INTERNATIONAL STANDARD

ISO 13183

First edition
2012-05-01

Intelligent transport systems — Communications access for land mobiles (CALM) — Using broadcast communications

Systèmes intelligents de transport — Accès aux communications des services mobiles terrestres (CALM) — CALM utilisant les communications de diffusion générale

Reference number
ISO 13183:2012(E)

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Published in Switzerland

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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 13183 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Introduction

This International Standard is part of a family of International Standards for CALM ("Communications Access for Land Mobiles") which specify a common architecture, network protocols and communications interface definitions for wireless communications using different bearer technologies, e.g. 2nd generation cellular, cellular 3rd generation, 5 GHz microwave, 60 GHz millimetre-wave, mobile wireless broadband, infra-red communications, and satellite. These wireless communications interfaces are designed to provide parameters and protocols for broadcast, point-to-point, vehicle-vehicle, and vehicle-point communications in the ITS sector.

This International Standard provides definitions and procedures for the establishment, maintenance and termination of an ITS communications session within a CALM system environment using received public network broadcast communications messages. Such broadcast communications can be delivered by a variety of media that could include satellite, digital audio broadcast (e.g. $ISDB_{ss}$ and DAB), digital video broadcast (e.g. DVB and ISDB) or any other public communications broadcast service.

Some of the media developed explicitly for CALM include a fully defined broadcast capability, but this International Standard covers only those media that have not been developed specifically for CALM. Protocols for broadcasts that use new dedicated private ITS communications are fully defined in the standards developed for these new communications media.

CALM standards are explicitly designed to enable quasi-continuous communications as well as communications of protracted duration between vehicles and service providers, and between vehicles.

The fundamental advantage of the CALM concept over traditional systems is the ability to support media-independent handover (MIH), also referred to as heterogeneous or vertical handover, between the various media supported by CALM (e.g., cellular, microwave, mobile wireless broadband, infra-red, DSRC, and satellite). Selection policies are supported that include user preferences and media capabilities in making decisions as to which medium 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 protocols International Standard, ISO 21210, the CALM medium service access points International Standard, ISO 21218, and the CALM 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.

Broadcast communications using public networks will typically be used where large numbers of users are running applications intended to receive the same information. Examples of broadcast information include incremental map-update information, ephemeral information on road conditions including traffic and weather conditions, and the current road use charge that is applied to specific sections of road. Furthermore, GNSS location information can be routed to relevant applications using this protocol.

Broadcasting this information is very efficient spectrally, rather than sending the same information individually to thousands of vehicles via point-to-point communications: the transmission costs could be shared between all the users.

The broadcast medium can also be used to carry paging messages. Strictly speaking, these are unicast, but take advantage of the wide geographical coverage of the broadcast system at the physical layer.

There is no embedded means for the individual receivers to acknowledge correct receipt of broadcast transmissions in real time, and the intended recipient system could be powered down at the time of transmission.

This International Standard identifies techniques that can be used to overcome these limitations.

The time of transmission is determined by the information supplier and is not under the control of the recipient. Therefore it is possible that the ITS station could be powered down at the time of the transmission, in which case the information will not be received. For example, it is conceivable that there might be overnight transmission of map updates. This International Standard defines a “sleep mode”, which would be appropriate for a parked car which would normally require the ITS system to be powered down. However, the (very low power consumption) broadcast receiver and its associated “Medium Management Adaptation Entity” (MMAE) would remain powered to listen for, and store, relevant information transmissions. Any relevant information could be passed to the appropriate applications within the ITS station when the ITS station is next powered up. The following three possible methods have been identified to allow this operation:

a) The MMAE provides storage for all information received over the logical ITS channel, whilst the ITS is in sleep mode, for subsequent transfer to the relevant application via intermediate CALM protocols.

b) The MMAE uses selective storage of information received, following a filtering process. The filtering would be achieved by the application alerting the MMAE on the types of application that are of interest. The application type information will be included within the information header. The MMAE reads the application type information in the header, and stores only the selected information.

c) Filtering and buffering of information, whilst a wake-up message is sent to the rest of the ITS station so that the information being received can be passed to the application for immediate processing. The application would instruct the ITS station to return to sleep mode, once all the information has been received and processed.

