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Digital Video Broadcasting (DVB); Second Generation Common Interface (CI); Implementation Using the Universal Serial Bus (USB)

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Foreword

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NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993 to provide global standardization, interoperability and future proof specifications.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The DVB Common Interface (DVB-CI) specifications CENELEC EN 50221 [1] and ETSI TS 101 699 [2] describe a system whereby a removable Conditional Access CICAM, given the appropriate rights, unscrambles protected content and routes it back to the Host over the same interface. These DVB Common Interface specifications were extended by the CI Plus specification [3], developed by CI Plus™ LLP, which provides common methods (i.e. methods that are independent of the up-stream CA system) for mutual authentication of the CICAM and Host, and link encryption over the return interface from the CICAM to the Host. The first generation Common Interface connector was an industry standard PCMCIA slot. The connector for the second generation Common Interface as described in the present document is an industry standard USB Standard-A connector USB 2.0 [5] and USB 3.2 [6].

The first generation DVB-CI system defined two interfaces between the CICAM and the Host: a command interface, and a Transport Stream interface.

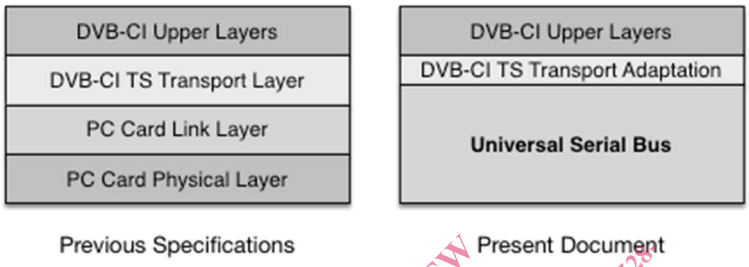

Figure 1: Transport Stream interface layers

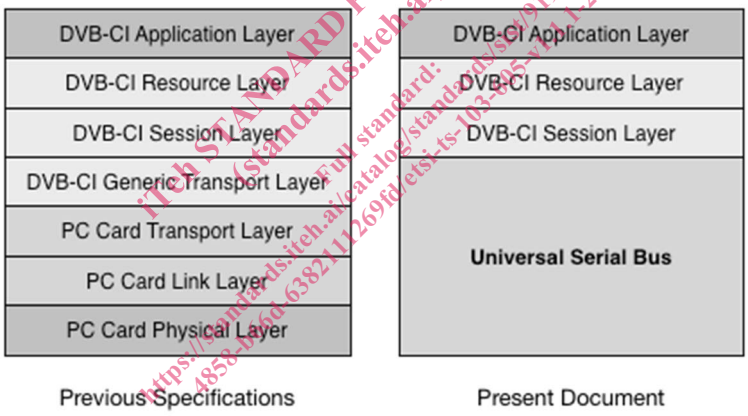

Figure 2: Command Interface layers

The USB makes use of so-called endpoints for all data transfers. Generally, these endpoints are uni-directional (i.e. they can either send or receive data, but not both). The only exception is the special, bi-directional endpoint zero which is used for discovery and control of USB devices. As shown in figure 3, the present document makes use of USB endpoint zero and of six further USB endpoints in each device. Since USB endpoints are implemented in the hardware of USB chipsets, they are a scarce resource and keeping their number to a minimum is important.

