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Intelligent transport systems — Evolved universal terrestrial radio access network (E-UTRAN) —

Part 2: Device to device communications (D2D)

Systèmes intelligents de transport — Réseau d'accès à la radio terrestre universelle évoluée (E-UTRAN) —

Partie 2: Communications directe entre appareils (D2D)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 17515 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Localized communications are an essential component of hybrid communications in Intelligent Transport Systems (ITS). Various access technologies are suited for localized communications. An increasing interest from ITS stakeholders in "Cooperative ITS" and "Urban ITS" is focussed on the access technology known as LTE, which refers to a packet switched cellular network technology specified by 3GPP. In addition to the "traditional" features of cellular networks, LTE also supports device-to-device communications (LTE-D2D) which can be efficiently used for ITS.

This document provides complements to LTE-D2D specifications from 3GPP needed to operate it as an ITS access technology in an ITS station unit as specified in ISO 21217. An implementation of this document is referred to as an ITS-LTE-D2D communication interface (CI).

ITS-LTE-D2D CIs are capable of:

— operating with the support of an LTE base station, and

— operating without the support of an LTE base station, e.g. outside an LTE coverage area,

as specified by 3GPP.

Intelligent transport systems — Evolved universal terrestrial radio access network (E-UTRAN) —

Part 2:
Device to device communications (D2D)

1 Scope

This document provides specification on the ITS-Station (ITS-S) access layer for a communication interface (CI) named "ITS-LTE-D2D".

This specification is appropriate in the context of LTE-D2D communications that are being used for the dissemination of ITS information from an ITS-SU to other ITS-SUs, where these ITS-SUs can be either vehicle ITS-SUs, roadside ITS-SUs, or personal ITS-SUs, as specified in ISO 21217. It provides a combination of options from relevant ETSI/3GPP releases and ITS-station management standards in ISO 24102 to enable and achieve this objective.

ITS-LTE-D2D CIs are based on the evolved-universal terrestrial radio access network (E-UTRAN) device-to-device (LTE-D2D) technology standardized at 3GPP Release 13.

This document enables the use of the LTE-D2D technology as an ITS access technology in an ITS station by reference to respective specifications from 3GPP, and by specifying details of the Communication Adaptation Layer (CAL) and the Management Adaptation Entity (MAE) of CIs specified in ISO 21218.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER) — Part 2*

ISO 21218, *Intelligent transport systems — Hybrid communications — Access technology support*

ISO 24102-3, *Intelligent transport systems — ITS station management — Part 3: Service access points*

3GPP TS 23.303, *3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Proximity-based services (ProSe); Stage 2 (Release 13)*

3GPP TS 24.334 V15.1.0, *3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Proximity-services (ProSe) User Equipment (UE) to ProSe function protocol aspects (Release 13)*

3GPP TS 36.300, *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 13)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
SideLink
UE to UE interface for direct communication between two or more nearby UEs

Note 1 to entry: The Sidelink corresponds to the *PC5* (3.2) interface as defined in 3GPP TS 23.303.

[SOURCE: 3GPP TS 36.300]

3.2
PC5
reference point between ProSe-enabled UEs used for control and user plane for ProSe Direct Discovery and ProSe Direct Communication

Note 1 to entry: The lower protocol layers of the PC5 reference point can be based on E-UTRA *SideLink* (3.1) capabilities.

[SOURCE: 3GPP TS 36.300]

4 Symbols and abbreviated terms

CAL	communication adaptation sub-layer
CI	communication interface
D2D	device-to-device
eNB	evolved node B
E-UTRA	evolved universal terrestrial radio access
E-UTRAN	evolved universal terrestrial radio access network
HSS	home subscriber subsystem
ITS	intelligent transport systems
ITS-SU	ITS station unit
LCID	logical channel identifier
MAE	management adaptation entity
PPPP	ProSe per packet priority
ProSe	Proximity based service
RNTI	radio network temporary identifier
SL	SideLink
SL-RNTI	SideLink RNTI
SL-SCH	SideLink shared channel

UE user equipment (mobile LTE device)

UM unacknowledged mode

VCI virtual CI

5 Usage of LTE in ITS

5.1 LTE features used in ITS

The LTE network is a packet-switched cellular network specified by 3GPP. It provides features that may be used in ITS station units (ITS-SUs), namely device-to-device communications (D2D) as described in 5.2.

5.2 Device-to-device communications (D2D)

D2D communications in LTE (LTE-D2D) are possible via LTE interface, i.e. the LTE PC5 (UE-UE) communications interface.

