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**Intelligent transport systems —  
Communications access for land mobiles  
(CALM) — General requirements for  
using public networks**

*Systèmes intelligents de transport — Accès aux communications des  
services mobiles terrestres (CALM) — Exigences générales pour  
l'usage des réseaux publics*

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## 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 25111 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

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## Introduction

This International Standard is part of a family of International Standards for communications access for land mobiles (CALM) which specify a common architecture, network protocols and a set of air interface definitions for wireless communications using a number of mobile (i.e. with horizontal or vertical cell/cell handover) wireless media, including cellular 2nd generation, cellular 3rd generation, 5 GHz, millimetre wave, infrared communications, and mobile wireless broadband (MWB), over packet-based networks. The CALM architecture is also designed to include short-range, short-duration, low-latency communication systems such as European dedicated short-range communications (DSRC) and North American wireless access in vehicular environments (WAVE) based on IEEE 802.11. It is anticipated that other air interfaces will be added in the future. Generally speaking, the CALM architecture is designed to include air interfaces that provide some subset of point-to-point, vehicle-to-vehicle and vehicle-to-point communications over packet-based networks in the ITS sector. In particular, this Standard provides general specifications for air interfaces designed to provide mobile access to packet-based networks.

The requirements for transmission of information over large distances using wireless technology are functionally very different from the requirements for European DSRC. Large volumes of data are required for purposes such as safety, traffic information and management, video downloads to vehicles for tourist information and entertainment, and navigation system updates. In order to support such services, mobile units need to be able to communicate over longer ranges with access points/base stations, and the system must be able to hand over sessions from one access point/base station to another (horizontal or vertical). CALM standards are explicitly designed to enable quasi-continuous data communications as well as data communications of protracted duration between vehicles and service providers, and between vehicles. It is important to note that the CALM architecture is specifically designed to support packet-based communications; support for circuit-switched communications is not included.

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The fundamental advantage of the CALM concept over traditional systems is the ability to support media independent handover (MIH), also referred to as heterogeneous handover, between the various media that can be included in a CALM system. Selection policies are supported that include user preferences and media capabilities in making decisions as to which media to use for a particular session, and when to hand over between media or between service providers on the same medium. These handover mechanisms are defined within the CALM architecture International Standard (ISO 21217), the CALM IPv6 networking for internet connectivity International Standard (ISO 21210), the CALM medium service access points International Standard (ISO 21218) and the CALM communication and station management International Standard (ISO 24102). Handovers between access points using the same technology and service provider use mechanisms that are defined within the particular medium-specific CALM Standard.

ITS applications that can be enhanced or are enabled by the CALM architecture include car-to-car and point-to-multipoint safety messaging, collision avoidance, update of roadside telemetry and messaging, probe data collection, general internet access, image and video transfer, infotainment, multimedia multicast, traffic management, monitoring and enforcement in mobile situations, and route guidance, just to mention a few.

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# Intelligent transport systems — Communications access for land mobiles (CALM) — General requirements for using public networks

## 1 Scope

This International Standard specifies general requirements for the provision of ITS services, using the CALM architecture and protocols, via the use of public wireless networks [including cellular telephony and mobile wireless broadband (MWB) systems].

In particular, this International Standard specifies protocols and parameters that public wireless networks shall include to support prolonged communication links in ITS environments where heterogeneous handovers or media independent handovers (MIH) are either necessary to maintain the link, or desirable as determined by media selection policies, and such handover is provided by the public wireless network.

The requirements for the use of CALM via public wireless networks where there is no provision for heterogeneous cell/cell handover (i.e. so-called nomadic services) is not the central focus of this International Standard, but general requirements to enable the use of such systems, within the limits of the range of a single cell, are also provided.

Wherever practicable, this International Standard has been developed by reference to suitable extant standards, adopted by selection. Required regional variations are provided.

Specifically, for this International Standard, extant national and International Standards for public wireless networks are adopted by reference and are not redefined herein.

Application-specific upper layers are not included in this International Standard, but will be driven by application standards (which might not be technology specific).

## 2 Conformance

In order to claim conformance with this International Standard, communication shall be established in full compliance with procedures and protocols for the appropriate public wireless networks standards, and shall comply with the requirements of

- ISO 21210 (CALM IPv6 networking),
- ISO 21217 (CALM system architecture),
- ISO 21218 (CALM medium service access points), and
- ISO 24102 (CALM management).

