INTERNATIONAL STANDARD

ISO 25111

First edition
2009-11-15

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

Reference number
ISO 25111:2009(E)

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

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*.

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.

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.

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.[1)]

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.

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.

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[2)]
MWB	mobile wireless broadband
OBE	on-board equipment

6 Requirements

6.1 Establishment of a medium-specific session

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.

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-wl2 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

operational environment that will itself operate within the International Standards which govern the management of the particular medium.

6.1.3 User controlled sessions

User controlled sessions, where they are permitted, regardless of whether the medium is continuous or time controlled, will operate according to the sequence of a time controlled session, except that the instruction to enable CALM to commence a session (with any specific or all media) is determined by the user. The means by which such user control is effected by the in-vehicle equipment is not determined within this International Standard. The instruction to terminate may originate from the user, or from the CALM Management International Standard (ISO 24102). Within the concept of user controlled sessions it is envisioned that there may be vendor/equipment based options and it is not the intention of this International Standard to propose or standardise such options.

6.1.4 Establishment and termination of a continuous session

In a continuous system, the session using the medium is connected at the earliest opportunity (i.e. when the CALM manager seeks to identify which media options are possible at ignition turn-on). The operational sequence is determined as follows.

a) Establish session with medium in accordance with the relevant CALM International Standard for that medium (e.g. ISO 21212, ISO 21213, ISO 25112, ISO 25113, ISO 29282, ISO 29283).

b) Subsequently establish CALM session as determined by the CALM management (ISO 24102) and CALM IPv6 networking (ISO 21210) International Standards.

c) A session with medium shall be terminated when ignition is switched off, i.e. the communication interface state “not-existent” (see ISO 21218) is reached.

6.1.5 Establishment and termination of a time controlled session

In a time controlled system the operational sequence is as follows.

a) CALM management (ISO 24102) identifies if the communication interface is available.

b) A CALM session is established as determined by CALM management (ISO 24102) and CALM IPv6 networking (ISO 21210) International Standards (with all media possibilities).

c) The CALM management (ISO 24102) monitors the continuing availability of the communication interface.

d) Each time that the CALM LL-SAP (ISO 21218) wishes to use the specific communication interface, a session with the communication interface is established in accordance with the procedures in ISO 24102 and the standards within which the specific public wireless network operates.

e) When the transaction is completed the CALM management (ISO 24102) instructs using CALM IPv6 networking (ISO 21210) to terminate the session with the medium, which is achieved by deletion of all virtual communication interfaces (ISO 21218). As a result the communication interface shall return to the state “registered”.

6.1.6 Establishment and termination of a user controlled session

The system shall establish a communication session only upon instruction by the user of the vehicle and shall disconnect a communication session immediately upon instruction from the user regardless of whether the system is of a continuous or time controlled type. Such systems shall operate in accordance with the procedures determined in 6.1.4.

6.2 Adoption of other standards and internationally adopted practices

Equipment and systems complying with this International Standard shall operate in the environment of, and to the parameters defined for, public wireless networks in one of the standards and internationally adopted practices referenced/specified in the CALM International Standard for the particular public wireless network.

6.3 Operational context

6.3.1 Horizontal handover capability

Systems claiming compliance with this International Standard would ideally be public mobile wireless networks, i.e. wireless broadband systems supporting communication sessions between user terminals and land mobile network points in which handover of sessions as the user terminals move between access points is supported.

NOTE ITS-specific services at 5,9 GHz are within the scope of ISO 21215, millimetre wave systems are within the scope of ISO 21216, and infrared systems are within the scope of ISO 21214.

6.3.2 Nomadic networks

Local area public wireless networks that support nomadic wireless systems, without heterogeneous or homogeneous handover [e.g. IEEE 802.11 variants, non-IEEE 802.16e variants of IEEE 802.16 (i.e. those variants that do not support heterogeneous handover, etc.)] cannot claim compliance to this International Standard. However, in-vehicle equipment that is able to connect to and use these networks, within the limitation of the range of the supported cell, may use the provisions of this International Standard to provide a CALM connection to these networks while operating within their read zone.