The initial primary purpose of LTE-D2D communications identified so far by 3GPP provides proximity services by using direct communications between UEs, see 3GPP TS 36.300, for example. LTE-D2D communications can be used for the dissemination of ITS information from an ITS-SU to other ITS-SUs: see 3GPP TR 23 303, for example, where these ITS-SUs can be either vehicle ITS-SUs, roadside ITS-SUs, or personal ITS-SUs as specified in ISO 21217.

PC5 is an interface between UE to UE used for direct communications in an LTE-D2D network. In PC5 communications, information dissemination goes directly from a UE to other UEs.

PC5 communications are also referred to as SideLink communications. Two operational modes of SideLink communications exist:

— operator managed;

  1) with dynamic scheduling of resources;

  2) without dynamic scheduling of resources;

— non-operator managed.

Table 1 shows the operational modes of E-UTRAN D2D.

Table 1 — Operational modes of E-UTRAN D2D

	Served by E-UTRAN	**Not served by E-UTRAN Out-of-coverage**
Scheduled mode (Mode 1)	eNB indicates the physical radio resource to be used on a UE-specific basis	N/A
Autonomous mode (Mode 2)	A UE on its own selects radio resource from resource pools allocated on a non-UE specific basis	A UE on its own selects radio resource from resource pools allocated on a non-UE specific basis
	eNB indicates the physical resource pool configuration (via SIB or RRC signalling)	eNB indicates the physical resource pool configuration (via SIB or RRC signalling)

In the operator-managed mode, the UE may either use communication resources scheduled by the LTE network or select resources autonomously among resources which are pre-configured by the LTE network; these resources are reserved for data communications of the LTE-D2D CI.

In accordance with ETSI/3GPP, the non-operator managed mode, the UE may on its own select resources among pre-configured resources which are stored in UEs.

In D2D communications, there exist 4 types of scenarios.

a) Scenario A (see Figure 1) can be used for non-operator managed D2D communication where UEs are located out of LTE network coverage.

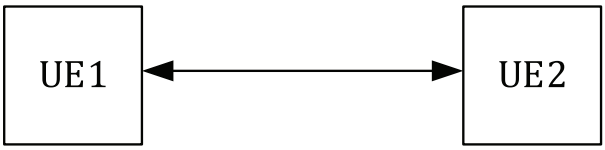

Figure 1 — D2D scenario A

b) Scenario B (see Figure 2) can be used for non-operator managed D2D communication where one of UE is located out of LTE network coverage. Also, it can be used for ProSe UE-to-Network Relay communication which supports LTE network connectivity to UEs located out of LTE network coverage.

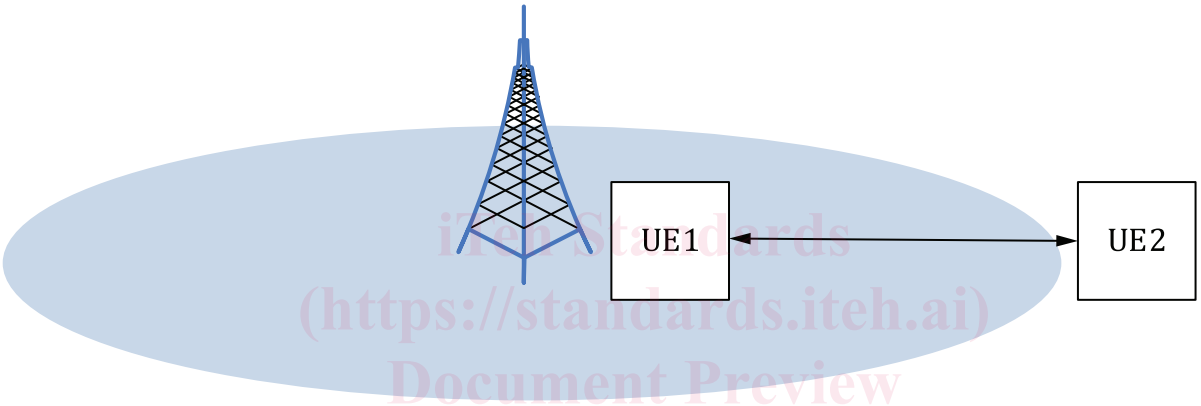

Figure 2 — D2D scenario B

c) Scenario C (see Figure 3) is for operator managed D2D communication in one LTE base station.