Local area public wireless networks that support nomadic wireless systems, without cell/cell handover, cannot claim compliance with this International Standard.

### 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 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*

### 4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.<sup>1)</sup>

#### 4.1

##### **broadband**

characteristic of systems that support information transmission rates greater than the **primary rate** (4.12)

NOTE The definition given here is consistent with that given in ITU-R F.1399.

#### 4.2

##### **CALM application session**

association of two or more parties for the provision of CALM application service and which, until its termination, can involve more than one communication session in order to exchange information (i.e. are involved in a transaction)

NOTE 1 A CALM application session is not possible unless a **communication session** (4.4) is first established.

NOTE 2 An application session will normally involve multiple bidirectional transfers of data, but can be a unidirectional transfer of data.

#### 4.3

##### **cell**

communication zone/service area of a wireless access point (AP) or base station

#### 4.4

##### **communication session**

association of two or more wireless communication devices between which a functional wireless communication link is available for mutual exchange of data/information

NOTE Application sessions (see 4.2) engage in and complete transactions using communication sessions.

#### 4.5

##### **fixed wireless broadband system**

wireless broadband system including communication between user terminals and wireless access points in which the locations of the user terminals and the wireless access points are stationary

NOTE The definition given here is consistent with that given in ITU-R F.1399.

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1) Reference should also be made to ISO 21217.



**4.6****handover**

process of switching a communications transaction in progress from one communication cell to another or between radio channels in the same cell

NOTE Handover is used to allow established sessions to continue when mobile stations move from one cell/AP to another and as a method for minimizing co-channel interference.

**4.7****local area wireless broadband system**

wireless broadband system including communication between user terminals and wireless access points in which the user terminals may move within the communication zones of the wireless access points during communication sessions, but session handover between wireless access points is not supported

**4.8****media independent handover**

handover in which a change of media may or may not be involved

**4.9****mobile wireless broadband system**

wireless broadband system including communication between user terminals and wireless access points in which the user terminals may move within and between the communication zones of the wireless access points during communication sessions, and session handover between wireless access points is supported

**4.10****nomadic wireless broadband system**

wireless broadband system including communication between user terminals and wireless access points in which the location of the user terminals and the wireless access points may change, but are stationary during communication sessions

NOTE The definition given here is consistent with that given in ITU-R F.1399.

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**4.11****on-board equipment**

equipment or device installed or put on-board implementing CALM functionalities

**4.12****primary rate**

data transmission rate of either 1 544 kbps or 2 048 kbps (depending on the network)

NOTE The primary rate is not necessarily the end-user data rate.

**4.13****public service**

wireless services available to the public and non-ITS-specific which can support connection between or among registered subscribers and may provide access to the internet

**4.14****public wireless network**

wireless communications network which supports **public services** (4.13) such as cellular telephony, **mobile wireless broadband systems** (4.10) and satellite systems

**4.15****wireless broadband system**

wireless communication system supporting broadband transmission rates over an air interface

NOTE Wireless broadband systems can be fixed, nomadic, local area or mobile.

## 5 Abbreviated terms

AP	access point
CALM	communications access for land mobiles
CME	CALM management entity
DSRC	dedicated short-range communication
HC-SDMA	high capacity–spatial division multiple access (ANSI/ATIS 0700004-2007)
IEEE	Institute for Electrical and Electronics Engineers
ITU	International Telecommunications Union
ITU-R	ITU-Radiocommunications sector
MIH	media independent handover
(mobile) WiMAX	(mobile) worldwide interoperability for microwave access <sup>2)</sup>
MWB	mobile wireless broadband
OBE	on-board equipment

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## 6 Requirements

### 6.1 Establishment of a medium-specific session

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#### 6.1.1 Public mobile network

The CALM architecture will support two types of air-interface media:

- those that are purpose-designed to provide ITS services (non-public media), and
- those that use public mobile network media.

Some ITS service provision can only be supported using “non-public” purpose designed media, such as those defined in ISO 21214 (CALM using infrared), ISO 21215 (CALM using 5 GHz), and ISO 21216 (CALM using millimetre wave). These services are primarily, but not exclusively, those requiring time critical dialogues and transactions (measured in milliseconds). Some ITS services may be provided using either type of media, and some commercial services may only be available from a particular type of public land mobile network.

