

This is a preview - click here to buy the full publication



ISO/IEC 14776-251

Edition 1.0 2014-04

INTERNATIONAL STANDARD



**Information technology – Small computer system interface (SCSI) –
Part 251: USB Attached SCSI (UAS)**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

B

ICS 35.200

ISBN 978-2-8322-1507-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	6
INTRODUCTION	8
SCSI standards family	8
1 Scope.....	10
2 Normative references	10
3 Terms, definitions, symbols, abbreviations and conventions	10
3.1 Terms and definitions.....	10
3.2 Symbols and abbreviations	13
3.3 Keywords.....	13
3.4 Editorial conventions.....	14
3.5 Numeric and character conventions	15
3.5.1 Numeric conventions.....	15
3.5.2 Byte encoded character strings conventions.....	15
3.6 Sequence figure notation	16
3.7 Notation for procedures and functions.....	16
4 Model	17
4.1 Overview.....	17
4.2 Tag handling.....	18
4.3 Data transfers	18
4.4 UAS domain.....	19
4.5 Addressing.....	20
4.6 World wide name	20
4.7 Resets	20
4.8 I_T Nexus loss	21
4.9 Target power loss expected	21
4.10 USB error handling	21
5 USB.....	22
5.1 Overview.....	22
5.2 USB resource requirements	22
5.2.1 Overview.....	22
5.2.2 USB class specific requests	22
5.2.3 USB descriptors	22
6 Transport.....	27
6.1 Overview.....	27
6.2 IUs.....	27
6.2.1 Overview	27
6.2.2 COMMAND IU.....	28
6.2.3 READ READY IU	29
6.2.4 WRITE READY IU	29
6.2.5 SENSE IU	30
6.2.6 RESPONSE IU.....	30
6.2.7 TASK MANAGEMENT IU	31
6.3 Information unit sequences	33
6.3.1 Overview	33

6.3.2	Non-data command/sense sequence.....	34
6.3.3	Non-data command/response sequence	35
6.3.4	Data-out command sequence.....	36
6.3.5	Data-in command sequence.....	37
6.3.6	Task management function sequence	37
6.3.7	Bi-directional command sequence.....	38
6.3.8	Multiple command example.....	38
6.4	Transport requirements.....	41
7	SCSI Application Layer transport protocol services.....	42
7.1	SCSI transport protocol services overview.....	42
7.2	Send SCSI Command transport protocol service	43
7.3	SCSI Command Received transport protocol service.....	44
7.4	Send Command Complete transport protocol service.....	44
7.5	Command Complete Received transport protocol service	45
7.6	Send Data-In transport protocol service.....	46
7.7	Data-In Delivered transport protocol service	46
7.8	Receive Data-Out transport protocol service.....	46
7.9	Data-Out Received transport protocol service.....	47
7.10	Terminate Data Transfer transport protocol service.....	47
7.11	Data Transfer Terminated transport protocol service.....	48
7.12	Send Task Management Request transport protocol service.....	48
7.13	Task Management Request Received transport protocol service	49
7.14	Task Management Function Executed transport protocol service.....	49
7.15	Received Task Management Function Executed transport protocol service	51
7.16	USB Acknowledgement.....	52
8	Device server error handling.....	53

Figure 1 – SCSI document structure	8
Figure 2 – Example Sequence figure	16
Figure 3 – USB Model	17
Figure 4 – Example Simple UAS domain	19
Figure 5 – Example Complex UAS Domain.....	20
Figure 6 – UAS sequence figure notation	34
Figure 7 – Non-data transfer with Sense.....	34
Figure 8 – Non-data Transfer with Response.....	35
Figure 9 – Write Data Transfer	36
Figure 10 – Read Data Transfer	37
Figure 11 – Task management	37
Figure 12 – Bi-directional Data Transfer	38
Figure 13 – Multiple Command example.....	40