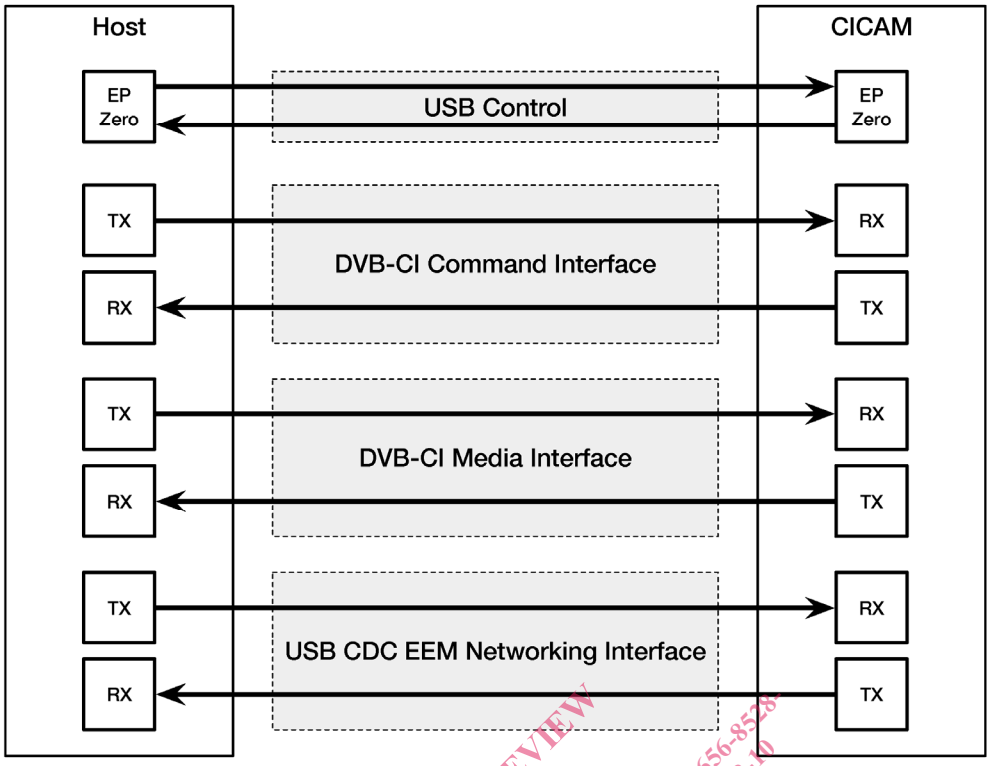

Figure 3: USB endpoints used by the second generation Common Interface

1 Scope

The present document defines USB physical, link and transport layers for the DVB Common Interface to replace the PC Card interface defined in CENELEC EN 50221 [1]. The present document also profiles and extends the application layer defined in CENELEC EN 50221 [1], ETSI TS 101 699 [2] and CI Plus specification [3] to cater for the use over USB.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] CENELEC EN 50221: "Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications".

[2] ETSI TS 101 699: "Digital Video Broadcasting (DVB); Extensions to the Common Interface Specification".

[3] CI Plus™ specification v1.3.2: "Content Security Extensions to the Common Interface".

NOTE: Available from http://www.ci-plus.com/data/ci-plus_specification_v1.3.1.pdfhttp://www.ci-plus.com/data/ci-plus_specification_v1.3.2.pdf.

[4] ETSI TS 103 205: "Digital Video Broadcasting (DVB); Extensions to the CI Plus™ Specification".

[5] Universal Serial Bus Specification, Revision 2.0.

NOTE: Available from https://www.usb.org/sites/default/files/documents/usb_20_20180904.zip.

[6] Universal Serial Bus 3.2 Specification.

NOTE: Available from https://www.usb.org/sites/default/files/documents/usb_32_20180912.zip.

[7] Universal Serial Bus Class Definitions for Communications Devices, Revision 1.2.

[8] Universal Serial Bus Communications Class, Subclass Specification for Ethernet Emulation Model Devices, Revision 1.0.

[9] ISO/IEC 23001-7: "Information technology -- MPEG systems technologies -- Part 7: Common encryption in ISO base media file format files".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] IEEE Registration Authority: "MAC Address Block Large (MA-L)".

NOTE: Available from http://standards.ieee.org/develop/regauth/oui/index.html.

[i.2] IEEE Std 802.1D-2004™: "IEEE Standard for Local and metropolitan area networks. Media Access Control (MAC) Bridges".

[i.3] IETF RFC 4541: "Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches".

[i.4] Universal Serial Bus Class Codes Registry.

NOTE: The registry can be consulted on-line at https://usb.org/defined-class-codes.

3 Definition of terms and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in CENELEC EN 50221 [1], ETSI TS 101 699 [2], CI Plus™ specification v1.3.2 [3], ETSI TS 103 205 [4] and the following apply:

cipher block size: size of the unit of operation of a block-based cipher algorithm

DVB-CI command interface: interface used to transfer commands and metadata between the Host and the CICAM

DVB-CI media interface: interface used to transfer media content between Host and CICAM

NOTE: This includes broadcast video and broadband video.

fragment: sequence of bytes transferred on the Media Interface that belong to Media Content and is preceded by a Fragment Header

subsample: block of clear data bytes followed by a block of encrypted data bytes

NOTE: Either one or the other block may be of zero size, but not both.

transfer: sequence of USB packets where all of them contain the maximum size for the endpoint except the last one which is either short or zero-length, as defined in clause 5.8.3 of Universal Serial Bus Specification, Revision 2.0 [2]

USB CDC EEM networking interface: interface used to transfer Ethernet datagrams between the Host and the CICAM

NOTE: The Host provides network connectivity on this interface. This interface is defined Universal Serial Bus Class Definitions for Communications Devices, Revision 1.2 [7] and Universal Serial Bus Communications Class, Subclass Specification for Ethernet Emulation Model Devices, Revision 1.0 [8].

