
**Intelligent transport systems —
Communications access for land mobiles
(CALM) — M5**

*Systèmes intelligents de transport — Accès aux communications des
services mobiles terrestres (CALM) — M5*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 21215:2010](https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010)

[https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-
c52a8349e9a3/iso-21215-2010](https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010)



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 21215:2010

<https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2010

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

| | |
|---|----|
| Foreword | iv |
| Introduction..... | v |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 2 |
| 4 Symbols and abbreviated terms | 2 |
| 5 Requirements..... | 3 |
| 6 Architecture | 4 |
| 7 Communication interface protocol stack..... | 5 |
| 7.1 Physical layer..... | 5 |
| 7.2 Medium access control layer | 7 |
| 7.2.1 General | 7 |
| 7.2.2 Elements..... | 7 |
| 7.2.3 MAC procedures | 11 |
| 7.3 Logical link control sub-layer | 12 |
| 7.4 Communication adaptation layer..... | 12 |
| 7.4.1 General | 12 |
| 7.4.2 Elements..... | 12 |
| 7.4.3 CAL procedures..... | 15 |
| 8 Communication interface management..... | 17 |
| 8.1 Communication module management entity..... | 17 |
| 8.2 Communication interface management adaptation entity..... | 17 |
| 8.2.1 Mapping of 802.11 parameters | 17 |
| 8.2.2 Mapping of 802.11 commands | 17 |
| 8.2.3 Management frames..... | 18 |
| 8.2.4 Cross-CI prioritization procedure | 18 |
| 8.2.5 CI registration | 19 |
| 8.2.6 VCI deletion..... | 19 |
| 8.2.7 Regulatory information management..... | 20 |
| 8.2.8 MI-parameters | 20 |
| 9 Conformance | 22 |
| 10 Test methods | 22 |
| 11 Marking, labelling and packaging..... | 22 |
| Annex A (normative) Parameters | 23 |
| Annex B (normative) MI-COMMAND | 31 |
| Annex C (normative) MI-REQUEST | 32 |
| Annex D (normative) Management frame MAC commands | 33 |
| Annex E (normative) ASN.1 definitions | 34 |
| Annex F (informative) Operation in Europe..... | 37 |
| Bibliography..... | 39 |

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member 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 shall not be held responsible for identifying any or all such patent rights.

ISO 21215 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 21215:2010

<https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010>

Introduction

This International Standard is part of a family of International Standards for communications access for land mobiles (CALM). An introduction to the whole set of International Standards is provided in ISO 21217.

This International Standard determines the CALM native medium using radio frequencies in the 5 GHz microwave range. This medium is named CALM M5.

CALM M5 was developed with knowledge of the work done at IEEE on WAVE; see IEEE 1609.4 and [14].

CALM M5 is based on the work done in IEEE P802.11p [16], which cannot be referenced at the time of writing this International Standard, as this will become part of IEEE 802.11.

A CALM M5 communication interface can be integrated with a CEN dedicated short-range communication (DSRC) on-board unit (OBU) that is compliant with [11], [12] and [13]. This is to efficiently protect payment transactions based on CEN DSRC systems that are globally in use.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 21215:2010](https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010)

<https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 21215:2010

<https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-c52a8349e9a3/iso-21215-2010>

Intelligent transport systems — Communications access for land mobiles (CALM) — M5

1 Scope

This International Standard provides specifications of the access layer (OSI layers 1 and 2 and the related management functionality) of a communication interface (CI) named "CALM M5", operating in the 5 GHz microwave frequency range.

CALM M5 CIs include communication modules (CMs) that are based on the wireless LAN technology standardized at IEEE. This International Standard specifies the additions to and deviations from IEEE 802.11, including the amendment [16] developed by IEEE Task Group p (TGp) required to make CALM M5 CIs compatible with the ITS station reference architecture based on the CALM concept specified in ISO 21217.

Frequency allocations in regions other than North America are supported.

