Universal Serial Bus Cable & Connector Class Specification

Version 1.0

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CONTRIBUTORS:

Name	Company	E-mail Address
Richard Bentley	Acon	<rbentley@acon.com>
Bob Wertz	AMP, Inc.	<rhwertz@amp.com>
Jim R. Koser	Berg Electronics Group	<koserjr@bergelect.com>
Charles E. Brill	Brill Consulting	<cebrill@ix.netcom.com>
Ira Kistenberg	Cable Specialties International	<ira.kistenberg@csi-cables.com>
Dave Jones	Hewlett-Packard	<dave_jones@hp.com>
John S. Howard	Intel Corporation	<John.Howard@intel.com>
Richard L. Hill	IO Systems, Inc.	<richard@fastbus.com>
Tohru Iwama	ITT Cannon	<tohrui@ittdeere.cannon.itt.com>
Watson Lee	Joinsoon Electronics Mfg. Co., Ltd.	<watson@jem.com.tw>
Mark Williams	Microsoft	<markwi@microsoft.com>
Rod Morgan	National Technical Systems	<Rodm@ntscorp.com>
Sam Liu	Newnex	<saml@newnex.com>
Jason Sloey	Northstar Systems	<jsloey@northstar1.com>
Ralph Smith	USB-IF	<ralph.s.smith@intel.com>

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Please send comments via electronic mail to
richard@fastbus.com and John.Howard@intel.com

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DOCUMENT REVISION HISTORY. In order to move this document to Revision 1.0 in an orderly manner, this document includes all modifications suggested at face to face meetings held to date and subsequent E-mail and telephone contributions.

REVISION	ISSUE DATE	COMMENTS
1.0	May 22, 1999	Accepted unanimously by USB-IF DWG after 30-day posting without negative comment.
1.0RC	March 27, 1999	Release for industry comment.
0.9a	January 19, 1999	Moved to Revision 0.9 by consensus of the Cable & Connector Work Group. Pending final editorial cleanup RRs to be voted on at a special Cable & Connector Work Group meeting February 21, 1999.
0.9RC	December 18, 1998	Moves Document to 0.9RC by consensus of the Cable & Connector Group to Version 0.9 without Appendices Drawings and Lab Listings. Special dispensation by the DWG to move to Revision 1.0 for use at the January 1999 PlugFest.
0.8a	October 27, 1998	Table 4-1: Reinsert ‘ Durability’ per Bill Baker — Iomega 10/27/1998.
0.8	October 20, 1998	Release for industry comment.
0.7m	October 16, 1998	Adds Addenda content.
0.7f	October 9, 1998	Adds additional Application Specific USB Product Specification content.
0.7	September 30, 1998	Supersedes segments of Chapter 6 Revision 1.1 Release Candidate 1.0c.

1.0 INTRODUCTION.

1.1 PURPOSE. This document describes the mechanical, electrical, environmental, design and performance criteria and voluntary supplier compliance requirements for USB connectors, cable and fabricated cable assemblies. In addition, this document provides detailed requirements for the design, approval and implementation of application specific USB connectors and fabricated cable assemblies.

1.2 SCOPE. The information provided in this document serves as a guideline for design, development and voluntary compliance testing of USB connectors and fabricated cables assemblies, as well as defining mechanical, electrical, environmental and performance characteristics. As such, it defines how USB connectors, cable and fabricated cables assemblies are to be implemented and how manufacturers and/or fabricators will interact with the voluntary compliance requirements.

1.3 RELATED DOCUMENTS.

1.3.1 Universal Serial Bus Specification (USB) Revision 1.1.

1.3.2 American National Standards/Electronic Industries Association.

1.3.2.1 ANSI/EIA-364-C (12/94), Electrical Connector/Socket Test Procedures Including Environmental Classifications.

1.3.3 American Standard Test Materials.

1.3.3.1 ASTM-D-4565, Physical and Environmental Performance Properties of Insulation and Jacket for Telecommunication Wire and Cable, Test Method.

1.3.3.2 ASTM-D-4566, Electrical Performance Properties of Insulation and Jacket for Telecommunication Wire and Cable, Test Method.

1.3.4 Underwriters' Laboratory, Inc.

1.3.4.1 UL STD-94, Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.3.4.2 UL Subject-444, Communications Cables.

1.3.5 Miscellaneous Publications.

1.3.5.1 Hewlett-Packard Applications Note 380-2.

1.3.5.2 FCC Part 15 — Classes A & B requirements for electromagnetic emission profiles.

1.3.5.3 CE Mark EN55011 and **CE Mark EN55022** requirements for electromagnetic emission profiles.

1.4 TERMS AND ABBREVIATIONS.

Acronym/Term/Name	Description/Definition
Acceptable Quality Level (AQL)	A nominal value expressed in terms of defects per hundred units or percentage defective, whichever is applicable, specified for a given group of defects or a product.
A2LA	The American Association for Laboratory Accreditation (**A2LA**) is a nonprofit, professional membership society. A2LA coordinates and manages a broad-spectrum, nationwide laboratory accreditation system and offers training and continuing education in laboratory practices and management. A2LA offers accreditation to private, independent (for hirer), in-house and government testing laboratories in the following fields: acoustics and vibration; biological; chemical; construction materials; electrical; environmental; geotechnical; mechanical; calibration; and, nondestructive and thermal.
Acceptance Number	The maximum number of defects or defective units in the sample that will permit acceptance.
ANSI	American National Standards
Approved Vendor Listing (AVL)	An electronic listing maintained by the USB-IF Management Office of cable and connector products that have successfully completed a Voluntary Compliance Testing program conducted in accordance with the most current version of the USB Specification' s Electrical, Mechanical and Environmental Performance Standards as shown in Chapter 6 and this document.
ASTM	American Standard Test Materials.
ASUPS	The acronym for Application Specific USB Product Specification. An ASUPS describes the unique characteristics of a special purpose nonstandard USB connector or cable assembly specification.
C of C	The acronym for Certificate of Compliance. C of C as used in the document refers to certified proof of compliance with the testing regimen specified herein. The C of C must be issued by a certified testing facility that has direct traceability to a recognized regulatory body, e.g., NVLAP *(National Voluntary Laboratory Accreditation Program)*, ISO *(International Standards Organization)*, et cetera.
Characteristic	A physical, chemical, visual or any other measurable property of a product or material.
Contact Point	One electrical contact of a multicontact connector.
Defect	Any nonconformance of the unit of product with specified requirements.
Defective Unit	A unit of product that contains one or more defects.
Double Sampling Plan	Sampling inspection in which the inspection of the first sample leads to a decision to accept, to reject, or to take a second sample. The inspection of a second sample, when required then leads to a decision to accept or reject.

Acronym/Term/Name	Description/Definition
EIA	Electronic Industries Association.
EMI/RFI	Electro-magnetic Interference/Radio Frequency Interference.
Full-speed	The USB ' Full-speed' data transfer rate is ≥12M/bs.
Inspection Level	An indication of the relative sample size for a given amount of product.
Inspection Lot	A collection of units of product from which a sample is drawn and inspected to determine compliance with the acceptability criteria.
Inspection	The examination and/or testing of raw materials, components, fabricated piece parts, data, documents or subassemblies to determine whether the product and/or services conform to the specified criteria.
ISO	The International Organization for Standardization (**ISO**) is a worldwide federation of national standards bodies from 130 countries, one from each country.
Low-speed	The USB ' Low-speed' data transfer rate is ≥1.5M/bs.
Multiple Sampling Plan	A type of sampling plan in which a decision to accept or reject an inspection lot may be reached after one or more samples from that inspection lot have been inspected, and will always be reached after not more than a designated number of samples have been inspected.
NAVLAP	National Voluntary Laboratory Accreditation Program for commercial and military testing laboratories. The program rigorously evaluates the competencies and technical qualifications of public and private laboratories for providing testing and calibration services. An accredited laboratory must meet all requirements of national consensus standards as well as international accreditation requirements of the *International Standards Organization (**ISO**) ¾ Guides 25 and 58, ISO 9002 and related standards issued by NIST.* NVLAP accredits qualified laboratories that offer services in a variety of industrial and military testing areas, as well as electromagnetic compatibility, telecommunications and personnel radiation dosimetry. NVLAP accreditation is also available in the following calibration areas: dimensional; electrical; radiation; mechanical; thermodynamics; and, time and frequency. Any interested laboratory, organization, or agency can apply for accreditation in these and other areas. Requests for expanded program services are evaluated by NVLAP on a case-by-case basis. Among the many benefits of NVLAP accreditation are certification of proficiency with a quality assurance check on laboratory performance, substantive advice for improving performance, and national and international recognition of competency. Accreditation also helps users — from industry, government, and elsewhere — identify providers of high-quality testing and calibration services.
NIST	National Institute of Standards and Technology.

Acronym/Term/Name	Description/Definition
Normal Inspection	Inspection, which is used when there is no statistically significant evidence that the quality of the product being submitted is better or worse than the specified quality level.
Power Pair	The non-twisted pair of electrical conductors in a USB cable used to carry power from the ‘ host controller’ and/or a ‘ self-powered hub’ to the device. Where the *‘Red’* conductor is **VBUS** and the *‘Black’* conductor is **GROUND**.
Qualification Inspection	Examination and testing as required in an individual specification to determine whether a product being submitted is satisfactory for listing on approved source list.
Random Sampling	The procedure used to select items from the inspection lot so that each item in the lot has an equal chance of being included in the sample.
Reduced Inspection	Inspection under a sampling plan using the same quality level as for normal inspection but requiring a smaller sample for inspection.
Rejection Number	The minimum number of defects or defective units in the sample that will cause rejection.
Resubmitted Lot	A lot which has been rejected, subjected to inspection, reworked as necessary, and subsequently resubmitted for acceptance.
Sample Size	The number of sample units selected for inspection.
Sample Unit	A unit of product selected to be part of a sample may be use interchangeably with ‘ specimen.’ *(Please see specimen.)*
Sample	One or more units of product selected at random from the material or process represented.
Sampling Plan	A statement of the sample size or sizes to be used and the associated acceptance and rejection criteria.
Screening Inspection	Inspection in which each item of product is inspected and all defective items are rejected.
Signal Pair	The twisted pair of electrical conductors in a USB cable used to carry data from the ‘ host controller’ and/or a ‘ self-powered hub’ to the device. Where the *‘Green’* conductor is **DPLUS (D+)** and the *‘White’* conductor is **DMINUS (D-)**.
Single Sampling Plan	A plan that consists of a single sample size with associated acceptance and rejection criteria.
Specimen	A unit of product selected to be part of a sample may be use interchangeably with ‘ sample unit.’ *(Please see sample unit.)*
Tightened Inspection	Inspection under a sampling plan using the same quality level for normal inspection, but requiring more stringent acceptance criteria.

