses, and event notifications ... 84
3.6.4 State machine counters, timers, and variables ... 84
3.6.5 State machine arguments ... 85
3.7 Bit and byte ordering ... 85
3.8 Notation for procedures and functions ... 85

4 General ... 87
4.1 Architecture ... 87
4.1.1 Architecture overview ... 87
4.1.2 Physical links and phys ... 88
4.1.3 Logical links ... 93
4.1.4 Narrow ports and wide ports ... 93
4.1.5 Application clients and device servers ... 96
4.1.6 SAS devices ... 97
4.1.7 Expander devices ... 98
4.1.8 Service delivery subsystem ... 99
4.1.9 Domains ... 99
4.1.10 Expander device topologies ... 102
4.1.10.1 Expander device topology overview ... 102
4.1.10.2 Expander device topologies ... 102
4.1.11 Pathways ... 104
4.1.12 Connections ... 104
4.1.13 Broadcasts ... 106
4.2 Names and identifiers ... 109
4.2.1 Names and identifiers overview ... 109
4.2.2 NAA IEEE Registered format identifier ... 109
4.2.3 NAA Locally Assigned format identifier ... 110
4.2.4 SAS address ... 111
4.2.5 Hashed SAS addresses ... 111
4.2.6 Device names and expander device SAS addresses ... 112
4.2.7 Device names for SATA devices with world wide names ... 112
4.2.8 Port names ... 113
4.2.9 Port identifiers and SAS port SAS addresses ... 113
4.2.10 Phy identifiers ... 114
4.3 State machines ... 115
4.3.1 State machine overview ... 115

4.3.2 Transmit data path 116
4.3.3 Receive data path 121
4.3.4 State machines and SAS Device, SAS Port, and SAS Phy classes 125
4.4 Events 126
4.4.1 Reset sequences 126
4.4.2 Hard reset 128
4.4.2.1 Hard reset overview 128
4.4.2.2 Additional hard reset processing by SAS ports 128
4.4.2.3 Additional hard reset processing by expander ports 128
4.4.3 I_T nexus loss 128
4.4.4 Power loss expected 129
4.5 Expander device model 129
4.5.1 Expander device model overview 129
4.5.2 Expander ports 131
4.5.3 Expander connection manager (ECM) 131
4.5.4 Expander connection router (ECR) 131
4.5.5 Broadcast propagation processor (BPP) 132
4.5.6 Expander device interfaces 132
4.5.6.1 Expander device interface overview 132
4.5.6.2 Expander device interfaces detail 134
4.5.6.3 ECM interface 135
4.5.6.4 ECR interface 137
4.5.6.5 BPP interface 138
4.5.7 Expander device routing 140
4.5.7.1 Routing attributes and routing methods 140
4.5.7.2 Expander device topology routing attribute restrictions 140
4.5.7.3 Connection request routing 141
4.5.7.4 Expander route table 141
4.5.7.4.1 Expander route table overview 141
4.5.7.4.2 Phy-based expander route table 142
4.5.7.4.3 Expander-based expander route table 143
4.5.8 Expander device reduced functionality 143
4.5.9 Broadcast (Expander) handling 144
4.6 Discover process 144
4.6.1 Discover process overview 144
4.6.2 Starting the discover process (Broadcast (Change) handling) 144
4.6.3 Discover process traversal 144
4.6.4 Discover process in a self-configuring expander device 146
4.6.5 Enabling multiplexing 147
4.7 Configuration subprocess 147
4.7.1 Configuration subprocess overview 147
4.7.2 Allowed expander device topologies 148
4.7.3 Externally configurable expander device route table optimization 149
4.7.4 Externally configurable expander device expander route index order 150
4.8 Zoning 157
4.8.1 Zoning overview 157
4.8.2 Zoning expander device requirements 161
4.8.3 Zoning operation 164
4.8.3.1 Zone phy information 164
4.8.3.2 Zone groups 166
4.8.3.3 Zone permission table 166
4.8.3.4 Zoning expander route table 168
4.8.3.5 Source zone group and destination zone group determination 169
4.8.4 Zone phy information and link reset sequences 169
4.8.5 Broadcast processing in a zoning expander device with zoning enabled 172
4.8.6 Zone configuration 172
4.8.6.1 Zone configuration overview 172
4.8.6.2 Lock step 173

4.8.6.3 Load step ... 173
4.8.6.4 Activate step ... 174
4.8.6.5 Unlock step ... 174
4.8.6.6 Zone lock inactivity timer ... 175
4.8.6.7 Enable a zoning expander device ... 175
4.9 SAS device and expander device power conditions ... 176
4.10 Phy power conditions ... 176
4.10.1 Low phy power conditions ... 176
4.10.1.1 Low phy power conditions overview ... 176
4.10.1.2 Active phy power condition ... 176
4.10.1.3 Partial phy power condition ... 176
4.10.1.4 Slumber phy power condition ... 177
4.10.1.5 End device low phy power conditions ... 177
4.10.1.6 Expander device low phy power conditions ... 177
4.10.2 SATA phy power conditions ... 178
4.11 Phy test functions ... 178
4.11.1 Phy test functions overview ... 178
4.11.2 Transmit pattern phy test function ... 179
4.12 Phy events ... 179

5 Phy layer ... 184
5.1 Phy layer overview ... 184
5.2 8b10b coding ... 184
5.2.1 8b10b coding overview ... 184
5.2.2 8b10b coding notation conventions ... 184
5.3 Character encoding and decoding ... 185
5.3.1 Introduction ... 185
5.3.2 Bit transmission order ... 185
5.3.3 Character transmission order ... 185
5.3.4 Frame transmission order ... 185
5.3.5 Running disparity (RD) ... 186
5.3.6 Data characters ... 186
5.3.7 Control characters ... 191
5.3.8 Encoding characters in the transmitter ... 192
5.3.9 Decoding characters in the receiver ... 193
5.4 Dwords, primitives, data dwords, and invalid dwords ... 193
5.5 Bit order ... 193
5.6 Out of band (OOB) signals ... 195
5.6.1 OOB signals overview ... 195
5.6.2 SP Transmission of OOB signals ... 195
5.6.3 Receiver detection of OOB signals ... 196
5.6.4 SATA port selection signal ... 198
5.6.5 Phy power conditions ... 199
5.7 Phy capabilities bits ... 199
5.8 BMC coding ... 203
5.8.1 BMC coding overview ... 203
5.8.2 TTIU bit cell encoding in the transmitter ... 204
5.8.3 TTIU bit transmission order ... 205
5.8.4 TTIU bit cell decoding in the receiver ... 205
5.9 Train_Tx-SNW TTIUs ... 206
5.9.1 Train_Tx-SNW TTIU format ... 206
5.9.2 Control/Status TTIU ... 207
5.9.3 Error Response TTIU ... 211
5.10 Phy reset sequences ... 213
5.10.1 Phy reset sequences overview ... 213
5.10.2 SATA phy reset sequence ... 214
5.10.2.1 SATA OOB sequence ... 214
5.10.2.2 SATA speed negotiation sequence ... 215

5.10.3 SAS to SATA phy reset sequence 216
5.10.4 SAS to SAS phy reset sequence 217
5.10.4.1 SAS OOB sequence 217
5.10.4.2 SAS speed negotiation sequence 219
5.10.4.2.1 SAS speed negotiation sequence overview 219
5.10.4.2.2 SAS speed negotiation sequence timing specifications 219
5.10.4.2.3 Speed negotiation window (SNW) definitions 221
5.10.4.2.3.1 SNW definitions overview 221
5.10.4.2.3.2 SNW-1, SNW-2, and Final-SNW 221
5.10.4.2.3.3 SNW-3 223
5.10.4.2.3.4 Train_Tx-SNW 224
5.10.4.2.3.4.1 Phy's transmitter initial condition 224
5.10.4.2.3.4.2 Transmitter training 224
5.10.4.2.3.4.3 Pattern marker 226
5.10.4.2.3.5 Train_Rx-SNW 227
5.10.4.2.4 SAS speed negotiation sequence 230
5.10.4.2.5 SAS speed negotiation sequence examples 231
5.10.4.2.6 Train_Tx pattern sequence 239
5.10.4.2.6.1 Train_Tx pattern sequence overview 239
5.10.4.2.6.2 Train_Tx pattern initial sequence 239
5.10.4.2.6.3 Train_Tx pattern handshake sequence 243
5.10.4.2.6.3.1 Train_Tx pattern handshake sequence overview 243
5.10.4.2.6.3.2 Attached phy's receiver increment or decrement request 243
5.10.4.2.6.3.3 Attached phy's receiver reference_1, reference_2, or no_equalization request 246
5.10.4.2.6.4 Train_Tx pattern completion sequence 248
5.10.4.2.6.5 Invalid TTIU sequence 251
5.10.4.3 Multiplexing sequence 252
5.10.5 Phy reset sequence after devices are attached 253
5.11 Phy power condition sequences 254
5.11.1 Transitioning from the active phy power condition to a low phy power condition 254
5.11.2 Transitioning from a low phy power condition to the active phy power condition 254
5.11.3 Events during low phy power condition 255
5.12 SP (phy layer) state machine 256
5.12.1 SP state machine overview 256
5.12.2 SP transmitter and SP receiver 259
5.12.3 OOB sequence states 262
5.12.3.1 OOB sequence states overview 262
5.12.3.2 SP0:OOB_COMINIT state 263
5.12.3.2.1 State description 263
5.12.3.2.2 Transition SP0:OOB_COMINIT to SP1:OOB_AwaitCOMX 264
5.12.3.2.3 Transition SP0:OOB_COMINIT to SP3:OOB_AwaitCOMINIT_Sent 264
5.12.3.2.4 Transition SP0:OOB_COMINIT to SP4:OOB_COMSAS 264
5.12.3.3 SP1:OOB_AwaitCOMX state 264
5.12.3.3.1 State description 264
5.12.3.3.2 Transition SP1:OOB_AwaitCOMX to SP0:OOB_COMINIT 264
5.12.3.3.3 Transition SP1:OOB_AwaitCOMX to SP4:OOB_COMSAS 264
5.12.3.4 SP2:OOB_NoCOMSASTimeout state 264
5.12.3.4.1 State description 264
5.12.3.4.2 Transition SP2:OOB_NoCOMSASTimeout to SP0:OOB_COMINIT 265
5.12.3.4.3 Transition SP2:OOB_NoCOMSASTimeout to SP4:OOB_COMSAS 265
5.12.3.5 SP3:OOB_AwaitCOMINIT_Sent state 265
5.12.3.5.1 State description 265
5.12.3.5.2 Transition SP3:OOB_AwaitCOMINIT_Sent to SP4:OOB_COMSAS 265
5.12.3.6 SP4:OOB_COMSAS state 265
5.12.3.6.1 State description 265
5.12.3.6.2 Transition SP4:OOB_COMSAS to SP5:OOB_AwaitCOMSAS_Sent 265
5.12.3.6.3 Transition SP4:OOB_COMSAS to SP6:OOB_AwaitNoCOMSAS 265
5.12.3.6.4 Transition SP4:OOB_COMSAS to SP7:OOB_AwaitCOMSAS 266

5.12.3.7 SP5:OOB_AwaitCOMSAS_Sent state 266
5.12.3.7.1 State description 266
5.12.3.7.2 Transition SP5:OOB_AwaitCOMSAS_Sent to SP6:OOB_AwaitNoCOMSAS 266
5.12.3.8 SP6:OOB_AwaitNoCOMSAS state 266
5.12.3.8.1 State description 266
5.12.3.8.2 Transition SP6:OOB_AwaitNoCOMSAS to SP0:OOB_COMINIT 266
5.12.3.8.3 Transition SP6:OOB_AwaitNoCOMSAS to SP8:SAS_Start 266
5.12.3.9 SP7:OOB_AwaitCOMSAS state 266
5.12.3.9.1 State description 266
5.12.3.9.2 Transition SP7:OOB_AwaitCOMSAS to SP2:OOB_NoCOMSASTimeout 266
5.12.3.9.3 Transition SP7:OOB_AwaitCOMSAS to SP6:OOB_AwaitNoCOMSAS 266
5.12.3.9.4 Transition SP7:OOB_AwaitCOMSAS to SP16:SATA_COMWAKE 266
5.12.3.9.5 Transition SP7:OOB_AwaitCOMSAS to SP26:SATA _SpinupHold 267
5.12.4 SAS speed negotiation states 267
5.12.4.1 SAS speed negotiation states overview 267
5.12.4.2 Negotiation idle 267
5.12.4.3 SP8:SAS_Start state 270
5.12.4.3.1 State description 270
5.12.4.3.2 Transition SP8:SAS_Start to SP0:OOB_COMINIT 270
5.12.4.3.3 Transition SP8:SAS_Start to SP1:OOB_AwaitCOMX 270
5.12.4.3.4 Transition SP8:SAS_Start to SP9:SAS_WindowNotSupported 271
5.12.4.3.5 Transition SP8:SAS_Start to SP10:SAS_AwaitALIGN 271
5.12.4.3.6 Transition SP8:SAS_Start to SP27:SAS_Settings 271
5.12.4.4 SP9:SAS_WindowNotSupported state 271
5.12.4.4.1 State description 271
5.12.4.4.2 Transition SP9:SAS_WindowNotSupported to SP0:OOB_COMINIT 271
5.12.4.4.3 Transition SP9:SAS_WindowNotSupported to SP14:SAS_Fail 271
5.12.4.5 SP10:SAS_AwaitALIGN state 271
5.12.4.5.1 State description 271
5.12.4.5.2 Transition SP10:SAS_AwaitALIGN to SP0:OOB_COMINIT 271
5.12.4.5.3 Transition SP10:SAS_AwaitALIGN to SP11:SAS_AwaitALIGN1 271
5.12.4.5.4 Transition SP10:SAS_AwaitALIGN to SP12:SAS_AwaitSNW 272
5.12.4.5.5 Transition SP10:SAS_AwaitALIGN to SP14:SAS_Fail 272
5.12.4.6 SP11:SAS_AwaitALIGN1 state 272
5.12.4.6.1 State description 272
5.12.4.6.2 Transition SP11:SAS_AwaitALIGN1 to SP0:OOB_COMINIT 272
5.12.4.6.3 Transition SP11:SAS_AwaitALIGN1 to SP12:SAS_AwaitSNW 272
5.12.4.6.4 Transition SP11:SAS_AwaitALIGN1 to SP14:SAS_Fail 272
5.12.4.7 SP12:SAS_AwaitSNW state 272
5.12.4.7.1 State description 272
5.12.4.7.2 Transition SP12:SAS_AwaitSNW to SP0:OOB_COMINIT 272
5.12.4.7.3 Transition SP12:SAS_AwaitSNW to SP13:SAS_Pass 272
5.12.4.8 SP13:SAS_Pass state 273
5.12.4.8.1 State description 273
5.12.4.8.2 Transition SP13:SAS_Pass to SP0:OOB_COMINIT 273
5.12.4.8.3 Transition SP13:SAS_Pass to SP8:SAS_Start 273
5.12.4.8.4 Transition SP13:SAS_Pass to SP15:SAS_PHY_Ready 273
5.12.4.9 SP14:SAS_Fail state 273
5.12.4.9.1 State description 273
5.12.4.9.2 Transition SP14:SAS_Fail to SP1:OOB_AwaitCOMX 273
5.12.4.9.3 Transition SP14:SAS_Fail to SP8:SAS_Start 273
5.12.4.10 SP15:SAS_PHY_Ready state 273
5.12.4.10.1 State description 273
5.12.4.10.2 Transition SP15:SAS_PHY_Ready to SP0:OOB_COMINIT 274
5.12.4.10.3 Transition SP15:SAS_PHY_Ready to SP31:SAS_PS_Low_Phy_Power 274
5.12.4.11 SP27:SAS_Settings state 274
5.12.4.11.1 State description 274
5.12.4.11.2 Transition SP27:SAS_Settings to SP0:OOB_COMINIT 274

5.12.4.11.3 Transition SP27:SAS_Settings to SP1:OOB_AwaitCOMX 275
5.12.4.11.4 Transition SP27:SAS_Settings to SP8:SAS_Start 275
5.12.4.11.5 Transition SP27:SAS_Settings to SP28:SAS_TrainSetup 275
5.12.4.12 SP28:SAS_TrainSetup 275
5.12.4.12.1 State description 275
5.12.4.12.2 Transition SP28:SAS_TrainSetup to SP0:OOB_COMINIT 275
5.12.4.12.3 Transition SP28:SAS_TrainSetup to SP29:SAS_Train_Rx 276
5.12.4.12.4 Transition SP28:SAS_TrainSetup to SP34:SAS_Train_Tx 276
5.12.4.13 SP34:SAS_Train_Tx state 276
5.12.4.13.1 State description 276
5.12.4.13.2 Transition SP34:SAS_Train_Tx to SP1:OOB_AwaitCOMX 276
5.12.4.13.3 Transition SP34:SAS_Train_Tx to SP28:SAS_TrainSetup 276
5.12.4.13.4 Transition SP34:SAS_Train_Tx to SP29:SAS_Train_Rx 277
5.12.4.14 SP29:SAS_Train_Rx state 277
5.12.4.14.1 State description 277
5.12.4.14.2 Transition SP29:SAS_Train_Rx to SP0:OOB_COMINIT 277
5.12.4.14.3 Transition SP29:SAS_Train_Rx to SP1:OOB_AwaitCOMX 277
5.12.4.14.4 Transition SP29:SAS_Train_Rx to SP28:SAS_TrainSetup 277
5.12.4.14.5 Transition SP29:SAS_Train_Rx to SP30:SAS_TrainingDone 278
5.12.4.15 SP30:SAS_TrainingDone state 278
5.12.4.15.1 State description 278
5.12.4.15.2 Transition SP30:SAS_TrainingDone to SP0:OOB_COMINIT 278
5.12.4.15.3 Transition SP30:SAS_TrainingDone to SP1:OOB_AwaitCOMX 278
5.12.4.15.4 Transition SP30:SAS_TrainingDone to SP28:SAS_TrainSetup 278
5.12.4.15.5 Transition SP30:SAS_TrainingDone to SP15:SAS_PHY_Ready 279
5.12.5 SAS phy power conditions states 279
5.12.5.1 SAS phy power conditions states overview 279
5.12.5.2 SP31:SAS_PS_Low_Phy_Power state 280
5.12.5.2.1 State description 280
5.12.5.2.2 Transition SP31:SAS_PS_Low_Phy_Power to SP0:OOB_COMINIT 281
5.12.5.2.3 Transition SP31:SAS_PS_Low_Phy_Power to SP32:SAS_PS_ALIGN0 281
5.12.5.3 SP32:SAS_PS_ALIGN0 state 281
5.12.5.3.1 State description 281
5.12.5.3.2 Transition SP32:SAS_PS _ALIGN0 state to SP0:OOB_COMINIT 281
5.12.5.3.3 Transition SP32:SAS_PS _ALIGN0 to SP33:SAS_PS _ALIGN1 281
5.12.5.4 SP33:SAS_PS_ALIGN1 state 282
5.12.5.4.1 State description 282
5.12.5.4.2 Transition SP33:SAS_PS_ALIGN1 state to SP0:OOB_COMINIT 282
5.12.5.4.3 Transition SP33:SAS_PS_ALIGN1 state to SP15:SAS_PHY_Ready 282
5.12.6 SATA host emulation states 282
5.12.6.1 SATA host emulation states overview 282
5.12.6.2 SP16:SATA_COMWAKE state 283
5.12.6.2.1 State description 283
5.12.6.2.2 Transition SP16:SATA_COMWAKE to SP0:OOB_COMINIT 284
5.12.6.2.3 Transition SP16:SATA_COMWAKE to SP17:SATA_AwaitCOMWAKE 284
5.12.6.3 SP17:SATA_AwaitCOMWAKE state 284
5.12.6.3.1 State description 284
5.12.6.3.2 Transition SP17:SATA_AwaitCOMWAKE to SP0:OOB_COMINIT 284
5.12.6.3.3 Transition SP17:SATA_AwaitCOMWAKE to SP18:SATA_AwaitNoCOMWAKE 284
5.12.6.4 SP18:SATA_AwaitNoCOMWAKE state 284
5.12.6.4.1 State description 284
5.12.6.4.2 Transition SP18:SATA_AwaitNoCOMWAKE to SP0:OOB_COMINIT 284
5.12.6.4.3 Transition SP18:SATA_AwaitNoCOMWAKE to SP19:SATA_AwaitALIGN 284
5.12.6.5 SP19:SATA_AwaitALIGN state 284
5.12.6.5.1 State description 284
5.12.6.5.2 Transition SP19:SATA_AwaitALIGN to SP0:OOB_COMINIT 284
5.12.6.5.3 Transition SP19:SATA_AwaitALIGN to SP20:SATA_AdjustSpeed 285
5.12.6.6 SP20:SATA_AdjustSpeed state 285