2 Normative references

iTeh STANDARD PREVIEW
(standards.iteh.ai)

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 TR 8802-1, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 1: Overview of Local Area Network Standards*

ISO/IEC 8802-2, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 2: Logical link control*

IEEE 802.11, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*

IEEE 1609.4, *IEEE Trial-Use Standard for Wireless Access in Vehicular Environments (WAVE) — Multi-channel Operation*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ISO 21210, *Intelligent transport systems — Communications access for land mobiles (CALM) — IPv6 Networking*

ISO 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

ISO 21218, *Intelligent transport systems — Communications access for land mobiles (CALM) — Medium service access points*

ISO 24102, *Intelligent transport systems — Communications access for land mobiles (CALM) — Management*

ISO 21215:2010(E)

ISO 29281, *Intelligent transport systems — Communications access for land mobiles (CALM) — Non-IP networking*

ETSI EN 302 571:2007, *Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive*

ETSI EN 301 893:2007, *Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21217, ISO 21210, ISO 24102, ISO 21218, ISO/IEC 8802-2, IEEE 802.11, ETSI EN 301 893:2007, ETSI EN 302 571:2007 and the following apply.

NOTE Terminology in the set of CALM standards was modified during the process of harmonizing International Standards. This might lead to an editorial difference in terms used in this International Standard and in other International Standards from the set of CALM standards. These editorial differences will be resolved during the ongoing process of harmonizing the whole set of CALM standards.

3.1
CALM M5
CALM communication interface that is compliant with one or more modes of operation in the 4 GHz to 5 GHz band as specified in this International Standard (ISO 21215:2010)

3.2
control channel
logical channel associated with a physical communication channel to manage the access of applications to the communication medium which can include assignment of a service channel or an auxiliary channel to an application

3.3
service channel
logical channel associated with a physical communication channel

3.4
auxiliary channel
logical channel associated with a physical communication channel

4 Symbols and abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 21217, ISO 29281, ISO 21210, ISO 24102, ISO 21218, ISO/IEC 8802-2, IEEE 802.11, ETSI EN 301 893:2007, ETSI EN 302 571:2007 and the following apply.

| | |
|-----|--------------------------------|
| ACH | Auxiliary Channel |
| CAL | Communication Adaptation Layer |
| CCH | Control Channel |
| CI | Communication Interface |
| CM | Communication Module |

| | |
|--------------|---|
| DSRC | Dedicated short-range communication |
| ITS-S | Intelligent Transport System Station |
| ITS-SI | Intelligent Transport System Station Information |
| MAC | Medium Access Control Sub-layer |
| MI-parameter | Parameter of a CI or virtual CI (VCI) specified in ISO 21218 |
| M5-parameter | Parameter of a CALM M5 CI / VCI specified in this International Standard (ISO 21215:2010) |
| OBU | On-board unit |
| PHY | Physical layer for microwave communications |
| QoS | Quality of Service |
| SCH | Service Channel |
| VCI | Virtual Communication Interfaces |
| , | Commas within numbers are used as decimal points |
| e.i.r.p. | Equivalent isotropic radiated power |
| c | speed of light in m/s |
| d | estimated free space communication distance |
| f | centre frequency in Hz |
| G | gain of receiver antenna |
| L_{impl} | implementation specific losses |
| L_{path} | path loss |
| P_{sens} | receiver sensitivity |
| P_{tx} | transmit power e.i.r.p |

5 Requirements

Clauses 6, 7 and 8 provide the principal requirements of this International Standard:

- Clause 6 specifies the global architecture based on the OSI model, together with general requirements by reference to other International Standards;
- Clause 7 specifies the CALM M5 communication interface protocol stack;
- Clause 8 specifies the CALM M5 communication interface management.

Annexes provide further normative and informative details.

6 Architecture

Figure 1 shows the architecture diagram of a CALM M5 communication interface (CI) embedded in the general CALM architecture.