Acronym/Term/Name	Description/Definition
Unit of Product	The entity of product inspected in order to determine its classification as defective, nonconforming or acceptable. This may be a single article, a pair, a set, a length, an area, a volume, a component of a product or the product itself. It may or may not be the same as the unit of purchase, supply, production or shipment.
Universal Serial Bus	Universal Serial Bus is a serial interconnect bus that supports transfer rates up to 12M/bs for a maximum of 127 USB devices. *(Please see USB.)*
USB Devices	USB devices can be: ' Hubs' that provide attachment points for USB; or, ' Functions' that provide capabilities to the system, such as an ISDN connection, a digital joystick, a printer, speakers, et cetera.
USB Host	The USB interface to the host computer system is referred to as the Host Controller. The Host Controller may be implemented in a combination of hardware, firmware or software. A ' root hub' is integrated within the host system to provide one or more attachment points. Additional information concerning the ' USB host' may be found in Section 4.9 and Chapter 10 of the USB Specification Revision 1.1.
USB Topology	The USB connects USB devices with the USB host. The USB physical interconnection is a tiered star topology. A ' hub' is at the center of each star. Each wire segment is a point-to-point connection between the ' host' and a ' hub' or ' function,' or a ' hub' connected to another ' hub' or ' function.'
USB	The acronym for Universal Serial Bus. *(Please see Universal Serial Bus.)*
USB-IF	USB Implementers Forum is a nonprofit industry organization made up of original equipment manufacturers (**OEMs**), component manufacturers and firmware/software developers who are actively involved in the advancement of USB technology.
Voluntary Compliance Testing	Voluntary testing of USB cable, cable assemblies and connectors to the most current version of the USB Specification' s Electrical, Mechanical and Environmental Performance Standards as shown in Chapter 6 and this document. Testing must be conducted by a testing laboratory, either in-house or third party, which has direct traceability to NVLAP or ISO.

2.0 MANAGEMENT OVERVIEW. This section is an overview of the contents of this document and provides a brief summary of each of the subsequent sections. It does not establish any requirements or guidelines.

2.1 SECTION 3.0, USB CABLE AND CONNECTOR PRODUCT ACCEPTANCE CRITERIA, TEST METHODS AND TEST PROCEDURES. This section describes the acceptance testing criteria and test procedures for USB connectors, bulk cable and fabricated cable assemblies. USB connector and fabricated cable assembly manufacturers will voluntarily submit certified proof of satisfactory completion *(a Certificate of Compliance (**C of C**) from a certified testing laboratory)* of all product acceptance tests shown in the most current version of the USB Specification and this document. A certified copy of the C of C will be sent to the USB Implementers Forum (**USB-IF**).

2.2 SECTION 4.0, USB ELECTRICAL, MECHANICAL AND ENVIRONMENTAL COMPLIANCE STANDARDS. USB bulk cable, connector and fabricated cable assembly performance standards as specified by the most current version of Chapter 6 of the USB Specification.

2.3 SECTION 5.0, USB CONNECTOR AND CABLE ASEMBLY PHYSICAL SELF-CERTIFICATION TEST SEQUENCE AND PROCEDURES. This section describes the Self-Certification Test Sequence and Test Procedures for USB connectors, bulk cable and fabricated cable assemblies.

2.4 SECTION 6.0, SELF-CERTIFICATION ACCEPTANCE AND SUBMISSION PROCEDURES. This section describes the Self-Certification Acceptance and Submission Procedures for USB connectors, bulk cable and fabricated cable assemblies. This section also describes the authorization requirements and procedures for cable, cable assembly and connector manufacturers use of the trademarked *USB ' logo.'*

2.5 SECTION 7.0, DESIGN AND IMPLEMENTATION PROCEDURES FOR APPLICATION SPECIFIC USB CONNECTORS AND CABLE ASSEMBLIES. This section describes the electrical, mechanical and software descriptor requirements and procedures for the design, development, implementation and acceptance of application specific USB connectors for industry-wide use.

2.6 SECTION 8.0, ADDENDA. This section contains a world-wide listing of test laboratories capable of performing certification testing, sample certificate of compliance forms, approved application specific product specifications and other related USB connector, cable and cable assembly information.

3.0 USB CABLE AND CONNECTOR PRODUCT ACCEPTANCE CRITERIA, TEST METHODS AND TEST PROCEDURES. Manufacturers of USB cable, connectors and fabricated cable assemblies will voluntarily submit certified proof of satisfactory compliance with all product acceptance tests shown in this document to the USB Implementers Forum (**USB-IF**). Upon receipt of a Certificate of Compliance (**C of C**) from a certified testing laboratory.

IMPORTANT NOTICE: *Fabricated USB cable assemblies are required to successfully pass all inspection procedures and compliance testing at the intervals shown in* ***Table 5-3, Primary Qualification Approval Testing, and Table 5-4, Sustaining Qualification Approval Testing*** *of this specification before recommendation for use will be granted.*

3.1 USB-IF will maintain a current Approved Vendor Listing (**AVL**) of manufacturers and/or fabricators who have been authorized to use the trademarked *'USB logo'* in conjunction with or on their connector and/or fabricated cable assembly products. The USB-IF' s listing of approved manufacturers will be updated monthly and will be available to all USB-IF member companies.

3.2 Continuing *'USB logo'* usage authorization and USB-IF AVL status will require manufacturers and/or fabricators to submit an updated C of C annually for each family of part numbers listed on the AVL. The C of C will be considered delinquent if not received within 15 days of its due date. If the updated C of C has not been received within 30 days of its due date, the manufacturer' s part number is subject to removal from the AVL.

3.3 ACCEPTANCE CRITERIA. The Acceptance Quality Level (**AQL**) for all Electrical, Mechanical and Environmental Tests shall as specified in ***Table 5-3, Primary Qualification Approval Testing, and Table 5-4, Sustaining Qualification Approval Testing.*** All acceptance tests shall be performed on the minimum number of connectors specified in the appropriate table unless otherwise specified. The USB Random Sample Selection Plan has been based on the recommendations of ANSI/ASQC Z1.4, Sampling Procedures and Tables for Inspection by Attributes.

3.4 GENERAL ACCEPTANCE TESTING. All USB piece parts used for performance testing under this specification will be randomly selected by the laboratory performing the tests. The selected USB components will then be tested for compliance in accordance with the procedures specified by this document and the criteria set forth in Chapter 6 of the most current revision of the USB Specification.

IMPORTANT NOTE: *All compliance testing will be performed at the manufacturer's expense by a certified laboratory. The certified laboratory, either in-house or third party, shall have direct traceability to a recognized standards organization, e.g., NAVLAP, A2LA, ISO, NIST, BSA, CSA, UL, VDE, et cetera. All C of Cs shall clearly indicate the ultimate certifying authority and/or authorities, and the expiration date of its current certification.*

3.4.1 Certificate of Compliance (C of C). The certified testing laboratory performing the compliance testing will issue a certified test report detailing the tests performed complete with the results of the tests before issuing a certified C of C to the manufacturer who commissioned the compliance testing. It is the manufacturer' s responsibility to forward a copy of the C of C to USB-IF. Upon receipt of the C of C, USB-IF will add the manufacturer' s approved USB part to the Approved Vendor List (**AVL**).

3.4.2 Test Lots. Lot integrity must be maintained. Should cumulative failures reduce the test lot size to less than the specified number of specimens, i.e., piece parts, all testing will be stopped.

3.4.2.1 If the test lot is statistically within limits, additional units may be added to the test lot provided the parts being added have successfully passed all required testing up to the point that they are being inserted. When the lot size is equal to or greater than the specified minimum number testing can resume.

3.4.2.2 If the test lot is statistically out of limits, all testing will stop and the testing laboratory will notify the submitter of the product under test that the product has failed.

3.4.2.3 Dimensions and Configurations. The USB-IF Device Working Group Class Document for Connectors and Cables and the most current revision of the USB Specification Chapter 6 shall define the design, construction and physical dimensions of the USB interconnection system. This dimensional and configuration data shall apply to USB Full-speed Cable, USB Low-speed Cable, USB Cable Assemblies, Series "A" Connectors, Series "B" Connectors and other USB cables, connectors and cable assemblies that may be added from time to time in accordance with the revision policies of this specification.

3.4.3 USB Electrical, Mechanical and Environmental Compliance Standards. *Table 4–1, Electrical, Mechanical and Environmental Compliance Standards,* lists the minimum test criteria that must be successfully completed for all USB cable, cable assembly and connector products that display the *USB logo*. Product performance testing must be performed by a certified testing facility that has direct traceability to one or more recognized standards organizations, e.g., NALAP, A2LA, ISO, NIST/NBS, CSA, UL, et cetera. Upon successful completion, the test facility performing the USB compliance testing will supply the manufacturer who commissioned the tests with a certified Certificate of Compliance (**C of C**). The C of C will serve the as manufacturer' s proof of compliance and a copy must be submitted to the Universal Serial Bus Implementers Forum (**USB-IF**) prior to receiving an Approved Vendor Listing (**AVL**) from USB-IF. To sustain an existing AVL listing, manufacturers must annually provide USB-IF with an updated C of C from a certified testing facility for each family of USB cable, cable assembly and/or connector products listed.