5.12.6.6.1 State description 285
5.12.6.6.2 Transition SP20:SATA_AdjustSpeed to SP0:OOB_COMINIT 285
5.12.6.6.3 Transition SP20:SATA_AdjustSpeed to SP21:SATA_TransmitALIGN 285
5.12.6.7 SP21:SATA_TransmitALIGN state 285
5.12.6.7.1 State description 285
5.12.6.7.2 Transition SP21:SATA_TransmitALIGN to SP0:OOB_COMINIT 285
5.12.6.7.3 Transition SP21:SATA_TransmitALIGN to SP22:SATA_PHY_Ready 285
5.12.6.8 SP22:SATA_PHY_Ready state 286
5.12.6.8.1 State description 286
5.12.6.8.2 Transition SP22:SATA_PHY_Ready to SP0:OOB_COMINIT 286
5.12.6.8.3 Transition SP22:SATA_PHY_Ready to SP23:SATA_PM_Partial 286
5.12.6.8.4 Transition SP22:SATA_PHY_Ready to SP24:SATA_PM_Slumber 286
5.12.6.9 SP23:SATA_PM_Partial state 286
5.12.6.9.1 State description 286
5.12.6.9.2 Transition SP23:SATA_PM_Partial to SP0:OOB_COMINIT 286
5.12.6.9.3 Transition SP23:SATA_PM_Partial to SP16:SATA_COMWAKE 286
5.12.6.9.4 Transition SP23:SATA_PM_Partial to SP19:SATA_AwaitALIGN 287
5.12.6.10 SP24:SATA_PM_Slumber state 287
5.12.6.10.1 State description 287
5.12.6.10.2 Transition SP24:SATA_PM_Slumber to SP0:OOB_COMINIT 287
5.12.6.10.3 Transition SP24:SATA_PM_Slumber to SP16:SATA_COMWAKE 287
5.12.6.10.4 Transition SP24:SATA_PM_Slumber to SP19:SATA_AwaitALIGN 287
5.12.7 SATA port selector state SP25:SATA_PortSel 288
5.12.7.1 State description 288
5.12.7.2 Transition SP25:SATA_PortSel to SP1:OOB_AwaitCOMX 288
5.12.8 SATA spinup hold state SP26:SATA_SpinupHold 289
5.12.8.1 State description 289
5.12.8.2 Transition SP26:SATA_SpinupHold to SP0:OOB_COMINIT 289
5.13 SP_DWS (phy layer dword synchronization) state machine 289
5.13.1 SP_DWS state machine overview 289
5.13.2 SP_DWS receiver 291
5.13.3 SP_DWS0:AcquireSync state 292
5.13.3.1 State description 292
5.13.3.2 Transition SP_DWS0:AcquireSync to SP_DWS1:Valid1 292
5.13.4 SP_DWS1:Valid1 state 292
5.13.4.1 State description 292
5.13.4.2 Transition SP_DWS1:Valid1 to SP_DWS0:AcquireSync 293
5.13.4.3 Transition SP_DWS1:Valid1 to SP_DWS2:Valid2 293
5.13.5 SP_DWS2:Valid2 state 293
5.13.5.1 State description 293
5.13.5.2 Transition SP_DWS2:Valid2 to SP_DWS0:AcquireSync 293
5.13.5.3 Transition SP_DWS2:Valid2 to SP_DWS3:SyncAcquired 293
5.13.6 SP_DWS3:SyncAcquired state 293
5.13.6.1 State description 293
5.13.6.2 Transition SP_DWS3:SyncAcquired to SP_DWS0:AcquireSync 293
5.13.6.3 Transition SP_DWS3:SyncAcquired to SP_DWS4:Lost1 293
5.13.7 SP_DWS4:Lost1 state 293
5.13.7.1 State description 293
5.13.7.2 Transition SP_DWS4:Lost1 to SP_DWS0:AcquireSync 293
5.13.7.3 Transition SP_DWS4:Lost1 to SP_DWS5:Lost1Recovered 294
5.13.7.4 Transition SP_DWS4:Lost1 to SP_DWS6:Lost2 294
5.13.8 SP_DWS5:Lost1Recovered state 294
5.13.8.1 State description 294
5.13.8.2 Transition SP_DWS5:Lost1Recovered to SP_DWS0:AcquireSync 294
5.13.8.3 Transition SP_DWS5:Lost1Recovered to SP_DWS3:SyncAcquired 294
5.13.8.4 Transition SP_DWS5:Lost1Recovered to SP_DWS6:Lost2 294
5.13.9 SP_DWS6:Lost2 state 294
5.13.9.1 State description 294

5.13.9.2 Transition SP_DWS6:Lost2 to SP_DWS0:AcquireSync 294
5.13.9.3 Transition SP_DWS6:Lost2 to SP_DWS7:Lost2Recovered 294
5.13.9.4 Transition SP_DWS6:Lost2 to SP_DWS8:Lost3 294
5.13.10 SP_DWS7:Lost2Recovered state 294
5.13.10.1 State description 294
5.13.10.2 Transition SP_DWS7:Lost2Recovered to SP_DWS0:AcquireSync 295
5.13.10.3 Transition SP_DWS7:Lost2Recovered to SP_DWS4:Lost1 295
5.13.10.4 Transition SP_DWS7:Lost2Recovered to SP_DWS8:Lost3 295
5.13.11 SP_DWS8:Lost3 state 295
5.13.11.1 State description 295
5.13.11.2 Transition SP_DWS8:Lost3 to SP_DWS0:AcquireSync 295
5.13.11.3 Transition SP_DWS8:Lost3 to SP_DWS9:Lost3Recovered 295
5.13.12 SP_DWS9:Lost3Recovered state 295
5.13.12.1 State description 295
5.13.12.2 Transition SP_DWS9:Lost3Recovered to SP_DWS0:AcquireSync 295
5.13.12.3 Transition SP_DWS9:Lost3Recovered to SP_DWS6:Lost2 295
5.14 PTT (phy layer transmitter training) state machines 295
5.14.1 PTT state machines overview 295
5.14.2 SP transmitter additions for transmitter training 296
5.14.2.1 SP transmitter additions for transmitter training overview 296
5.14.2.2 TTIU transmit setup 296
5.14.2.3 No_equalization, reference_1, and reference_2 coefficient settings request 297
5.14.2.4 Coefficient limits 297
5.14.2.5 Coefficient request result of update complete 297
5.14.2.5.1 Coefficient request processing 297
5.14.2.5.2 Coefficient adjustment completes 297
5.14.2.5.3 No coefficient adjustment 298
5.14.2.6 Coefficient request result of maximum 298
5.14.2.6.1 Coefficient request processing 298
5.14.2.6.2 Coefficient adjustment completes 298
5.14.2.6.3 No coefficient adjustment 298
5.14.2.7 Coefficient request result of minimum 299
5.14.2.7.1 Coefficient request processing 299
5.14.2.7.2 Coefficient adjustment completes 299
5.14.2.7.3 No coefficient adjustment 299
5.14.3 SP receiver additions for transmitter training 299
5.14.4 PTT_T (phy layer transmitter training transmit pattern) state machine 300
5.14.4.1 PTT_T state machine overview 300
5.14.4.2 PTT_T0:Idle state 303
5.14.4.2.1 State description 303
5.14.4.2.2 Transition PTT_T0:Idle to PTT_T1:Initialize 303
5.14.4.3 PTT_T1:Initialize state 303
5.14.4.3.1 State description 303
5.14.4.3.2 Transition PTT_T1:Initialize to PTT_T0:Idle 303
5.14.4.3.3 Transition PTT_T1:Initialize to PTT_T2:Tx_Training 304
5.14.4.4 PTT_T2:Tx_Training state 304
5.14.4.4.1 State description 304
5.14.4.4.2 Entry conditions 304
5.14.4.4.3 Control word and status word mappings 304
5.14.4.4.4 Error message handling 305
5.14.4.4.5 Resetting attached phy’s transmitter 306
5.14.4.4.6 Local phy’s transmitter and attached phy’s transmitter training completed 307
5.14.4.4.7 Transition PTT_T2:Tx_Training to PTT_T0:Idle 307
5.14.4.4.8 Transition PTT_T2:Tx_Training to PTT_T3:Local_Tx_Training 307
5.14.4.5 PTT_T3:Local_Tx_Training state 308
5.14.4.5.1 State description 308
5.14.4.5.2 Entry conditions 308
5.14.4.5.3 Status word mappings 308

5.14.4.5.4 Local phy's transmitter and attached phy's transmitter training completed 308
5.14.4.5.5 Error message handling 308
5.14.4.5.6 Transition PTT_T3:Local_Tx_Training to PTT_T0:Idle 309
5.14.5 PTT_R (phy layer transmitter training receive pattern) state machine 309
5.14.5.1 PTT_R0:Idle state 311
5.14.5.1.1 State description 311
5.14.5.1.2 Transition PTT_R0:Idle to PTT_R1:Initialize 311
5.14.5.2 PTT_R1:Initialize state 311
5.14.5.2.1 State description 311
5.14.5.2.2 Transition PTT_R1:Initialize to PTT_R0:Idle 311
5.14.5.2.3 Transition PTT_R1:Initialize to PTT_R2:Receive_Train_Tx_Pattern 311
5.14.5.3 PTT_R2:Receive_Train_Tx_Pattern state 311
5.14.5.3.1 State description 311
5.14.5.3.2 Transition PTT_R2:Receive_Train_Tx_Pattern to PTT_R0:Idle 317
5.14.5.3.3 Transition PTT_R2:Receive_Train_Tx_Pattern to PTT_R1:Initialize 317
5.14.6 PTT_SC (phy layer transmitter training set transmitter coefficient) state machines 317
5.14.6.1 PTT_SC (phy layer transmitter training set transmitter coefficient) state machines overview 317
5.14.6.2 PTT_SC1 state machine overview 319
5.14.6.3 PTT_SC1_0:Idle state 319
5.14.6.3.1 State description 319
5.14.6.3.2 Transition PTT_SC1_0:Idle to PTT_SC1_1:Wait_Inc_Dec 319
5.14.6.4 PTT_SC1_1:Wait_Inc_Dec state 319
5.14.6.4.1 State description 319
5.14.6.4.2 Transition PTT_SC1_1:Wait_Inc_Dec to PTT_SC1_0:Idle 319
5.14.6.4.3 Transition PTT_SC1_1:Wait_Inc_Dec to PTT_SC1_2:Set_Coefficient 319
5.14.6.5 PTT_SC1_2:Set_Coefficient state 320
5.14.6.5.1 State description 320
5.14.6.5.2 Transition PTT_SC1_2:Set_Coefficient to PTT_SC1_0:Idle 320
5.14.6.5.3 Transition PTT_SC1_2:Set_Coefficient to PTT_SC1_3:Wait_Hold 321
5.14.6.6 PTT_SC1_3:Wait_Hold state 321
5.14.6.6.1 State description 321
5.14.6.6.2 Transition PTT_SC1_3:Wait_Hold to PTT_SC1_0:Idle 321
5.14.6.6.3 Transition PTT_SC1_3:Wait_Hold to PTT_SC1_1:Wait_Inc_Dec 321
5.14.7 PTT_SC2 (phy layer transmitter training set transmitter coefficient 2) state machine 321
5.14.8 PTT_SC3 (phy layer transmitter training set transmitter coefficient 3) state machine 321
5.14.9 PTT_GC (phy layer transmitter training get transmitter coefficient) state machines 322
5.14.9.1 PTT_GC (phy layer transmitter training get transmitter coefficient) state machines overview 322
5.14.9.2 PTT_GC1 state machine 323
5.14.9.3 PTT_GC1_0:Idle state 323
5.14.9.3.1 State description 323
5.14.9.3.2 Transition PTT_GC1_0:Idle to PTT_GC1_1:Get_Coefficient 324
5.14.9.4 PTT_GC1_1:Get_Coefficient state 324
5.14.9.4.1 State description 324
5.14.9.4.2 Transition PTT_GC1_1:Get_Coefficient to PTT_GC1_0:Idle 324
5.14.9.4.3 Transition PTT_GC1_1:Get_Coefficient to PTT_GC1_2:Wait_Restart 324
5.14.9.5 PTT_GC1_2:Wait_Restart state 324
5.14.9.5.1 State description 324
5.14.9.5.2 Transition PTT_GC1_2:Wait_Restart to PTT_GC1_0:Idle 325
5.14.10 PTT_GC2 (phy layer transmitter training get transmitter coefficient 2) state machine 325
5.14.11 PTT_GC3 (phy layer transmitter training get transmitter coefficient 3) state machine 325
5.14.12 PTT_PL (phy layer transmitter training pattern lock) state machine 325
5.14.12.1 PTT_PL state machine overview 325
5.14.12.2 PTT_PL0:Idle state 327
5.14.12.2.1 State description 327
5.14.12.2.2 Transition PTT_PL0:Idle to PTT_PL1:Acquire_Lock 328
5.14.12.3 PTT_PL1:Acquire_Lock state 328
5.14.12.3.1 State description 328
5.14.12.3.2 Transition PTT_PL1:Acquire_Lock to PTT_PL2:Valid 328

5.14.12.4 PTT_PL2:Valid state 328
5.14.12.4.1 State description 328
5.14.12.4.2 Transition PTT_PL2:Valid to PTT_PL1:Acquire_Lock 328
5.14.12.4.3 Transition PTT_PL2:Valid to PTT_PL3:Lock_Acquired 328
5.14.12.5 PTT_PL3:Lock_Acquired state 328
5.14.12.5.1 State description 328
5.14.12.5.2 Transition PTT_PL3:Lock_Acquired to PTT_PL4:Lost1 328
5.14.12.6 PTT_PL4:Lost1 state 328
5.14.12.6.1 State description 328
5.14.12.6.2 Transition PTT_PL4:Lost1 to PTT_PL3:Lock_Acquired 329
5.14.12.6.3 Transition PTT_PL4:Lost1 to PTT_PL5:Lost2 329
5.14.12.7 PTT_PL5:Lost2 state 329
5.14.12.7.1 State description 329
5.14.12.7.2 Transition PTT_PL5:Lost2 to PTT_PL3:Lock_Acquired 329
5.14.12.7.3 Transition PTT_PL5:Lost2 to PTT_PL6:Lost3 329
5.14.12.8 PTT_PL6:Lost3 state 329
5.14.12.8.1 State description 329
5.14.12.8.2 Transition PTT_PL6:Lost3 to PTT_PL3:Lock_Acquired 329
5.14.12.8.3 Transition PTT_PL6:Lost3 to PTT_PL7:Lost4 329
5.14.12.9 PTT_PL7:Lost4 state 329
5.14.12.9.1 State description 329
5.14.12.9.2 Transition PTT_PL7:Lost4 to PTT_PL3:Lock_Acquired 329
5.14.12.9.3 Transition PTT_PL7:Lost4 to PTT_PL1:Acquire_Lock 330
5.15 Multiplexing 330
5.16 Spinup 331

6 Link layer 332
6.1 Link layer overview 332
6.2 Primitives 332
6.2.1 Primitives overview 332
6.2.2 Primitive summary 333
6.2.3 Primitive encodings 338
6.2.4 Primitive sequences 343
6.2.4.1 Primitive sequences overview 343
6.2.4.2 Single primitive sequence 343
6.2.4.3 Repeated primitive sequence 343
6.2.4.4 Continued primitive sequence 344
6.2.4.5 Extended primitive sequence 344
6.2.4.6 Triple primitive sequence 345
6.2.4.7 Redundant primitive sequence 346
6.2.5 Deletable primitives 347
6.2.5.1 ALIGN 347
6.2.5.2 MUX (Multiplex) 348
6.2.5.3 NOTIFY 349
6.2.5.3.1 NOTIFY overview 349
6.2.5.3.2 NOTIFY (ENABLE SPINUP) 349
6.2.5.3.3 NOTIFY (POWER LOSS EXPECTED) 350
6.2.5.4 OOB_IDLE 351
6.2.6 Primitives not specific to type of connections 351
6.2.6.1 AIP (Arbitration in progress) 351
6.2.6.2 BREAK 351
6.2.6.3 BREAK_REPLY 351
6.2.6.4 BROADCAST 352
6.2.6.5 CLOSE 352
6.2.6.6 EOAF (End of address frame) 352
6.2.6.7 ERROR 353
6.2.6.8 HARD_RESET 353
6.2.6.9 OPEN_ACCEPT 353

6.2.6.10 OPEN_REJECT 353
6.2.6.11 PS_ACK 356
6.2.6.12 PS_NAK 356
6.2.6.13 PS_REQ 356
6.2.6.14 PWR_ACK 356
6.2.6.15 PWR_DONE 356
6.2.6.16 PWR_GRANT 356
6.2.6.17 PWR_REQ 356
6.2.6.18 SOAF (Start of address frame) 356
6.2.6.19 TRAIN 357
6.2.6.20 TRAIN_DONE 357
6.2.7 Primitives used only inside SSP and SMP connections 357
6.2.7.1 ACK (Acknowledge) 357
6.2.7.2 CREDIT_BLOCKED 357
6.2.7.3 DONE 357
6.2.7.4 EOF (End of frame) 358
6.2.7.5 NAK (Negative acknowledgement) 358
6.2.7.6 RRDY (Receiver ready) 358
6.2.7.7 SOF (Start of frame) 358
6.2.8 Primitives used only inside STP connections and on SATA physical links 358
6.2.8.1 SATA_ERROR 358
6.2.8.2 SATA_PMACK, SATA_PMNAK, SATA_PMREQ_P, and SATA_PMREQ_S (Power management acknowledgements and requests) 359
6.2.8.3 SATA_HOLD and SATA_HOLDA (Hold and hold acknowledge) 359
6.2.8.4 SATA_R_RDY and SATA_X_RDY (Receiver ready and transmitter ready) 359
6.2.8.5 Other primitives used inside STP connections and on SATA physical links 359
6.3 Physical link rate tolerance management 359
6.3.1 Physical link rate tolerance management overview 359
6.3.2 Phys originating dwords 360
6.3.3 Expander phys forwarding dwords 361
6.4 Idle physical links 362
6.5 CRC 362
6.5.1 CRC overview 362
6.5.2 CRC generation 364
6.5.3 CRC checking 366
6.6 Scrambling 367
6.7 Bit order of CRC and scrambler 369
6.8 Address frames 372
6.8.1 Address frames overview 372
6.8.2 IDENTIFY address frame 374
6.8.3 OPEN address frame 378
6.9 Link reset sequence 381
6.9.1 Link reset sequence overview 381
6.9.2 Expander device handling of link reset sequences 384
6.10 SL_IR (link layer identification and hard reset) state machines 384
6.10.1 SL_IR state machines overview 384
6.10.2 SL_IR transmitter and receiver 386
6.10.3 SL_IR_TIR (transmit IDENTIFY or HARD_RESET) state machine 386
6.10.3.1 SL_IR_TIR state machine overview 386
6.10.3.2 SL_IR_TIR1:Idle state 387
6.10.3.2.1 State description 387
6.10.3.2.2 Transition SL_IR_TIR1:Idle to SL_IR_TIR2:Transmit_Identify 387
6.10.3.2.3 Transition SL_IR_TIR1:Idle to SL_IR_TIR3:Transmit_Hard_Reset 387
6.10.3.3 SL_IR_TIR2:Transmit_Identify state 387
6.10.3.3.1 State description 387
6.10.3.3.2 Transition SL_IR_TIR2:Transmit_Identify to SL_IR_TIR4:Completed 387
6.10.3.4 SL_IR_TIR3:Transmit_Hard_Reset state 387
6.10.3.4.1 State description 387

6.10.3.4.2 Transition SL_IR_TIR3:Transmit_Hard_Reset to SL_IR_TIR4:Completed 387
6.10.3.5 SL_IR_TIR4:Completed state 387
6.10.4 SL_IR_RIF (receive IDENTIFY address frame) state machine 388
6.10.4.1 SL_IR_RIF state machine overview 388
6.10.4.2 SL_IR_RIF1:Idle state 388
6.10.4.2.1 State description 388
6.10.4.2.2 Transition SL_IR_RIF1:Idle to SL_IR_RIF2:Receive_Identify_Frame 388
6.10.4.3 SL_IR_RIF2:Receive_Identify_Frame state 388
6.10.4.3.1 State description 388
6.10.4.3.2 Transition SL_IR_RIF2:Receive_Identify_Frame to SL_IR_RIF3:Completed 389
6.10.4.4 SL_IR_RIF3:Completed state 389
6.10.5 SL_IR_IRC (identification and hard reset control) state machine 389
6.10.5.1 SL_IR_IRC state machine overview 389
6.10.5.2 SL_IR_IRC1:Idle state 389
6.10.5.2.1 State description 389
6.10.5.2.2 Transition SL_IR_IRC1:Idle to SL_IR_IRC2:Wait 389
6.10.5.3 SL_IR_IRC2:Wait state 389
6.10.5.3.1 State description 389
6.10.5.3.2 Transition SL_IR_IRC2:Wait to SL_IR_IRC3:Completed 390
6.10.5.4 SL_IR_IRC3:Completed state 390
6.11 Entering a low phy power condition 390
6.12 Power control and SL_P (link layer power control) state machines 391
6.12.1 Power source device 391
6.12.2 Power consumer device 391
6.12.3 NOTIFY (ENABLE SPINUP) usage 392
6.12.4 SL_P_S (link layer power source device) state machine 392
6.12.4.1 SL_P_S state machine overview 392
6.12.4.2 SL_P_S transmitter and SL_P_S receiver 394
6.12.4.3 SL_P_S_1:Idle state 395
6.12.4.3.1 State description 395
6.12.4.3.2 Transition SL_P_S_1:Idle to SL_P_S_2:Wait_Grant 395
6.12.4.4 SL_P_S_2:Wait_Grant state 395
6.12.4.4.1 State description 395
6.12.4.4.2 Transition SL_P_S_2:Wait_Grant to SL_P_S_1:Idle 396
6.12.4.4.3 Transition SL_P_S_2:Wait_Grant to SL_P_S_3:Wait_Done 396
6.12.4.5 SL_P_S_3:Wait_Done state 396
6.12.4.5.1 State description 396
6.12.4.5.2 Transition SL_P_S_3:Wait_Done to SL_P_S_1:Idle 396
6.12.5 SL_P_C (link layer power consumer device) state machine 396
6.12.5.1 SL_P_C state machine overview 396
6.12.5.2 SL_P_C receiver 399
6.12.5.3 SL_P_C_1:Idle state 399
6.12.5.3.1 State description 399
6.12.5.3.2 Transition SL_P_C_1:Idle to SL_P_C_2:Request_Power 399
6.12.5.4 SL_P_C_2:Request_Power state 399
6.12.5.4.1 State description 399
6.12.5.4.2 Transition SL_P_C_2:Request_Power to SL_P_C_1:Idle 400
6.12.5.4.3 Transition SL_P_C_2:Request_Power to SL_P_C_3:Wait_Grant 400
6.12.5.4.4 Transition SL_P_C_2:Request_Power to SL_P_C_4:Wait_Done 400
6.12.5.5 SL_P_C_3:Wait_Grant state 400
6.12.5.5.1 State description 400
6.12.5.5.2 Transition SL_P_C_3:Wait_Grant to SL_P_C_1:Idle 400
6.12.5.5.3 Transition SL_P_C_3:Wait_Grant to SL_P_C_4:Wait_Done 401
6.12.5.6 SL_P_C_4:Wait_Done state 401
6.12.5.6.1 State description 401
6.12.5.6.2 Transition SL_P_C_4:Wait_Done to SL_P_C_1:Idle 401
6.13 SAS domain changes (Broadcast (Change) usage) 401
6.14 Connections 402