USB control: interface defined by Universal Serial Bus Specification, Revision 2.0 [5] to set-up and control the configuration of the device

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in CENELEC EN 50221 [1], ETSI TS 101 699 [2], CI Plus™ specification v1.3.2 [3], ETSI TS 103 205 [4] and the following apply:

CENC Common ENCryption scheme

NOTE: See ISO/IEC 23001-7 [9].

MPEG Moving Pictures Expert Group

4 Mechanical and electrical characteristics

4.1 Mechanical characteristics

4.1.1 Connector

The CICAM shall have a USB 2.0 Standard-A plug as defined in clause 6.5.4 of USB 2.0 [5], or a USB 3.1 Standard-A plug as defined in clause 5.3.1 of USB 3.2 [6].

NOTE: The compatibility between USB 2.0 and USB 3.1 plugs and receptacles is described in clause 5.2.1 of USB 3.2 [6].

Since the Standard-A is the most widespread USB connector type, and as it is interoperable between all versions of USB up to and including 3.1 (the latest version as of this writing), it is expected that future versions of USB retain interoperability with this connector type.

4.1.2 Mechanical properties

To be able to be plugged directly into a Host, a CICAM shall not exceed the size limits defined in table 1. These limits do not include the USB Standard-A plug [5] and USB 3.2 [6]. If a CICAM is designed to not be directly plugged into a Host (e.g. by using a flying lead), it may exceed these size limits. A Host shall provide at least one USB Standard-A receptacle with appropriate spacing to accommodate a CICAM up to the size limits given in table 1. The USB Standard-A plug [5] and USB 3.2 [6] shall be located as shown in figure 4. The plug shall be centred relative to dimension W.

Table 1: CICAM size limits

Dimension	W	D	L	A
Limit	22 mm	12 mm	70 mm	<= 1.75 mm

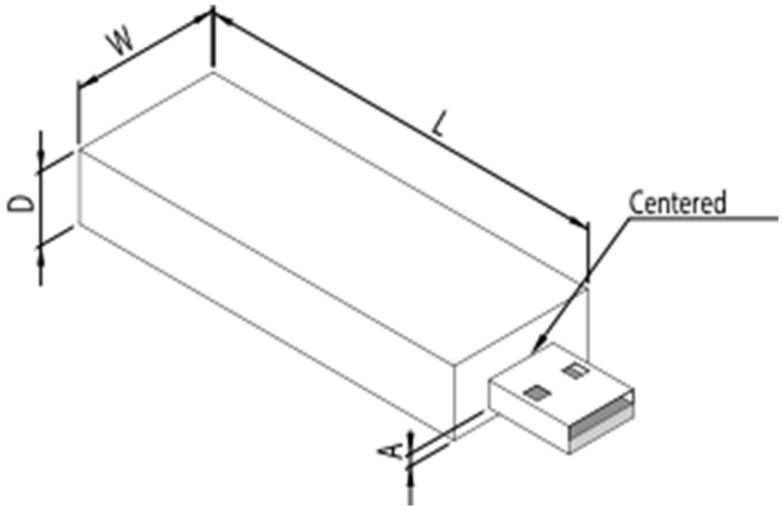

Figure 4: Application of CICAM size limits

NOTE: Specification for flying lead can be found in USB 2.0 [5], clause 6.3 and following and in USB 3.2 [6], clause 5.4 and following.

4.2 Electrical characteristics

The CICAM shall work within the electrical characteristics defined in USB 2.0 [5] or USB 3.2 [6].

A Host which implements one or more USB 2.0 slots with the mechanical characteristics defined in clause 4.1.2, shall allow for high-power bus-powered functions as defined in clause 7.2.1 of USB 2.0 [5] on these ports.

NOTE 1: Such devices draw no more than 100 mA upon power-up and may draw up to 500 mA after being configured.

A Host which implements one or more USB 3.1 slots with the mechanical characteristics defined in clause 4.1.2, shall allow for high-power bus-powered functions as defined in clause 11.4.1 of USB 3.2 [6] on these ports.

NOTE 2: The amount of current draw for Enhanced SuperSpeed devices is increased to 150 mA for low-power devices and 900 mA for high-power devices when operating at Gen X speed.

5 Module discovery and capabilities description

5.1 General

For describing the CICAM during bus enumeration, the following rules shall apply:

a) In the device descriptor, the CICAM shall report a device Class code of 0xEF, SubClass 0x02, and DeviceProtocol 0x01 to indicate a multi-interface function class, for which the information is given in the Interface Association Descriptor.

b) In each configuration offered by the CICAM which support DVB-CI function, there shall be exactly one Interface Association Descriptor (IAD) for the DVB-CI function.

NOTE: This does not preclude the presence of further IADs for other functions the device may be offering such as for example mass storage.