3.4.4 USB Acceptance Testing. The minimum acceptable USB Acceptance Testing to achieve and/or to sustain an USB-IF Approved Vendor Listing (**AVL**) is specified in *Table 5-3, Primary Qualification Approval Testing, and Table 5-4, Sustaining Qualification Approval Testing.* If a manufacturer chooses to test its USB products at intervals that are more frequent and/or in a more stringent manner than those specified in *Tables 5-3 and 5-4,* the manufacturer is still required to submit proof of satisfactory compliance from a certified testing facility to USB-IF as specified.

3.4.4.1 USB Acceptance Tests shall apply to all USB cables, cable assemblies and connectors. The tests shown *Table 5-3, Primary Qualification Approval Testing, and Table 5-4, Sustaining Qualification Approval Testing,* shall be applied to each product type according to accepted industry practices for that product type.

3.4.4.2 Deviations. Any deviation from the accepted practices detailed in *Table 5-3, Primary Qualification Approval Testing, and Table 5-4, Sustaining Qualification Approval Testing,* will be clearly noted by the certified testing facility on the Certificate of Compliance.

3.4.4.3 Failures During Acceptance Testing. Acceptance testing will cease immediately if the failure rate for the USB product under test exceeds the minimum acceptable quality level.

3.4.5 USB Compliance Testing Interval.

3.4.5.1 Primary Qualification Approval Testing, Table 5-3, will be performed for initial product qualification and then every third year thereafter, e.g., fourth, seventh, tenth year, et cetera, or when the manufacturer experiences a major changes in manufacturing process and/or materials.

3.4.5.2 Sustaining Qualification Approval Testing, Table 5-4; will be performed in the interim years, e.g., second, third, fifth, sixth, et cetera. If the USB product under test fails the Table 5-4 tests, the manufacturer will be required to satisfactorily complete the full range of testing in Table 5-3 in order to maintain his USB-IF AVL status for the product.

4.0 USB ELECTRICAL, MECHANICAL AND ENVIRONMENTAL COMPLIANCE STANDARDS. USB cable, connectors and fabricated cable assemblies must meet or exceed the requirements specified by the most current version of Chapter 6 of the USB Specification *(please see Table 4-1, USB Electrical, Mechanical and Environmental Compliance Standards)*.

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards

Test Description	Test Procedure	Performance Requirement
Visual and Dimensional Inspection	**EIA 364-18** Visual, dimensional and functional inspection in accordance with the USB quality inspection plans.	Must meet or exceed the requirements specified by the most current version of Chapter 6 of the USB Specification.
Insulation Resistance	**EIA 364-21** The object of this test procedure is to detail a standard method to assess the insulation resistance of USB connectors. This test procedure is used to determine the resistance offered by the insulation materials and the various seals of a connector to a DC potential tending to produce a leakage of current through or on the surface of these members.	1,000 MΩ minimum.
Dielectric Withstanding Voltage	**EIA 364-20** The object of this test procedure is to detail a test method to prove that a USB connector can operate safely at its rated voltage and withstand momentary over potentials due to switching, surges and/or other similar phenomena.	The dielectric must withstand 500 VAC for one minute at sea level.
Low Level Contact Resistance	**EIA 364-23** The object of this test is to detail a standard method to measure the electrical resistance across a pair of mated contacts such that the insulating films, if present, will not be broken or asperity melting will not occur.	30 mΩ maximum when measured at 20 mV maximum open circuit at 100 mA. Mated test contacts must be in a connector housing.
Contact Current Rating	**EIA 364-70 — Method B** The object of this test procedure is to detail a standard method to assess the current carrying capacity of mated USB connector contacts.	1.5 A at 250 VAC minimum when measured at an ambient temperature of 25^{O} C. With power applied to the contacts, the Δ T shall not exceed $+30^{O}$ C at any point in the USB connector under test.

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Contact Capacitance	**EIA 364-30** The object of this test is to detail a standard method to determine the capacitance between conductive elements of a USB connector.	2 pF maximum unmated per contact
Insertion Force	**EIA 364-13** The object of this test is to detail a standard method for determining the mechanical forces required for inserting a USB connector.	35 Newtons maximum at a maximum rate of 12.5 mm (0.492") per minute.
Extraction Force	**EIA 364-13** The object of this test is to detail a standard method for determining the mechanical forces required for extracting a USB connector.	10 Newtons minimum at a maximum rate of 12.5 mm (0.492") per minute.
Durability	**EIA 364-09** The object of this test procedure is to detail a uniform test method for determining the effects caused by subjecting a USB connector to the conditioning action of insertion and extraction, simulating the expected life of the connectors. Durability cycling with a gauge is intended only to produce mechanical stress. Durability performed with mating components is intended to produce both mechanical and wear stress.	1,500 insertion/extraction cycles at a maximum rate of 200 cycles per hour
Cable Pull-Out	**EIA 364-38** **Test Condition A** The object of this test procedure is to detail a standard method for determining the holding effect of a USB plug cable clamp without causing any detrimental effects upon the cable or connector components when the cable is subjected to inadvertent axial tensile loads.	After the application of a steady state axial load of 25 Newtons for one minute.

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Physical Shock	**EIA 364-27** **Test Condition H** The object of this test procedure is to detail a standard method to assess the ability of a USB connector to withstand specified severity of mechanical shock.	No discontinuities of 1 µS or longer duration when mated USB connectors are subjected to 11 ms duration 30 Gs half-sine shock pulses. Three shocks in each direction applied along three mutually perpendicular planes for 18 shocks.
Random Vibration	**EIA 364-28** **Test Condition V Test Letter A** This test procedure is applicable to USB connectors that may, in service, be subjected to conditions involving vibration. Whether a USB connector has to function during vibration or merely to survive conditions of vibration should be clearly stated by the detailed product specification. In either case, the relevant specification should always prescribe the acceptable performance tolerances.	No discontinuities of 1 µS or longer duration when mated USB connectors are subjected to 5.35 Gs RMS. 15 minutes in each of three mutually perpendicular planes.
Thermal Shock	**EIA 364-32** **Test Condition I** The object of this test is to determine the resistance of a USB connector to exposure at extremes of high and low temperatures and to the shock of alternate exposures to these extremes, simulating the worst case conditions for storage, transportation and application.	10 Cycles -55^{O}C and $+85^{O}$C. The USB connectors under test must be mated.
Humidity Life	**EIA 364-31** **Test Condition A Method III** The object of this test procedure is to detail a standard test method for the evaluation of the properties of materials used in USB connectors as they are influenced by the effects of high humidity and heat.	168 Hours minimum (seven (7) complete cycles). The USB connectors under test shall be tested in accordance with EIA 364-31.

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Solderability	**EIA 364-52** The object of this test procedure is to detail a uniform test method for determining USB connector solderability. The test procedure contained herein utilizes the solder dip technique. It is not intended to test or evaluate solder cup, solder eyelet, other hand-soldered type or SMT type terminations.	USB contact solder tails shall pass 95% coverage after one hour steam aging as specified in Category 2.
Flammability	**UL 94 V-0** This procedure is to ensure thermoplastic resin compliance to UL flammability standards.	The manufacturer will require its thermoplastic resin vendor to supply a detailed C of C with each resin shipment. The C of C shall clearly show the resin' s UL listing number, lot number, date code, et cetera.
Shielding Effectiveness *(Only required for Full-speed)*	The object of this test is to ensure that USB *'full-speed'* cable assemblies provide adequate *'shielding effectiveness'* for data transmission rates from 12 Mb/s through 400 Mb/s. ***IMPORTANT NOTE:*** *The shorter wavelengths associated with higher data transmission rates emit more energy that may cause interference problems with the end item usage.* Shielding Effectiveness testing shall be conducted in accordance with the most current revisions of FCC Part 15 — Classes A & B, CE Mark EN55011 and CE Mark EN55022 for electromagnetic emission profiles.	Shielding Effectiveness minimum acceptable attenuation 20 dB between 30 MHz and 1 GHz..

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Cable Impedance *(Only required for Full-speed)*	The object of this test is to ensure the signal conductors have the proper impedance. **1.** Connect the Time Domain Reflectometer (**TDR**) outputs to the impedance/delay/skew test fixture *(Note 1)*. Use separate 50Ω cables for the plus *(or true)* and minus *(or complement)* outputs. Set the TDR head to differential TDR mode. **2.** Connect the Series "A" plug of the cable to be tested to the text fixture, leaving the other end open-circuited. **3.** Define a waveform composed of the difference between the true and complement waveforms, to allow measurement of differential impedance. **4.** Measure the minimum and maximum impedances found between the connector and the open circuited far end of the cable.	Impedance must be in the range specified in Table 7-9 (**ZO**).

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Signal Pair Attenuation. *(Only required for Full-speed)*	The object of this test is to ensure that adequate signal strength is presented to the receiver to maintain a low error rate. **1.** Connect the Network Analyzer output port *(port 1)* to the input connector on the attenuation test fixture *(Note 2)*. **2.** Connect the Series "A" plug of the cable to be tested to the test fixture, leaving the other end open-circuited. **3.** Calibrate the network analyzer and fixture using the appropriate calibration standards, over the desired frequency range. **4.** Follow the method listed in Hewlett Packard Application Note 380-2 to measure the open-ended response of the cable. **5.** Short circuit the Series "B" end *(or bare leads end, if a captive cable)*, and measure the short-circuit response. **6.** Using the software in H-P Application Note 380-2 or equivalent, calculate the cable attenuation, accounting for resonance effects in the cable as needed.	Refer to Section 7.1.17 for frequency range and allowable attenuation.