EXAMPLE WiFi zones at service stations are nomadic networks.

NOTE Fixed wireless broadband systems are outside the scope of this International Standard.

6.3.3 Communication and application session management

Communication session connection/disconnection shall be performed according to the methods specified in the relevant public wireless network standards, and shall be sequenced according to the provisions of 6.1.3, 6.1.4 and 6.1.5.

CALM *application* sessions shall not attempt communication over the candidate public wireless network until the associated communication session has been initiated. Once a communication session has been established, the CALM application session shall be transacted in accordance with the provisions of the relevant CALM medium International Standard in respect of operation in an ITS environment (and any standards for the generic use of the medium) and in accordance with the requirements of the CALM manager and networking protocols determined in the relevant CALM International Standards

Once the session is operational, communications over the public wireless network medium may continue until a disconnect command is issued by the CME and the timing of such instruction shall depend on whether the session is of a time controlled or continuous type (see 6.1.3, 6.1.4 and 6.1.5), or a disconnect event is announced by the interface manager defined in CALM manager (loss of communications link).

Communication sessions shall be terminated by one of the two following methods.

a) Medium-dependent method: the communication session shall be terminated by the medium upon detection of loss of signal as specified by the equipment manufacturer. Notification of this event shall be sent to the CME immediately.

b) User controlled method: the system shall disconnect a communication session immediately upon instruction from the user.

The method and options available to the user to connect/disconnect to/from a communication session are not specified in this International Standard and shall be determined by the in-vehicle systems/equipment. Such provisions may be manual or automatic and if automatic shall be triggered by events that are determined by parameters predetermined in the manufacture of in-vehicle equipment or predetermined by parameters determined within ISO 21217 (CALM system architecture) and ISO 21210 (CALM IPv6 networking).

6.3.4 Architectural context

CALM communications via public wireless networks shall operate within and conform to the requirements of ISO 21217. Figure 1 provides an overview of that architecture. See ISO 21217 for operational details.

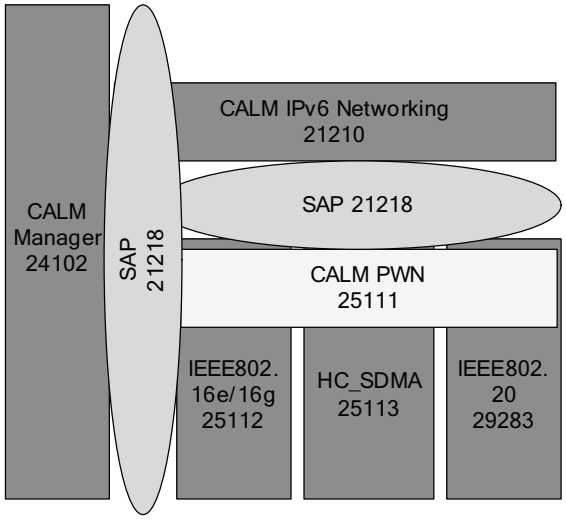

Figure 1 — CALM high level system architecture as it relates to public wireless networks

6.3.5 Networking context

CALM communications via public wireless networks shall operate within and conform to the requirements of ISO 21210. Figure 1 also shows the role of networking within the CALM architecture. See ISO 21217 for operational details.

6.4 Parameter definition

The physical layer parameters are defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

6.5 Spectrum management

Spectrum management is defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards and shall operate within local regulations.

The mobile on-board equipment (OBE) intended for open, global use shall be configurable when moving between regulatory jurisdictions. This configuration shall be performed automatically and securely.

OBEs may also be configured for local/regional use only. Such units need only follow the relevant national/regional requirements.

The automatic configuration shall be performed in accordance with the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

6.5.1 Spectrum

Spectrum parameters and limits shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards and other associated national and International Standards and regulations.

6.5.2 Transmitted power

Transmitted power parameters and limits shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards and shall be operated within local regulations.