6.14.1 Connections overview 402
6.14.2 Opening a connection 403
6.14.2.1 Connection request 403
6.14.2.2 Results of a connection request 405
6.14.3 Arbitration fairness 405
6.14.4 Arbitration inside an expander device 406
6.14.4.1 Expander logical phy arbitration requirements 406
6.14.4.2 ECM arbitration requirements 407
6.14.4.2.1 ECM arbitration requirements overview 407
6.14.4.2.2 Arbitrating confirmations 407
6.14.4.2.3 Arb Won confirmation 408
6.14.4.2.4 Arb Lost confirmation 409
6.14.4.2.5 Arb Reject confirmation 409
6.14.4.3 Arbitration status 409
6.14.4.4 Partial Pathway Timeout timer 410
6.14.4.5 Pathway recovery 410
6.14.5 BREAK handling 411
6.14.6 Aborting a connection request 411
6.14.7 Closing a connection 414
6.14.8 Breaking a connection 415
6.15 Rate matching 416
6.16 SL (link layer for SAS logical phys) state machines 419
6.16.1 SL state machines overview 419
6.16.2 SL transmitter and receiver 422
6.16.3 SL_RA (receive OPEN address frame) state machine 424
6.16.4 SL_CC (connection control) state machine 424
6.16.4.1 SL_CC state machine overview 424
6.16.4.2 SL_CC0:Idle state 426
6.16.4.2.1 State description 426
6.16.4.2.2 Transition SL_CC0:Idle to SL_CC1:ArbSel 427
6.16.4.2.3 Transition SL_CC0:Idle to SL_CC2:Selected 428
6.16.4.2.4 Transition SL_CC0:Idle to SL_CC8:PS_Request 428
6.16.4.2.5 Transition SL_CC0:Idle to SL_CC9:PS_Quiet 428
6.16.4.3 SL_CC1:ArbSel state 428
6.16.4.3.1 State description 428
6.16.4.3.2 Transition SL_CC1:ArbSel to SL_CC0:Idle 430
6.16.4.3.3 Transition SL_CC1:ArbSel to SL_CC2:Selected 430
6.16.4.3.4 Transition SL_CC1:ArbSel to SL_CC3:Connected 430
6.16.4.3.5 Transition SL_CC1:ArbSel to SL_CC5:BreakWait 431
6.16.4.3.6 Transition SL_CC1:ArbSel to SL_CC6:Break 431
6.16.4.4 SL_CC2:Selected state 431
6.16.4.4.1 State description 431
6.16.4.4.2 Transition SL_CC2:Selected to SL_CC0:Idle 432
6.16.4.4.3 Transition SL_CC2:Selected to SL_CC3:Connected 432
6.16.4.4.4 Transition SL_CC2:Selected to SL_CC5:BreakWait 432
6.16.4.4.5 Transition SL_CC2:Selected to SL_CC6:Break 432
6.16.4.5 SL_CC3:Connected state 432
6.16.4.5.1 State description 432
6.16.4.5.2 Transition SL_CC3:Connected to SL_CC4:DisconnectWait 433
6.16.4.5.3 Transition SL_CC3:Connected to SL_CC5:BreakWait 433
6.16.4.5.4 Transition SL_CC3:Connected to SL_CC6:Break 433
6.16.4.5.5 Transition SL_CC3:Connected to SL_CC7:CloseSTP 433
6.16.4.6 SL_CC4:DisconnectWait state 433
6.16.4.6.1 State description 433
6.16.4.6.2 Transition SL_CC4:DisconnectWait to SL_CC0:Idle 434
6.16.4.6.3 Transition SL_CC4:DisconnectWait to SL_CC5:BreakWait 434
6.16.4.6.4 Transition SL_CC4:DisconnectWait to SL_CC6:Break 434
6.16.4.7 SL_CC5:BreakWait state 434

6.16.4.7.1 State description 434
6.16.4.7.2 Transition SL_CC5:BreakWait to SL_CC0:Idle 434
6.16.4.8 SL_CC6:Break state 434
6.16.4.8.1 State description 434
6.16.4.8.2 Transition SL_CC6:Break to SL_CC0:Idle 435
6.16.4.9 SL_CC7:CloseSTP state 435
6.16.4.9.1 State description 435
6.16.4.9.2 Transition SL_CC7:CloseSTP to SL_CC0:Idle 435
6.16.4.10 SL_CC8:PS_Request state 435
6.16.4.10.1 State description 435
6.16.4.10.2 Transition SL_CC8:PS_Request to SL_CC9:PS_Quiet 436
6.16.4.10.3 Transition SL_CC8:PS_Request to SL_CC0:Idle 436
6.16.4.10.4 Transition SL_CC8:PS_Request to SL_CC2:Selected 436
6.16.4.11 SL_CC9:PS_Quiet state 436
6.16.4.11.1 State description 436
6.16.4.11.2 Transition SL_CC9:PS_Quiet to SL_CC0:Idle 437
6.16.4.11.3 Transition SL_CC9:PS_Quiet to SL_CC1:ArbSel 437
6.17 XL (link layer for expander logical phys) state machine 437
6.17.1 XL state machine overview 437
6.17.2 XL transmitter and receiver 443
6.17.3 XL0:Idle state 444
6.17.3.1 State description 444
6.17.3.2 Transition XL0:Idle to XL1:Request_Path 445
6.17.3.3 Transition XL0:Idle to XL5:Forward_Open 446
6.17.3.3.1 Transition XL0:Idle to XL11:PS_Request 446
6.17.3.3.2 Transition XL0:Idle to XL12:PS_Quiet 446
6.17.4 XL1:Request_Path state 446
6.17.4.1 State description 446
6.17.4.2 Transition XL1:Request_Path to XL0:Idle 447
6.17.4.3 Transition XL1:Request_Path to XL2:Request_Open 447
6.17.4.4 Transition XL1:Request_Path to XL4:Open_Reject 447
6.17.4.5 Transition XL1:Request_Path to XL5:Forward_Open 448
6.17.4.6 Transition XL1:Request_Path to XL9:Break 448
6.17.5 XL2:Request_Open state 448
6.17.5.1 State description 448
6.17.5.2 Transition XL2:Request_Open to XL3:Open_Confirm_Wait 448
6.17.6 XL3:Open_Confirm_Wait state 449
6.17.6.1 State description 449
6.17.6.2 Transition XL3:Open_Confirm_Wait to XL0:Idle 449
6.17.6.3 Transition XL3:Open_Confirm_Wait to XL1:Request_Path 449
6.17.6.4 Transition XL3:Open_Confirm_Wait to XL5:Forward_Open 450
6.17.6.5 Transition XL3:Open_Confirm_Wait to XL7:Connected 450
6.17.6.6 Transition XL3:Open_Confirm_Wait to XL9:Break 450
6.17.6.7 Transition XL3:Open_Confirm_Wait to XL10:Break_Wait 450
6.17.7 XL4:Open_Reject state 450
6.17.7.1 State description 450
6.17.7.2 Transition XL4:Open_Reject to XL0:Idle 450
6.17.7.3 Transition XL4:Open_Reject to XL5:Forward_Open 450
6.17.8 XL5:Forward_Open state 451
6.17.8.1 State description 451
6.17.8.2 Transition XL5:Forward_Open to XL6:Open_Response_Wait 451
6.17.9 XL6:Open_Response_Wait state 451
6.17.9.1 State description 451
6.17.9.2 Transition XL6:Open_Response_Wait to XL0:Idle 452
6.17.9.3 Transition XL6:Open_Response_Wait to XL1:Request_Path 452
6.17.9.4 Transition XL6:Open_Response_Wait to XL2:Request_Open 452
6.17.9.5 Transition XL6:Open_Response_Wait to XL7:Connected 452
6.17.9.6 Transition XL6:Open_Response_Wait to XL9:Break 452

6.17.9.7 Transition XL6:Open_Response_Wait to XL10:Break_Wait 453
6.17.10 XL7:Connected state 453
6.17.10.1 State description 453
6.17.10.2 Transition XL7:Connected to XL8:Close_Wait 453
6.17.10.3 Transition XL7:Connected to XL9:Break 453
6.17.10.4 Transition XL7:Connected to XL10:Break_Wait 453
6.17.11 XL8:Close_Wait state 454
6.17.11.1 State description 454
6.17.11.2 Transition XL8:Close_Wait to XL0:Idle 454
6.17.11.3 Transition XL8:Close_Wait to XL9:Break 454
6.17.11.4 Transition XL8:Close_Wait to XL10:Break_Wait 454
6.17.12 XL9:Break state 455
6.17.12.1 State description 455
6.17.12.2 Transition XL9:Break to XL0:Idle 455
6.17.13 XL10:Break_Wait state 455
6.17.13.1 State description 455
6.17.13.2 Transition XL10:Break_Wait to XL0:Idle 455
6.17.14 XL11:PS_Request state 455
6.17.14.1 State description 455
6.17.14.2 Transition XL11:PS_Request to XL12:PS_Quiet 456
6.17.14.3 Transition XL11:PS_Request to XL0:Idle 456
6.17.14.4 Transition XL11:PS_Request to XL1:Request_Path 456
6.17.15 XL12:PS_Quiet state 456
6.17.15.1 State description 456
6.17.15.2 Transition XL12:PS_Quiet to XL0:Idle 457
6.18 SSP link layer 457
6.18.1 Opening an SSP connection 457
6.18.2 Full duplex 457
6.18.3 SSP frame transmission and reception 458
6.18.4 SSP flow control 458
6.18.5 Interlocked frames 459
6.18.6 Breaking an SSP connection 461
6.18.7 Closing an SSP connection 461
6.18.8 SSP (link layer for SSP phys) state machines 462
6.18.8.1 SSP state machines overview 462
6.18.8.2 SSP transmitter and receiver 465
6.18.8.3 SSP_TIM (transmit interlocked frame monitor) state machine 466
6.18.8.4 SSP_TCM (transmit frame credit monitor) state machine 467
6.18.8.5 SSP_D (DONE control) state machine 467
6.18.8.6 SSP_TF (transmit frame control) state machine 468
6.18.8.6.1 SSP_TF state machine overview 468
6.18.8.6.2 SSP_TF1:Connected_Idle state 469
6.18.8.6.2.1 State description 469
6.18.8.6.2.2 Transition SSP_TF1:Connected_Idle to SSP_TF2:Tx_Wait 469
6.18.8.6.2.3 Transition SSP_TF1:Connected_Idle to SSP_TF4:Transmit_DONE 469
6.18.8.6.3 SSP_TF2:Tx_Wait state 469
6.18.8.6.3.1 State description 469
6.18.8.6.3.2 Transition SSP_TF2:Tx_Wait to SSP_TF3:Transmit_Frame 469
6.18.8.6.3.3 Transition SSP_TF2:Tx_Wait to SSP_TF4:Transmit_DONE 469
6.18.8.6.4 SSP_TF3:Transmit_Frame state 470
6.18.8.6.4.1 State description 470
6.18.8.6.4.2 Transition SSP_TF3:Transmit_Frame to SSP_TF1:Connected_Idle 470
6.18.8.6.5 SSP_TF4:Transmit_DONE state 470
6.18.8.7 SSP_RF (receive frame control) state machine 471
6.18.8.8 SSP_RCM (receive frame credit monitor) state machine 471
6.18.8.9 SSP_RIM (receive interlocked frame monitor) state machine 472
6.18.8.10 SSP_TC (transmit credit control) state machine 472
6.18.8.11 SSP_TAN (transmit ACK/NAK control) state machine 473

6.19 STP link layer 473
6.19.1 STP frame transmission and reception 473
6.19.2 STP flow control 474
6.19.2.1 STP flow control overview 474
6.19.2.2 SATA frame buffering 474
6.19.2.3 STP flow control buffer size 475
6.19.2.4 STP flow control example 476
6.19.2.5 STP insufficient buffer support 478
6.19.3 Continued primitive sequence 478
6.19.4 Affiliations 479
6.19.5 Opening an STP connection 481
6.19.6 Closing an STP connection 483
6.19.7 STP connection management examples 483
6.19.8 STP (link layer for STP phys) state machines 486
6.19.9 SMP target port support 486
6.20 SMP link layer 486
6.20.1 SMP frame transmission and reception 486
6.20.2 SMP flow control 486
6.20.3 Opening an SMP connection 486
6.20.4 Closing an SMP connection 486
6.20.5 SMP (link layer for SMP phys) state machines 487
6.20.5.1 SMP state machines overview 487
6.20.5.2 SMP transmitter and receiver 487
6.20.5.3 SMP_IP (link layer for SMP initiator phys) state machine 487
6.20.5.3.1 SMP_IP state machine overview 487
6.20.5.3.2 SMP_IP1:Idle state 488
6.20.5.3.2.1 State description 488
6.20.5.3.2.2 Transition SMP_IP1:Idle to SMP_IP2:Transmit_Frame 488
6.20.5.3.3 SMP_IP2:Transmit_Frame state 489
6.20.5.3.3.1 State description 489
6.20.5.3.3.2 Transition SMP_IP2:Transmit_Frame to SMP_IP3:Receive_Frame 489
6.20.5.3.4 SMP_IP3:Receive_Frame state 489
6.20.5.4 SMP_TP (link layer for SMP target phys) state machine 490
6.20.5.4.1 SMP_TP state machine overview 490
6.20.5.4.2 SMP_TP1:Receive_Frame state 490
6.20.5.4.2.1 State description 490
6.20.5.4.2.2 Transition SMP_TP1:Receive_Frame to SMP_TP2:Transmit_Frame 491
6.20.5.4.3 SMP_TP2:Transmit_Frame state 491

7 Port layer 492
7.1 Port layer overview 492
7.2 PL (port layer) state machines 492
7.2.1 PL state machines overview 492
7.2.2 PL_OC (port layer overall control) state machine 494
7.2.2.1 PL_OC state machine overview 494
7.2.2.2 PL_OC1:Idle state 496
7.2.2.2.1 PL_OC1:Idle state description 496
7.2.2.2.2 Transition PL_OC1:Idle to PL_OC2:Overall_Control 497
7.2.2.3 PL_OC2:Overall_Control state 497
7.2.2.3.1 PL_OC2:Overall_Control state overview 497
7.2.2.3.2 PL_OC2:Overall_Control state establishing connections 498
7.2.2.3.3 PL_OC2:Overall_Control state connection established 501
7.2.2.3.4 PL_OC2:Overall_Control state unable to establish a connection — Unable To Connect message 502
7.2.2.3.5 PL_OC2:Overall_Control state unable to establish a connection — Unable To Connect message - Retry Open message processed as an Unable To Connect message 502
7.2.2.3.6 PL_OC2:Overall_Control state unable to establish a connection — I_T Nexus Loss timer expires 502

7.2.2.3.7 PL_OC2:Overall_Control state - I_T nexus loss 502
7.2.2.3.8 PL_OC2:Overall_Control state connection management 503
7.2.2.3.9 PL_OC2:Overall_Control state frame transmission 503
7.2.2.3.10 PL_OC2:Overall_Control state frame transmission cancellations 505
7.2.2.3.11 Transition PL_OC2:Overall_Control to PL_OC1:Idle 505
7.2.3 PL_PM (port layer phy manager) state machine 505
7.2.3.1 PL_PM state machine overview 505
7.2.3.2 PL_PM1:Idle state 508
7.2.3.2.1 PL_PM1:Idle state description 508
7.2.3.2.2 Transition PL_PM1:Idle to PL_PM2:Req_Wait 509
7.2.3.2.3 Transition PL_PM1:Idle to PL_PM3:Connected 509
7.2.3.3 PL_PM2:Req_Wait state 509
7.2.3.3.1 PL_PM2:Req_Wait state overview 509
7.2.3.3.2 PL_PM2:Req_Wait establishing a connection 509
7.2.3.3.3 PL_PM2:Req_Wait connection established 509
7.2.3.3.4 PL_PM2:Req_Wait unable to establish a connection 510
7.2.3.3.5 PL_PM2:Req_Wait connection management 511
7.2.3.3.6 Transition PL_PM2:Req_Wait to PL_PM1:Idle 511
7.2.3.3.7 Transition PL_PM2:Req_Wait to PL_PM3:Connected 511
7.2.3.3.8 Transition PL_PM2:Req_Wait to PL_PM4:Wait_For_Close 511
7.2.3.4 PL_PM3:Connected state 511
7.2.3.4.1 PL_PM3:Connected state description 511
7.2.3.4.2 Transition PL_PM3:Connected to PL_PM1:Idle 514
7.2.3.5 PL_PM4:Wait_For_Close state 514
7.2.3.5.1 PL_PM4:Wait_For_Close state description 514
7.2.3.5.2 Transition PL_PM4:Wait_For_Close to PL_PM1:Idle 515

8 Transport layer 516
8.1 Transport layer overview 516
8.2 SSP transport layer 517
8.2.1 SSP frame format 517
8.2.2 Information units 521
8.2.2.1 COMMAND frame - Command information unit 521
8.2.2.2 TASK frame - Task Management Function information unit 522
8.2.2.3 XFER_RDY frame - Transfer Ready information unit 525
8.2.2.4 DATA frame - Data information unit 526
8.2.2.5 RESPONSE frame - Response information unit 528
8.2.2.5.1 RESPONSE frame - Response information unit overview 528
8.2.2.5.2 Response information unit - NO_DATA format 530
8.2.2.5.3 Response information unit - RESPONSE_DATA format 530
8.2.2.5.4 Response information unit - SENSE_DATA format 531
8.2.3 Sequences of SSP frames 532
8.2.3.1 Sequences of SSP frames overview 532
8.2.3.2 Task management function sequence of SSP frames 532
8.2.3.3 Non-data command sequence of SSP frames 533
8.2.3.4 Write command sequence of SSP frames 533
8.2.3.5 Read command sequence of SSP frames 534
8.2.3.6 Bidirectional command sequence of SSP frames 535
8.2.4 SSP transport layer handling of link layer errors 535
8.2.4.1 SSP transport layer handling of link layer errors overview 535
8.2.4.2 COMMAND frame - handling of link layer errors 536
8.2.4.3 TASK frame - handling of link layer errors 536
8.2.4.4 XFER_RDY frame - handling of link layer errors 537
8.2.4.4.1 XFER_RDY frame overview 537
8.2.4.4.2 XFER_RDY frame with transport layer retries enabled 537
8.2.4.4.3 XFER_RDY frame with transport layer retries disabled 538
8.2.4.5 Read DATA frame - handling of link layer errors 538
8.2.4.5.1 Read DATA frame overview 538

8.2.4.5.2 Read DATA frame with transport layer retries enabled 538
8.2.4.5.3 Read DATA frame with transport layer retries disabled 538
8.2.4.6 Write DATA frame - handling of link layer errors 539
8.2.4.6.1 Write DATA frame overview 539
8.2.4.6.2 Write DATA frame with transport layer retries enabled 539
8.2.4.6.3 Write DATA frame with transport layer retries disabled 539
8.2.4.7 RESPONSE frame - handling of link layer errors 540
8.2.5 SSP transport layer error handling summary 540
8.2.5.1 SSP transport layer error handling summary introduction 540
8.2.5.2 SSP initiator port transport layer error handling summary 540
8.2.5.3 SSP target port transport layer error handling summary 541
8.2.6 ST (transport layer for SSP ports) state machines 542
8.2.6.1 ST state machines overview 542
8.2.6.2 ST_I (transport layer for SSP initiator ports) state machines 542
8.2.6.2.1 ST_I state machines overview 542
8.2.6.2.2 ST_IFR (initiator frame router) state machine 544
8.2.6.2.2.1 ST_IFR state machine overview 544
8.2.6.2.2.2 Processing transport protocol service requests 544
8.2.6.2.2.3 Processing Frame Received confirmations 545
8.2.6.2.2.4 Processing Transmission Complete and Reception Complete messages 546
8.2.6.2.2.5 Processing miscellaneous requests 547
8.2.6.2.3 ST_ITS (initiator transport server) state machine 548
8.2.6.2.3.1 ST_ITS state machine overview 548
8.2.6.2.3.2 ST_ITS1:Initiator_Start state 549
8.2.6.2.3.2.1 State description 549
8.2.6.2.3.2.2 Transition ST_ITS1:Initiator_Start to ST_ITS3:Prepare_Command 549
8.2.6.2.3.2.3 Transition ST_ITS1:Initiator_Start to ST_ITS4:Prepare_Task 549
8.2.6.2.3.3 ST_ITS2:Initiator_Send_Frame state 549
8.2.6.2.3.3.1 Transition ST_ITS2:Initiator_Send_Frame to ST_ITS1:Initiator_Start 553
8.2.6.2.3.3.2 Transition ST_ITS2:Initiator_Send_Frame to ST_ITS5:Prepare_Data_Out 553
8.2.6.2.3.3.3 Transition ST_ITS2:Initiator_Send_Frame to ST_ITS6:Process_Data_In 553
8.2.6.2.3.4 ST_ITS3:Prepare_Command state 554
8.2.6.2.3.4.1 State description 554
8.2.6.2.3.4.2 Transition ST_ITS3:Prepare_Command to ST_ITS2:Initiator_Send_Frame 554
8.2.6.2.3.5 ST_ITS4:Prepare_Task state 554
8.2.6.2.3.5.1 State description 554
8.2.6.2.3.5.2 Transition ST_ITS4:Prepare_Task to ST_ITS2:Initiator_Send_Frame 555
8.2.6.2.3.6 ST_ITS5:Prepare_Data_Out state 555
8.2.6.2.3.6.1 State description 555
8.2.6.2.3.6.2 Transition ST_ITS5:Prepare_Data_Out to ST_ITS2:Intiator_Send_Frame 556
8.2.6.2.3.7 ST_ITS6:Receive_Data_In state 556
8.2.6.2.3.7.1 State description 556
8.2.6.2.3.7.2 Transition ST_ITS6:Receive_Data_In to ST_ITS1:Initiator_Start 557
8.2.6.2.3.7.3 Transition ST_ITS6:Receve_Data_In to ST_ITS2:Initiator_Send_Frame 557
8.2.6.3 ST_T (transport layer for SSP target ports) state machines 557
8.2.6.3.1 ST_T state machines overview 557
8.2.6.3.2 ST_TFR (target frame router) state machine 560
8.2.6.3.2.1 ST_TFR state machine overview 560
8.2.6.3.2.2 Processing Frame Received confirmations 560
8.2.6.3.2.3 Processing transport protocol service requests and responses 562
8.2.6.3.2.4 Processing miscellaneous requests and confirmations 566
8.2.6.3.3 ST_TTS (target transport server) state machine 566
8.2.6.3.3.1 ST_TTS state machine overview 566
8.2.6.3.3.2 ST_TTS1:Target_Start state 567
8.2.6.3.3.2.1 State description 567
8.2.6.3.3.2.2 Transition ST_TTS1:Target_Start to ST_TTS3:Prepare_Data_In 568
8.2.6.3.3.2.3 Transition ST_TTS1:Target_Start to ST_TTS4:Prepare_Xfer_Rdy 568
8.2.6.3.3.2.4 Transition ST_TTS1:Target_Start to ST_TTS5:Receive_Data_Out 568