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Propagation Delay	The purpose of the test is to verify the end to end propagation of the cable. **1.** Connect one output of the TDR sampling head to the D+ and D- inputs of the impedance/delay/skew test fixture *(Note 1)*. Use one 50Ω cable for each signal, and set the TDR head to differential TDR mode. **2.** Connect the cable to be tested to the test fixture. If detachable, plug both connectors in to the matching fixture connectors. If captive, plug the series "A" plug into the matching fixture connector, and solder the stripped leads on the other end to the test fixture. **3.** Measure the propagation delay of the test fixture by connecting a short piece of wire across the fixture from input to output, and recording the delay. **4.** Remove the short piece of wire and re-measure the propagation delay. Subtract from it the delay of the test fixture measured in the previous step.	**Full-speed** See Section 7.1.1.1, Section 7.1.4, Section 7.1.16 and Table 7-9 (**TFSCBL**) **Low-speed** See Section 7.1.1.2, Section 7.1.16 and Table 7-9 (**TLSCBL**)
Propagation Delay Skew	This test ensures that the signal on both the D+ and D- lines arrive at the receiver at the same time. **1.** Connect the TDR to the fixture with test sample cable, as in the previous section. **2.** Measure the difference in delay for the two conductors in the test cable. Use the TDR cursors to find the open-circuited end of each conductor *(where the impedance goes infinite)*, and subtract the time difference between the two values.	Propagation skew must meet the requirements as listed in Section 7.1.3.

Table 4-1 ¾ USB Electrical, Mechanical and Environmental Compliance Standards		
Test Description	**Test Procedure**	**Performance Requirement**
Capacitive Load Only required for Low-speed	The purpose of this test is to ensure the distributed interwire capacitance is less then the lumped capacitance specified by the Low-speed transmit driver. **1.** Connect the one lead of the Impedance Analyzer to the D+ pin on the impedance/delay/skew *fixture (Note 1),* and the other lead to the D- pin. **2.** Connect the series "A" plug to the fixture, with the series "B" end leads open-circuited. **3.** Set the Impedance Analyzer to a frequency of 100 KHz, to measured the capacitance.	See Section 7.1.1.2 and Table 7-7 (**CLINUA**)
Note1: Impedance, Propagation Delay and Skew Test Fixture. *This fixture will be used with the TDR for measuring the time domain performance of the cable under test. The fixture impedance should be matched to the equipment, typically 50W. Coaxial connectors should be provided on the fixture for connection from the TDR.*		
Note 2: Attenuation Text Fixture. *This fixture provides a means of connection from the network analyzer to the Series "A" plug. Since USB signals are differential in nature and operate over balanced cable, a transformer or balun (North Hills NH13734 or equivalent) is ideally used. The transformer converts the unbalanced (also known as single-ended) signal from the signal generator which is typically a 50W output, to the balanced (also known as differential) and likely different impedance loading presented by the cable. A second transformer or balun should be used on the other end of the cable under test to convert the signal back to an unbalanced form of the correct impedance to match the network analyzer.*		

5.0 USB CONNECTOR AND CABLE ASEMBLY PHYSICAL SELF-CERTIFICATION TEST SEQUENCE AND PROCEDURES. In case of conflict between the requirements of this document and the Universal Serial Bus (**USB**) Specification, the most current revision of the USB Specification shall take precedence. Unless otherwise specified, all tests shall be performed at the following standard atmospheric conditions.

Table 5-1 ¾ Standard Atmospheric Conditions	
Temperature	15^{o}C to 35^{o}C
Air Pressure	86 to 106 kPa
Relative Humidity	25% to 85%

5.1 ENVIRONMENTAL CATEGORY.

Table 5-2 ¾ Performance Levels					
Performance Level	**EIA Classification**	**Temperature Degrees C**	**Humidity % RH**	**Marine Atmosphere**	**Harsh Environment**
1	G1.1	25° C to 65° C	40% to 75%	No	No
***NOTE**: Testing details are described in Paragraph 5.4.2.*					

5.1.1 Thermal Shock. Condition: EIA 364-32 ¾ Test Condition I. Subject mated connector pairs to 10 cycles between -55° C to +85° C with 1 hour at each temperature extreme. There shall be no physical damage and meet requirements of subsequent tests.

5.1.2 Humidity-Temperature Cycling. Condition: EIA 364-31 ¾ Method III (less step 7a and 7b). Subject mated connector pairs to seven cycles between 25° C and 65° C at 95% relative humidity (**RH**). There shall be no physical damage and meet requirements of subsequent tests.

5.1.3 Temperature Life. Condition: EIA 364-17 ¾ Method 'A,' Test Condition 3. Subject mated connector pairs to +85° C for 250 hours. There shall be no physical damage and meet requirements of subsequent tests.

5.1.4 Mixed Flowing Gas. Condition: EIA 364-65 ¾ Class II. Subject mated connector pairs to 14 days exposure. There shall be no physical damage permitted.

5.2 ELECTRICAL.

5.2.1 Withstanding Voltage. Condition: EIA 364-20 ¾ Method 'B.' Subject mated connector pairs to 500 VAC at sea level for one minute. No breakdown or flashover permitted.

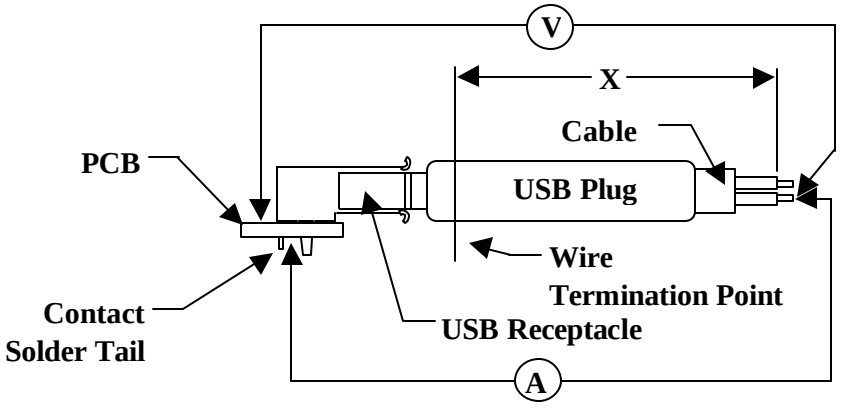

Figure 5 -1 ¾ Typical Contact Resistance Measurement Points

NOTE: Termination resistance reading shall be made as close as practical to the point where the contact exits the socket' s dielectric material.

5.2.2 Contact Resistance (Single Contact). Conditions: EIA 364-23 *(please see Figure 5-1)*. Mated connector pairs shall have a resistance of 30 milliohms ' maximum initially' and a ΔR of 10 milliohms ' maximum final.'

5.2.3 Insulation Resistance. Conditions: EIA 364-21. Subject mated connector pairs to a test voltage 500 VDC for one minute. Insulation resistance of 1000 megohms ' minimum initially' and 100 megohms ' minimum final.'

5.2.4 Capacitance. Conditions: EIA 364-30. Apply a 1 KHz signal to the adjacent contacts of an unmated connector. Capacitance shall not exceed 2 pF maximum.

5.3 MECHANICAL.

5.3.1 Durability. Conditions: EIA 364-09. Mate and unmate connectors 1500 times at a rate of 200 cycles per hour. There shall be no physical damage and meet requirements of subsequent tests.

5.3.2 Mating and Unmating Force. Conditions: EIA 364-13. At a rate of 12.5 millimeters per minute.

5.3.2.1 Mating Force: Maximum 35 Newtons.

5.3.2.2 Unmating Force: Minimum 10 Newtons.

5.3.3 Vibration. Conditions: EIA 364-28 ¾ Test Condition V (Test Letter A). Subject mated connector attached to a printed circuit board (**PCB**) to 5.35 Gs RMS for 15 minutes in each of three mutually perpendicular axes *(please see Figure 5-2)*. There shall be no discontinuities of one microsecond duration or longer.

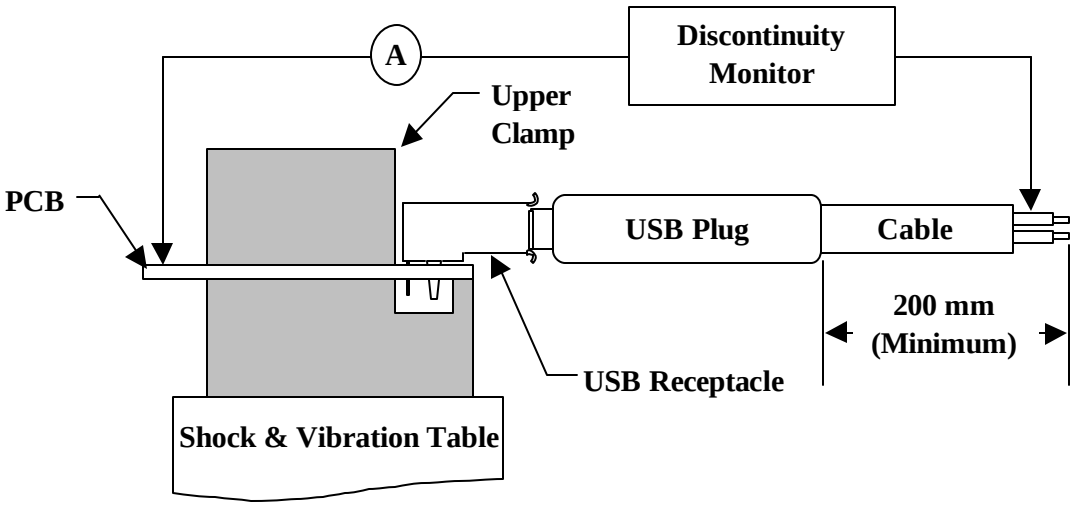

Figure 5-2 ¾ Vibration and Physical Shock Test Fixture

5.3.4 Physical Shock. Condition: EIA 364-27 ¾ Test Condition H. Subject mated connector attached to a PCB to 30 g_n peak acceleration, half sine pulse of 11 milliseconds, three shocks applied along three mutually perpendicular planes for a total

of 18 shocks *(please see Figure 5-2)*. There shall be no discontinuities of one microsecond duration or longer.

5.3.5 Cable Pull Out. EIA364-38 ¾ Test Condition A. Apply a steady state axial load at a rate of 25 Newtons for one minute. Cable shall not dislodge from crimp.