6.5.3 Access methods

Access methods shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

6.5.4 Data rate

Data rates and the availability of such information to the CME shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific national and International Standards. The system shall report its achieved data rates to the CME in accordance with procedures defined in ISO 21210 (CALM IPv6 networking) within the constraints of the availability of such information (which can vary from operator to operator). It shall be the responsibility of the CALM equipment manufacturer to design equipment to collect and send current available data rate information to the CME; the manufacturer is given flexibility as to how this is achieved.

6.6 Layer management

Layer management shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

6.7 PHY configuration

PHY configuration shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

7 Medium access control (MAC)

Medium access control shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

8 Service access point (SAP)

Service access point requirements shall support ISO 21218 (CALM medium service access points).

9 CALM public wireless network manager

9.1 CALM public wireless network manager functionality

The *public wireless network manager* function is to support and provide the functionality offered by the management SAP (as defined in ISO 21218).

9.2 CALM public wireless network manager functions

The means of achieving the CALM public wireless network manager functions will vary according to the services offered by the communications service provider agreements and built into the devices. A system overview, sequence diagrams and state transition diagrams are given in Annex A.

Those implementing such devices shall be responsible for product-specific design solutions; however, the following manager functions shall always be supported.

9.2.1 Initialisation

There shall be a routine which commences the public wireless network function within a device.

9.2.2 Establish session

There shall be a routine which sets up and commences a public wireless network communication session with a public wireless network service provider.

9.2.3 Establish IPv6

There shall be a routine which sets up and commences a link to an IPv6 packet service connected to the public Internet.

9.2.4 Monitor changing status

There shall be a routine which monitors the medium status for a communication link.

If the status of the medium changes, the CALM manager shall be notified and the current status registered with the CALM manager.

10 Test and conformance requirements

10.1 Test and conformance requirements for public wireless network equipment shall be defined by reference to the relevant International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific national and International Standards.

10.2 Test and conformance requirements in respect of networking protocols shall be defined in accordance with ISO 21210 (CALM IPv6 networking) and ISO 21217 (CALM architecture).

11 Marking, labelling and packaging

All transmitting equipment is to be clearly and permanently marked, stating with which national regulations it complies.

All transmitting equipment is to be provided with clear instructions as to tuning and adjustment to meet the regulations of the country or countries in which it is to be used.

All transmitting equipment is to be clearly and permanently marked to indicate which CALM interfaces it supports.

All transmitting equipment is to be clearly and permanently marked to instruct that it shall only be used when adjusted to meet pertinent national radio regulations for the frequencies at which it operates.

12 Declaration of patents and intellectual property

Patents and intellectual property used in public wireless network communications may be obtained by reference to the relevant International Standard(s) and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific International Standards.

Any patents and intellectual property associated with CALM architecture are given in ISO 21217.

Any patents and intellectual property associated with CALM IPv6 networking are given in ISO 21210.

Any patents and intellectual property associated with CALM lower-layer service access protocols are given in ISO 21218.

Patents and intellectual property used in public wireless network communications can be obtained by reference to the relevant CALM media International Standards, other standards and recommendations provided in 6.1 and their subsidiaries and the associated medium-specific national and International Standards.

Annex A
(normative)

System overview, sequence and state diagrams

Figure A.1 shows an overview of a mobile public wireless network system. There are multiple access points (RSUs) to the backbone system, and there are potentially multiple mobile stations within each read zone.

Note that the access point, generally known in ITS circles as a roadside unit (RSU), may be physically located at the roadside at regular intervals, or may be some distance from the roadside, as in 2G/3G and in particular with mobile wireless broadband.

The mobile stations, commonly known as *on-board equipment* (OBE) or *on-board units* (OBU), will most commonly be equipment in a car, but may be equipment on a motorcycle, commercial vehicle, personal data assistant/phone held by a pedestrian, or a piece of remotely located infrastructure equipment such as a mobile variable message sign located at the scene of an accident or roadworks.

Whereas a nomadic wireless system (such as Bluetooth or IEEE 802.11 a/b/c/g/n) operates only within a single access point cell, a mobile wireless system has the capability to transfer (seamlessly from the user's view) the user from one cell to another.