8.2.6.3.3.2.5 Transition ST_TTS1:Target_Start to ST_TTS7:Prepare_Response 568
8.2.6.3.3.3 ST_TTS2:Target_Send_Frame state 568
8.2.6.3.3.3.1 State description 568
8.2.6.3.3.3.2 Transition ST_TTS2:Target_Send_Frame to ST_TTS1:Target_Start 572
8.2.6.3.3.3.3 Transition ST_TTS2:Target_Send_Frame to ST_TTS3:Prepare_Data_In 572
8.2.6.3.3.3.4 Transition ST_TTS2:Target_Send_Frame to ST_TTS5:Receive_Data_Out 572
8.2.6.3.3.4 ST_TTS3:Prepare_Data_In state 572
8.2.6.3.3.4.1 State description 572
8.2.6.3.3.4.2 Transition ST_TTS3:Prepare_Data_In to ST_TTS2:Target_Send_Frame 574
8.2.6.3.3.5 ST_TTS4:Prepare_Xfer_Rdy state 574
8.2.6.3.3.5.1 State description 574
8.2.6.3.3.5.2 Transition ST_TTS4:Prepare_Xfer_Rdy to ST_TTS2:Target_Send_Frame 574
8.2.6.3.3.6 ST_TTS5:Receive_Data_Out state 575
8.2.6.3.3.6.1 State description 575
8.2.6.3.3.6.2 Transition ST_TTS5:Receive_Data_Out to ST_TTS1:Target_Start 576
8.2.6.3.3.6.3 Transition ST_TTS5:Receive_Data_Out to ST_TTS4:Prepare_Xfer_Rdy 576
8.2.6.3.3.7 ST_TTS6:Prepare_Response state 577
8.2.6.3.3.7.1 State description 577
8.2.6.3.3.7.2 Transition ST_TTS6:Prepare_Response to ST_TTS2:Target_Send_Frame 578
8.3 STP transport layer 578
8.3.1 Initial FIS 578
8.3.2 BIST Activate FIS 578
8.3.3 TT (transport layer for STP ports) state machines 578
8.4 SMP transport layer 579
8.4.1 SMP transport layer overview 579
8.4.2 SMP_REQUEST frame 580
8.4.3 SMP_RESPONSE frame 581
8.4.4 Sequence of SMP frames 581
8.4.5 MT (transport layer for SMP ports) state machines 582
8.4.5.1 SMP transport layer state machines overview 582
8.4.5.2 MT_IP (transport layer for SMP initiator ports) state machine 582
8.4.5.2.1 MT_IP state machine overview 582
8.4.5.2.2 MT_IP1:Idle state 583
8.4.5.2.2.1 State description 583
8.4.5.2.2.2 Transition MT_IP1:Idle to MT_IP2:Send 583
8.4.5.2.3 MT_IP2:Send state 584
8.4.5.2.3.1 State description 584
8.4.5.2.3.2 Transition MT_IP2:Send to MT_IP1:Idle 584
8.4.5.2.3.3 Transition MT_IP2:Send to MT_IP3:Receive 584
8.4.5.2.4 MT_IP3:Receive state 584
8.4.5.2.4.1 State description 584
8.4.5.2.4.2 Transition MT_IP3:Receive to MT_IP1:Idle 584
8.4.5.3 MT_TP (transport layer for SMP target ports) state machine 584
8.4.5.3.1 MT_TP state machine overview 584
8.4.5.3.2 MT_TP1:Idle state 585
8.4.5.3.2.1 State description 585
8.4.5.3.2.2 Transition MT_TP1:Idle to MT_TP2:Respond 585
8.4.5.3.3 MT_TP2:Respond state 586
8.4.5.3.3.1 State description 586
8.4.5.3.3.2 Transition MT_TP2:Respond to MT_TP1:Idle 586

9 Application layer 587
9.1 Application layer overview 587
9.2 SCSI application layer 587
9.2.1 SCSI transport protocol services 587
9.2.1.1 SCSI transport protocol services overview 587
9.2.1.2 Send SCSI Command transport protocol service 588
9.2.1.3 SCSI Command Received transport protocol service 589

9.2.1.4 Send Command Complete transport protocol service 590
9.2.1.5 Command Complete Received transport protocol service 591
9.2.1.6 Send Data-In transport protocol service 592
9.2.1.7 Data-In Delivered transport protocol service 593
9.2.1.8 Receive Data-Out transport protocol service 593
9.2.1.9 Data-Out Received transport protocol service 594
9.2.1.10 Terminate Data Transfer transport protocol service 594
9.2.1.11 Data Transfer Terminated transport protocol service 595
9.2.1.12 Send Task Management Request transport protocol service 595
9.2.1.13 Task Management Request Received transport protocol service 596
9.2.1.14 Task Management Function Executed transport protocol service 597
9.2.1.15 Received Task Management Function Executed transport protocol service 598
9.2.2 SCSI application client error handling 599
9.2.3 SCSI device server error handling 600
9.2.3.1 SCSI Command Received () error handling 600
9.2.3.2 Data-Out Received () error handling 600
9.2.4 Task router and task manager error handling 601
9.2.5 SCSI transport protocol services for event notifications 601
9.2.6 SCSI commands 602
9.2.6.1 INQUIRY command 602
9.2.6.2 LOG SELECT and LOG SENSE commands 602
9.2.6.3 MODE SELECT and MODE SENSE commands 602
9.2.6.4 SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands 602
9.2.6.5 START STOP UNIT command 602
9.2.7 SCSI mode parameters 602
9.2.7.1 SCSI mode parameters overview 602
9.2.7.2 Disconnect-Reconnect mode page 603
9.2.7.2.1 Disconnect-Reconnect mode page overview 603
9.2.7.2.2 BUS INACTIVITY TIME LIMIT field 604
9.2.7.2.3 MAXIMUM CONNECT TIME LIMIT field 605
9.2.7.2.4 MAXIMUM BURST SIZE field 605
9.2.7.2.5 FIRST BURST SIZE field 605
9.2.7.3 Protocol Specific Logical Unit mode page 606
9.2.7.4 Protocol Specific Port mode page 606
9.2.7.5 Phy Control And Discover mode page 608
9.2.7.6 Shared Port Control mode page 612
9.2.7.7 Enhanced Phy Control mode page 613
9.2.8 SCSI log parameters 615
9.2.8.1 Protocol Specific Port log page 615
9.2.8.2 Protocol Specific Port log parameter for SAS target ports 616
9.2.9 SCSI diagnostic parameters 619
9.2.9.1 SCSI diagnostic parameters overview 619
9.2.9.2 Protocol Specific diagnostic page 619
9.2.9.3 Enclosure Control diagnostic page 625
9.2.9.4 Enclosure Status diagnostic page 625
9.2.9.5 Additional Element Status diagnostic page 625
9.2.10 SCSI power conditions 626
9.2.10.1 SCSI power conditions overview 626
9.2.10.2 SA_PC (SCSI application layer power condition) state machine 626
9.2.10.2.1 SA_PC state machine overview 626
9.2.10.2.2 SA_PC_0:Powered_On state 630
9.2.10.2.2.1 State description 630
9.2.10.2.2.2 Transition SA_PC_0:Powered_On to SA_PC_4:Active_Wait 630
9.2.10.2.2.3 Transition SA_PC_0:Powered_On to SA_PC_8:Stopped 630
9.2.10.2.3 SA_PC_1:Active state 630
9.2.10.2.3.1 State description 630
9.2.10.2.3.2 Transition SA_PC_1:Active to SA_PC_5:Wait_Idle 630
9.2.10.2.3.3 Transition SA_PC_1:Active to SA_PC_6:Wait_Standby 630

9.2.10.2.3.4 Transition SA_PC_1:Active to SA_PC_10:Wait_Stopped 630
9.2.10.2.4 SA_PC_2:Idle state 630
9.2.10.2.4.1 State description 630
9.2.10.2.4.2 Transition SA_PC_2:Idle to SA_PC_4:Active_Wait 630
9.2.10.2.4.3 Transition SA_PC_2:Idle to SA_PC_5:Wait_Idle 630
9.2.10.2.4.4 Transition SA_PC_2:Idle to SA_PC_6:Wait_Standby 631
9.2.10.2.4.5 Transition SA_PC_2:Idle to SA_PC_7:Idle_Wait 631
9.2.10.2.4.6 Transition SA_PC_2:Idle to SA_PC_10:Wait_Stopped 631
9.2.10.2.5 SA_PC_3:Standby state 631
9.2.10.2.5.1 State description 631
9.2.10.2.5.2 Transition SA_PC_3:Standby to SA_PC_4:Active_Wait 631
9.2.10.2.5.3 Transition SA_PC_3:Standby to SA_PC_6:Wait_Standby 631
9.2.10.2.5.4 Transition SA_PC_3:Standby to SA_PC_7:Idle_Wait 631
9.2.10.2.5.5 Transition SA_PC_3:Standby to SA_PC_9: Standby_Wait 631
9.2.10.2.5.6 Transition SA_PC_3:Standby to SA_PC_10:Wait_Stopped 631
9.2.10.2.6 SA_PC_4:Active_Wait state 632
9.2.10.2.6.1 State description 632
9.2.10.2.6.2 Transition SA_PC_4:Active_Wait to SA_PC_1:Active 633
9.2.10.2.7 SA_PC_5:Wait_Idle state 634
9.2.10.2.7.1 SA_PC_5:Wait_Idle state description 634
9.2.10.2.7.2 Transition SA_PC_5:Wait_Idle to SA_PC_2:Idle 634
9.2.10.2.8 SA_PC_6:Wait_Standby state 634
9.2.10.2.8.1 SA_PC_6:Wait_Standby state description 634
9.2.10.2.8.2 Transition SA_PC_6:Wait_Standby to SA_PC_3:Standby 634
9.2.10.2.9 SA_PC_7:Idle_Wait state 634
9.2.10.2.9.1 State description 634
9.2.10.2.9.2 Transition SA_PC_7:Idle_Wait to SA_PC_2:Idle 635
9.2.10.2.10 SA_PC_8:Stopped state 635
9.2.10.2.10.1 State description 635
9.2.10.2.10.2 Transition SA_PC_8:Stopped to SA_PC_4:Active_Wait 636
9.2.10.2.10.3 Transition SA_PC_8:Stopped to SA_PC_7:Idle_Wait 636
9.2.10.2.10.4 Transition SA_PC_8:Stopped to SA_PC_9:Standby_Wait 636
9.2.10.2.11 SA_PC_9:Standby_Wait state 636
9.2.10.2.11.1 SA_PC_9:Standby_Wait state description 636
9.2.10.2.11.2 Transition SA_PC_9:Standby_Wait to SA_PC_3:Standby 636
9.2.10.2.12 SA_PC_10:Wait_Stopped state 636
9.2.10.2.12.1 SA_PC_10:Wait_Stopped state description 636
9.2.10.2.12.2 Transition SA_PC_10:Wait_Stopped to SA_PC_8:Stopped 636
9.2.11 SCSI vital product data (VPD) 636
9.2.11.1 SCSI vital product data (VPD) overview 636
9.2.11.2 Device Identification VPD page 636
9.2.11.3 Protocol Specific Logical Unit Information VPD page 638
9.3 ATA application layer 640
9.4 Management application layer 640
9.4.1 READY LED signal behavior 640
9.4.2 Management protocol services 641
9.4.3 SMP functions 642
9.4.3.1 SMP functions overview 642
9.4.3.2 SMP function request frame format 644
9.4.3.2.1 SMP function request frame format overview 644
9.4.3.2.2 SMP FRAME TYPE field 644
9.4.3.2.3 FUNCTION field 644
9.4.3.2.4 ALLOCATED RESPONSE LENGTH field 644
9.4.3.2.5 REQUEST LENGTH field 645
9.4.3.2.6 Additional request bytes 645
9.4.3.2.7 CRC field 646
9.4.3.3 SMP function response frame format 646
9.4.3.3.1 SMP function response frame format overview 646

9.4.3.3.2 SMP FRAME TYPE field 646
9.4.3.3.3 FUNCTION field 646
9.4.3.3.4 FUNCTION RESULT field 647
9.4.3.3.5 RESPONSE LENGTH field 654
9.4.3.3.6 Additional response bytes 655
9.4.3.3.7 CRC field 655
9.4.3.4 REPORT GENERAL function 655
9.4.3.5 REPORT MANUFACTURER INFORMATION function 662
9.4.3.6 REPORT SELF-CONFIGURATION STATUS function 665
9.4.3.6.1 REPORT SELF-CONFIGURATION STATUS function overview 665
9.4.3.6.2 REPORT SELF-CONFIGURATION STATUS request 665
9.4.3.6.3 REPORT SELF-CONFIGURATION STATUS response 666
9.4.3.6.4 Self-configuration status descriptor 668
9.4.3.7 REPORT ZONE PERMISSION TABLE function 670
9.4.3.7.1 REPORT ZONE PERMISSION TABLE function overview 670
9.4.3.7.2 REPORT ZONE PERMISSION TABLE request 670
9.4.3.7.3 REPORT ZONE PERMISSION TABLE response 672
9.4.3.7.4 Zone permission descriptor 673
9.4.3.8 REPORT ZONE MANAGER PASSWORD function 674
9.4.3.9 REPORT BROADCAST function 676
9.4.3.9.1 REPORT BROADCAST function overview 676
9.4.3.9.2 REPORT BROADCAST request 677
9.4.3.9.3 REPORT BROADCAST response 678
9.4.3.9.4 Broadcast descriptor 679
9.4.3.10 DISCOVER function 680
9.4.3.11 REPORT PHY ERROR LOG function 697
9.4.3.12 REPORT PHY SATA function 700
9.4.3.13 REPORT ROUTE INFORMATION function 704
9.4.3.14 REPORT PHY EVENT function 707
9.4.3.14.1 REPORT PHY EVENT function overview 707
9.4.3.14.2 REPORT PHY EVENT request 707
9.4.3.14.3 REPORT PHY EVENT response 709
9.4.3.14.4 Phy event descriptor 710
9.4.3.15 DISCOVER LIST function 710
9.4.3.15.1 DISCOVER LIST function overview 710
9.4.3.15.2 DISCOVER LIST request 711
9.4.3.15.3 DISCOVER LIST response 713
9.4.3.15.4 DISCOVER LIST response SHORT FORMAT descriptor 715
9.4.3.16 REPORT PHY EVENT LIST function 716
9.4.3.16.1 REPORT PHY EVENT LIST function overview 716
9.4.3.16.2 REPORT PHY EVENT LIST request 716
9.4.3.16.3 REPORT PHY EVENT LIST response 717
9.4.3.16.4 Phy event list descriptor 719
9.4.3.17 REPORT EXPANDER ROUTE TABLE LIST function 719
9.4.3.17.1 REPORT EXPANDER ROUTE TABLE LIST function overview 719
9.4.3.17.2 REPORT EXPANDER ROUTE TABLE LIST request 720
9.4.3.17.3 REPORT EXPANDER ROUTE TABLE LIST response 722
9.4.3.17.4 Expander route table descriptor 724
9.4.3.18 CONFIGURE GENERAL function 724
9.4.3.19 ENABLE DISABLE ZONING function 728
9.4.3.20 ZONED BROADCAST function 730
9.4.3.21 ZONE LOCK function 732
9.4.3.22 ZONE ACTIVATE function 734
9.4.3.23 ZONE UNLOCK function 736
9.4.3.24 CONFIGURE ZONE MANAGER PASSWORD function 737
9.4.3.25 CONFIGURE ZONE PHY INFORMATION function 740
9.4.3.25.1 CONFIGURE ZONE PHY INFORMATION function overview 740
9.4.3.25.2 CONFIGURE ZONE PHY INFORMATION request 740

9.4.3.25.3 Zone phy configuration descriptor 741
9.4.3.25.4 CONFIGURE ZONE PHY INFORMATION response 742
9.4.3.26 CONFIGURE ZONE PERMISSION TABLE function 742
9.4.3.26.1 CONFIGURE ZONE PERMISSION TABLE function overview 742
9.4.3.26.2 CONFIGURE ZONE PERMISSION TABLE request 743
9.4.3.26.3 Zone permission configuration descriptor 745
9.4.3.26.4 CONFIGURE ZONE PERMISSION TABLE response 746
9.4.3.27 CONFIGURE ROUTE INFORMATION function 747
9.4.3.28 PHY CONTROL function 749
9.4.3.29 PHY TEST FUNCTION function 757
9.4.3.30 CONFIGURE PHY EVENT function 761
9.4.3.30.1 CONFIGURE PHY EVENT function overview 761
9.4.3.30.2 CONFIGURE PHY EVENT request 761
9.4.3.30.3 Phy event configuration descriptor 762
9.4.3.30.4 CONFIGURE PHY EVENT response 763

Annex A (normative) Jitter tolerance patterns 764
A.1 Jitter tolerance pattern (JTPAT) 764
A.2 Compliant jitter tolerance pattern (CJTPAT) 764
A.3 Considerations for a phy transmitting JTPAT and CJTPAT 770
A.4 Considerations for a phy receiving JTPAT and CJTPAT 770

Annex B (informative) SAS to SAS phy reset sequence examples 772

Annex C (informative) CRC 777
C.1 CRC generator and checker implementation examples 777
C.2 CRC implementation in C 777
C.3 CRC implementation with XORs 778
C.4 CRC examples 780

Annex D (informative) SAS address hashing 781
D.1 SAS address hashing overview 781
D.2 Hash collision probability 781
D.3 Hash generation 782
D.4 Hash implementation in C 782
D.5 Hash implementation with XORs 783
D.6 Hash examples 784

Annex E (informative) Scrambling 787
E.1 Scrambler implementation example 787
E.2 Scrambler implementation in C 787
E.3 Scrambler implementation with XORs 788
E.4 Scrambler examples 789

Annex F (informative) ATA architectural notes 791
F.1 STP differences from Serial ATA (SATA) 791
F.2 STP differences from Serial ATA II 791
F.3 Affiliation policies 791
F.3.1 Affiliation policies overview 791
F.3.2 Affiliation policy for static STP initiator port to STP target port mapping 792
F.3.3 Affiliation policy with SATA queued commands and multiple STP initiator ports 792
F.3.4 Applicability of affiliation for STP target ports 792
F.4 SATA port selector considerations 792
F.5 SATA device not transmitting initial Register Device-to-Host FIS 792

Annex G (informative) Minimum deletable primitive insertion rate summary 794

Annex H (informative) Zone permission configuration descriptor examples 795

Annex I (informative) SAS addressing 798
I.1 SAS addressing in SAS domains 798
I.2 Expander device SAS addresses 798

Annex J (informative) Expander device handling of connections 799
J.1 Expander device handling of connections overview 799
J.2 Connection request - OPEN_ACCEPT 801
J.3 Connection request - OPEN_REJECT by end device 802
J.4 Connection request - OPEN_REJECT by expander device 803
J.5 Connection request - arbitration lost 804
J.6 Connection request - backoff and retry 805
J.7 Connection request - backoff and reverse path 806
J.8 Connection close - single step 807
J.9 Connection close - simultaneous 808
J.10 BREAK handling during path arbitration when the BREAK_REPLY method is disabled 809
J.11 BREAK handling during connection when the BREAK_REPLY method is disabled 810
J.12 BREAK handling during path arbitration when the BREAK_REPLY method is enabled 811
J.13 BREAK handling during connection when BREAK_REPLY method is enabled 812
J.14 STP connection - originated by STP initiator port 813
J.15 STP connection - originated by STP target port in an STP SATA bridge 814
J.16 STP connection close - originated by STP initiator port 815
J.17 STP connection close - originated by STP target port in an STP SATA bridge 816
J.18 Connection request - XL1:Request_Path to XL5:Forward_Open transition 817
J.19 Pathway blocked and pathway recovery example 818

Annex K (informative) Primitive encoding 820

Annex L (informative) Standards bodies contact information 823

Bibliography 824

Figure 1 — Organization of this standard 38
Figure 2 — SCSI document relationships 39
Figure 3 — ATA document relationships 39
Figure 4 – Examples of association relationships in class diagrams 79
Figure 5 – Examples of aggregation relationships in class diagrams 80
Figure 6 – Example of generalization relationships in class diagrams 81
Figure 7 – Example of a dependency relationship in class diagrams 81
Figure 8 – Examples of link relationships for object diagrams 82
Figure 9 – State machine conventions 83
Figure 10 – SAS Domain class diagram 88
Figure 11 – Phy class diagram 90
Figure 12 – SAS phy object diagram 91
Figure 13 – Expander phy object diagram 92
Figure 14 – Ports (narrow ports and wide ports) 94
Figure 15 – Port class diagram 95
Figure 16 – Port object diagram 96
Figure 17 – SAS devices 97
Figure 18 – Expander device 98
Figure 19 – Domains 99
Figure 20 – SAS domain bridging to ATA domains 100
Figure 21 – SAS domains bridging to ATA domains with SATA port selectors 101
Figure 22 – Devices spanning SAS domains 102
Figure 23 – Single expander device topology example 102
Figure 24 – Multiple expander device topologies 103
Figure 25 – Potential pathways 104
Figure 26 – Multiple connections on wide ports 106
Figure 27 – State machines for SAS devices 115
Figure 28 – State machines for expander devices 116
Figure 29 – Transmit data path in a SAS phy 117
Figure 30 – SSP link, port, SSP transport, and SCSI application layer state machines 118
Figure 31 – SMP link, port, SMP transport, and management application layer state machines 119
Figure 32 – STP link, port, STP transport, and ATA application layer state machines 120
Figure 33 – Transmit data path and state machines in an expander phy 121
Figure 34 – Receive data path in a SAS phy 123
Figure 35 – Receive data path in an expander phy 124
Figure 36 – State machines and SAS Device classes 125
Figure 37 – State machines and Expander Device classes 126
Figure 38 – Reset terminology 127
Figure 39 – Expander device model 130
Figure 40 – Expander device interfaces 133
Figure 41 – Expander device interface detail 134
Figure 42 – Phy-based expander route table 142
Figure 43 – Expander-based expander route table 143
Figure 44 – Level-order traversal example 145
Figure 45 – Examples of invalid topologies 149
Figure 46 – Externally configurable expander device and table-to-table attachment 152
Figure 47 – Expander route index levels example 153
Figure 48 – Expander route index order example 155
Figure 49 – Zoning example 157
Figure 50 – One ZPSDS example 158
Figure 51 – Zone manager location examples 159
Figure 52 – Three ZPSDSes example 160
Figure 53 – Extending a ZPSDS example 162
Figure 54 – Overtaking a ZPSDS example 163
Figure 55 – Zoning expander route table 168
Figure 56 – SAS bit transmission logic 194
Figure 57 – SAS bit reception logic 195
Figure 58 – OOB signal transmission 196