5.3.6 Solderability. EIA 364-52 ¾ Category 2 - Class 1. Solderability area shall have a minimum coverage of 95%.

5.4 QUALITY ASSESSMENT PROCEDURE. All USB piece parts used for performance testing under this specification will be randomly selected by the laboratory performing the tests. The selected USB components will then be tested for compliance in accordance with the procedures specified by this document and the criteria set forth in Chapter 6 of the most current revision of the USB Specification.

NOTE: *All compliance testing will be performed at the manufacturer's expense by a certified laboratory. The certified laboratory, either in-house or third party, shall have direct traceability to a recognized standards organization, e.g., NALAP, A2LA, ISO, UL, CSA, BSA, VDE, NIST/NBS, et cetera. All C of Cs shall clearly indicate the ultimate certifying authority and/or authorities.*

5.4.1 General Information. This document shows minimum compliance tests to be performed, the order in which they shall be performed and the performance requirements for each test.

5.4.1.1 ' Mated Pairs' will consist of one USB Receptacle and USB Plug and will be tested as such unless otherwise specified. Typically in most tests, the USB Receptacle is ' fixed' and the USB Plug is ' free.' Each ' receptacle' and ' plug' shall be clearly and individually identified.

NOTE: *When testing 'mated connectors' reasonable care should be used to ensure that the 'mated pairs' remain together for the duration of the testing sequence.*

EXAMPLE: *When 'unmating' is required by a test, the same 'receptacle and plug pair' as before shall be mated for the subsequent tests.*

5.4.1.3 Before testing commences, the specimens shall have been stored for at least 24 hours in the non-inserted state under standard atmospheric conditions, unless otherwise specified.

5.4.1.4 In the following test sequence tables, where an EIA test is specified without a letter suffix, the latest approved version of that test shall be used.

5.4.2 Certificate of Compliance (C of C). The certified testing laboratory performing the compliance testing will issue a certified test report detailing the tests performed complete with the results of the tests before issuing a certified C of C to the manufacturer who commissioned the compliance testing. It is the manufacturer' s responsibility to forward the C of C to USB-IF. Upon receipt of the C of C, USB-IF will add the manufacturer' s approved USB part to Approved Vendor List (**AVL**).

5.4.3 Test Lots. Lot integrity must be maintained. Should cumulative failures reduce the test lot size to less than the specified number of specimens all testing will be stopped.

5.4.3.1 If the test lot is statistically within limits, additional units may be added to the test lot provided the parts being added have successfully passed all required testing up to the point that they are being inserted. When the lot size is equal to or greater than the specified minimum number testing can resume.

5.4.3.2 If the test lot is statistically out of limits, all testing will stop and the testing laboratory will notify the submitter of the product under test that the product has failed.

5.4.3.3 Dimensions and Configurations. The USB-IF Device Working Group Class Document for Connectors and Cables and the most current revision of the USB Specification Chapter 6 shall define the design, construction and physical dimensions of the USB interconnection system. This dimensional and configuration data shall apply to USB Full-speed Cable, USB Low-speed Cable, USB Cable Assemblies, Series "A" Connectors, Series "B" Connectors and other USB cables, connectors and cable assemblies that may be added from time to time in accordance with the revision policies of this specification.

5.4.4 Primary Qualification Approval Testing. The following number of specimens shall be subjected to the tests under the conditions as specified in *Sections 5.1 (Environmental), 5.2 (Electrical) and 5.3 (Mechanical)*. The specimens shall meet the testing requirements with not more than the number of defectives permitted in accordance with *Table 5-3, Qualification Approval Testing*.

Table 5-3¾ Primary Qualification Approval Testing

Test Procedure	Number of Specimens		Performance Level 1
	Connectors	Cable Assemblies	Number of Permitted Defects
P	30	35	0
AP	5	*Note 2*	0
BP	5	*Note 2*	0
CP	5	*Note 2*	0
DP	5	*Note 2*	0
EP	5	*Note 2*	0
FP	5 *(Note 1)*	5 *(Note 1)*	0
GP		5	0
HP		5	0
IP		5	0
JP		5	0
KP		5	0
LP	5 *(Note 3)*	5 *(Note 4)*	0

NOTES:

1. *To affect 100% Critical Dimension Inspection of some piece parts may require destructive disassembly of the part for complete dimensional inspection.*

2. *If the fabricated cable assembly connectors successfully pass the nondestructive connector tests AP through EP without degradation, they may be used to perform the cable assembly specific test procedures HP through LP.*

3. *As USB data transmission are increased above 12 Mb/s connector manufacturers will be required to subject Series 'A' and 'B' receptacles to Test Procedure LP, Shielding Effectiveness testing.*

4. *When performing Test Procedure LP, Shielding Effectiveness, it recommended that the fabricated cable assembly evaluation samples used should have successfully passed Test Procedures P, GP, HP, IP and KP.*

5. *Table 5-3 —Primary Qualification Approval Testing will be performed for initial product qualification and then every third year thereafter, e.g., fourth, seventh, tenth year, et cetera, or when the manufacturer experiences a major changes in manufacturing process and/or materials. (Please see Paragraph 3.4.5 USB Compliance Testing Interval.)*

5.4.5 Sustaining Qualification Approval Testing. The following number of specimens shall be subjected to the tests under the conditions as specified in *Sections 5.1 (Environmental), 5.2 (Electrical) and 5.3 (Mechanical)*. The specimens shall meet the testing requirements with not more than the number of defectives permitted in accordance with *Table 5-4, Sustaining Qualification Approval Testing.*

Table 5-4 ¾ Sustaining Qualification Approval Testing

Test Procedure	Number of Specimens		Performance Level 1
	Connectors	Cable Assemblies	Number of Permitted Defects
P	15	20	0
Sub Group I:	5	5	0
AP1			0
AP3			0
AP4			0
AP7			0
Sub Group II:	5	5	0
CP1	*Note 1*	*Note 1*	0
CP2	*Note 1*	*Note 1*	0
CP3	*Note 1*	*Note 1*	0
CP4	*Note 1*	*Note 1*	0

Table 5-4 ¾ Sustaining Qualification Approval Testing			
Test Procedure	**Number of Specimens**		**Performance Level 1**
	Connectors	**Cable Assemblies**	**Number of Permitted Defects**
Sub Group III:	5	5	0
DP1			0
DP2			0
DP3			0
DP4			0
DP5			0
DP6			0
DP7			0
GP	*5 (Note 2)*	*5 (Note 2)*	0
HP		*Note 3*	0
IP		*Note 3*	0
JP		*Note 3*	0
KP		*Note 3*	0
LP	5 *(Note 4)*	5 *(Note 5)*	0

NOTES:

1. *Mixed Flow Gas, CP, Testing for Sub Group II for Sustaining Qualification Approval Testing will be conducted over six days in lieu of 14 days.*

2. *If all test samples in Sub Group III pass Dp1 through DP7 testing, Critical Dimension Inspection, GP, will not be required.* ***Please Note:*** *If 100% Critical Dimension Inspection is required, it may require some piece parts to be destructively disassembled for complete dimensional inspection.*

3. *If the fabricated cable assembly connectors successfully pass the nondestructive connector tests DP1 through DP7 without degradation, they may be used to perform the cable assembly specific test procedures HP through KP.*

4. *As USB data transmission are increased above 12 Mb/s connector manufacturers will be required to subject Series 'A' and 'B' receptacles to Test Procedure LP, Shielding Effectiveness testing.*

5. *When performing Test Procedure LP, Shielding Effectiveness, it recommended that the fabricated cable assembly evaluation samples used should have successfully passed Test Procedures P, GP, HP, IP and KP.*

6. *Table 5-4 —Sustaining Qualification Approval Testing will be performed in the interim years, e.g., second, third, fifth, sixth, et cetera. If the USB product under test fails the Table 5-4 tests, the manufacturer will be required to satisfactorily complete the full range of testing in Table 5-3 in order to maintain his USB-IF AVL status for the product. (Please see Paragraph 3.4.5 USB Compliance Testing Interval.)*

5.5 Test Sequences.

5.5.1 Minimum test sequence for product qualification.

5.5.1.1 Test Group ‘ P’ Preliminary.

Representative specimens should be subjected to the following tests to verify that a USB connector and/or cable assembly demonstrates sufficient product integrity to be processed through the remaining product acceptance test procedures ‘ AP’ through ‘ FP.’

Table 5-5 ¾ Test Group ‘ P’ General Examination

Test Phase	Test			Measurement to be Performed		Comments
	Title	EIA 364 Test	Severity or Condition of Test	Title	EIA 364 Test	
P1	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

5.5.1.2 Test Group ‘AP’ Durability, Vibration, Shock, Cable Retention and Mating/Unmating Force.

Table 5-6 ¾ Test Group ‘ AP’ Durability, Vibration, Shock, Cable Retention and Mating/Unmating Force

Test Phase	Test			Measurement To Be Performed			Comments/ Requirements
	Title	EIA 364 Test	Severity or Condition of Test	Title	EIA 364 Test	P1	
AP1	Mating Force	13	Measure force to mate at a rate of 12.5 mm per minute maximum.			1	35 Newtons Maximum.
AP2			20 mV maximum open circuit at 100 mA maximum, *see Figure 5-1*.	Contact Resistance *(Single Contact)*	23	1	30 milliohms maximum initial resistance.
AP3	Durability	09	1500 cycles at rate of 200 cycles per hour.			1	No physical damage and shall meet requirements of subsequent tests.
AP4	Vibration	28	5.35 Gn RMS for 15 minutes in each of three mutually perpendicular planes, *see Figure 5-2*.	Continuity	87	1	No discontinuities of one microsecond or longer duration.