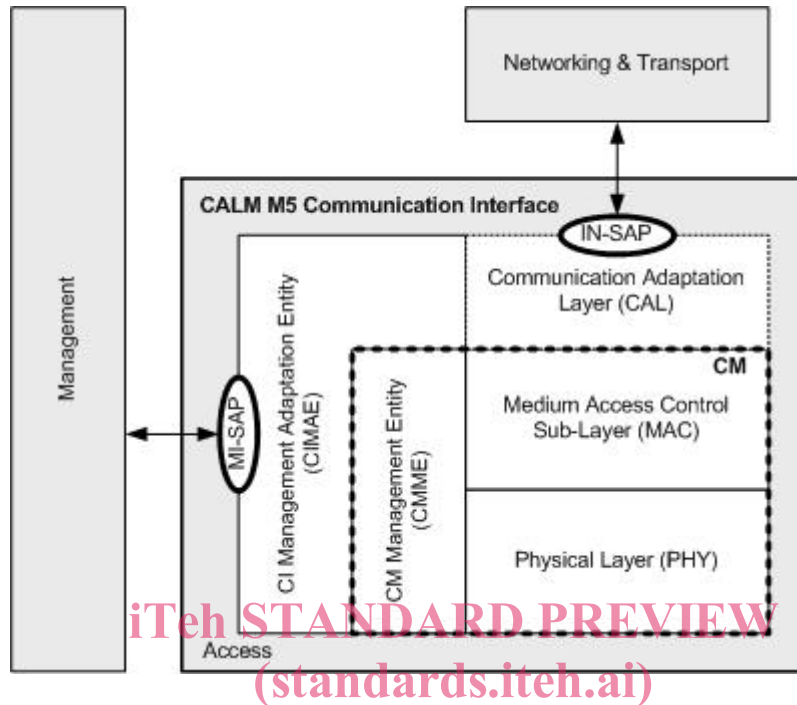


Figure 1 — CALM M5 CI architecture

<https://standards.iteh.ai/catalog/standards/sist/bd37aba5-d5bd-4581-85f8-53824919a310-iso-21215-2010>

The M5 communication module (CM) is indicated with a bold dotted line. The CM along with the communication adaptation layer (CAL) and CI management adaptation entity (CIMAE) constitute a CALM CI as specified in ISO 21218.

The communication protocol layers of the CM are

- a) physical layer for microwave communications (PHY), and
- b) medium access control sub-layer (MAC).

A CALM M5 CI shall comply with the following CALM International Standards:

- ISO 21218 on access layer service access points;
- ISO 24102 on ITS station management;
- ISO 21217 on global ITS architecture;
- ISO 29281 on non-IP networking; and
- ISO 21210 on IPv6 networking;

with restrictions and amendments as specified in this International Standard.

A CALM M5 CM shall be compliant with IEEE 802.11 with restrictions and amendments as specified in this International Standard.

A CALM M5 CI and virtual CI (VCI) shall support MI-parameters specified in ISO 21218 with amendments and restrictions as specified in this International Standard.

A CALM M5 CI as specified in this International Standard is a CALM wireless CI that shall support CI class CIC-w1 for general simultaneous bi-directional communications with multiple peer stations, coded in MI-parameter 15 "CIclass" specified in ISO 21218.

NOTE 1 This includes the capability of CI class CIC-w3 and CIC-w4.

A CALM M5 CI shall support at least CI access class CIAC-1 coded in MI-parameter 24 "CIaccessClass" specified in ISO 21218.

A CALM M5 CI shall provide an IN-SAP and an MI-SAP as specified in ISO 21218 with restrictions as specified in this International Standard.

A CALM M5 CI shall support Cross-CI prioritization as specified in ISO 21218 with details as specified in this International Standard.

NOTE 2 Multiple CALM M5 CIs per ITS station are possible, regardless of whether the CIs belong to the same ITS-SCU or to different ITS-SCUs; see ISO 24102 for the specification of an ITS-SCU.

A CALM M5 CI shall support all modes of usage of the CtrlCI bits in the CI-ID as specified in ISO 29281 with details as specified in this International Standard.

A CALM M5 CI shall support packets carrying management data being transferred via the MI-SAP as specified in ISO 21218.

A CALM M5 CI shall support one or more of the logical channels "control channel" (CCH), "service channel" (SCH) and "auxiliary channel" (ACH) as specified in ISO 21218.

A CALM M5 CI shall provide quality of service (QoS) functionality based on user priorities as specified in ISO 21218, and based on access categories as specified in IEEE 1609.4.

7 Communication interface protocol stack

7.1 Physical layer

The physical layer of a CALM M5 CI shall be compliant with IEEE 802.11, orthogonal frequency division multiplexing (OFDM) PHY specification for the 5 GHz band, with restrictions and amendments as specified in this International Standard.

Figure 2 shows the PHY frame as transmitted in the microwave medium. It consists of a "PHY Header", a "MAC Frame" and an optional "PHY Trailer".

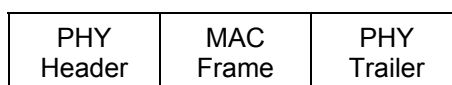


Figure 2 — PHY frame

Table 1 shows how CALM M5 channels are identified by means of "CALM channel number", centre frequency, bandwidth (channel spacing) and channel set identifier. "CALM channel number" is a reference number to the following set of parameters:

- IEEE channel starting frequency;
- IEEE channel number;
- channel bandwidth (channel spacing); and
- channel set identifier (region code, set identifier).