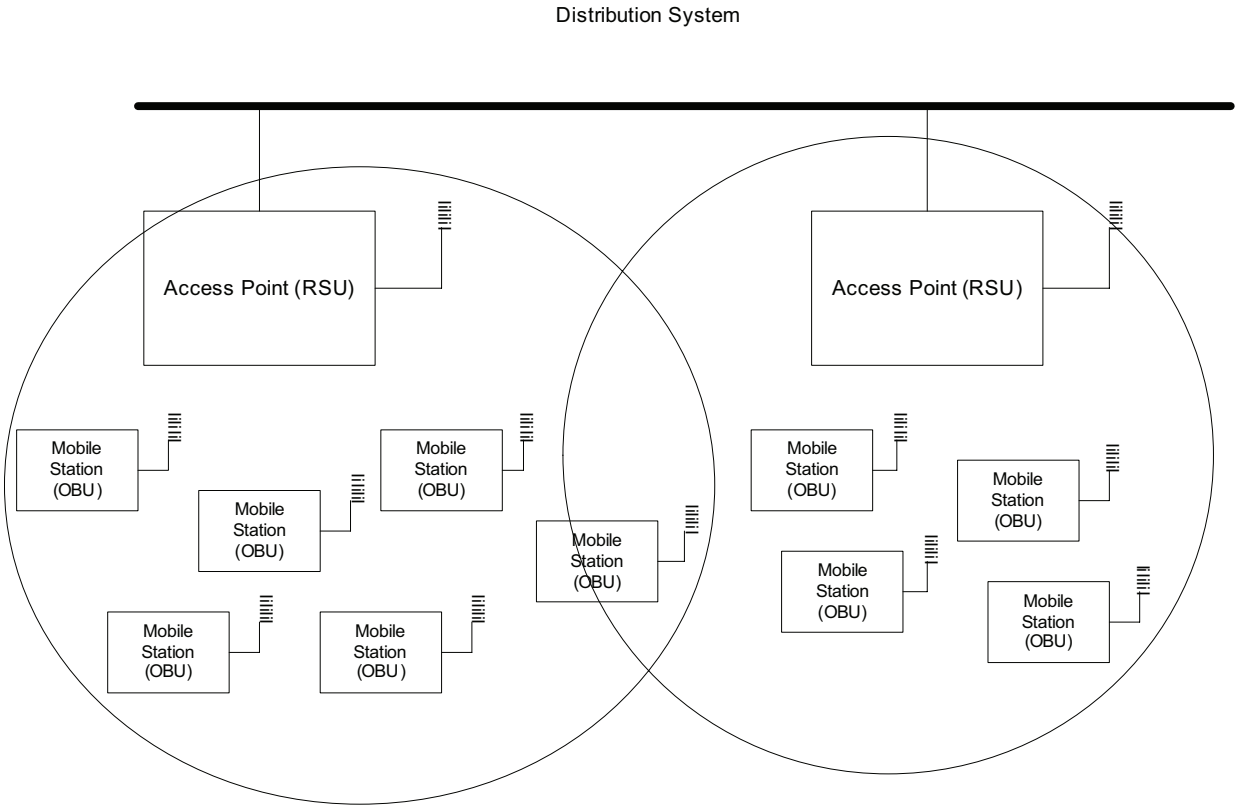

Figure A.1 — Overview of a mobile wireless communications system

Figure A.2 shows a state transition diagram for the connection to, service provision and disconnection of a communications transaction using this International Standard combined with one of the medium-specific CALM standards.