Figure 59 – OOB signal detection 198
Figure 60 – TTIU transmitter BMC encoding 204
Figure 61 – TTIU bit cell transmitter encoding 205
Figure 62 – TTIU bit cell receiver decoding 206
Figure 63 – SATA OOB sequence 215
Figure 64 – SATA speed negotiation sequence 215
Figure 65 – SAS to SATA OOB sequence 217
Figure 66 – SAS to SAS OOB sequence 218
Figure 67 – SNW-1, SNW-2, and Final-SNW 222
Figure 68 – SNW-3 223
Figure 69 – Train_Tx-SNW 225
Figure 70 – Pattern marker transmission 226
Figure 71 – Valid pattern marker detection 227
Figure 72 – Train_Rx-SNW 228
Figure 73 – SAS speed negotiation sequence SNW flowchart 230
Figure 74 – SAS speed negotiation sequence (both phys SNW-1 through Train_Rx-SNW with no Train_Tx-SNW) 232
Figure 75 – SAS speed negotiation sequence (both phys SNW-1 through Train_Rx-SNW with Train_Tx-SNW) 233
Figure 76 – SAS speed negotiation sequence (phy A: SNW-1 through SNW-3, phy B: SNW-2 only) 234
Figure 77 – SAS speed negotiation sequence (phy A: SNW-3 only, phy B: SNW-1 only) 235
Figure 78 – SAS speed negotiation sequence - phy reset problem in Final-SNW 236
Figure 79 – SAS speed negotiation sequence - phy reset problem in SNW-3 237
Figure 80 – SAS speed negotiation sequence - phy reset problem in Train_Rx-SNW 238
Figure 81 – SAS speed negotiation sequence - multiple Train_Rx-SNWs 239
Figure 82 – Local phy achieves pattern lock before the attached phy achieves pattern lock 241
Figure 83 – Local phy achieves pattern lock after the attached phy achieves pattern lock 242
Figure 84 – Attached receiver handshake sequence (requesting two increments to coefficient 1) 244
Figure 85 – Attached receiver handshake sequence (requesting a decrement and an increment to coefficient 1) 245
Figure 86 – Handshake sequence to set local phy's receiver coefficients to no_equalization values (attached phy) 247
Figure 87 – Handshake sequence to set local phy's receiver coefficients to no_equalization values (local phy) 248
Figure 88 – Local phy's receiver indicates completion of training before the attached phy's receiver completes training 249
Figure 89 – Attached phy's receiver indicates completion of training before the local phy's receiver completes training 250
Figure 90 – Processing an invalid TTIU 252
Figure 91 – Hot-plug and the phy reset sequence 254
Figure 92 – Transition to active phy power condition 255
Figure 93 – Hot plug and low phy power condition 256
Figure 94 – SP (phy layer) state machine - OOB sequence states 262
Figure 95 – SP (phy layer) state machine - SAS speed negotiation states 268
Figure 96 – SP (phy layer) state machine - SAS speed negotiation states for SNW-3 and Train_Rx-SNW and Train_Tx-SNW 269
Figure 97 – SP (phy layer) state machine - SAS phy power condition states 280
Figure 98 – SP (phy layer) state machine - SATA host emulation states 283
Figure 99 – SP (phy layer) state machine – SATA port selector state 288
Figure 100 – SP (phy layer) state machine - SATA spinup hold state 289
Figure 101 – SP_DWS (phy layer dword synchronization) state machine 291
Figure 102 – PTT_T (phy layer transmitter training transmit pattern) state machine 302
Figure 103 – PTT_R (phy layer transmitter training receive pattern) state machine 310
Figure 104 – PTT_SC1, PTT_SC2, and PTT_SC3 (phy layer transmitter training set transmitter coefficient) state machines 318
Figure 105 – PTT_GC1, PTT_GC2, and PTT_GC3 (phy layer transmitter training get transmitter coefficient) state machines 323
Figure 106 – PTT_PL (phy layer transmitter training pattern lock) state machine 327

Figure 107 – Multiplexing disabled 330
Figure 108 – Multiplexing enabled 330
Figure 109 – Transmitting a repeated primitive sequence 343
Figure 110 – Receiving a repeated primitive sequence 344
Figure 111 – Extended primitive sequences 345
Figure 112 – Triple primitive sequences 346
Figure 113 – Redundant primitive sequences 347
Figure 114 – Elasticity buffer 360
Figure 115 – Address frame, SSP frame, and SMP frame CRC bit ordering 365
Figure 116 – STP frame CRC bit ordering 366
Figure 117 – Transmit path bit ordering 369
Figure 118 – Receive path bit ordering 370
Figure 119 – STP transmit path bit ordering 371
Figure 120 – STP receive path bit ordering 372
Figure 121 – Address frame transmission 372
Figure 122 – Identification sequence 382
Figure 123 – Hard reset sequence 383
Figure 124 – SL_IR (link layer identification and hard reset) state machines 385
Figure 125 – Transitioning from the active phy power condition to a low phy power condition 390
Figure 126 – SL_P_S (link layer power source device) state machine 394
Figure 127 – SL_P_C (link layer power consumer device) state machine 398
Figure 128 – Example simultaneous connection recommendations for wide ports 404
Figure 129 – Aborting a connection request with a BREAK primitive sequence 413
Figure 130 – Connection request timeout example 414
Figure 131 – Closing a connection example 415
Figure 132 – Rate matching example 418
Figure 133 – SL (link layer for SAS logical phys) state machines (part 1) 420
Figure 134 – SL (link layer for SAS logical phys) state machines (part 2) 421
Figure 135 – SL (link layer for SAS logical phys) state machines (part 3) 422
Figure 136 – XL (link layer for expander logical phys) state machine (part 1) 439
Figure 137 – XL (link layer for expander logical phys) state machine (part 2) 440
Figure 138 – XL (link layer for expander logical phys) state machine (part 3) 441
Figure 139 – XL (link layer for expander logical phys) state machine (part 4) 442
Figure 140 – SSP frame transmission 458
Figure 141 – Interlocked frames 460
Figure 142 – Non-interlocked frames with the same initiator port transfer tags 460
Figure 143 – Non-interlocked frames with different initiator port transfer tags 461
Figure 144 – Closing an SSP connection example 462
Figure 145 – SSP (link layer for SSP phys) state machines (part 1 - frame transmission) 464
Figure 146 – SSP (link layer for SSP phys) state machines (part 2 - frame reception) 465
Figure 147 – STP frame transmission 473
Figure 148 – STP flow control 477
Figure 149 – Transmitting a continued primitive sequence 478
Figure 150 – Receiving a continued primitive sequence 479
Figure 151 – Example simultaneous connection recommendations for an expander device 482
Figure 152 – STP initiator port opening an STP connection 484
Figure 153 – STP target port opening an STP connection 485
Figure 154 – SMP frame transmission 486
Figure 155 – SMP_IP (link layer for SMP initiator phys) state machine 488
Figure 156 – SMP_TP (link layer for SMP target phys) state machine 490
Figure 157 – Port layer examples 493
Figure 158 – PL_OC (port layer overall control) state machine 496
Figure 159 – PL_PM (port layer phy manager) state machine (part 1) 507
Figure 160 – PL_PM (port layer phy manager) state machine (part 2) 508
Figure 161 – Task management function sequence of SSP frames 532
Figure 162 – Non-data command sequence of SSP frames 533
Figure 163 – Write command sequence of SSP frames 533
Figure 164 – Read command sequence of SSP frames 534

Figure 165 – Bidirectional command sequence of SSP frames 535
Figure 166 – ST_I (transport layer for SSP initiator ports) state machines 543
Figure 167 – ST_T (transport layer for SSP target ports) state machines 559
Figure 168 – Sequence of SMP frames 581
Figure 169 – MT_IP (transport layer for SMP initiator ports) state machine 583
Figure 170 – MT_TP (transport layer for SMP target ports) state machine 585
Figure 171 – SA_PC (SCSI application layer power condition) state machine for SAS 629
Figure A.1 – CJTPAT pre-scrambling 765
Figure B.1 – SAS speed negotiation sequence (phy A: SNW-1 only, phy B: SNW-1 only) 772
Figure B.2 – SAS speed negotiation sequence (phy A: SNW-1, SNW-2, phy B: SNW-1, SNW-2) 773
Figure B.3 – SAS speed negotiation sequence (phy A: SNW-1, SNW-2, and SNW-3, phy B: SNW-1 and SNW-2) 774
Figure B.4 – SAS speed negotiation sequence (phy A: SNW-2, SNW-3, phy B: SNW-1, SNW-2) 775
Figure B.5 – SAS speed negotiation sequence (phy A: SNW-1 only, phy B: SNW-2 only) 776
Figure C.1 – CRC generator example 777
Figure C.2 – CRC checker example 777
Figure D.1 – BCH(69, 39, 9) code generator 782
Figure E.1 – Scrambler 787
Figure J.1 – Example topology 799
Figure J.2 – Connection request - OPEN_ACCEPT 801
Figure J.3 – Connection request - OPEN_REJECT by end device 802
Figure J.4 – Connection request - OPEN_REJECT by expander device 803
Figure J.5 – Connection request - arbitration lost 804
Figure J.6 – Connection request - backoff and retry 805
Figure J.7 – Connection request - backoff and reverse path 806
Figure J.8 – Connection close - single step 807
Figure J.9 – Connection close - simultaneous 808
Figure J.10 – BREAK handling during path arbitration when the BREAK_REPLY method is disabled 809
Figure J.11 – BREAK handling during a connection when the BREAK_REPLY method is disabled 810
Figure J.12 – BREAK handling during path arbitration when the BREAK_REPLY method is enabled 811
Figure J.13 – BREAK handling during a connection when the BREAK_REPLY method is enabled 812
Figure J.14 – STP connection - originated by STP initiator port 813
Figure J.15 – STP connection - originated by STP target port in an STP SATA bridge 814
Figure J.16 – STP connection close - originated by STP initiator port 815
Figure J.17 – STP connection close - originated by STP target port in an STP SATA bridge 816
Figure J.18 – XL1:Request_Path to XL5:Forward_Open transition 817
Figure J.19 – Partial pathway recovery 818

Table 1 – Numbering conventions 76
Table 2 – Constraint and note notation 77
Table 3 – Class diagram notation for classes 78
Table 4 – Multiplicity notation 78
Table 5 – Class diagram notation for associations 79
Table 6 – Class diagram notation for aggregations 80
Table 7 – Class diagram notation for generalizations 80
Table 8 – Class diagram notation for dependency 81
Table 9 – Object diagram notation for objects 82
Table 10 – Object diagram notation for link 82
Table 11 – Data dword containing a value 85
Table 12 – Data dword containing four one-byte fields 85
Table 13 – Logical links 93
Table 14 – Broadcast types 107
Table 15 – Names and identifiers 109
Table 16 – SCSI architecture model object attribute mapping 109
Table 17 – NAA IEEE Registered format 110
Table 18 – NAA Locally Assigned format 111
Table 19 – Hashed SAS address code parameters 111
Table 20 – Device name created from the IDENTIFY DEVICE data from an ATA device or IDENTIFY PACKET DEVICE data from an ATAPI device world wide name 113
Table 21 – Expander logical phy to ECM requests 135
Table 22 – Expander logical phy to ECM responses 135
Table 23 – ECM to expander logical phy confirmations 136
Table 24 – Expander logical phy to ECR to expander logical phy requests and indications 137
Table 25 – Expander logical phy to ECR to expander logical phy responses and confirmations 138
Table 26 – Expander logical phy to BPP requests 139
Table 27 – BPP to expander logical phy indications 139
Table 28 – Routing attributes and routing methods 140
Table 29 – Expander route table types 141
Table 30 – Expander route table levels for externally configurable expander device R phy A 154
Table 31 – Expander route table levels for externally configurable expander device N 154
Table 32 – Expander route entries for externally configurable expander device E0 phy 1 156
Table 33 – Expander route entries for externally configurable expander device F phy 0 156
Table 34 – Zone manager password 161
Table 35 – Zone phy information 164
Table 36 – Zone phy information usage 164
Table 37 – Zone groups 166
Table 38 – Zone permission table 167
Table 39 – Zone permission table granting minimal permissions 167
Table 40 – Source zone group determination 169
Table 41 – Destination zone group determination 169
Table 42 – REQUESTED INSIDE ZPSDS bit and INSIDE ZPSDS PERSISTENT bit changes after a link reset sequence 170
Table 43 – ZONE GROUP field values if the ZONE GROUP PERSISTENT bit is set to one 171
Table 44 – Conditions that cause the ZONE GROUP field to be reset if the ZONE GROUP PERSISTENT bit is set to zero 171
Table 45 – PHY EVENT SOURCE field 180
Table 46 – Bit designations 184
Table 47 – Conversion from byte notation to character name example 185
Table 48 – Data characters 187
Table 49 – Control characters 192
Table 50 – Control character usage 192
Table 51 – Delayed code violation example 193
Table 52 – SNW-3 phy capabilities 199
Table 53 – Requested logical link rate 200
Table 54 – Multiplexing negotiation 201
Table 55 – Supported settings bit priorities 202

Table 56 – Example SNW-3 phy capabilities values 203
Table 57 – Train_Tx-SNW TTIU bit 206
Table 58 – Train_Tx-SNW TTIU 206
Table 59 – PATTERN TYPE field 207
Table 60 – Control/Status TTIU 207
Table 61 – COEFFICIENT SETTINGS field 208
Table 62 – COEFFICIENT 1 REQUEST field, COEFFICIENT 2 REQUEST field, and COEFFICIENT 3 REQUEST field 209
Table 63 – Valid coefficient requests 210
Table 64 – COEFFICIENT 1 STATUS field, COEFFICIENT 2 STATUS field, and COEFFICIENT 3 STATUS field 211
Table 65 – Error Response TTIU 211
Table 66 – ERROR CODE field 213
Table 67 – Phy reset sequence timing specifications 214
Table 68 – SATA speed negotiation sequence timing specifications 216
Table 69 – SAS speed negotiation sequence timing specifications 220
Table 70 – SNW rates used in SNW-1, SNW-2, and Final-SNW 222
Table 71 – SNW-3 phy capabilities bit 223
Table 72 – Transmitter training pattern 225
Table 73 – Receiver training patterns 228
Table 74 – SP state machine timers 259
Table 75 – Messages to SP transmitter and SP receiver at start of RCDT 270
Table 76 – SP_DWS state machine timers 290
Table 77 – Mapping messages to the Training Control word 305
Table 78 – Mapping messages from PTT_SC1 state machine, PTT_SC2 state machine, and PTT_SC3 state machine to the Training Status word 305
Table 79 – Mapping Transmit Error Response message arguments to Error Response TTIU fields 306
Table 80 – Transmit Error Response message arguments sent to PTT_T state machine 312
Table 81 – Mapping the Training Status word to SP receiver messages 313
Table 82 – Mapping the Training Status word to PTT_GC1 state machine messages, PTT_GC2 state machine messages, and PTT_GC3 state machine messages 314
Table 83 – Mapping the Training Control word to PTT_SC1 state machine messages, PTT_SC2 state machine messages, and PTT_SC3 state machine messages 315
Table 84 – Mapping Coefficient Request byte to PTT_SC3 state machine message, PTT_SC2 state machine message, and PTT_SC1 state machine messages 316
Table 85 – Mapping messages to the PTT_T state machine 320
Table 86 – PTT_SC1 messages to substitute for PTT_SC2 messages 321
Table 87 – PTT_SC1 messages to substitute for PTT_SC3 messages 322
Table 88 – Mapping messages to the PTT_T state machine 324
Table 89 – PTT_GC1 messages to substitute for PTT_GC2 messages 325
Table 90 – PTT_GC1 messages to substitute for PTT_GC2 messages 325
Table 91 – Primitive format 332
Table 92 – Deletable primitives 333
Table 93 – Primitives not specific to type of connection 334
Table 94 – Primitives used inside SSP and SMP connections 336
Table 95 – Primitives used inside STP connections and on SATA physical links 337
Table 96 – Primitive encoding for deletable primitives 338
Table 97 – Primitive encoding for primitives not specific to type of connection 339
Table 98 – Primitive encoding for primitives used only inside SSP and SMP connections 341
Table 99 – Primitive encoding for primitives that are used only inside STP connections and only on SATA physical links 342
Table 100 – Primitive sequences 343
Table 101 – ALIGN primitives 348
Table 102 – MUX primitives 349
Table 103 – NOTIFY primitives 349
Table 104 – AIP primitives 351
Table 105 – BROADCAST primitives 352
Table 106 – CLOSE primitives 352
Table 107 – Abandon-class OPEN_REJECT primitives 354
Table 108 – Retry-class OPEN_REJECT primitives 355

Table 109 – PS_REQ primitives 356
Table 110 – DONE primitives 357
Table 111 – NAK primitives 358
Table 112 – RRDY primitives 358
Table 113 – Physical link rate tolerance management deletable primitive insertion requirement 361
Table 114 – CRC notation and definitions 363
Table 115 – Scrambling for different data dword types 367
Table 116 – Address frame format 373
Table 117 – ADDRESS FRAME TYPE field 373
Table 118 – IDENTIFY address frame format 374
Table 119 – DEVICE TYPE field 375
Table 120 – REASON field 375
Table 121 – POWER CAPABLE field 377
Table 122 – OPEN address frame format 378
Table 123 – SAS PROTOCOL field 379
Table 124 – FEATURES field 379
Table 125 – CONNECTION RATE field 379
Table 126 – ARBITRATION WAIT TIME field 381
Table 127 – SL_IR_IRC state machine timers 384
Table 128 – PS_ACK pattern 391
Table 129 – SL_P_S state machine timers 393
Table 130 – SL_P_C state machine timers 397
Table 131 – Connection results of a connection request 405
Table 132 – Arbitration priority for OPEN address frames passing on a logical link 406
Table 133 – Arbitration priority for a Request Path request in the ECM 409
Table 134 – Pathway recovery priority 411
Table 135 – Results of aborting a connection request 412
Table 136 – Results of closing a connection 414
Table 137 – Results of breaking a connection 416
Table 138 – Rate matching deletable primitive insertion requirements 417
Table 139 – SL_CC state machine timers 426
Table 140 – SL_CC state machine variables 426
Table 141 – OPEN_REJECT Received message to Open Failed confirmation mapping 430
Table 142 – XL state machine timers 438
Table 143 – XL state machine variable 438
Table 144 – SSP frame interlock requirements 459
Table 145 – SSP state machines timers 463
Table 146 – STP link layer differences from SATA link layer during an STP connection 474
Table 147 – Affiliation policies 479
Table 148 – Affiliation context relative identifier example 481
Table 149 – PL_OC state machine timers 495
Table 150 – Confirmations from Unable To Connect messages 502
Table 151 – PL_PM state machine timers 506
Table 152 – Messages from Open Failed confirmations 510
Table 153 – SSP frame format 517
Table 154 – FRAME TYPE field 518
Table 155 – TLR CONTROL field for COMMAND frames 519
Table 156 – COMMAND frame - Command information unit 521
Table 157 – TASK ATTRIBUTE field 522
Table 158 – TASK frame - Task Management Function information unit 523
Table 159 – TASK MANAGEMENT FUNCTION field 524
Table 160 – XFER_RDY frame - Transfer Ready information unit 526
Table 161 – DATA frame - Data information unit 527
Table 162 – RESPONSE frame - Response information unit 529
Table 163 – DATAPRES field 530
Table 164 – RESPONSE DATA field 531
Table 165 – RESPONSE CODE field 531
Table 166 – Sequences of SSP frames 532