See the ASN.1 element M5channel specified in Annex E. A "CALM channel number" shall be unique inside an ITS station.

Table 1 — Centre frequencies — Informative

| | |
|--|--|
| CALM channel number | As assigned to CCH, SCH, ACH. The value zero shall not be assigned to the CALM channel number as it has a special meaning; see MI-parameters 0, 1, and 2 specified in ISO 21218. |
| IEEE channel starting frequency | Used to calculate the centre frequency as specified in IEEE 802.11. |
| IEEE channel number | As specified in IEEE 802.11. |
| Bandwidth in MHz | Equals the IEEE channel spacing. |
| Channel set identifier | Points to a regulation. |

NOTE 1 Channel set identifier details are outside the scope of this International Standard.

In Europe, CALM M5 shall comply with the harmonized standards ETSI EN 301 893:2007 and ETSI EN 302 571:2007, respectively, for the frequency bands covered by these ENs. Frequency allocation and some modes of operation in Europe are presented in Annex F.

In case there is only a single common RX-VCI for all TX-VCI of the same CI, all virtual VCIs of a CI shall use the same centre frequency and bandwidth.

All data rates for a given channel bandwidth as indicated in Table 2 may be supported; the lowest data rate for each supported channel bandwidth shall be mandatory.

iTech STANDARD PREVIEW
(standards.itech.ai)

Table 2 — Data rates

| IEEE Modulation coding scheme (MCS) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|--------|--------|--------|--------|--------|--------|--------|--------|
| Data rate in Mbit/s 40 MHz channels | 12 | 18 | 24 | 36 | 48 | 72 | 96 | 108 |
| Data rate in Mbit/s 30 MHz channels | 9 | 13,5 | 18 | 27 | 36 | 54 | 72 | 81 |
| Data rate in Mbit/s 20 MHz channels | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| Data rate in Mbit/s 10 MHz channels | 3 | 4,5 | 6 | 9 | 12 | 18 | 24 | 27 |
| IEEE RATE coding R1 ... R4 | '1101' | '1111' | '0101' | '0111' | '1001' | '1011' | '0001' | '0011' |
| Modulation scheme | BPSK | BPSK | QPSK | QPSK | 16-QAM | 16-QAM | 64-QAM | 64-QAM |
| Coding rate R | 1/2 | 3/4 | 1/2 | 3/4 | 1/2 | 3/4 | 2/3 | 3/4 |

The transmitter power (e.i.r.p.) shall be adjustable in steps of 0,25 dB.

NOTE 2 The step size indicates resolution; accuracy can be worse than resolution.

7.2 Medium access control layer

7.2.1 General

The medium access control layer of a CALM M5 CI shall be compliant with IEEE 802.11, with restrictions and amendments as specified in this International Standard.

7.2.2 Elements

7.2.2.1 Frame format

Figure 3 shows details of the CALM M5 MAC frame presented in Figure 2.



Figure 3 — CALM M5 MAC frame

Details of the "MAC Header" are specified below. The FCS shall be constructed as specified in IEEE 802.11.

7.2.2.2 MAC header

The general format of the "MAC Header" as applicable for data frames of type "DATA" and "QoS DATA", and for management frames of type "BEACON" and "ACTION", see Table 3, is specified in IEEE 802.11 and presented in the informative Figure 4.

NOTE 1 The MAC header of the data frame "DATA" does not contain the element "QoS Control".

| Frame Control | Duration / ID | Address 1 | Address 2 | Address 3 | Address 4 | Sequence Control | QoS Control |
|---------------|---------------|-----------|-----------|-----------|-----------|------------------|-------------|
| 2 octets | 2 octets | 6 octets | 6 octets | 6 octets | 6 octets | 2 octets | 2 octets |

Figure 4 — MAC header for data frames

"Address 1" and "Address 2" in Figure 4 shall be the MAC addresses of the destination VCI and source VCI, respectively.

The general format of the "Frame Control" field is presented in the informative Figure 5.

| Protocol Version | Type | Subtype | To DS | From DS | More Frag | Retry | Pwr Mgt | More Data | WEP | Order |
|------------------|--------|---------|-------|---------|-----------|-------|---------|-----------|-------|-------|
| 2 bits | 2 bits | 4 bits | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit |

Figure 5 — MAC frame control field

The "Protocol Version" field shall be set to the value zero.

"Type" and "Subtype" combinations specified in IEEE 802.11 are as presented in Table 3.