The wake-up process in a) above is not currently supported by the relevant CALM standards, so this mode is not currently supported.

The inclusion of this function in the MMAE is not mandated. However, each of these arrangements would greatly increase the probability that broadcast information will be received by a large proportion of the users. As noted above, the broadcast medium does not include a return path. However, reliable information transfer can be supported by using an alternative medium for the return channel. This can be a very sensible approach where there is significant asymmetry, with large amounts of information downloaded with very simple acknowledgement messages to be returned.

Bi-directional satellite communications in the CALM environment are specified in ISO 29282.

Intelligent transport systems — Communications access for land mobiles (CALM) — Using broadcast communications

1 Scope

This International Standard specifies the architectural communications framework of intelligent transport systems (ITS) for the family of communications access for land mobiles (CALM) related International Standards. The architecture is described in an abstract way with several graphical views and examples. The graphical representations partly follow the ISO open systems interconnection (OSI) principles. In addition to the requirements specified within this International Standard, a number of notes and examples are provided to illustrate the CALM concept.

Wherever practicable, this International Standard has been developed by reference to suitable extant International Standards, adopted by selection. The architecture provides for regional variations where regulations differ in different countries and regions.

2 Conformance

2.1 General

Conformance declarations for the various parts of a CALM-compliant system shall be based on the appropriate CALM related International Standards as listed in Clause 3: ISO 21210, ISO 21217, ISO 21218, ISO 24102, ISO 25111, ISO 29281.

2.2 Public telecoms network conformance

Broadcast communications media are defined in various standards set by a variety of standardization fora. This International Standard does not require conformance to any specific broadcast standard, but in order to claim compliance with this International Standard, a system shall declare with which broadcast standards it complies.

The following are examples of systems that are already used, or can be used, for ITS solutions in certain regions:

— ITU-R BS.1194-2, *Systems for multiplexing frequency modulation (FM) sound broadcasts with a sub-carrier data channel having a relatively large transmission capacity for stationary and mobile reception*

— ITU-R BO.1408-1, *Transmission system for advanced multimedia services provided by integrated services digital broadcasting in a broadcasting-satellite channel*

— ITU-R BO.1516 System D, *Digital multiprogramme television systems for use by satellites operating in the 11/12 GHz frequency range*

— ITU-R BT.1306-4 System C, *Error correction, data framing modulation and emission methods for digital terrestrial television broadcasting*

— ITU-R BT.1833, *Multimedia System C, Broadcasting of multimedia and data applications for mobile reception by handheld receivers*

— ITU-R BT.1833, *Multimedia System F, Broadcasting of multimedia and data applications for mobile reception by handheld receivers*

— ITU-R BT.1833, *Multimedia system M, Broadcasting of multimedia and data applications for mobile reception by handheld receivers*

— ITU-R BS.1114-6, *System F, Systems for terrestrial digital sound broadcasting to vehicular, portable and fixed receivers in the frequency range 30-3,000 MHz*

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*

ISO 25111, *Intelligent transport systems — Communications access for land mobiles (CALM) — General requirements for using public networks*

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

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21217 and the following apply.

4.1
broadcast
some form of digitally coded information being transmitted to a significant percentage of users within the intended area of coverage which could extend to a continent in the case of a satellite broadcast system

4.2
paging
broadcast medium that can be used to carry unicast messages intended for a single recipient, typically in order to request the mobile ITS station to establish a call back to the ITS station that initiated the paging, using the most cost-effective routing

NOTE 1 A specific ITS station could be paged with the instruction to connect to the calling ITS station.