Table 1 – Numbering conventions	15
Table 2 – Device descriptor	22
Table 3 – Configuration descriptor	23
Table 4 – Interface Descriptor.....	24
Table 5 – Bulk-in endpoint descriptor.....	24
Table 6 – Bulk-out endpoint descriptor	25
Table 7 – Pipe Usage Descriptor	25
Table 8 – Pipe ID.....	26
Table 9 – IU ID field summary	27
Table 10 – IU Header	27
Table 11 – COMMAND IU.....	28
Table 12 – TASK ATTRIBUTE field	28
Table 13 – READ READY IU	29
Table 14 – WRITE READY IU.....	29
Table 15 – SENSE IU	30
Table 16 – RESPONSE IU.....	30
Table 17 – RESPONSE CODE field	31
Table 18 – TASK MANAGEMENT IU	31
Table 19 – task management function field.....	32
Table 20 – Execute Command procedure call transport protocol services	42
Table 21 – Execute Command procedure call transport protocol services	43
Table 22 – Send SCSI Command transport protocol service arguments	43
Table 23 – SCSI Command Received transport protocol service arguments.....	44
Table 24 – Send Command Complete transport protocol service arguments	45
Table 25 – Command Complete Received transport protocol service arguments	45
Table 26 – Send Data-In transport protocol service arguments.....	46
Table 27 – Data-In Delivered transport protocol service arguments	46
Table 28 – Receive Data-Out transport protocol service arguments.....	47
Table 29 – Data-Out Received transport protocol service arguments.....	47
Table 30 – Terminate Data Transfer transport protocol service arguments	48
Table 31 – Data Transfer Terminated transport protocol service arguments	48
Table 32 – Send Task Management Request transport protocol service arguments	48
Table 33 – Task Management Request Received transport protocol service arguments	49
Table 34 – Task Management Function Executed transport protocol service arguments.....	50
Table 35 – Received Task Management Function Executed transport protocol service arguments	51
Table 36 – USB Acknowledgement.....	52
Table 37 – Delivery Result to additional sense code mapping	53

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE (SCSI) –

Part 251: USB Attached SCSI (UAS)

FOREWORD

- 1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.
- 2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees and ISO member bodies.
- 3) IEC, ISO and ISO/IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO, IEC or ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.
- 5) ISO and IEC do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. ISO or IEC are not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC National Committees or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC Publication or any other IEC, ISO or ISO/IEC publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this ISO/IEC Publication may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 14776-251 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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

This International Standard standard encompasses the following:

- Clause 1 describes the scope.
- Clause 2 provides normative references for the entire standard.
- Clause 3 provides definitions, abbreviations, and conventions used within the entire standard.
- Clause 4 describes the model.
- Clause 5 describes USB requirements.
- Clause 6 describes transport requirements (e.g., IUs).
- Clause 7 describes the SCSI Application Layer Transport Protocol Services.
- Clause 8 describes device server error handling.

SCSI standards family

Figure 1 shows the relationship of this standard to the other standards and related projects in the SCSI family of standards as of the publication of this standard.