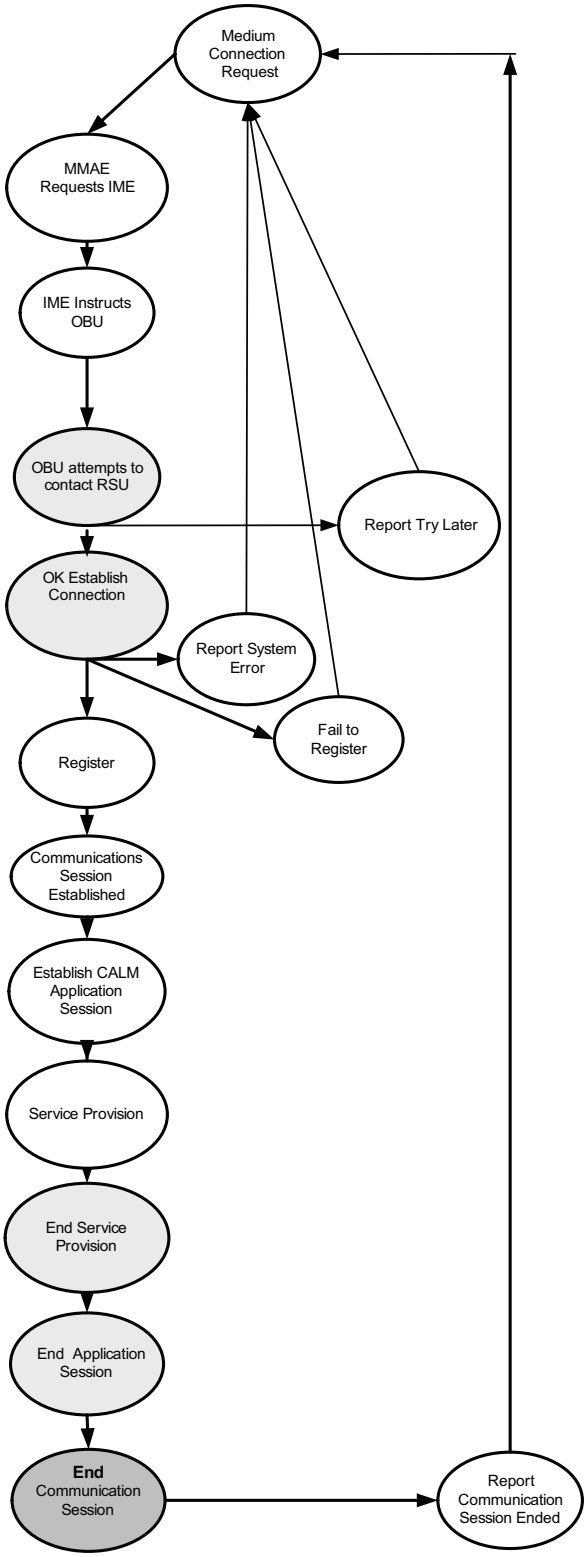

Figure A.2 — State transition diagram (user controlled example)

Figure A.3 provides a sequence diagram for the communications transaction.