Table 167 – Confirmations sent to the SCSI application layer if a frame transmission error or reception error occurs 547
Table 168 – ST_ITS state machine variables 548
Table 169 – ST_ITS state machine arguments 549
Table 170 – Messages sent to the ST_IFR state machine 551
Table 171 – Transmission Complete messages for XFER_RDY frame verification failures 552
Table 172 – Reception Complete messages for read DATA frame verification failures 556
Table 173 – ST_T state machine timers 558
Table 174 – Task Management Function Executed Service Response argument mapping to Request (Send Transport Response) Service Response argument 563
Table 175 – Confirmations sent to the SCSI application layer 565
Table 176 – ST_TTS state machine variables 567
Table 177 – ST_TTS state machine arguments 567
Table 178 – Messages sent to the ST_TFR state machine 571
Table 179 – Additional messages sent to the ST_TFR state machine 572
Table 180 – Reception Complete message for write DATA frame verification failures 575
Table 181 – Request (Send Transport Response) message Service Response argument to RESPONSE frame RESPONSE DATA field mapping 577
Table 182 – SMP frame format 579
Table 183 – SMP FRAME TYPE field 579
Table 184 – SMP_REQUEST frame format 580
Table 185 – SMP_RESPONSE frame format 581
Table 186 – MT_TP time limits 585
Table 187 – Execute Command procedure call transport protocol services 587
Table 188 – Task management function procedure call transport protocol services 588
Table 189 – Send SCSI Command transport protocol service arguments 589
Table 190 – SCSI Command Received transport protocol service arguments 590
Table 191 – Send Command Complete transport protocol service arguments 591
Table 192 – Command Complete Received transport protocol service arguments 592
Table 193 – Send Data-In transport protocol service arguments 593
Table 194 – Data-In Delivered transport protocol service arguments 593
Table 195 – Receive Data-Out transport protocol service arguments 594
Table 196 – Data-Out Received transport protocol service arguments 594
Table 197 – Terminate Data Transfer transport protocol service arguments 595
Table 198 – Data Transfer Terminated transport protocol service arguments 595
Table 199 – Send Task Management Request transport protocol service arguments 596
Table 200 – Task Management Request Received transport protocol service arguments 597
Table 201 – Task Management Function Executed transport protocol service arguments 598
Table 202 – Received Task Management Function Executed transport protocol service arguments 599
Table 203 – Delivery Result to additional sense code mapping 601
Table 204 – SCSI transport protocol events 602
Table 205 – SSP target port mode pages 603
Table 206 – Disconnect-Reconnect mode page for SAS SSP 604
Table 207 – Protocol Specific Logical Unit mode page for SAS SSP 606
Table 208 – Protocol Specific Port mode page for SAS SSP 607
Table 209 – I_T NEXUS LOSS TIME field 608
Table 210 – Phy Control And Discover mode page 609
Table 211 – SAS phy mode descriptor 611
Table 212 – Shared Port Control mode page 612
Table 213 – Enhanced Phy Control mode page 613
Table 214 – Enhanced phy control mode descriptor 614
Table 215 – Protocol Specific Port log parameters 615
Table 216 – Protocol Specific Port log page for SAS SSP 615
Table 217 – Protocol Specific Port log parameter for SAS target ports 616
Table 218 – SAS phy log descriptor 617
Table 219 – SSP target port diagnostic pages 619
Table 220 – Diagnostic pages affected by zoning 619
Table 221 – Protocol Specific diagnostic page for SAS SSP 620

Table 222 – PHY TEST FUNCTION field 621
Table 223 – PHY TEST PATTERN field 622
Table 224 – PHY TEST FUNCTION SSC field 623
Table 225 – PHY TEST FUNCTION PHYSICAL LINK RATE field 623
Table 226 – PHY TEST PATTERN DWORDS CONTROL field 624
Table 227 – TWO_DWORDS phy test pattern examples 625
Table 228 – Summary of states in the SA_PC state machine 627
Table 229 – VPD pages with special requirements for SAS SSP 636
Table 230 – Device Identification VPD page designation descriptors for the SAS target port 637
Table 231 – Device Identification VPD page designation descriptors for the SAS target device 638
Table 232 – Protocol Specific Logical Unit Information VPD page for SAS SSP 639
Table 233 – Logical unit information descriptor for SAS SSP 640
Table 234 – READY LED signal behavior 641
Table 235 – SMP functions (FUNCTION field) 642
Table 236 – SMP request frame format 644
Table 237 – SMP response frame format 646
Table 238 – FUNCTION RESULT field 647
Table 239 – Function result priority 651
Table 240 – REPORT GENERAL request 655
Table 241 – REPORT GENERAL response 656
Table 242 – NUMBER OF ZONE GROUPS field 660
Table 243 – REPORT MANUFACTURER INFORMATION request 662
Table 244 – REPORT MANUFACTURER INFORMATION response 663
Table 245 – REPORT SELF-CONFIGURATION STATUS request 665
Table 246 – REPORT SELF-CONFIGURATION STATUS response 666
Table 247 – Self-configuration status descriptor 668
Table 248 – STATUS TYPE field 668
Table 249 – REPORT ZONE PERMISSION TABLE request 670
Table 250 – REPORT TYPE field 671
Table 251 – REPORT ZONE PERMISSION TABLE response 672
Table 252 – Zone permission descriptors 673
Table 253 – Zone permission descriptor for a source zone group (i.e., s) with 128 zone groups 673
Table 254 – Zone permission descriptor for a source zone group (i.e., s) with 256 zone groups 674
Table 255 – Zone permission descriptor bit requirements 674
Table 256 – REPORT ZONE MANAGER PASSWORD request 675
Table 257 – REPORT TYPE field 675
Table 258 – REPORT ZONE MANAGER PASSWORD response 676
Table 259 – REPORT BROADCAST request 677
Table 260 – REPORT BROADCAST response 678
Table 261 – Broadcast descriptor 679
Table 262 – BROADCAST REASON field for originated Broadcasts 680
Table 263 – DISCOVER request 681
Table 264 – DISCOVER response 682
Table 265 – ATTACHED DEVICE TYPE field 685
Table 266 – NEGOTIATED LOGICAL LINK RATE field and NEGOTIATED PHYSICAL LINK RATE field 686
Table 267 – NEGOTIATED LOGICAL LINK RATE field 687
Table 268 – ATTACHED SATA PORT SELECTOR and ATTACHED SATA DEVICE bits 688
Table 269 – PROGRAMMED MINIMUM PHYSICAL LINK RATE field and PROGRAMMED MAXIMUM PHYSICAL LINK RATE field 691
Table 270 – The HARDWARE MINIMUM PHYSICAL LINK RATE field and the HARDWARE MAXIMUM PHYSICAL LINK RATE field 691
Table 271 – ROUTING ATTRIBUTE field 692
Table 272 – PHY POWER CONDITION field 692
Table 273 – SAS POWER CAPABLE field 693
Table 274 – ATTACHED DEVICE NAME field 694
Table 275 – SELF-CONFIGURATION STATUS field 695
Table 276 – SELF-CONFIGURATION LEVELS COMPLETED field 695
Table 277 – REPORT PHY ERROR LOG request 698

Table 278 – REPORT PHY ERROR LOG response 699
Table 279 – REPORT PHY SATA request 700
Table 280 – REPORT PHY SATA response 702
Table 281 – REPORT ROUTE INFORMATION request 704
Table 282 – REPORT ROUTE INFORMATION response 706
Table 283 – REPORT PHY EVENT request 707
Table 284 – REPORT PHY EVENT response 709
Table 285 – Phy event descriptor 710
Table 286 – DISCOVER LIST request 711
Table 287 – PHY FILTER field 712
Table 288 – DESCRIPTOR TYPE field 712
Table 289 – DISCOVER LIST response 713
Table 290 – SHORT FORMAT descriptor 715
Table 291 – REPORT PHY EVENT LIST request 716
Table 292 – REPORT PHY EVENT LIST response 717
Table 293 – Phy event list descriptor 719
Table 294 – REPORT EXPANDER ROUTE TABLE LIST request 720
Table 295 – REPORT EXPANDER ROUTE TABLE LIST response 722
Table 296 – Expander route table descriptor 724
Table 297 – CONFIGURE GENERAL request 725
Table 298 – STP SMP I_T NEXUS LOSS TIME field 727
Table 299 – CONFIGURE GENERAL response 727
Table 300 – ENABLE DISABLE ZONING request 728
Table 301 – SAVE field 729
Table 302 – ENABLE DISABLE ZONING field 729
Table 303 – ENABLE DISABLE ZONING response 729
Table 304 – ZONED BROADCAST request 730
Table 305 – BROADCAST TYPE field 731
Table 306 – ZONED BROADCAST response 731
Table 307 – ZONE LOCK request 733
Table 308 – ZONE LOCK response 734
Table 309 – ZONE ACTIVATE request 735
Table 310 – ZONE ACTIVATE response 735
Table 311 – ZONE UNLOCK request 736
Table 312 – ZONE UNLOCK response 737
Table 313 – CONFIGURE ZONE MANAGER PASSWORD request 738
Table 314 – SAVE field 739
Table 315 – CONFIGURE ZONE MANAGER PASSWORD response 739
Table 316 – CONFIGURE ZONE PHY INFORMATION request 740
Table 317 – SAVE field 741
Table 318 – Zone phy configuration descriptor 741
Table 319 – CONFIGURE ZONE PHY INFORMATION response 742
Table 320 – CONFIGURE ZONE PERMISSION TABLE request 743
Table 321 – NUMBER OF ZONE GROUPS field 744
Table 322 – SAVE field 744
Table 323 – Zone permission configuration descriptors 745
Table 324 – Zone permission configuration descriptor for source zone group for 128 zone groups 745
Table 325 – Zone permission configuration descriptor for source zone group for 256 zone groups 745
Table 326 – Zone permission configuration descriptor bit requirements 746
Table 327 – CONFIGURE ZONE PERMISSION TABLE response 746
Table 328 – CONFIGURE ROUTE INFORMATION request 747
Table 329 – CONFIGURE ROUTE INFORMATION response 748
Table 330 – PHY CONTROL request 750
Table 331 – PHY OPERATION field 752
Table 332 – PROGRAMMED MINIMUM PHYSICAL LINK RATE field and PROGRAMMED MAXIMUM PHYSICAL LINK RATE field 754
Table 333 – ENABLE SAS SLUMBER field 755
Table 334 – ENABLE SAS PARTIAL field 755

Table 335 – ENABLE SATA SLUMBER field 755
Table 336 – ENABLE SATA PARTIAL field 756
Table 337 – PHY CONTROL response 756
Table 338 – PHY TEST FUNCTION request 758
Table 339 – PHY TEST FUNCTION field 759
Table 340 – PHY TEST FUNCTION PHYSICAL LINK RATE field 760
Table 341 – PHY TEST FUNCTION response 760
Table 342 – CONFIGURE PHY EVENT request 761
Table 343 – Phy event configuration descriptor 762
Table 344 – CONFIGURE PHY EVENT response 763
Table A.1 – JTPAT for RD+ and RD- 764
Table A.2 – CJTPAT 766
Table A.3 – CJTPAT with fixed content 770
Table C.1 – CRC examples 780
Table D.1 – Monte-Carlo simulation results 781
Table D.2 – Hash results for simple SAS addresses 784
Table D.3 – Hash results for realistic SAS addresses 784
Table D.4 – Hash results for a walking ones pattern 785
Table D.5 – Hash results for a walking zeros pattern 786
Table E.1 – Scrambler examples 789
Table E.2 – Initial scrambler output 790
Table G.1 – Minimum deletable primitive insertion rate examples 794
Table H.1 – Zone permission table example initial value 795
Table H.2 – CONFIGURE ZONE PERMISSION TABLE request example 796
Table H.3 – Zone permission table after processing first zone permission configuration descriptor 797
Table H.4 – Zone permission table after processing second zone permission configuration descriptor 797
Table J.1 – Column descriptions for connection examples 800
Table K.1 – Primitives with Hamming distance of at least 7 820
Table K.2 – Primitives without Hamming distance of 7 822
Table L.1 – Standards bodies 823

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE (SCSI) –

Part 262: SAS PROTOCOL LAYER - 2 (SPL-2)

FOREWORD

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International Standard ISO/IEC 14776-262 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14776 series, under the general title *Information technology – Small computer system interface (SCSI)*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2, except as described in 3.4.

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE (SCSI) –

Part 262: SAS PROTOCOL LAYER - 2 (SPL-2)

INTRODUCTION

General

The SCSI family of standards provides for many different transport protocols that define the rules for exchanging information between different SCSI devices. This standard defines the rules for exchanging information between SCSI devices using a serial interconnect. Other SCSI transport protocol standards define the rules for exchanging information between SCSI devices using other interconnects.

The following figure shows the organization of the layers of this standard.

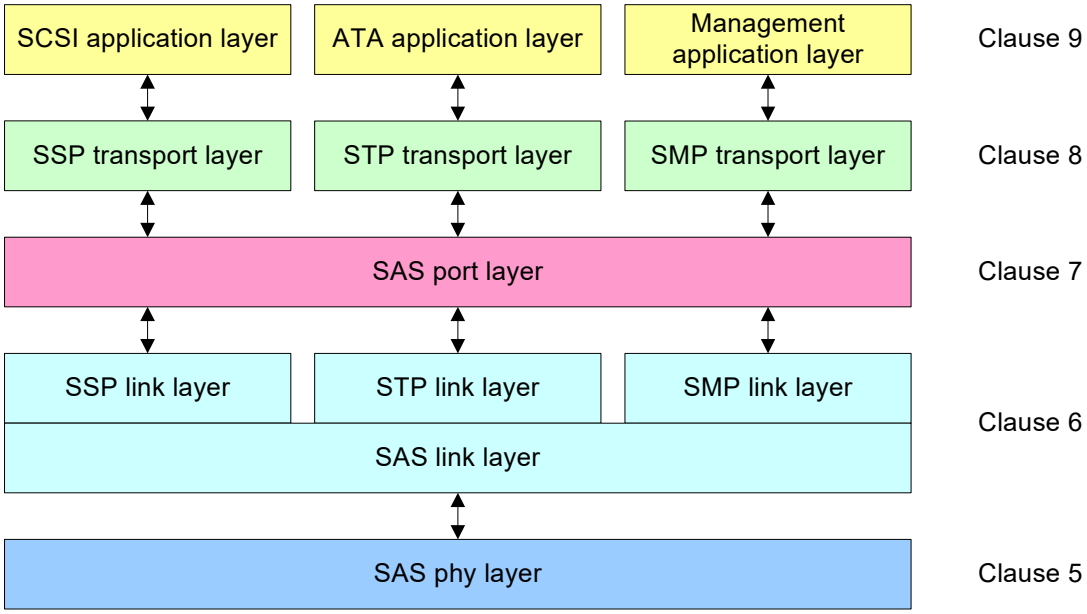


Figure 1 – Organization of this standard

SCSI standards family

Figure 2 shows the relationship of this standard to the other standards and related projects in the SCSI family of standards.

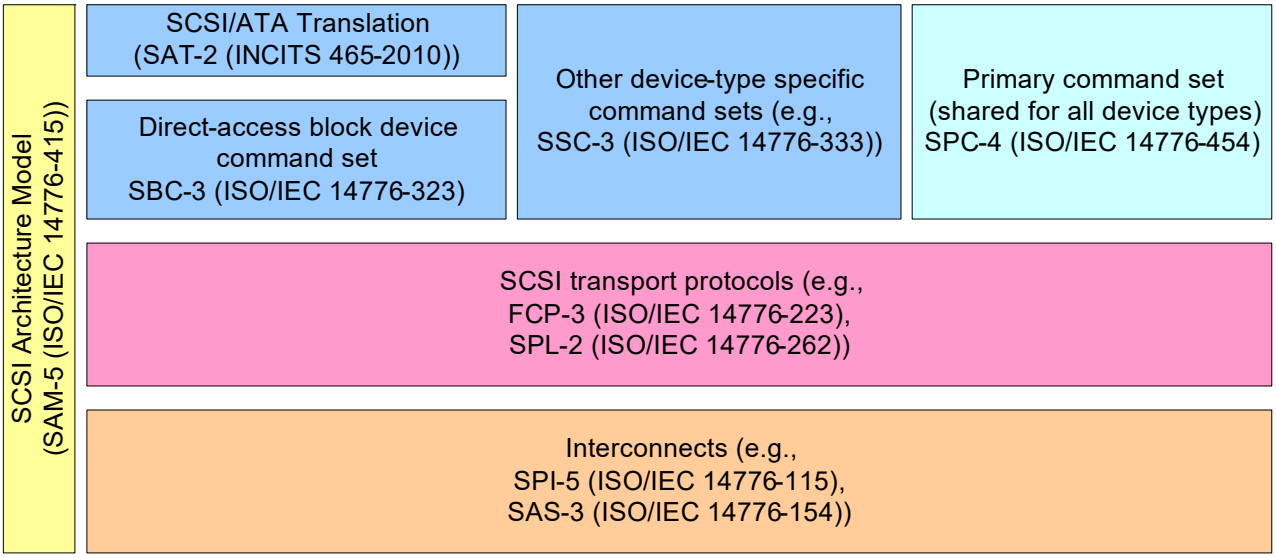


Figure 2 – SCSI document relationships

This standard also defines the rules for exchanging information between ATA hosts and ATA devices using the same serial interconnect. Other ATA transport protocol standards define the rules for exchanging information between ATA hosts and ATA devices using other interconnects.

Figure 3 shows the relationship of this standard to other standards and related projects in the ATA family of standards.

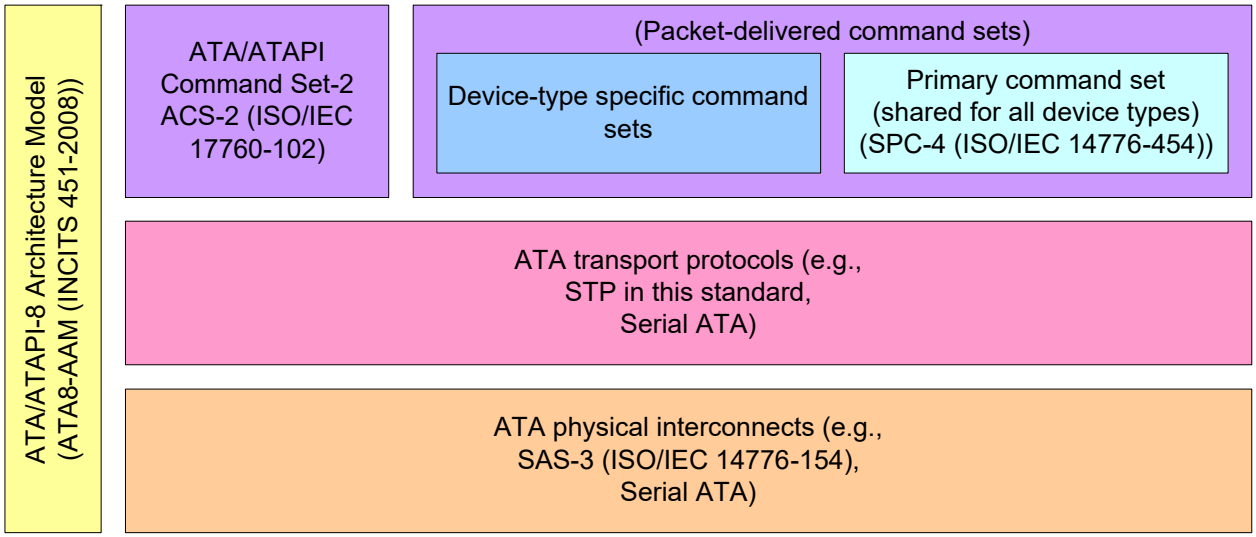


Figure 3 – ATA document relationships

Figure 2 and figure 3 show the general relationship of the documents to one another, and do not imply any hierarchy, protocol stack or system architecture relationship.

These standards specify the interfaces, functions and operations necessary to ensure interoperability between conforming implementations. This standard is a functional description. Conforming implementations may employ any design technique that does not violate interoperability.

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE (SCSI) –

Part 262: SAS Protocol Layer - 2 (SPL-2)

1 Scope

This standard defines the protocol layer of the Serial Attached SCSI (SAS) interconnect and three transport protocols that use the SAS interconnect:

a) Serial SCSI Protocol (SSP): a mapping of SCSI supporting multiple initiators and targets;
b) Serial ATA Tunneled Protocol (STP): a mapping of Serial ATA expanded to support multiple initiators and targets; and
c) Serial Management Protocol (SMP): a management protocol.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Additional availability contact information is provided in Annex L.

ISO/IEC 14776-151, *Information technology – Small Computer System Interface (SCSI) – Part 151*: *Serial Attached SCSI - 1.1 (SAS-1.1)*

ISO/IEC 14776-372, *Information technology – Small Computer System Interface (SCSI) – Part 372*: *SCSI Enclosure Services - 2 (SES-2)*

ISO/IEC 17760-102, *Information technology – AT Attachment – Part 102: ATA/ATAPI Command Set - 2 (ACS-2)*

INCITS 451-2008, *AT Attachment - 8 ATA/ATAPI Architecture Model (ATA8-AAM)*

INCITS 465-2010, *SCSI/ATA Translation - 2 (SAT-2)*

INCITS 514-2014, *SCSI Block Commands - 3 (SBC-3)*

INCITS 515-2016, *SCSI Architecture Model - 5 (SAM-5)*

INCITS 513-2015, *SCSI Primary Commands - 4 (SPC-4)*

INCITS 519-2014, *Serial Attached SCSI - 3 (SAS-3)*

For information on the current status of the listed documents, or regarding availability, contact the indicated organization.

Serial AT Attachment Revision 3.1 (SATA). 18-July-2011[1]

SFF-8485, *Serial GPIO (SGPIO) Bus*[2]

1.For information on the current status of Serial ATA documents, contact the Serial ATA International Organization (see http://www.sata-io.org).

2.For more information on the current status of SFF documents, contact the SFF Committee at 408-867-6630 (phone), or 408-867-2115 (fax). To obtain copies of these documents, contact the SFF Committee at 14426 Black Walnut Court, Saratoga, CA 95070 at 408-867-6630 (phone) or 408-741-1600 (fax) or see http://www.sffcommittee.org.

3 Terms, definitions, symbols, abbreviations, keywords, and conventions

3.1 Terms and definitions

For the purposes of this document the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

"IEC Electropedia: available at http://www.electropedia.org/
"ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
8b10b coding
coding scheme that represents an 8-bit byte (i.e., a control byte or data byte) as a 10-bit character (i.e., a control character or data character)

Note 1 to entry: See 5.2.

3.1.2
8b10b encoding
method of encoding an 8-bit byte (i.e., a control byte or data byte) into a 10-bit character (i.e., a control character or data character)

Note 1 to entry: See 5.2.

3.1.3
10b8b decoding
method for decoding a 10-bit character (i.e., a control character or data character) into an 8-bit byte (i.e., a control byte or data byte)

Note 1 to entry: See 5.2.

3.1.4
active cable assembly
cable assembly (see SAS-3) that requires power for internal circuitry used in the transmission of the signal through the cable assembly

Note 1 to entry: See SAS-3.

3.1.5
active phy power condition
normal power condition for a SAS phy or expander phy

Note 1 to entry: See 4.10.1.2.

3.1.6
active zone manager
zone manager (see 3.1.253) that locks a zoning expander device (see 3.1.257)

Note 1 to entry: See 4.8.6.

3.1.7
affiliation
STP target port (see 3.1.224) state of limiting acceptance of connection requests to those from one or more STP initiator ports (see 3.1.219)

Note 1 to entry: See 6.19.4.