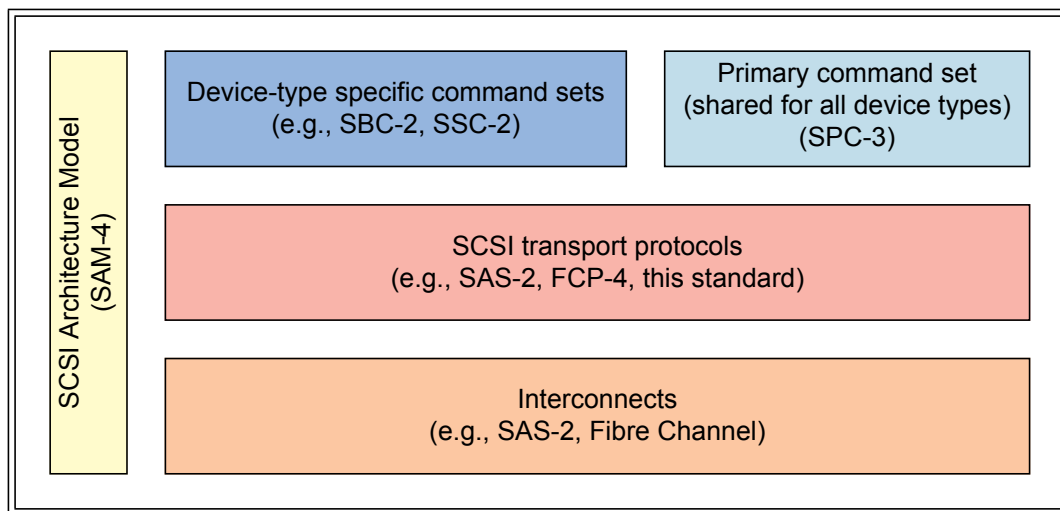


Figure 1 — SCSI document structure

The SCSI document structure in figure 1 is intended to show the general applicability of the documents to one another. Figure 1 is not intended to imply a relationship such as a hierarchy, protocol stack, or system architecture.

SCSI Architecture Model: Defines the SCSI systems model, the functional partitioning of the SCSI standard set and requirements applicable to all SCSI implementations and implementation standards.

Device-Type Specific Command Sets: Implementation standards that define specific device types including a device model for each device type. These standards specify the required commands and behaviors that are specific to a given device type and prescribe the requirements to be followed by a SCSI initiator device when sending commands to a SCSI target device having the specific device type. The commands and behaviors for a specific device type may include by reference commands and behaviors that are shared by all SCSI devices.

Shared Command Set: An implementation standard that defines a model for all SCSI device types. This standard specifies the required commands and behavior that is common to all SCSI devices, regardless of device type, and prescribes the requirements to be followed by a SCSI initiator device when sending commands to any SCSI target device.

SCSI Transport Protocols: Implementation standards that define the requirements for exchanging information so that different SCSI devices are capable of communicating.

Interconnects: Implementation standards that define the communications mechanism employed by the SCSI transport protocols. These standards may describe the electrical and signaling requirements essential for SCSI devices to interoperate over a given interconnect. Interconnect standards may allow the interconnection of devices other than SCSI devices in ways that are outside the scope of this standard.

The term SCSI is used to refer to the family of standards described in this introduction.

INFORMATION TECHNOLOGY – SMALL COMPUTER SYSTEM INTERFACE (SCSI) –

Part 251: USB Attached SCSI (UAS)

1 Scope

This part of ISO/IEC 14776 describes a SCSI transport protocol (see ISO/IEC 14776-414) for USB-2 and USB-3 with the following properties:

- a) mechanism to send commands associated with any SCSI standard to a USB device;
- b) complies with SCSI Architecture Model - 4 (e.g., autosense and command queuing); and
- c) other capabilities.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14776-414, *Information technology, Small Computer System Interface (SCSI) – Part 414: SCSI Architecture Model-4* (herein referred to as SAM-4) ¹

IEC 62680-1, *Universal serial bus interfaces for data and power – Part 1: Universal serial bus specification, revision 2.0* (herein referred to as USB-2)

ANSI INCITS 513-2004, *SCSI Primary Commands-4* (herein referred to as SPC-4) [T10/1731-D]²

Universal Serial Bus 3.0 Specification Revision 1.0 (herein referred to as USB-3). November 12, 2008

Universal Serial Bus Mass Storage Class Specification Overview Rev 1.3 (herein referred to as MSC). September 5, 2008³

1. ANSI INCITS 447-2008

2. planned as ISO/IEC 14776-454

For more information on the current status of these documents, contact the INCITS Secretariat at 202-737-8888 (phone), 202-638-4922 (fax) or via E-mail at incits@itic.org. To obtain copies of these documents, contact Global Engineering at 15 Inverness Way, East Englewood, CO 80112-5704 at 303-792-2181 (phone), 800-854-7179 (phone), or 303-792-2192 (fax) or see <http://www.incits.org>.

3. For information on the current status of USB documents, see the USB Implementers Forum at <http://www.usb.org>.