Table 5-6 ¾ Test Group ' AP' Durability, Vibration, Shock, Cable Retention and Mating/Unmating Force							
Test Phase	**Test**			**Measurement To Be Performed**			**Comments/ Requirements**
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
AP5	Shock	27	30 g_n peak acceleration half sine 11 ms three shocks applied along three mutually perpendicular planes total 18 shocks, *see Figure 5-2.*	Continuity	87	1	No discontinuities of one microsecond or longer duration.
AP6			Same as AP2	Contact Resistance *(Single Contact)*	23	1	ΔR 10 milliohms maximum final.
AP7	Unmating Force	13	Measure force to unmate at a rate of 12.5mm per minute maximum.			1	10 Newtons Minimum.
AP8	Cable Pull Out	38	Apply steady state axial load for one minute.				25 Newtons Minimum *(cable shall not dislodge from crimp).*
AP9	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

5.5.1.3 Test Group 'BP' Temperature Life

Table 5-7 ¾ Test Group 'BP' Temperature Life							
Test Phase	**Test**			**Measurement To Be Performed**			**Comments/ Requirements**
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
BP1			20 mV max. open circuit at 100 mA maximum, *see Figure 5-1.*	Contact Resistance *(Single Contact)*	23	1	30 milliohms maximum initial resistance.
BP2	Temperature Life	17	+85° C for 250 hours mated			1	No physical damage and shall meet requirements of subsequent tests.

Table 5-7 ¾ Test Group 'BP' Temperature Life							
Test Phase	**Test**			**Measurement To Be Performed**			**Comments/ Requirements**
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
BP3			Same as BP1	Contact Resistance *(Single Contact)*	23	1	ΔR 10 milliohms maximum final.
BP4	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

5.5.1.4 Test Group 'CP' Mixed Flowing Gas

Table 5-8 ¾ Test Group ' CP' Mixed Flowing Gas							
Test Phase	**Test**			**Measurement To Be Performed**			**Comments/ Requirements**
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
CP1			20 mV max. open circuit at 100 mA maximum, *see figure 5-1*.	Contact Resistance *(Single Contact)*	23	1	30 milliohms maximum initial resistance.
CP2	Mixed Flowing Gas	65	Class II for 14 days			1	No physical damage
CP3			20 mV max. open circuit at 100 mA max., *see figure 5-1*.	Contact Resistance *(Single Contact)*	23	1	ΔR 10 milliohms maximum final.
CP4	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

5.5.1.5 Test Group 'DP' Insulation Resistance, Dielectric Withstanding Voltage, Thermal Shock and Humidity Temperature Cycling

Table 5-9 ¾ Test Group ' DP' Insulation Resistance, Dielectric Withstanding Voltage, Thermal Shock and Humidity Temperature Cycling

Test Phase	Test			Measurement To Be Performed			Comments/ Requirements
	Title	EIA 364 Test	Severity or Condition of Test	Title	EIA 364 Test	P1	
DP1	Capacitance	30	Test between adjacent contacts unmated connector at 1 KHz.			1	2 pF Maximum.
DP2			500 VDC for one minute mated.	Insulation Resistance	21	1	1000 megohms minimum.
DP3			500 VAC at sea level for one minute mated.	Withstanding Voltage	20	1	No breakdown or flashover.
DP4	Thermal Shock	32	-55^{O} C to $+85^{O}$ C, One hour at each temperature, and 10 cycles, mated.			1	No physical damage and shall meet requirements of subsequent tests.
DP5	Humidity-Temperature Cycling	31	25^{O} C and 65^{O} C at 95% RH, seven cycles, mated.			1	No physical damage and shall meet requirements of subsequent tests.
DP6			500 VDC for one minute mated.	Insulation Resistance	21	1	1000 megohms final.
DP7			500 VAC at sea level for one minute mated.	Withstanding Voltage	20	1	No breakdown or flashover.
DP8	General Examination		Unmated connectors.	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

5.5.1.6 Test Group 'EP' Solderability

Table 5-10 ¾ Test Group ' EP' Solderability							
Test Phase	**Test**			**Measurement To Be Performed**			**Comments/ Requirements**
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
EP1	Solderability	52	Category 2 Steam Age RMA Class 1 flux immerse in molten solder at a temperature of $+245^{o}$ C ± 5^{o} C ($+473^{o}$ F ± 9^{o} F) at rate of 25.4 mm ± 6.35 mm (1.00 in ± 0.25 in) per second, hold in solder for 5 +0/-0.5 seconds			1	Solderable area shall have a minimum of 95% solder coverage when testing 30 random loose contacts.
EP2	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

5.5.1.7 Test Group ' FP' Critical Dimension Inspection

Table 5-11 ¾ Test Group ' FP' Critical Dimension Inspection						
Test Phase	**Test**			**Measurement to be Performed**		**Comments**
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	
FP1	Critical Dimensional Inspection		Unmated connectors	Critical Dimensional Inspection	18	Dimensions shall comply with this document.

IMPORTANT NOTE: *To affect 100% Critical Dimension Inspection of some piece parts may require destructive disassembly of the part to perform complete the dimensional inspections.*

5.5.1.8 Test Group ' GP' Cable Impedance

Table 5-12 ¾ Test Group ‘ GP’ Cable Impedance

Test Phase	Test			Measurement To Be Performed			Comments/ Requirements
	Title	**Severity Or Condition Of Test**		**Signal Conductor Impedance**		**P1**	
GP1	Cable Impedance	**1.** Connect the Time Domain Reflectometer (**TDR**) outputs to the impedance/delay/skew test fixture *(Note 1)*. Use separate 50Ω cables for the plus *(or true)* and minus *(or complement)* outputs. Set the TDR head to differential TDR mode. **2.** Connect the Series “A” plug of the cable to be tested to the text fixture, leaving the other end open-circuited. **3.** Define a waveform composed of the difference between the true and complement waveforms, to allow measurement of differential impedance.				1	Impedance must be in the range specified in the most current revision of the USB Specification Table 7 - 9.
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
GP2	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

GENERAL NOTE: *Required for Full-speed cable assemblies only.*

NOTE1: Impedance, Propagation Delay and Skew Test Fixture. *This fixture will be used with the TDR for measuring the time domain performance of the cable under test. The fixture impedance should be matched to the equipment, typically 50W. Coaxial connectors should be provided on the fixture for connection from the TDR.*

NOTE 2: Attenuation Text Fixture. *This fixture provides a means of connection from the network analyzer to the Series “A” plug. Since USB signals are differential in nature and operate over balanced cable, a transformer or balun (North Hills NH13734 or equivalent) is ideally used. The transformer converts the unbalanced (also known as single-ended) signal from the signal generator which is typically a 50W output, to the balanced (also known as differential) and likely different impedance loading presented by the cable. A second transformer or balun should be used on the other end of the cable under test to convert the signal back to an unbalanced form of the correct impedance to match the network analyzer.*

5.5.1.9 Test Group ‘ HP’ Attenuation (Single Pair)

Table 5-13 ¾ Test Group ‘ HP’ Attenuation (Single Pair)

Test Phase	Test			Measurement To Be Performed			Comments/ Requirements
	Title	Severity Or Condition Of Test		Signal Conductor Impedance		P1	
HP1	Attenuation *(Single Pair)*	**1.** Connect the Network Analyzer output port *(port 1)* to the input connector on the attenuation test fixture *(Note 2 Table 5-10)*. **2.** Connect the Series “A” plug of the cable to be tested to the test fixture, leaving the other end open-circuited. **3.** Calibrate the network analyzer and fixture using the appropriate calibration standards, over the desired frequency range. **4.** Follow the method listed in Hewlett Packard Application Note 380-2 to measure the open-ended response of the cable. **5.** Short circuit the Series “B” end *(or bare leads end, if a captive cable)*, and measure the short-circuit response. **6.** Using the software in H-P Application Note 380-2 or equivalent, calculate the cable attenuation, accounting for resonance effects in the cable as needed		The object of this test is to ensure that adequate signal strength is presented to the receiver to maintain a low error rate.		1	See the most current revision of the USB Specification Section 7.1.17 for frequency range and allowable attenuation.
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
HP2	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document.

NOTE: *Required for Full-speed cable assemblies only.*

5.5.1.10 Test Group 'IP' Propagation Delay

Table 5-14 ¾ Test Group ' IP' Propagation Delay

Test Phase	Test			Measurement To Be Performed			Comments/ Requirements
	Title	Severity or Condition of Test		Cable Propagation Delay Test		P1	
IP1	Propagation Delay	**1.** Connect one output of the TDR sampling head to the D+ and D- inputs of the impedance/delay/skew test fixture *(Note 1)*. Use one 50Ω cable for each signal, and set the TDR head to differential TDR mode. **2.** Connect the cable to be tested to the test fixture. If detachable, plug both connectors in to the matching fixture connectors. If captive, plug the series "A" plug into the matching fixture connector, and solder the stripped leads on the other end to the test fixture. **3.** Measure the propagation delay of the test fixture by connecting a short piece of wire across the fixture from input to output, and recording the delay. **4.** Remove the short piece of wire and re-measure the propagation delay. Subtract from it the delay of the test fixture measured in the previous step.		The purpose of the test is to verify the end to end propagation of the cable.		1	**Full-speed** See the most current revision of the USB Specification Sections 7.1.1.1, 7.1.4, 7.1.16 and Table 7-9 (**TFSCBL**). **Low-speed** See the most current revision of the USB Specification Sections 7.1.1.2, 7.1.16 and Table 7-9 (**TLSCBL**).
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
IP2	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document

NOTE1: Impedance, Propagation Delay and Skew Test Fixture. *This fixture will be used with the TDR for measuring the time domain performance of the cable under test. The fixture impedance should be matched to the equipment, typically 50W. Coaxial connectors should be provided on the fixture for connection from the TDR.*

5.5.1.11 Test Group 'JP' Propagation Delay Skew

Table 5-15 ¾ Test Group ' JP' Propagation Delay Skew							
Test Phase	**Test**			**Measurement To Be Performed**			**Comments/ Requirements**
	Title	**Severity or Condition of Test**		**Cable Propagation Delay Skew Test**		**P1**	
JP1	Propagation Delay Skew	**1.** Connect the TDR to the fixture with test sample cable, as in the previous section. **2.** Measure the difference in delay for the two conductors in the test cable. Use the TDR cursors to find the open-circuited end of each conductor *(where the impedance goes infinite)*, and subtract the time difference between the two values		This test ensures that the signal on both the D+ and D- lines arrive at the receiver at the same time.		1	Propagation Skew must meet the requirements as listed in the most current revision of the USB Specification Section 7.1.3.
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
JP2	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document