3.1.8
affiliation context
set of registers maintained by an STP target port for an STP initiator port holding an affiliation

Note 1 to entry: See 6.19.4.

3.1.9
aggregation
form of association that defines a whole-part relationship between the whole (i.e., aggregate) class and its parts

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: See 3.5.

3.1.10
association
relationship between two or more classes that specifies connections among their objects

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: An association is a relationship that specifies that objects of one class are connected to objects of another class.

Note 3 to entry: See 3.5.

3.1.11
attached
attribute of a class used when an instance of that class is only accessible over a service delivery subsystem

3.1.12
attached SAS address
SAS address (see 3.1.164) of the attached phy or the SAS address of the STP target port in an STP SATA bridge (see 4.5.2)

Note 1 to entry: For example, the SAS address of an attached phy may be received in the incoming IDENTIFY address frame during the initialization sequence (see 4.1.2),

3.1.13
attribute
named property of a class that describes a range of values that its objects may hold

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: See 3.5.

3.1.14
AT Attachment
ATA
standard for the internal attachment of storage devices to hosts

Note 1 to entry: See ATA8-AAM.

3.1.15
ATA device
storage peripheral that processes ATA commands and device management functions

Note 1 to entry: Analogous to a SCSI target device (see 3.1.191).

Note 2 to entry: See ATA8-AAM.

3.1.16
ATA domain
I/O system consisting of an ATA host and one or more ATA devices that communicate with one another by means of a service delivery subsystem (see 3.1.199)

Note 1 to entry: Analogous to a SCSI domain (see 3.1.187).

Note 2 to entry: See ATA8-AAM.

3.1.17
ATA host
host device that originates requests to be processed by an ATA device

Note 1 to entry: Analogous to a SCSI initiator device (see 3.1.188).

Note 2 to entry: See ATA8-AAM.

3.1.18
big-endian
format for storage or transmission of binary data in which the most significant byte appears first

Note 1 to entry: In a multi-byte value, the byte containing the most significant bit is stored in the lowest memory address and transmitted first, and the byte containing the least significant bit is stored in the highest memory address and transmitted last (e.g., for the value 0080h, the byte containing 00h is stored in the lowest memory address, and the byte containing 80h is stored in the highest memory address).

3.1.19
bi-phase mark code
BMC
encoding in which a transition occurs at the beginning of each TTIU bit cell (see 3.1.242), a one is represented by a transition in the middle of the TTIU bit cell, and a zero is represented by no transition within the TTIU bit cell

Note 1 to entry: See 5.8.

3.1.20
bit cell time
time for transmitting a phy capabilities bit during SNW-3 (see 5.10.4.2.3.3)

3.1.21
Broadcast
information about an event in the SAS domain, communicated between phys with the BROADCAST primitive sequence (see 6.2.6.4) and/or the SMP ZONED BROADCAST function (see 9.4.3.20)

Note 1 to entry: See 4.1.13.

3.1.22
Broadcast propagation processor
BPP
object within an expander function (see 3.1.66) that manages Broadcasts (see 3.1.21)

Note 1 to entry: See 4.5.5.

3.1.23
burst time
part of an OOB signal where the OOB burst is transmitted

Note 1 to entry: See SAS-3.

3.1.24
byte
sequence of eight contiguous bits considered as an unit

3.1.25
character
sequence of ten contiguous bits considered as an unit

Note 1 to entry: A byte is encoded as a character using 8b10b coding (see 5.2)

3.1.26
class
description of a set of objects that share the same attributes, operations relationships, and semantics

Note 1 to entry: Classes may have attributes and may support operations.

3.1.27
class diagram
diagram that shows a collection of classes and their contents and relationships

Note 1 to entry: See 3.5.

3.1.28
command descriptor block
CDB
structure used to communicate a command from a SCSI application client to a SCSI device server

Note 1 to entry: See SAM-5.

3.1.29
commonly supported setting
supported settings bit (see table 52) with a value set to one by both the phy and the attached phy as transmitted during the most recent SNW-3

3.1.30
compliant jitter tolerance pattern
CJTPAT
test pattern for jitter testing

Note 1 to entry: See A.2 and SAS-3.

3.1.31
configuration subprocess
subprocess invoked from the discover process (see 3.1.55) to configure an externally configurable expander device (see 3.1.73)

Note 1 to entry: See 4.7.

3.1.32
confirmation
information passed from a lower layer state machine to a higher layer state machine, usually responding to a request from that higher layer state machine

Note 1 to entry: For an example of a response from a peer layer state machine see figure 41 in 4.5.6.2.

Note 2 to entry: See 3.6.

3.1.33
connection
temporary association between a SAS initiator port and a SAS target port using a pathway (see 3.1.136)

Note 1 to entry: See 4.1.12 and 6.14.

3.1.34
connection rate
effective rate of dwords through the pathway (see 3.1.136) between a SAS initiator phy and a SAS target phy, established through the connection request

3.1.35
connection request
request to establish a connection originated by a SAS phy (see 3.1.170) using an OPEN address frame (see 6.8.3)

Note 1 to entry: See 6.14.2.1.

3.1.36
constraint
mechanism for specifying semantics or conditions that are maintained as true between entities

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: An example of a constraint is a required condition between associations.

Note 3 to entry: See 3.5.

3.1.37
control byte
byte containing control information defined in table 49

Note 1 to entry: See 5.3.7.

3.1.38
control character
Kxx.y
character containing control information defined in table 49

Note 1 to entry: See 5.3.7.

3.1.39
cyclic redundancy check
CRC
error checking mechanism that checks data integrity by computing a polynomial algorithm based checksum

Note 1 to entry: See 6.5.

3.1.40
D.C. idle
differential signal level that is nominally 0 V peak-to-peak

Note 1 to entry: See SAS-3.

3.1.41
D.C. mode
mode in which D.C. idle is used, during the idle time and negation time of an OOB signal (see SAS-3), and during the RCDT time of speed negotiation windows (see 5.10.4.2.2)

3.1.42
data byte
byte containing data information defined in table 48

Note 1 to entry: See 5.3.6.

3.1.43
data character
Dxx.y
character containing data information defined in table 48 (see 5.2)

Note 1 to entry: See 5.3.6.

3.1.44
data dword
dword containing four data bytes or four data characters with correct disparity

3.1.45
deadlock
condition in which two or more processes (e.g., connection requests) are waiting on the others to complete, resulting in none of the processes completing

3.1.46
deletable primitive
primitive which may be deleted by a receiver instead of being placed into its elasticity buffer (see 6.3)

Note 1 to entry: See 6.2.5.

3.1.47
dependency
relationship between two classes where a change to one class (i.e., the independent class) may cause a change in the other class (i.e., the dependent class)

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: See 3.5.

3.1.48
device name
worldwide unique name for a device within a transport protocol

Note 1 to entry: See 4.2.6.

3.1.49
device server
object that processes SCSI commands (see SAM-5), ATA commands (see ATA8-AAM), or SMP functions

Note 1 to entry: See 4.1.5.

3.1.50
differential high signal level
Tx+ signal of a transmitter circuit (see SAS-3) is higher than the voltage measured on the Tx- signal of a transmitter circuit

3.1.51
differential low signal level
Tx+ signal of a transmitter circuit (see SAS-3) is lower than the voltage measured on the Tx- signal of a transmitter circuit

3.1.52
direct current
D.C.
non-A.C. component of a signal

Note 1 to entry: See SAS-3.

3.1.53
direct routing attribute
attribute of an expander phy that indicates that the expander phy may be used by the ECM (see 3.1.63) to route a connection request to an end device

Note 1 to entry: See 4.5.7.1.

3.1.54
direct routing method
method the ECM (see 3.1.63) uses to route connection requests to an attached end device or an attached expander device

Note 1 to entry: See 4.5.7.1.

3.1.55
discover process
process performed by a management application client to discover all the SAS devices and expander devices in the SAS domain

Note 1 to entry: The discover process invokes the configuration subprocess (see 3.1.31) as needed.

Note 2 to entry: See 4.6.

3.1.56
disparity
difference between the number of ones and zeros in a character (see 5.2)

3.1.57
domain
I/O system consisting of devices that communicate with one another by means of a service delivery subsystem

Note 1 to entry: Examples of domains are a SAS domain (see 3.1.166), a SCSI domain (see 3.1.187), or an ATA domain (see 3.1.16)

Note 2 to entry: See 4.1.9.

3.1.58
dword
sequence of four contiguous bytes or four contiguous characters considered as an unit

Note 1 to entry: The meaning depends on the context (e.g., when discussing the bits being transmitted over a physical link, dword represents four characters (i.e., 40 bits) and when discussing the contents of a frame before 8b10b encoding (see 3.1.2) or after 10b8b decoding (see 3.1.3), dword represents four bytes (i.e., 32 bits)).

3.1.59
dword synchronization
detection of an incoming stream of dwords from a physical link by a phy

Note 1 to entry: See 5.13.

3.1.60
enclosure
box, rack, or set of boxes providing the powering, cooling, mechanical protection, EMI protection, and external electronic interfaces for one or more end device(s) (see 3.1.61) and/or expander device(s) (see 3.1.65)

Note 1 to entry: The enclosure provides the outermost electromagnetic boundary and acts as an EMI barrier; an enclosure is not a class in this standard.

3.1.61
end device
SAS device (see 3.1.165) or SATA device (see 3.1.176) that is not contained within an expander device (see 3.1.65)

3.1.62
event notification
information passed from the SSP transport layer to the SCSI application layer notifying the SCSI application layer that a SCSI event has occurred

Note 1 to entry: See SAM-5.

3.1.63
expander connection manager
ECM
object within an expander function (see 3.1.66) that manages routing

Note 1 to entry: See 4.5.3.

3.1.64
expander connection router
ECR
portion of an expander function (see 3.1.66) that routes messages between expander phys

Note 1 to entry: See 4.5.4.

3.1.65
expander device
device that is part of a service delivery subsystem (see 3.1.199), facilitates communication between SAS devices (see 3.1.165) and SATA devices (see 3.1.176), and is either an externally configurable expander device (see 3.1.73) or a self-configuring expander device (see 3.1.193)

Note 1 to entry: See 4.1.7.

3.1.66
expander function
object within an expander device (see 3.1.65) that contains an expander connection manager (see 3.1.63), expander connection router (see 3.1.64), and Broadcast propagation processor (see 3.1.22)

Note 1 to entry: See 4.5.1.

3.1.67
expander logical phy
expander phy (see 3.1.68) or a multiplexed portion of an expander phy

Note 1 to entry: See 4.1.2.

3.1.68
expander phy
phy in an expander device (see 3.1.65) that interfaces to a service delivery subsystem (see 3.1.199)

3.1.69
expander port
expander device object that interfaces to a service delivery subsystem (see 3.1.199) and to SAS ports in other devices

Note 1 to entry: See 4.5.2.

3.1.70
expander route entry
SAS address and an enable/disable bit in an expander route table (see 3.1.72)

3.1.71
expander route index
value used in combination with a phy identifier to select an expander route entry in an expander route table (see 3.1.72) in an externally configurable expander device (see 3.1.73)

Note 1 to entry: See 4.5.7.4.

3.1.72
expander route table
table of expander route entries (see 3.1.70) within an expander device (see 3.1.65)

Note 1 to entry: The table is used by the expander function (see 3.1.66) to resolve connection requests.

Note 2 to entry: See 4.5.7.4.

3.1.73
externally configurable expander device
non-self-configuring expander device (see 3.1.65) containing an expander route table (see 3.1.72)

Note 1 to entry: An externally configurable expander device that is configurable with the SMP CONFIGURE ROUTE INFORMATION function (see 9.4.3.27).

Note 2 to entry: See 4.1.7.

3.1.74
field
group of one or more contiguous bits

3.1.75
Final-SNW
final speed negotiation window for 1.5 Gbit/s or 3 Gbit/s without training (see 5.10.4.2.3.2)

3.1.76
frame
sequence of data dwords between a start of frame primitive and an end of frame primitive

Note 1 to entry: Start of frame primitives are SOF, SOAF, and SATA_SOF.

Note 2 to entry: End of frame primitives are EOF, EOAF, and SATA_EOF.

3.1.77
frame information structure
FIS
SATA frame format

Note 1 to entry: See SATA.

3.1.78
generalization
relationship among classes where one class (i.e., the superclass) shares the attributes and operations of one or more other classes (i.e., the subclasses)

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: See 3.5.

3.1.79
hard reset
SAS device or expander device action in response to a reset event in which the device performs the operations described in 4.4.2

3.1.80
hard reset sequence
sequence that causes a hard reset (see 3.1.79)

Note 1 to entry: See 4.4 and 6.9.

3.1.81
hardware maximum physical link rate
maximum physical link rate capability of a phy

3.1.82
hardware minimum physical link rate
minimum physical link rate capability of a phy

3.1.83
hash
mathematical function that maps values from a larger set of values into a smaller set of values, reducing a long value into a shorter hashed value

3.1.84
highest priority commonly supported setting
commonly supported setting based on the priority defined in table 55

3.1.85
I_T nexus
nexus between a SAS initiator port and a SAS target port or a nexus between a SCSI initiator port and a SCSI target port

Note 1 to entry: When referring to SAS ports, a nexus between a SAS initiator port and a SAS target port.

Note 2 to entry: When referring to SCSI ports, a nexus between a SCSI initiator port and a SCSI target port.

Note 3 to entry: See SAM-5.

3.1.86
I_T nexus loss
condition where a SAS port determines that another SAS port is no longer available or an I_T nexus loss operation occurs in a SCSI port

Note 1 to entry: When referring to SAS ports (see 3.1.172), a condition where a SAS port determines that another SAS port is no longer available.

Note 2 to entry: When referring to SCSI ports (see 3.1.190) (e.g., SSP ports), a condition resulting from the events defined by SAM-5 in which the SCSI device performs the I_T nexus loss operations described in SAM-5, SPC-4, and the appropriate command standards.

Note 3 to entry: See 4.4.3 and SAM-5.

3.1.87
I_T nexus loss event
event that results in an I_T nexus loss condition (see SAM-5)

Note 1 to entry: See 4.4.3 and SAM-5.

3.1.88
I_T nexus loss timer event
event that starts an I_T nexus loss timer (see 7.2.2.1)

Note 1 to entry: See 4.4.3.

3.1.89
I_T_L nexus
nexus between a SCSI initiator port, a SCSI target port, and a logical unit

Note 1 to entry: See SAM-5.

3.1.90
I_T_L_Q nexus
nexus between a SCSI initiator port, a SCSI target port, a logical unit, and a command or task management function

Note 1 to entry: See SAM-5.

3.1.91
identification sequence
sequence where phys exchange IDENTIFY address frames

Note 1 to entry: See 4.4 and 6.9.

3.1.92
idle dword
vendor specific data dword that is scrambled and is transmitted outside a frame

Note 1 to entry: See 6.4.

3.1.93
idle time
part of an OOB signal (see 3.1.131) where OOB idle (see 3.1.129) is being transmitted

Note 1 to entry: See 5.6.

3.1.94
indication
information passed from a lower layer state machine to a higher layer state machine, usually responding to a request from that higher layer state machine (e.g., see figure 40)

Note 1 to entry: See 3.6.

3.1.95
information unit
portion of an SSP frame that carries command, task management function, data, response, or transfer ready information

Note 1 to entry: See 8.2.2.

3.1.96
initiator connection tag
value in the OPEN address frame used for SSP and STP connection requests to provide a SAS initiator port an alternative to using the SAS target port's SAS address for context lookup when the SAS target port originates a connection request

Note 1 to entry: See 6.8.3.

3.1.97
initiator port transfer tag
value that allows an SSP initiator port to establish a context for commands and task management functions

Note 1 to entry: See 8.2.1.

3.1.98
invalid character
character that is not a control character (see 3.1.38) or a data character (see 3.1.43)

3.1.99
invalid dword
dword that is not a data dword (see 3.1.44) or a primitive (see 3.1.150)

Note 1 to entry: In the character context, a dword that contains an invalid character, a control character in other than the first character position, a control character other than K28.3 or K28.5 in the first character position, or one or more characters with a running disparity error.

3.1.100
jitter tolerance pattern
JTPAT
test pattern for jitter testing

Note 1 to entry: See SAS-3.

3.1.101
least significant bit
LSB
bit or bit position with the smallest numerical weighting in a group of bits that, when taken as a whole, represent a numerical value

Note 1 to entry: This definition only applies when used in relation to binary codes.

Note 2 to entry: For example in the number 0001b, the LSB bit is the bit that is set to one.

3.1.102
left-aligned
type of field containing ASCII data in which unused bytes are placed at the end of the field (highest offset) and are filled with ASCII space (20h) characters

Note 1 to entry: See SPC-4.

3.1.103
link reset sequence
phy reset sequence

Note 1 to entry: For SATA a link reset sequence is only a phy reset sequence (see 3.1.141).

Note 2 to entry: For SAS a link reset sequence is a phy reset sequence followed by an identification sequence (see 3.1.91), or a phy reset sequence followed by a hard reset sequence (see 3.1.80), another phy reset sequence, and an identification sequence.

Note 3 to entry: See 4.4 and 6.9.

3.1.104
little-endian
format for storage or transmission of binary data in which the least significant byte appears first

Note 1 to entry: In a multi-byte value, the byte containing the least significant bit is stored in the lowest memory address and transmitted first, and the byte containing the most significant bit is stored in the highest memory address and transmitted last (e.g., for the value 0080h, the byte containing 80h is stored in the lowest memory address, and the byte containing 00h is stored in the highest memory address).

3.1.105
livelock
condition where two or more processes (e.g., connection requests) repeatedly change their state in response to changes in other processes, resulting in none of the processes completing

3.1.106
local
attribute of a class used when an instance of that class is accessible without having to access any service delivery subsystem

3.1.107
locked zoning expander device
zoning expander device (see 3.1.257) that has been locked by a zone manager (see 3.1.253)

Note 1 to entry: See 4.8.6.2.

3.1.108
logical link
physical link or a multiplexed portion of a physical link

Note 1 to entry: See 4.1.3.

3.1.109
logical link rate
link rate between two logical phys established as a result of speed negotiation and multiplexing negotiation between the physical phys containing those logical phys

3.1.110
logical phy
phy (see 3.1.138) or a multiplexed portion of a phy

Note 1 to entry: See 4.1.2.

3.1.111
logical unit
object that implements a device model and manages and processes commands sent by a SCSI application client

Note 1 to entry: See SAM-5.

3.1.112
logical unit number
LUN
identifier for a logical unit (see 3.1.111)

Note 1 to entry: See SAM-5.

3.1.113
low phy power condition
partial phy power condition or the slumber phy power condition

Note 1 to entry: See 4.10.1.

3.1.114
media
material on which data is stored

Note 1 to entry: Media is the plural of medium.

Note 2 to entry: An example of media on which data is stored are magnetic disks.

3.1.115
message
information sent between state machines

Note 1 to entry: See 3.6.

3.1.116
most significant bit
MSB
bit or bit position with the largest numerical weighting in a group of bits that, when taken as a whole, represent a numerical value

Note 1 to entry: This definition only applies when used in relation to binary codes.

Note 2 to entry: For example in the number 1000b the MSB bit is the bit that is set to one.

3.1.117
multiplexing
interleaving of dwords

Note 1 to entry: Multiplexing divides a single physical link into two logical links by creating two logical phys from a single physical phy.

Note 2 to entry: See 5.15.

3.1.118
multiplicity
indication of the range of allowable instances of an object or an attribute

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: See 3.5.

3.1.119
narrow link
physical link that attaches a narrow port to another narrow port

Note 1 to entry: See 4.1.4.

3.1.120
narrow port
port that contains exactly one phy

Note 1 to entry: See 4.1.4.

3.1.121
negation time
part of an OOB signal (see 3.1.131) during which OOB idle (see 3.1.129) is transmitted after the last OOB burst (see 3.1.128)

Note 1 to entry: See 5.6.

3.1.122
negotiation idle
transmission of OOB idle (see 3.1.129)

Note 1 to entry: See 5.12.4.2.

3.1.123
negotiated logical link rate
current operational logical link rate (see 3.1.109)

3.1.124
negotiated physical link rate
current operational physical link rate (see 3.1.143)

3.1.125
nexus
relationship between two SAS devices or two SCSI devices

Note 1 to entry: When referring to SAS devices (see 3.1.165), a relationship between two SAS devices, and the SAS initiator port and the SAS target port objects within those SAS devices.

Note 2 to entry: When referring to SCSI devices (see 3.1.186), a relationship between two SCSI devices, and the SCSI initiator port and the SCSI target port objects within those SCSI devices

Note 3 to entry: See SAM-5.

3.1.126
object
entity with a well-defined boundary and identity that encapsulates state and behavior

Note 1 to entry: All objects are instances of classes (i.e., a concrete manifestation of a class is an object).

3.1.127
object diagram
diagram that encompasses objects and their relationships at a point in time

Note 1 to entry: See 3.5.

3.1.128
OOB burst
transmission of signal transitions for a burst time

Note 1 to entry: See SAS-3.

3.1.129
OOB idle
transmission of D.C. idle when D.C. mode (see 3.1.41) is enabled, or a defined sequence of dwords when optical mode (see 3.1.133) is enabled

Note 1 to entry: See SAS-3.

3.1.130
OOB sequence
sequence where two phys exchange OOB signals (see 3.1.131)

Note 1 to entry: See 5.10.2.1 and 5.10.4.1.

3.1.131
OOB signal
pattern of idle time (see 3.1.93), burst time, and negation time (see 3.1.121) used during the link reset sequence

Note 1 to entry: See 5.6.

3.1.132
operation
service that may be requested from any object of the class in order to affect behavior

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: Operations describe what a class is allowed to do and may be a request or a query.

Note 3 to entry: An operation that is a request may change the state of the object but an operation that is a query should not.

Note 4 to entry: See 3.5.

3.1.133
optical mode
mode in which a defined sequence of dwords is used during the idle time and negation time of an OOB signal (see SAS-3) and during the RCDT time of speed negotiation windows (see 5.10.4.2.2)

3.1.134
partial pathway
set of logical links participating in a connection request that have not yet conveyed a connection response

Note 1 to entry: See 4.1.11.