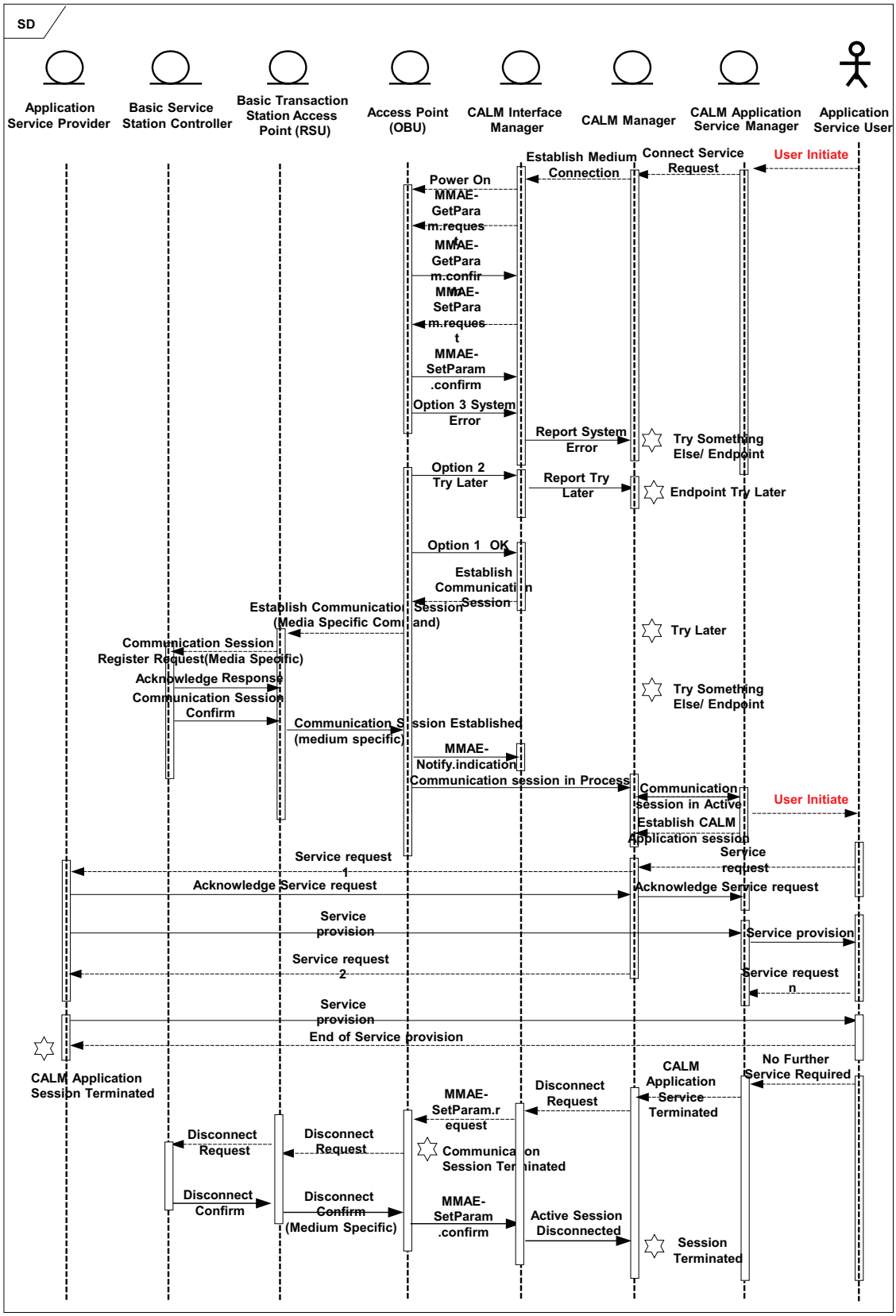

Figure A.3 — Sequence diagram (user controlled example)

Figure A.4 (shown on two pages for legibility) shows the sequence diagram and state transition diagram side by side.