5.5.1.12 Test Group 'KP' Capacitive Load

Table 5-16 ¾ Test Group ' KP' Capacitive Load

Test Phase	Test			Measurement To Be Performed			Comments/ Requirements
	Title	Severity or Condition of Test		Cable Capacitive Load Test		P1	
KP1	Capacitive Load	**1.** Connect the one lead of the Impedance Analyzer to the D+ pin on the impedance/delay/skew *fixture (Note 1)*, and the other lead to the D- pin. **2.** Connect the series "A" plug to the fixture, with the series "B" end leads open-circuited. **3.** Set the Impedance Analyzer to a frequency of 100 KHz, to measured the capacitance.		The purpose of this test is to ensure the distributed interwire capacitance is less then the lumped capacitance specified by the Low-speed transmit driver.		1	See the most current revision of the USB Specification Section 7.1.1.2 and Table 7-7 (**CLINUA**).
	Title	**EIA 364 Test**	**Severity or Condition of Test**	**Title**	**EIA 364 Test**	**P1**	
KP2	General Examination		Unmated connectors	Visual and Dimensional Inspection	18	1	There shall be no defects that would impair normal operations. Dimensions shall comply with this document

GENERAL NOTE: *Required for Low-speed cable assemblies only.*

NOTE1: Impedance, Propagation Delay and Skew Test Fixture. *This fixture will be used with the TDR for measuring the time domain performance of the cable under test. The fixture impedance should be matched to the equipment, typically 50W Coaxial connectors should be provided on the fixture for connection from the TDR.*

5.5.1.13 Test Group 'LP' Shielding Effectiveness

Table 5-17 ¾ Test Group ' LP' Shielding Effectiveness

Test Phase	Test		Measurement to be Performed		Comments
	Title	Severity or Condition of Test	Cable Shielding Effectiveness Test	P1	
LP1	Shielding Effectiveness	Latest revision FCC Part 15 — Classes A & B, CE Mark EN55011 and CE Mark EN55022 for electromagnetic emission profiles.	Shielding Effectiveness	1	Minimum acceptable attenuation 20 dB between 30 MHz and 1 GHz.

6.0 SELF-CERTIFICATION ACCEPTANCE AND SUBMISSION, AND USB PRODUCT AUTHORIZATION, LISTING AND NOTIFICATION PROCEDURES. Manufacturers of USB cable, connectors and/or fabricated cable assemblies desiring to have a product or products listed on the USB Implementers' Forum (**USB-IF**) Approved Vendor List (**AVL**) are required to voluntarily submit *'certified proof'* that their USB product meets or exceeds the performance requirements specified in Chapter 6 of the most current version of the USB Specification and this document. Certified proof of voluntary compliance shall be in the form of a Certificate of Compliance (**C of C**) completed by a NVLAP, A2LA or ISO certified testing laboratory *(Please see Form 8279-1, Certificate of Compliance)*. C of Cs demonstrating satisfactory completion of the required testing will be submitted to, reviewed and maintained on file by the USB-IF Management Office.

6.1 CERTIFICATE OF COMPLIANCE PREPARATION INSTRUCTIONS. Upon successful completion of the voluntary compliance testing, the certified laboratory performing the specified tests will complete Device Working Group Form 8279-1, Certificate of Compliance.

6.1.1 General Instructions. The manufacturer requesting testing certification, the testing laboratory performing the testing and the USB Implementers Forum (**USB-IF**) are responsible for completing specified sections of Form 8279-1.

6.1.1.1 Manufacturer Information. The manufacturer requesting testing is responsible for completing the following sections of Form 8279-1:

A. Manufacturer Requesting Testing. This section must contain the following information:

1. Manufacturer' s Correct Name;

2. Physical Address;

3. City, State or Province, Postal Code, Country;

4. Telephone, Facsimile and E-mail; and,

5. USB-IF Member Number

B. Part Number and Product Description. This section must contain the following information:

1. Manufacturer' s Part Number; and,

2. Manufacturer' s Commercial Description of the part.

3. It should be noted if the part under test is a representative sample of a family of parts to be listed on the AVL.

IMPORTANT NOTE. *When submitting a representative sample from a family of parts, the sample parts submitted for testing must represent the 'worst case' performance characteristics for that family of parts.*

USB Cable, Connectors and Cable Assemblies

Certificate of Compliance

Device Working Group Form 8279-1
(Original Sent To USB-IF)

*The certified testing laboratory conducting the voluntary compliance testing must complete a Certificate of Compliance (**C of C**) for each family of parts the manufacturer wishes to list on the USB-IF Approved Vendor List (**AVL**). Voluntary Compliance Testing shall be conducted in accordance with the most current version of the USB Specification' s Electrical, Mechanical and Environmental Performance Standards as shown in Chapter 6 and the USB-IF DWG Cable & Connector Class Document. Voluntary compliance testing is required for all USB cables, cable assemblies and connectors.*

IDENTIFICATION NUMBER

MANUFACTURER REQUESTING TESTING		LABORATORY PERFORMING TESTING	
PART NUMBER AND PRODUCT DESCRIPTION		NVLAP ACCREDITATION	ISO ACCREDITATION
TESTING TO BE PERFORMED		ACCREDITATION DATE	ACCREDITATION DATE
		EXPIRATION DATE	EXPIRATION DATE
APPLICABLE INSTRUCTIONS AND/OR SPECIFICATIONS		(1) SAMPLES SUBMITTED	(3) SAMPLES ADDED AT STEP
		(2) SAMPLES ADDED	(4) SAMPLES COMPLETING
SUBMISSION DATE	APPROVAL DATE	TESTED BY	APPROVED BY

TESTING LABORATORY COMMENTS

USB Implementers' Forum Use Only

MANUFACTURER' S NAME		MEMBERSHIP NUMBER	MEMBERSHIP DATE
DATE RECEIVED	AVL ENTRY NUMBER	AVL APPROVED DATE	AVL RENEWAL DATE

C. Testing To Be Performed. This section must contain the following information:

1. A detailed description of the testing that is to be performed by the laboratory conducting the testing.

D. Applicable Instructions and/or Specifications. This section must contain any special instructions and/or a complete listing of applicable specifications.

E. Submission Date. The date that the samples to be tested were submitted to the certified testing laboratory.

6.1.1.2 Certified Laboratory Information. The certified testing laboratory is responsible for completing the following sections of Form 8279-1:

A. Identification Number. To ensure traceability, this section shall contain the laboratory' s identification or tracking number for the testing performed.

B. Laboratory Performing Testing. This section must contain the following information:

1. Laboratory' s Correct Name;

2. Physical Address;

3. City, State or Province, Postal Code, Country; and,

4. Telephone, Facsimile and E-mail.

C. A2LA and/or NVLAP Accreditation. This section must contain the following information:

1. Laboratory' s A2LA or NVLAP Accreditation Identification Reference Number and/or Symbol.

2. Accreditation Date. The date that the laboratory received its initial NVLAP Accreditation Certificate.

3. Expiration Date. The date that the laboratory' s current NVLAP Accreditation Certificate expires or must be renewed.

D. ISO Accreditation. This section must contain the following information:

1. Laboratory' s ISO Accreditation Identification Reference Number and/or Symbol.

2. Accreditation Date. The date that the laboratory received its initial ISO Accreditation Certificate.

3. **Expiration Date.** The date that the laboratory' s current ISO Accreditation Certificate expires or must be renewed.

E. Samples. This section must contain the following information:

1. **Samples Submitted.** This section will contain the initial number of samples submitted for testing.

2. **Samples Added.** This section will contain the number of qualified samples added as makeup samples for testing purposes.

3. **Samples Added at Step.** The date and test step that the makeup samples were added for testing purposes must be clearly identified.

F. Testing Administration Information. This section must contain the following information:

1. **Tested By.** This section shall contain the name and/or unique stamp *(chop)* of the person or persons responsible for conducting the specified testing and the applicable dates.

2. **Approved By.** This section shall contain the name and/or unique stamp *(chop)* of the person who reviewed and approved the testing and issued the test report and C of C.

3. **Approval Date.** This section shall contain the date that the final test report and C of C are issued to the manufacturer of record.

4. **Testing Laboratory Comments.** This section shall contain any additional information, exceptions and/or comments that the testing laboratory feels are relevant for the record.

6.1.1.3 USB Implementers' Forum. The USB-IF is responsible for completing the following sections of Form 8279-1:

A. Manufacturer's Name. To ensure correctness and traceability, this section shall contain the *'manufacturer's name'* as shown in the USB-IF membership records.

B. Membership Number. USB-IF will verify that the manufacturer' s membership number is valid and that the manufacturer is a member in good standing. If the manufacturer dues are current, then USB-IF will then enter the verified membership number in this section.

C. Membership Date. Upon satisfactory completion of the verification process, USB-IF will enter the manufacturer' s '*membership date.'*

D. Date Received. USB-IF shall enter that date that the C of C is received in this section.

E. AVL Entry Number. Upon verification of the C of C by USB-IF for omissions and for the testing laboratory' s certification that submitted product meets or exceeds the requirements of the most current version of the USB Specification and/or this document, an AVL Entry number will be entered in this section.

F. AVL Approved Date. USB-IF shall enter the date that *the 'AVL Entry Number'* is issued in this section.

G. AVL Renewal Date. USB-IF shall enter the nearest business day date 12 months in advance of the *'AVL Approved Date'* in this section.

6.2 LISTING, AUTHORIZATION AND NOTIFICATION. Upon receipt of a completed Device Working Group Form 8279-1, Certificate of Compliance, from a manufacturer and its designated certified testing laboratory, the USB-IF Management Office will:

6.2.1 Certificate of Compliance Listing. Upon USB-IF completion the C of C form as described in paragraph 6.1.1.3 above.

6.2.1.1 The USB-IF Management Office will make an *'Approved Vendor List'* data base entry for the product and will place the original copy of the completed C of C in the USB-IF AVL file.

