INTERNATIONAL STANDARD

ISO/IEC 17417

First edition
2011-12-01

Information technology — Telecommunications and information exchange between systems — Short Distance Visible Light Communication (SDVLC)

Technologies de l'information — Téléinformatique — Communication à courte distance utilisant la lumière visible (SDVLC)

Reference number
ISO/IEC 17417:2011(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 17417 was prepared by Ecma International (as ECMA-397) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Introduction

Short Distance Visible Light Communication (SDVLC) uses visible light LEDs for data communication. In most cases, LEDs with the primary purpose of illumination will take on the secondary purpose of acting as a digital data communication source; in other cases the LED's primary purpose will be data communication while the secondary purpose will be to communicate visible status to the user. With the extension of the application of LEDs from the primary purpose of illumination to the secondary purpose of data communication, VLC can be also applied to short range data communication.

With SDVLC, "what you see is what you send". One possible application of SDVLC is high speed mobile-to-mobile communication.

Information technology — Telecommunications and information exchange between systems — Short Distance Visible Light Communication (SDVLC)

1 Scope

This International Standard specifies a phsical layer (PHY) and medium access control (MAC) for communication of up to 10 cm distance with an f_m of 120 MHz using visual light with the wavelength between 380 nm and 780 nm.

In addition it specifies human-detectable brightness control that is independent of the modulation for the data transfer.

2 Conformance

Conformant implementations:

- have both a Transmitter and a Receiver;
- use 8B10B encoding and may use 2B4B encoding;
- use an f_m of 120 MHz as specified in 8.3.

3 Normative references

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

ISO/IEC 18092:2004, *Information technology — Telecommunications and information exchange between systems — Near Field Communication — Interface and Protocol (NFCIP-1)*

ISO/IEC 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

ISO/IEC 14165-251, *Information technology — Fibre Channel — Part 251: Framing and Signaling (FC-FS)*

ITU-T Z.100, *Specification and Description Language (SDL)*

RFC 791, *Internet Protocol — DARPA Internet Program — Protocol Specification*

4 Terms,definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in ISO/IEC 7498-1 and the following apply.

4.1
Ack
Acknowledge

4.2
AK
Ack/Nack

4.3
ABR-REQ
Aperiodic Burst Request

4.4
ABR-RSP
Aperiodic Burst Response

4.5
AS-ACK
Association Acknowledge

4.6
AS-REQ
Association Request

4.7
AS-RSP
Association Response

4.8
Burst Master
Burst scheduler

4.9
Burst Slave
Burst schedule follower

4.10
BR-REQ
Burst Request

4.11
BR-RSP
Burst Response

4.12
BS
Burst Start

4.13
BWS
Burst Window Size

4.14
CHC
Control Header CRC

4.15
CRC
Cyclic Redundancy Check

4.16
DAS-ACK
Disassociation Acknowledge

4.17
DAS-REQ
Disassociation Request

4.18
DAS-RSP
Disassociation Response

4.19
DCC-REQ
Duty Cycle Change Request

4.20
DCC-RSP
Duty Cycle Change Response

4.21
dectet
group of 10 bits (cf. octet)

4.22
DER
Data Encoding Response

4.23
Disassociatee
recipient of a DAS-REQ

4.24
Disassociator
initiator of a disassociation

4.25
DQWS
Data Quiet Window Size

4.26
ENC
Data Encoding

4.27
FL
Frame Length

4.28
f_m
Frequency of modulation clock that changes the optical output signal

4.29
FT
Frame Type

4.30
Initiator
initiator of an association

4.31
LEN
Length

4.32
MF
MAC Flag

4.33
MHC
MAC Header CRC

4.34
MM
Management Message

4.35
Nack
Negative Acknowledge

4.36
OOK
On-Off Keying

4.37
OP
Operation

4.38
PL
Payload Length

4.39
PDU
Protocol Data Unit

[ISO/IEC 7498-1]

4.40
PSN
PDU Sequence Number

4.41
RC
Response Code

4.42
Recipient
receiver of a frame

4.43
RFU
Reserved for Future Use

4.44
RID
Recipient ID

4.45
RVF
Recipient VF

4.46
SDL
Specification and Description Language (ITU-T Z.100)

4.47
SDU
Service Data Unit

[ISO/IEC 7498-1]

4.48
SDVLC
Short Distance Visible Light Communication

4.49
Sender
sender of a frame

4.50
SI
Start Indicator

4.51
SID
Sender ID

4.52
SMF
Supported Modulation Frequencies

4.53
Target
recipient of an AS-REQ

4.54
VF
Visible Frame

4.55
VFA
VF Mode Stop Approve

4.56
VFR
VF Mode Stop Request

4.57
VLC
Visible Light Communication

5 Conventions and notations

The following conventions and notations apply in this document unless otherwise stated.

- The setting of bits is denoted by ZERO or ONE.
- An individual bit in a field is identified by a numerical subscript of the field name, where for numeric values the least significant bit of the value is assigned to the bit with subscript 0.
- (xxxxxxx)b denotes a sequence of binary digits.

6 General

All RFU bits shall be set to 0 by the Sender and ignored by the Recipient.

Unless otherwise stated, all RFU values shall be ignored by the Recipient.

7 Physical Layer

Figure 1 illustrates the basic model of the SDVLC Transmitter and Receiver.

A SDVLC Transmitter shall have an optical output with a minimum peak irradiance of 3 W/m^2 between 380 nm and 780 nm over an area of at least 1,0 cm × 1,0 cm at a distance of 10 cm, and a 10% to 90% rise time t_r and fall time t_f of at most 3,0 ns, illustrated in Figure 2. The SDVLC Transmitter shall have a maximum off irradiance of 1 mW/m^2.

A SDVLC Receiver shall have an optical sensitivity from 380 nm to 780 nm and from 0 cm to at least 10 cm from a SDVLC Transmitter.

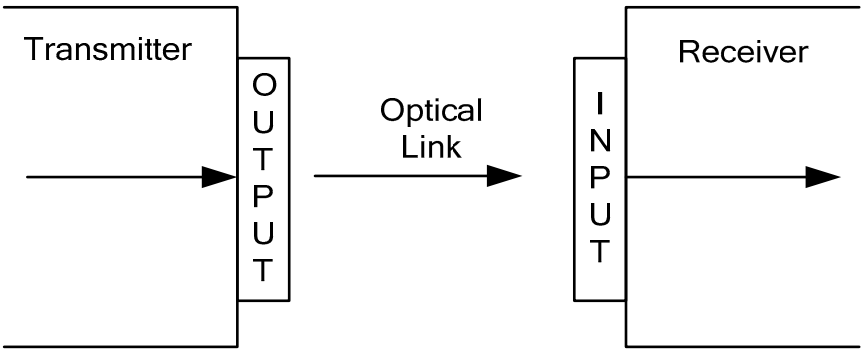

Figure 1 — SDVLC Transmitter and Receiver