3.1.135
partial phy power condition
low phy power condition for a SAS phy or expander phy

Note 1 to entry: See 4.10.1.3.

3.1.136
pathway
set of logical links between a SAS initiator phy and a SAS target phy being used by a connection (see 3.1.33)

Note 1 to entry: See 4.1.11.

3.1.137
pathway blocked count
number of times the port has retried this connection request due to receiving OPEN_REJECT (PATHWAY BLOCKED), OPEN_REJECT (RESERVED STOP 0), or OPEN_REJECT (RESERVED STOP 1)

3.1.138
phy
object in a device that is used to interface to other devices (e.g., an expander phy (see 3.1.68) or a SAS phy (see 3.1.170))

Note 1 to entry: See 4.1.2 and SAS-3.

3.1.139
phy identifier
value by which a phy is identified within a device

Note 1 to entry: See 4.2.10.

3.1.140
phy ready state
condition of a phy when its SP state machine is in the SP15:SAS_PHY_Ready state (see 5.12.4.10)

3.1.141
phy reset sequence
OOB sequence (see 3.1.130) followed by a speed negotiation sequence (see 3.1.208)

Note 1 to entry: See 4.4 and 5.10.

3.1.142
physical link
two differential signal pairs, one pair in each direction, that connect two physical phys

Note 1 to entry: See 4.1.2 and SAS-3.

3.1.143
physical link rate
link rate between two physical phys established as a result of speed negotiation between those phys

3.1.144
physical phy
phy that contains a transceiver and electrically interfaces to a physical link to communicate with another physical phy

Note 1 to entry: See 4.1.2 and SAS-3.

3.1.145
port
SAS port (see 3.1.172) or an expander port (see 3.1.69)

Note 1 to entry: Each port contains one or more phys (see 3.1.138).

Note 2 to entry: See 4.1.4.

3.1.146
port identifier
value by which a port is identified within a domain

Note 1 to entry: See 4.2.9.

3.1.147
port name
worldwide unique name for a port within a transport protocol

Note 1 to entry: See 4.2.8.

3.1.148
potential pathway
set of logical links between a SAS initiator phy and a SAS target phy

Note 1 to entry: See 4.1.11.

3.1.149
power on
power being applied

3.1.150
primitive
8b10b coded dword in which the first byte is a control byte (i.e., 7Ch or BCh) or a control character (i.e., K28.3 or K28.5)

Note 1 to entry: For a phy that supports being attached to SATA phy, an 8b10b coded dword containing a 7Ch or BCh control byte followed by three data bytes, or a K28.3 or K28.5 control character with correct disparity followed by three data characters with correct disparity.

Note 2 to entry: For a phy that does not support being attached to SATA phy, an 8b10b coded dword containing a BCh control byte followed by three data bytes, or a K28.5 control character with correct disparity followed by three data characters with correct disparity.

Note 3 to entry: See 6.2.

3.1.151
primitive sequence
set of primitives treated as a single entity

Note 1 to entry: See 6.2.4.

3.1.152
programmed maximum physical link rate
maximum operational physical link rate of a phy

Note 1 to entry: The programmed maximum physical link rate may be programmed via the SMP PHY CONTROL function (see 9.4.3.28) or the Phy Control and Discover mode page (see 9.2.7.5).

3.1.153
programmed minimum physical link rate
minimum operational physical link rate of a phy

Note 1 to entry: The programmed minimum physical link rate may be programmed via the SMP PHY CONTROL function (see 9.4.3.28) or the Phy Control and Discover mode page (see 9.2.7.5).

3.1.154
rate
data transfer rate of a physical or logical link

Note 1 to entry: Rate examples are 1.5 Gbit/s, 3 Gbit/s, 6 Gbit/s, and 12 Gbit/s.

3.1.155
read data
data transferred to the SCSI application client's data-in buffer from the SCSI device server, as requested by the Send Data-In transport protocol service (see 9.2.1.6)

3.1.156
receiver device
Rx
device downstream from a receiver device compliance point containing a portion of the physical link and a receiver circuit

Note 1 to entry: See SAS-3.

3.1.157
request
information passed from a higher layer state machine to a lower layer state machine, usually to initiate some action

Note 1 to entry: See 3.6.

3.1.158
reset event
event that triggers a hard reset (see 4.4.2) in a SAS device

3.1.159
response
information passed from a higher layer state machine to a lower layer state machine, usually in response to an indication (see 3.1.94)

Note 1 to entry: See 3.6.

3.1.160
role
label at the end of an association (see 3.1.10) or aggregation (see 3.1.9) that defines a relationship to the class on the other side of the association or aggregation

Note 1 to entry: This definition only applies when used in relation to UML.

Note 2 to entry: See 3.5.

3.1.161
route table optimization
configuration subprocess (see 3.1.31) algorithm that reduces the number of entries required in an expander route table (see 3.1.72) in an externally configurable expander device (see 3.1.73)

Note 1 to entry: See 4.7.3.

3.1.162
run length
number of consecutive identical bits in the transmitted signal

Note 1 to entry: For example the pattern 00 11111010b includes the following run lengths of five 1s, one 0, one 1, and indeterminate run lengths of 0s at the start and end.

3.1.163
running disparity
RD
binary parameter with a negative (-) or positive (+) value indicating the cumulative encoded signal imbalance between the one and zero signal state of all characters since dword synchronization has been achieved

Note 1 to entry: See 5.3.5.

3.1.164
SAS address
identifier assigned to a SAS port (see 3.1.172) or expander device (see 3.1.65)

Note 1 to entry: See 4.2.4.

3.1.165
SAS device
SAS initiator device and/or a SAS target device

Note 1 to entry: See 4.1.6.

3.1.166
SAS domain
I/O system defined by this standard that may serve as a SCSI domain

Note 1 to entry: See 4.1.9.

3.1.167
SAS initiator device
device containing SSP, STP, and/or SMP initiator ports in a SAS domain

Note 1 to entry: See 4.1.6.

3.1.168
SAS initiator phy
logical phy (see 3.1.110) in a SAS initiator device

3.1.169
SAS initiator port
SSP initiator port (see 3.1.212), STP initiator port (see 3.1.219), and/or SMP initiator port (see 3.1.202) in a SAS domain

3.1.170
SAS phy
phy in a SAS device that interfaces to a service delivery subsystem (see 3.1.199)

3.1.171
SAS logical phy
SAS phy (see 3.1.170) or a multiplexed portion of a SAS phy

Note 1 to entry: See 4.1.2.

3.1.172
SAS port
SAS initiator port (see 3.1.169) and/or a SAS target port (see 3.1.175)

3.1.173
SAS target device
device containing SSP, STP, and/or SMP target ports in a SAS domain

Note 1 to entry: See 4.1.6.

3.1.174
SAS target phy
logical phy (see 3.1.110) in a SAS target device

3.1.175
SAS target port
SSP target port (see 3.1.216), STP target port (see 3.1.224), and/or SMP target port (see 3.1.206) in a SAS domain

3.1.176
SATA device
ATA device that contains a SATA device port in an ATA domain; analogous to a SAS target device (see 3.1.173)

3.1.177
SATA device port
ATA device object that interfaces to a service delivery subsystem (see 3.1.199) with SATA

Note 1 to entry: Analogous to a SAS target port (see 3.1.175).

3.1.178
SATA host
ATA host that contains a SATA host port in an ATA domain

Note 1 to entry: Analogous to a SAS initiator device (see 3.1.167).

3.1.179
SATA host port
ATA host object that interfaces to a service delivery subsystem (see 3.1.199) with SATA

Note 1 to entry: Analogous to a SAS initiator port (see 3.1.169).

3.1.180
SATA phy
phy in a SATA device or SATA port selector that interfaces to a service delivery subsystem (see 3.1.199)

Note 1 to entry: Analogous to a SAS phy (see 3.1.170).

3.1.181
SATA port selector
device that attaches to two SATA host ports (i.e., two ATA domains) and one SATA device port, and provides the means for one SATA host to access the device at any given time (see SATA)

3.1.182
SATA spinup hold
state entered by an expander phy attached to a SATA device in which it halts the automatic phy reset sequence to delay temporary consumption of additional power

Note 1 to entry: An example when a SATA device consumes additional power is during spin up of rotating media.

Note 2 to entry: See 5.16.

3.1.183
saturating counter
counter that remains at its maximum value after reaching its maximum value

3.1.184
scrambling
modifying data by XORing each bit with a pattern generated by a linear feedback shift register to minimize repetitive character patterns

Note 1 to entry: See 6.6.

3.1.185
SCSI application client
object that is the source of SCSI commands and task management function requests (see SAM-5), ATA commands (see ATA8-AAM), or SMP function requests

Note 1 to entry: See 4.1.5.

3.1.186
SCSI device
device that contains one or more SCSI ports that are connected to a service delivery subsystem (see 3.1.199) and supports a SCSI application protocol

Note 1 to entry: See SAM-5.

3.1.187
SCSI domain
I/O system consisting of a set of SCSI devices that communicate with one another by means of a service delivery subsystem (see 3.1.199)

Note 1 to entry: See SAM-5.

3.1.188
SCSI initiator device
SCSI device containing SCSI application clients and SCSI initiator ports that originates device service and task management requests to be processed by a SCSI target device and receives device service and task management responses from SCSI target devices

Note 1 to entry: See SAM-5.

3.1.189
SCSI initiator port
SCSI initiator device object that acts as the connection between SCSI application clients and a service delivery subsystem (see 3.1.199) through which requests and confirmations are routed

Note 1 to entry: See SAM-5.

3.1.190
SCSI port
SCSI initiator port and/or a SCSI target port

Note 1 to entry: See SAM-5.

3.1.191
SCSI target device
SCSI device containing logical units and SCSI target ports that receives device service and task management requests for processing and sends device service and task management responses to SCSI initiator devices

Note 1 to entry: See SAM-5.

3.1.192
SCSI target port
SCSI target device object that contains a task router and acts as the connection between SCSI device servers and task managers and a service delivery subsystem (see 3.1.199) through which requests, indications, responses, and confirmations are routed

Note 1 to entry: See SAM-5.

3.1.193
self-configuring expander device
expander device (see 3.1.65) containing an SMP initiator port and a management application client to perform the discover process (see 3.1.55) to configure its own expander route table (see 3.1.72)

Note 1 to entry: See 4.6.4.

3.1.194
Serial ATA
SATA
protocol defined by SATA (see clause 2)

3.1.195
Serial ATA Tunneled Protocol
STP
protocol defined in this standard used by STP initiator ports (see 3.1.219) to communicate with STP target ports (see 3.1.224) in a SAS domain

Note 1 to entry: See 6.19 and 8.3.

3.1.196
Serial Attached SCSI
SAS
set of protocols defined by this standard and the interconnects defined in SAS-3

3.1.197
Serial Management Protocol
SMP
protocol defined in this standard used by SMP initiator ports (see 3.1.202) to communicate with SMP target ports (see 3.1.206) in a SAS domain

Note 1 to entry: See 6.20 and 8.4.

3.1.198
Serial SCSI Protocol
SSP
protocol defined in this standard used by SSP initiator ports (see 3.1.212) to communicate with SSP target ports (see 3.1.216) in a SAS domain

Note 1 to entry: See 6.18 and 8.2.

3.1.199
service delivery subsystem
part of the domain that transmits information

Note 1 to entry: A service delivery subsystem is the part of:

a) a SCSI I/O system that transmits information between a SCSI initiator port and a SCSI target port;
b) an ATA I/O system that transmits information between an ATA host and an ATA device; or
c) a SAS I/O system that transmits information between a SAS initiator port and a SAS target port.

Note 2 to entry: See 4.1.8.

3.1.200
slumber phy power condition
low phy power condition for a SAS phy or expander phy

Note 1 to entry: See 4.10.1.4.

3.1.201
SMP initiator phy
SAS initiator phy (see 3.1.168) in an SMP initiator port (see 3.1.202)

3.1.202
SMP initiator port
SAS initiator device object in a SAS domain that interfaces to a service delivery subsystem with SMP

3.1.203
SMP phy
SAS logical phy (see 3.1.171) in an SMP port

3.1.204
SMP port
SMP initiator port (see 3.1.202) and/or an SMP target port (see 3.1.206)

3.1.205
SMP target phy
SAS target phy (see 3.1.174) in an SMP target port (see 3.1.206)

3.1.206
SMP target port
SAS target device object in a SAS domain that interfaces to a service delivery subsystem (see 3.1.199) with SMP

3.1.207
SMP zone configuration function
SMP function that configures zoning expander shadow values (see 3.1.259) and is only accepted by a locked zoning expander device

Note 1 to entry: See 4.8.6.3.

3.1.208
speed negotiation sequence
sequence in which two phys negotiate the operational physical link rate

Note 1 to entry: See 5.10.2.2 and 5.10.4.2.

3.1.209
speed negotiation window
SNW
portion of the SAS speed negotiation sequence

Note 1 to entry: See 5.10.4.2.3.

3.1.210
spread spectrum clocking
SSC
technique of modulating the operating frequency of a transmitted signal (i.e., the physical link rate) to reduce the measured peak amplitude of radiated emissions

Note 1 to entry: See SAS-3.

3.1.211
SSP initiator phy
SAS initiator phy (see 3.1.168) in an SSP initiator port (see 3.1.212)

3.1.212
SSP initiator port
SCSI initiator port in a SAS domain that implements SSP

3.1.213
SSP phy
SAS logical phy (see 3.1.171) in an SSP port

3.1.214
SSP port
SSP initiator port (see 3.1.212) and/or an SSP target port (see 3.1.216)

3.1.215
SSP target phy
SAS target phy (see 3.1.174) in an SSP target port (see 3.1.216)

3.1.216
SSP target port
SCSI target port in a SAS domain that implements SSP

3.1.217
state machine variable
variable that exists within the context of a state machine

Note 1 to entry: A state machine variable may contain status from one state that is used in another state of the same state machine.

Note 2 to entry: The value contained in a state machine variable may affect subsequent state transitions or state machine outputs.

3.1.218
STP initiator phy
SAS initiator phy (see 3.1.168) in an STP initiator port (see 3.1.219)

3.1.219
STP initiator port
SAS initiator device object in a SAS domain that interfaces to a service delivery subsystem (see 3.1.199) with STP

3.1.220
STP phy
SAS logical phy (see 3.1.171) in an STP port

3.1.221
STP port
STP initiator port (see 3.1.219) and/or an STP target port (see 3.1.224)

3.1.222
STP primitive
primitive used only inside STP connections and on SATA physical links

Note 1 to entry: See 6.2.2.

3.1.223
STP target phy
SAS target phy (see 3.1.174) in an STP target port (see 3.1.224)

3.1.224
STP target port
SAS target device object in a SAS domain that interfaces to a service delivery subsystem (see 3.1.199) with STP

3.1.225
STP SATA bridge
expander device object containing an STP target port, a SATA host port, and the functions required to forward information between the STP target port and SATA host port to enable STP initiator ports in a SAS domain to communicate with SATA devices in an ATA domain

3.1.226
subtractive routing attribute
attribute of an expander phy that indicates that the expander phy may be used by the ECM (see 3.1.63) to route connection requests to an attached expander device that were not resolved using the direct routing method or table routing method

Note 1 to entry: See 4.5.7.1.

3.1.227
subtractive routing method
method the ECM (see 3.1.63) uses to route connection requests not resolved using the direct routing method or table routing method to an attached expander device (see 3.1.65)

Note 1 to entry: See 4.5.7.1.

3.1.228
table routing attribute
attribute of an expander phy that indicates that the expander phy may be used by the ECM (see 3.1.63) to route connection requests using an expander route table (see 3.1.72)

Note 1 to entry: See 4.5.7.1.

3.1.229
table routing method
method the ECM (see 3.1.63) uses to route connection requests to an attached expander device (see 3.1.65) using an expander route table (see 3.1.72)

Note 1 to entry: See 4.5.7.1.

3.1.230
target port transfer tag
optional value that allows an SSP target port to establish the write data context when receiving a write DATA frame

Note 1 to entry: See 8.2.1.

3.1.231
task management function
task manager service capable of being requested by a SCSI application client to affect the processing of one or more commands

Note 1 to entry: See SAM-5.

3.1.232
task manager
object that controls the sequencing of SCSI commands and processes SCSI task management functions

Note 1 to entry: See SAM-5.

3.1.233
Train_Rx-SNW
speed negotiation window with receiver training

Note 1 to entry: See 5.10.4.2.3.5.

3.1.234
Train_Rx-SNW window time
actual duration of Train_Rx-SNW

3.1.235
Train_Tx-SNW
speed negotiation window with transmitter training

Note 1 to entry: See 5.10.4.2.3.4.

3.1.236
transmitter device
Tx
device upstream from a transmitter device compliance point containing a portion of the physical link and a transmitter circuit (see SAS-3)

3.1.237
transport protocol service confirmation
information passed from the SSP transport layer to the SCSI application layer (e.g., from the SSP initiator port to the SCSI application client) that notifies the SCSI application layer that a SCSI transport protocol service has completed

3.1.238
transport protocol service indication
information passed from the SSP transport layer to the SCSI application layer notifying the SCSI application layer (e.g., from the SSP target port to the SCSI device server) to begin a SCSI transport protocol service

3.1.239
transport protocol service request
information passed from the SCSI application layer to the SSP transport layer (e.g., from the SCSI application client to the SCSI initiator port) to begin a SCSI transport protocol service

3.1.240
transport protocol service response
information passed from the SCSI application layer to the SSP transport layer (e.g., from the SCSI device server to the SSP target port) that completes the SCSI transport protocol service

3.1.241
transmitter training information unit
TTIU
32 TTIU bit cells that follow a pattern marker transmitted during Train_Tx-SNW (see 5.10.4.2.3.4)

Note 1 to entry: See 5.10.4.2.3.5.

3.1.242
TTIU bit cell
group of ten UIs that encode a single bit of BMC (see 3.1.19) information

3.1.243
unit interval
UI
time period that has the normalized, dimensionless, nominal duration of a symbol (see SAS-3) (e.g., 666.$\overline{6}$ ps at 1.5 Gbit/s, 333.$\overline{3}$ ps at 3 Gbit/s, 166.$\overline{6}$ ps at 6 Gbit/s, and 83.$\overline{3}$ ps at 12 Gbit/s)

Note 1 to entry: See SAS-3.

3.1.244
valid character
character that is a control character (see 3.1.38) or a data character (see 3.1.43)

3.1.245
valid dword
dword that is a data dword (see 3.1.44) or a primitive (see 3.1.150)

3.1.246
virtual phy
phy (see 3.1.138) that interfaces with a vendor specific interface to another virtual phy inside the same device

Note 1 to entry: See 4.1.2.

3.1.247
wide link
group of physical links that attaches a wide port to another wide port

Note 1 to entry: See 4.1.4.

3.1.248
wide port
port that contains more than one phy

Note 1 to entry: See 4.1.4.

3.1.249
word
sequence of 16 contiguous bits considered as an unit

3.1.250
wrapping counter
counter that wraps back to zero after reaching its maximum value

3.1.251
write data
data transferred from the SCSI application client's data-out buffer to the SCSI device server, as requested by the Request Data-Out transport protocol service (see 9.2.1.8)

3.1.252
zone group
set of phys in a ZPSDS (see 3.1.255) that all have the same access permission

Note 1 to entry: See 4.8.

3.1.253
zone manager
entity responsible for configuring a ZPSDS (see 3.1.255)

Note 1 to entry: See 4.8.

3.1.254
zone permission table
table that defines access permission between the zone group of a source phy and the zone group of the destination phy

Note 1 to entry: See 4.8.3.3.

3.1.255
zoned portion of a service delivery subsystem
ZPSDS
group of zoning expander devices (see 3.1.257) that cooperate to control access between phys; the ZPSDS may include all or part of a service delivery subsystem (see 3.1.199)

Note 1 to entry: See 4.8.

3.1.256
zoning expander current values
current zone permission table (see 3.1.254) and zone phy information in a zoning expander device (see 3.1.257)

Note 1 to entry: See 4.8.6.

3.1.257
zoning expander device
expander device (see 3.1.65) that supports zoning

Note 1 to entry: See 4.8.

3.1.258
zoning expander phy
expander phy in a zoning expander device (see 3.1.257)

3.1.259
zoning expander shadow values
shadow zone permission table (see 3.1.254) and zone phy information in a zoning expander device, which are changed by SMP zone configuration functions (see 3.1.207) but do not become active until the activate step (see 4.8.6.4) is performed

Note 1 to entry: See 4.8.6.

3.2 Symbols and abbreviations

See Annex L for abbreviations of standards bodies (e.g., ISO).

Units and abbreviations used in this standard:

Abbreviation	Meaning
AA	ATA application layer (see 9.3)
ACA	auto contingent allegiance (see SAM-5)
ACK	acknowledge (see 6.2.7.1)
AIP	arbitration in progress (see 6.2.6.1)
ATA	AT attachment (see 3.1.14)
ATAPI	AT attachment packet interface
ATA8-AAM	AT Attachment - 8 ATA/ATAPI Architecture Model standard (see clause 2)
A.C.	alternating current
ACS-2	ATA/ATAPI Command Set-2 standard (see clause 2)
AWT	arbitration wait time
BCH	Bose, Chaudhuri and Hocquenghem code (see 4.2.5)
BIST	built in self test
BMC	bi-phase mark code (see 3.1.19)
BPP	Broadcast propagation processor (see 3.1.22)
CDB	command descriptor block (see 3.1.28)
CJTPAT	compliant jitter tolerance pattern (see 3.1.30)
CRC	cyclic redundancy check (see 3.1.39)
CRN	command reference number (see SAM-5)
D.C.	direct current
Dxx.y	data character (see 3.1.43)
ECM	expander connection manager (see 3.1.63)
ECR	expander connection router (see 3.1.64)
EMI	electromagnetic interference
EOAF	end of address frame (see 6.2.6.6)
EOF	end of frame (see 6.2.7.4)
FIS	frame information structure (see 3.1.77)
G1	generation 1 physical link rate (i.e., 1.5 Gbit/s)
G2	generation 2 physical link rate (i.e., 3 Gbit/s)
G3	generation 3 physical link rate (i.e., 6 Gbit/s)
G4	generation 4 physical link rate (i.e., 12 Gbit/s)