This International Standard provides the general requirements for the provision of ITS services, via the CALM architecture, using public land mobile network media.

#### 6.1.2 Continuous and time controlled sessions

The principal difference between *continuous* and *time controlled* sessions to the communications architecture lies in the sequence of events, i.e. whether the CALM session is established before the medium session or whether the medium session is established prior to the CALM session.

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2) WiMax is a commercial instantiation of IEEE 802.16e.

A continuous communication system shall attempt to establish a session as soon as the vehicle is switched on, and shall maintain that session, so long as it is possible, for as long as the vehicle is operating. If it loses the connection, it shall immediately, and at regular intervals, try to establish a new session and restore a quasi-continuous session, regardless of whether there is an immediate need to transact an exchange of data or not. This means that the communications sequence is that at engine start *CALM management* seeks to determine which media are available (See ISO 24102), as soon as the medium possibility is detected a communication session is established, and that session is then quasi-instantaneously available to the CALM manager.

In contrast, with a time controlled system, at engine start the CALM manager seeks to determine which media are available (See CIC-w2 and CIAC-2 in ISO 24102), the communications equipment will identify itself to the medium and the medium may or may not establish a background session providing the location of the in-vehicle equipment, but does not establish an active communication session. An active communication session shall only be created when the in-vehicle (CALM) equipment chooses to initialise a time controlled session in order to send a message/exchange data, or it receives an inbound call, such as receipt of a safety message from the infrastructure. There may well be situational variations as systems evolve. However, the architectural consequence is as determined below.

Provided that the appropriate equipment is fitted in the vehicle, the CALM concept can create and maintain sessions with many different communication media. However, there is a fundamental difference between the sequencing of session establishment procedures for sessions with media that, so long as they are present, are continuously connected, and those that are connected only when it is required to send a message.

Further, for those that are connected only when it is required to send a message, there are media types (for example, 2G GSM) which, so long as the equipment is switched on, will establish a background link and non-charged connection in order to be able to locate a user for incoming calls, and those (such as some satellite systems, or "aircraft mode locked" equipment) which remain totally disconnected unless a session is initiated.

Finally, the user may, for whatever reason, elect only to connect upon the user's instruction and disconnect immediately when instructed to do so by the user. Clearly, in such an environment, ITS services via CALM can only be available when the system is connected.

NOTE 1 The user might also wish to control access to sessions with media. This can be for a number of reasons, including privacy and cost, but in some circumstances and countries, regulations for safety or national security might forbid such *user controlled* override options for certain types of transactions.

NOTE 2 This International Standard, and related International Standards, neither prescribe nor proscribe any of these session types or options within the session types, but simply enable them. Clearly, a session that is continuously connected can respond more quickly than one which has first to establish the communication session at the time of the request to send that message, and might therefore be better suited to support a greater range of services. However, there are a number of reasons (see Note 3) for each of the described types of communication session. This International Standard simply provides general procedures for all types of public wireless networks in order to function within the CALM environment.

NOTE 3 The reasons for continuous or time controlled communications sessions are commercial, technical and political. Some media might be available more commonly than others (such as satellite, 2G GSM, 3G) but be based on commercial models that only use call-time controlled charging, or have volume limitations that for technical reasons need to minimise actual connection time. Other media (such as many instantiations of MWB) are subscription based, and work on the principle of quasi-continuous connection to the medium (for example, for immediate internet access) on a non-session-time controlled subscription, and, in the case of use within the CALM context, to establish a connection, so long as it is possible, during the whole period that the vehicle engine is running. However, it is not possible to say that one medium will always use time controlled charging while another will always use subscription based charging. For example, there are instantiations of 2G and 3G that use "free call" subscription based charging and there examples of MWB that use session-time controlled charging. These models can vary according to location and service provider, and in any event can change over time. This International Standard provides technical provision to deal with all of these options, and to ensure that where permitted they function effectively; it does not concern commercial or political preferences.

The overall procedures for these options are described in 6.1.3 to 6.1.6. However, while the overall procedure in respect of CALM can be determined in this International Standard, the specific procedures for each medium are determined in the relevant CALM International Standard for that medium (e.g. ISO 21212, ISO 21213, ISO 25112, ISO 25113, ISO 29282 or ISO 29283), and these International Standards provide an ITS-CALM