6.2.2 Authorization To Use USB Icon. USB-IF' s issuance of an AVL Entry Number for an approved USB product authorizes the manufacturer' s use of the trademarked *'USB logo'* for that product only.

IMPORTANT NOTE. *An authorized USB product is defined as an individual piece part, or family of piece parts, that has successfully completed the Voluntary Compliance Testing Program which results in the submission of a C of C to the USB-IF Management Office and its assignment of an 'AVL Entry Number.' Assignment of an 'AVL Entry Number' by USB-IF for a specified USB product authorizes the manufacturer's use of the 'USB Icon' for that product only.*

6.2.2.1 If a manufacturer wishes to use the trademarked *'USB logo'* on more than one USB product, each product displaying the *'USB logo'* must have successfully completed the Voluntary Compliance Testing Program and must have an *'AVL Entry Number'* assigned by USB-IF.

6.2.2.2 Upon receiving official USB-IF Notification *(please see section 6.2.3, Notification, below)* the manufacturer may emboss the *'USB logo'* on the listed product.

6.2.3 Notification. Upon receipt and completion of the C of C, USB-IF will issue an AVL Entry Number and will notify the manufacturer.

6.2.3.1 The manufacturer of record will be notified by E-mail that their product has been listed.

6.2.3.2 A confirming copy of the completed C of C will be sent to the manufacturer of record by U.S. Mail.

7.0 DESIGN AND IMPLEMENTATION SPECIFICATION PROCEDURES FOR APPLICATION SPECIFIC USB CONNECTORS AND CABLE ASSEMBLIES.

7.1 APPLICATION SPECIFIC USB PRODUCT SPECIFICATION (ASUPS). This section provides the generic documentation structure required by a USB Class Document as defined in the Common Class Document Version 1.0.

7.1.1 Title. The name or title of the Application Specific USB Product Specification.

7.1.2 Preface. A brief written introduction about the Application Specific USB Product Specification.

7.1.3 Contributors. A listing of the people responsible for developing the specification that includes company affiliations and E-mail addresses.

7.1.4 Intellectual Property Disclaimer. A boilerplate disclaimer statement shall be include. The Intellectual Property Disclaimer shall read as follows:

This specification is provided "as is" with no warranties whatsoever including any warranty of merchantability, fitness for any particular purpose, or any warranty otherwise arising out of any proposal, specification, or sample. A license is hereby granted to reproduce and distribute this specification for internal use only. No other license, express, implied, by estopple, or otherwise, to any other intellectual property rights is granted or intended hereby. Authors of this specification disclaim all liability, including liability for infringement of proprietary rights, relating to implementation of information in this specification. Authors of this specification also do not warrant or represent that such implementation(s) will not infringe such rights.

7.1.4.1 Standard Trademark Statement. The following trademark statement shall be shown directly beneath the Intellectual Property Disclaimer.

All product names are trademarks, registered trademarks or service-marks of their respective owners.

7.1.5 Revision History. A living history of changes to the document.

7.1.6 Document Conventions. Unique document features and procedures.

7.1.7 Table of Contents. An itemized listing of topics by description and page number.

7.2 SECTION 1.0, INTRODUCTION AND PRODUCT DEFINITION. The introduction and product definition section sets the overall goals for an Application Specific USB Product Specification (**ASUPS**).

7.2.1 Section 1.1, Purpose. This section describes why the ASUPS is being created.

7.2.2 Section 1.2, Scope. This section describes an application specific USB connector and/or fabricated cable assembly that is intended for use by the ' USB community at large,' and may or may not specifically identify a class or classes of devices that the application specific USB product is intended to support.

7.2.3 Section 1.3, References and Related Documents. This section identifies other document sources that contribute to the definition of the ASUPS. If the ASUPS uses other industry standards, the specific citations are required.

7.2.4 Section 1.4, Management Overview. This section is an overview of the contents of the ASUPS document and provides a brief summary of each of the subsequent sections. It does not establish any requirements or guidelines.

7.3 SECTION 2.0, MECHANICAL REQUIREMENTS. This section of the ASUPS provides a description of the mechanical characteristics and material requirements for the USB product being defined.

7.3.1 Section 2.1, Mechanical Features and Requirements. This section describes the USB product' s unique mechanical features and requirements.

7.3.2 Section 2.2, 'A-Side' (Host) Mechanical Description. This section describes the ASUPS' specific A-Side (Host), or *'upstream,'* mechanical features and configuration requirements.

7.3.3 Section 2.3, 'B-Side' (Device) Mechanical Description. This section describes the ASUPS' specific B-Side (Device), or *'downstream,'* mechanical features and configuration requirements.

7.3.4 Section 2.4, Unique Fabrication Requirements. This section describes all standard and nonstandard criteria required to fabricate the ASUPS' A-Side and B-Side configurations.

7.3.5 Section 2.5, Specified Material Requirements. This section describes all materials required to fabricate the ASUPS' A-Side and B-Side configurations.

7.4 SECTION 3.0, ELECTRICAL REQUIREMENTS. This section of the ASUPS provides a description of the electrical characteristics and requirements for the USB product being defined.

7.4.1 Section 3.1, Electrical Features and Requirements. This section describes the USB product' s unique electrical features and requirements.

7.4.2 Section 3.2, 'A-Side' (Host) Electrical Description. This section describes the ASUPS' specific A-Side (Host), or *'upstream,'* electrical features and configuration requirements.

7.4.3 Section 3.3, 'B-Side' (Device) Electrical Description. This section describes the ASUPS' specific B-Side (Device), or *'downstream,'* electrical features and configuration requirements.

7.4.4 Section 3.4, Unique Voltage Requirements. This section of the ASUPS defines

the standard USB voltage requirements as well as the nonstandard voltage requirements for the USB product being defined.

7.4.5 Section 3.5, Unique Current Requirements. This section of the ASUPS defines the standard USB current requirements as well as the nonstandard current requirements for the USB product being defined.

7.4.6 Section 3.6, Overcurrent Protection Requirements. If required, this section of the ASUPS will describe the applicable *'overcurrent protection'* requirements.

7.4.7 Section 3.7, In-Rush Current Control Requirements. If required, this section of the ASUPS will describe the applicable *'in-rush current control'* requirements.

7.4.8 Section 3.8, Safety Circuit Requirements. If required, this section of the ASUPS will describe all applicable *'safety circuit' and the applicable safety agency specification for such requirements.*

7.4.9 Section 3.9, Unique Contact Assignment Requirements. If required, this section of the ASUPS will describe the applicable *'nonstandard contact assignment'* requirements.

7.4.10 Section 3.10, Hot-Plugging/Unplugging Considerations. If required, this section of the ASUPS will describe the applicable *'hot plugging and unplugging'* requirements.

7.4.11 Section 3.11, Plugging Sequence Requirements. If required, this section of the ASUPS will describe the applicable *'plugging sequence'* requirements.

7.5 SECTION 4.0, REPORT DESCRIPTOR AND POWER MANAGEMENT REQUIREMENTS. This section describes how a typical USB device is expected to interact with a host system when connected to the *'bus'* using electro-mechanical interface described in the ASUPS under development. For example, this section may explain: specialized enumeration procedures; how the *'host system'* selects *'class specific actions'* on an interrupt pipe from commands sent on the *'default pipe;'* or, detailed *'power management requirements.'*

7.5.1 Section 4.1, Report Descriptor and Power Management Overview. If the proposed USB product design requires the use of *'report descriptors'* and/or a *'power management scheme,'* this section will define how the standard descriptors from the most current version of the *Universal Serial Bus Specification* shall apply. Should the ASUPS under development require new and unique of *'report descriptors,'* the proposed requirements will be define in the following sections.

7.6 SECTION 5.0, MECHANICAL, ELECTRICAL AND ENVIRONMENTAL TESTING REQUIREMENTS. This section shall state the minimum performance requirements for USB cable, connectors and fabricated cable assemblies must meet or exceed the requirements specified by the most current version of Chapter 6 of the USB Specification and the Cable and Connector Class Document. In case of conflict between the requirements of the ASUPS, Cable and Connector Class Document and the most current revision of Universal Serial Bus (**USB**) Specification, the specification with most comprehensive and stringent testing and acceptance procedures shall take precedence.

7.6.1 Section 5.1, Mechanical, Electrical and Environmental Testing Overview. This section will provide an overview of the selection process, 100% visual inspection and preliminary electrical inspection for gross defects, mechanical, electrical and environmental testing and the sequence in which the testing should occur.

7.6.2 Section 5.2, Unique Testing and Requirements. This section will detail the minimum test sequence required for product qualification according to accepted industry policies, procedures and practices, or as defined Cable and Connector Class Document and/or the most current revision of USB Specification.

7.6.3 Section 5.3, Device Working Group (DWG) Acceptance and Universal Serial Bus Implementers' Forum (USB-IF) Certificate of Compliance Procedures. This section will detail the procedures for achieving DWG approval and C of C submission procedures.

7.7 SECTION 6.0, APPENDICES. This section of the ASUPS provides appendices to list tabular or supplemental information to the basic specification. For example, if an ASUPS adds a number of specific requests or descriptors, an appendix might be used to provide tables illustrating the numeric constants used for specific requests or descriptors. In addition, as required, specific electrical, mechanical or environmental data.

8.0 APPENDICES

THIS SPECIFICATION HAS BEEN DEVELOPED AS A 'LIVING DOCUMENT.' IN ORDER TO PROVIDE SYSTEM ENGINEERS AND DESIGNERS THE MOST CURERNT USB CABLE AND CONNECTOR INFORMATION, USB-IF DEVICE WORKING GROUP MEMBERS MAY FROM TIME TO TIME CHOOSE TO ADD ADDITIONAL USEFUL INFORMATION TO THIS DOCUMENT, E.G., PRODUCT DRAWINGS FOR NEW USB INDUSTRY STANDARDS, LISTINGS OF INTERNATIONAL LABORATORIES CAPABLE OF PERFORMING APPROVAL TESTING, ET CETERA. SECTION 8.0, APPENDICES, HAS SET ASIDE FOR THAT PURPOSE