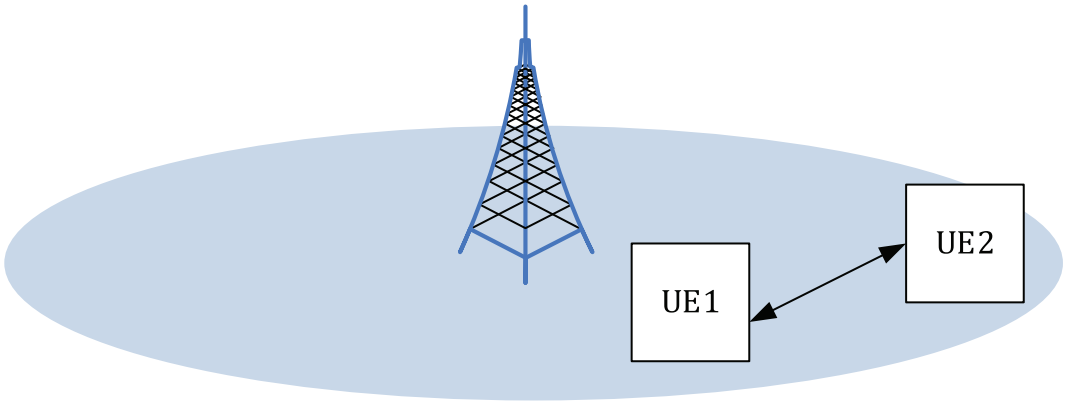

Figure 3 — D2D scenario C

d) Scenario D (see Figure 4) is for operator managed D2D communication in different LTE base stations.

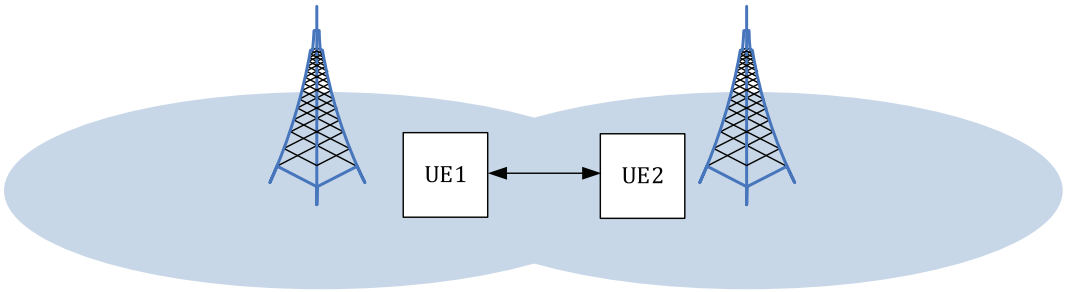

Figure 4 — D2D scenario D (3GPP 36.843)

In this document, D2D scenarios A, B, and C are considered and specifications for use in the C-ITS context are provided.

5.3 D2D communication basics

5.3.1 General

In D2D communications, in accordance with 3GPP 36.300, the UE supporting SideLink communication can operate in two modes for resource allocation:

— Scheduled resource allocation is characterized by:

  — UE requests resources for SideLink communication to the eNB. The eNB schedules resources for transmission of SideLink control information and data;

  — UE receives the scheduled resource for SideLink communication and transmits Sidelink control information and data via the resource.

— UE autonomous resource selection is characterized by:

  — A UE on its own selecting resources among pre-configured resources. Sidelink communication is performed by managing Sidelink control information and data.

5.3.2 User plane

Figure 5 shows the protocol stack for the user plane, where PDCP, RLC, MAC, and PHY sublayers (terminated at the UE) perform the functions for the user plane.

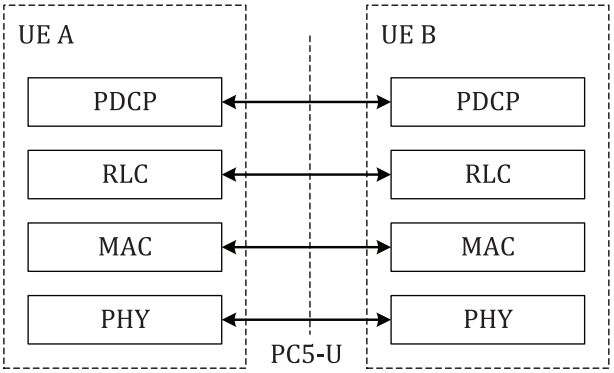

Figure 5 — User-Plane protocol stack for SideLink communication