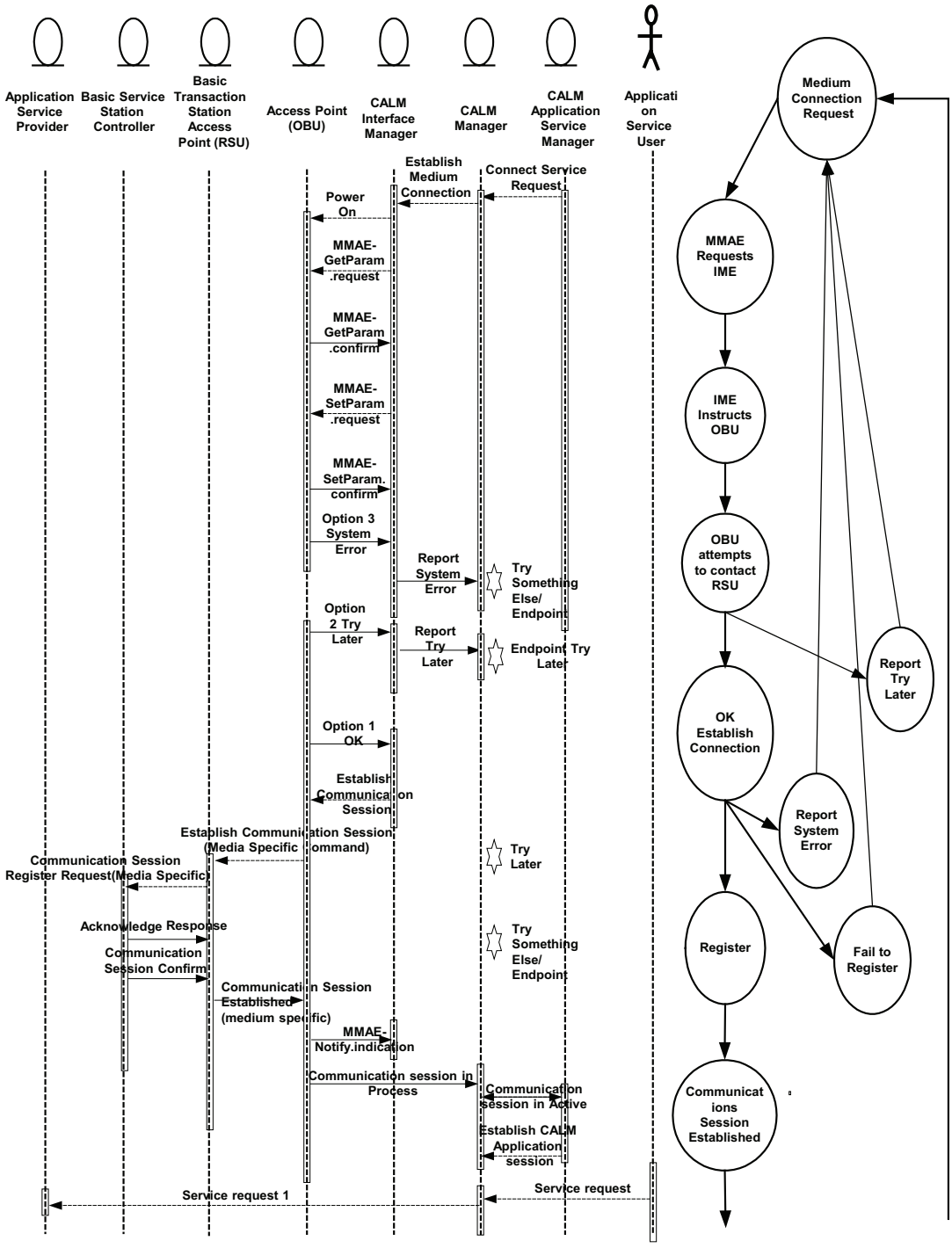

Figure A.4 — Sequence and state transition diagram (user controlled example)