NOTE 2 The calling ITS station can include its identity and current connectivity, so that the paged ITS station knows how to connect to the calling ITS station.

NOTE 3 Paging is an important concept because the CALM architecture does not provide an efficient method for one ITS station to contact a specific mobile ITS station unless these two already have an established communications routing.

4.3
sleep mode
power saving mode of the ITS station when most of the system is powered down, but one or more broadcast radio communications receivers and their associated MMAEs remain powered so that the system can receive and store relevant broadcast information

5 Symbols and abbreviated terms

5.1
CALM
communications access for land mobiles

5.2
CI
communication interface

5.3
DVB
digital video broadcast

5.4
FEC
forward error control

5.5
FLO
forward link only

5.6
GNSS
global navigation satellite systems

5.7
ISDB
integrated services digital broadcasting

5.8
MMAE
medium management adaptation entity

5.9
S-DAB
satellite digital audio broadcast

5.10
S-DMB
satellite digital multimedia broadcast

5.11
UDLR
uni-directional link routing

6 Background

6.1 Proprietary and standardized connectivity protocols

There are many terrestrial broadcast transmitters and satellites that provide broadcast services.

Typically these are primarily for entertainment and carry either video or audio but can also provide digital information broadcast services. Additionally global navigation satellite systems (GNSS) broadcast their location and time in order that the receiver can determine its location and the time. The interface to these systems is the subject of this CALM broadcast International Standard.

Terrestrial services include:

a) Sub carrier services carried on FM broadcast entertainment systems
   1) RDS (Radio Data Service)
   2) DARC (Data Radio Channel) ITU-R BS 1194-2.

b) Digital coded audio
   1) DAB – 'Digital Audio Broadcasting' in Europe
   2) $ISDB_{ss}$ (ITU-R BS.1114-6 System F) / (ITU-R BT.1833.multimedia system F)
   3) 'Digital Multimedia Broadcasting' (DMB)
   4) ISDB-T (ITU-R BT.1306-3 System C)/(ITU-R BT.1833 multimedia system C)
   5) SDB-Tmm(ITU-R BS.1114-6 System F)/(ITU-R BT.1306-3 System C)/ (ITU-R BT.1833 multimedia system F)
   6) FLO (ITU-R BT. 1833 multimedia system M)

c) Digital terrestrial TV
   1) DVB as defined by ETSI
   2) DVB-H
   3) ISDB_Tmm
   4) FLO

Satellite services include:

a) S-DAB (Digital Audio Broadcast)
   1) ONDAS
   2) SIRIUS
   3) Worldspace
   4) XM Radio

b) Digital Satellite Television
   1) ISDB-S (ITU-R BO.1408-1) / (ITU-R BO.1516 System D)

c) S-DMB (Satellite Digital Multimedia Broadcast)
   1) Solaris (Eutelsat / SES Astra)
   2) Mobile Broadcasting Corporation

d) GNSS
   1) COMPASS
   2) GALILEO
   3) 'Global Positioning System' (GPS)4) GLONASS
   4) Correction information from reference stations – including networked real time kinematics

NOTE The satellite systems identified above are illustrative. These are proprietary systems and not normative.

New systems are in development and this International Standard has been developed to be able to make full use of those new services.

7 Requirements of the MMAE

7.1 General

The efficient connection of a CALM broadcast receiver requires compliance with a number of related standards. The overall CALM architecture is defined in ISO 21217, which defines how the individual standards operate together to deliver the total functionality. An abstraction of the total architecture is shown in Figure 1 below. The satellite 'Medium Management Adaptation Entity' is an adaptation layer between the broadcast communication system and the 'ITS station management', it uses the generic protocol defined in ISO 25111 and ISO 21218 and in this International Standard. Figure 1 shows only the modules that the broadcast communications system has direct interaction with, and identifies the relevant standards. The requirements from each of these standards will be considered in the following sections, together with consideration of the need to interface to a diverse range of proprietary broadcast technologies.