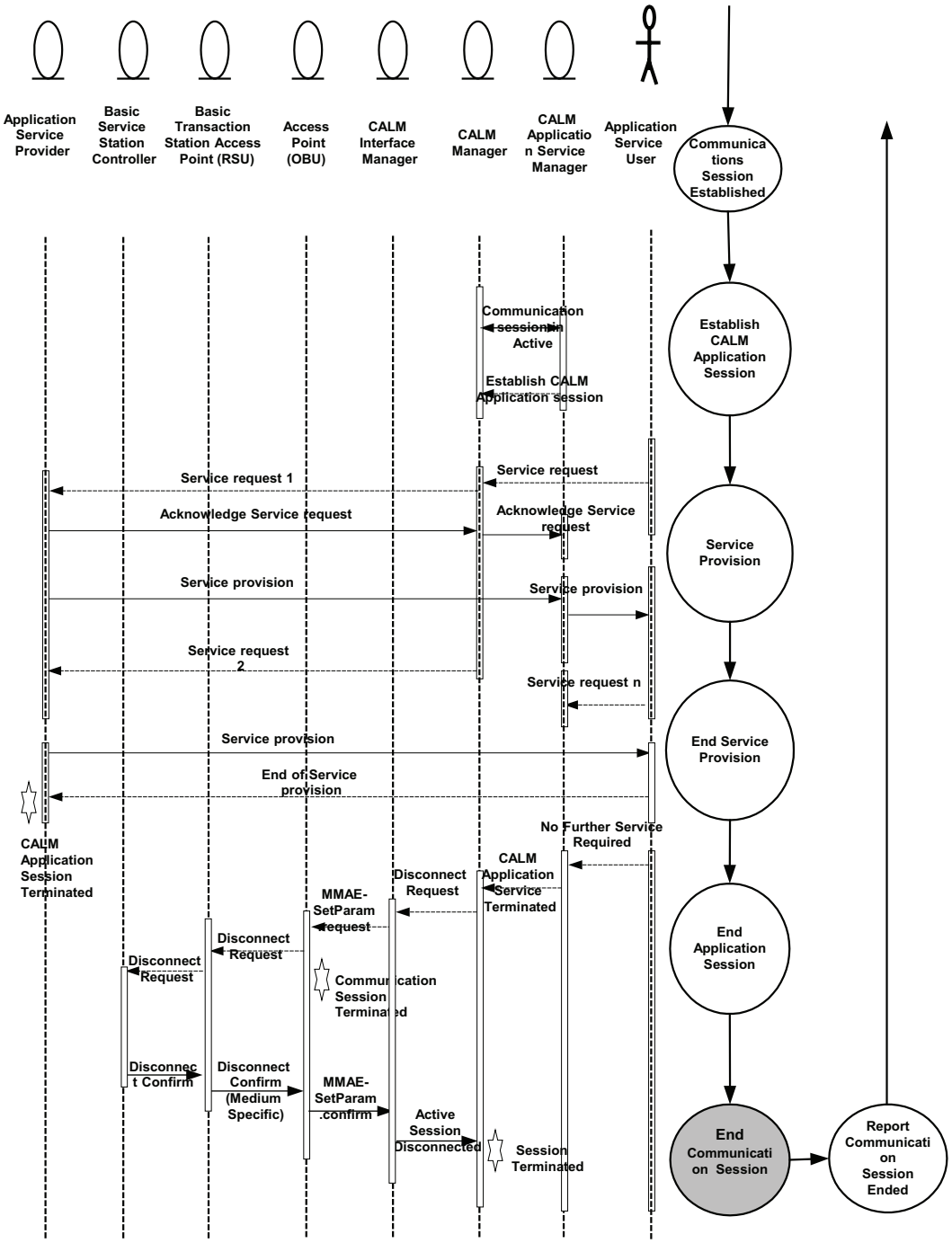

Figure A.4 (*continued*)

Bibliography

[1] ISO 21212, *Intelligent transport systems — Communications access for land mobiles (CALM) — 2G Cellular systems*

[2] ISO 21213, *Intelligent transport systems — Communications access for land mobiles (CALM) — 3G Cellular systems*

[3] ISO 21214, *Intelligent transport systems — Communications access for land mobiles (CALM) — Infra-red systems*

[4] ISO 21215, *Intelligent transport systems — Communications access for land mobiles (CALM) — CALM M5*

[5] ISO 21216, *Intelligent transport systems — Wireless communications — CALM using millimetre communications*

[6] ISO 25112, *Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband using IEEE 802.16e/IEEE 802.16g*

[7] ISO 25113, *Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband using high capacity spatial division multiple access (HC-SDMA)*

[8] ISO 29282, *Intelligent transport systems — Communications access for land mobiles (CALM) — Applications using satellite networks*

[9] ISO 29283, *Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband applications using communications in accordance with IEEE 802.20*

[10] ANSI/ATIS 0700004-2007, *High Capacity-Spatial Division Multiple Access (HC-SDMA) Radio Interface Standard*

[11] Bluetooth SIG, Inc., *Specification of the Bluetooth system* (Available at http://www.bluetooth.com)

[12] IEEE 802.11, *IEEE Standard for 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*

[13] IEEE 802.16, *IEEE Standard for Local and metropolitan area networks — Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems*

[14] IEEE 802.16e, *IEEE Standard for Local and metropolitan area networks — Part 16: Amendment for Physical & Medium Access Control Layers for Combined Fixed & Mobile Operation*

[15] IEEE 802.16g, *IEEE Standard for Local and metropolitan area networks — Part 16: Air Interface for Fixed Broadband Wireless Access Systems Amendment 3: Management Plane Procedures and Services*

[16] IEEE 802.20, *IEEE Standard for Local and metropolitan area networks — Part 20: Air Interface for Mobile Broadband Wireless Access Systems Supporting Vehicular Mobility — Physical and Media Access Control Layer Specification*

[17] ITU-R F.1399, *Vocabulary of terms for wireless access*

ICS 03.220.01; 35.240.60

Price based on 17 pages