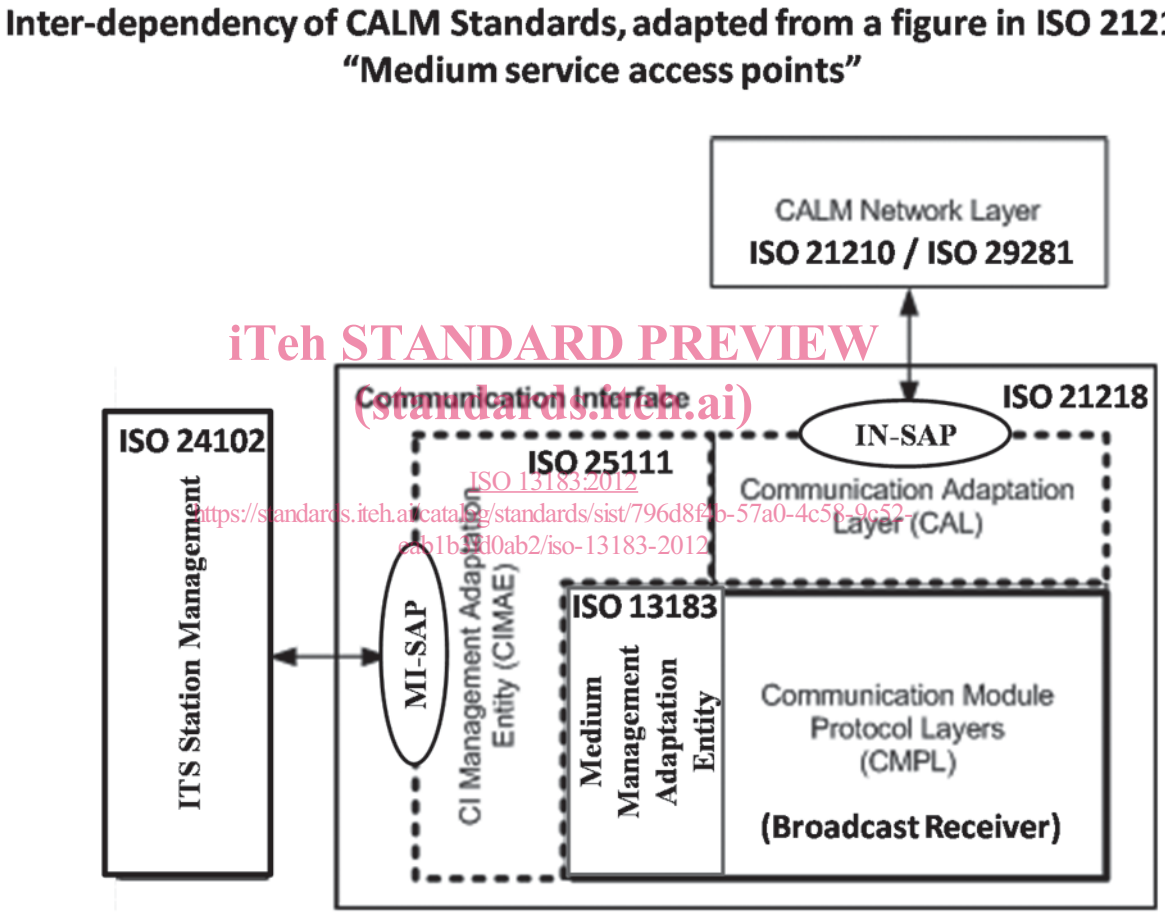

Figure 1 — Interdependency of CALM standards

7.2 Adoption of broadcast standards and internationally adopted practices

Equipment and systems complying with this International Standard shall operate in the environment, regulations and parameters defined for broadcast systems in internationally adopted practices and within the limits and parameters defined in regional and national regulations.

7.3 CALM architecture

Equipment and systems complying with this International Standard shall operate in the environment of, and to the parameters defined within ISO 21217.