

# ETSI ES 202 663 V1.1.0 (2010-01)

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ETSI Standard

## Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band

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## Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Intelligent Transport System (ITS).

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## Introduction

Intelligent Transport Systems (ITS) are being developed in all regions by standard institutes, industry initiatives and research activities.

The present document provides the European profile standard for communications in the 5 GHz band. The work is based on the published IEEE standard 802.11 [3] and on developments at IEEE on the amendment 802.11p [i.5].

The functionality specified in the present document is named "ITS-G5" and distinguishes several frequency ranges. It covers the physical layer and parts of the data link layer, i.e. the medium access control sub-layer and extensions to handle parameters of these layers to be used on a per-MSDU basis, including the related management.

# 1 Scope

The present document specifies the European profile in line with [i.10] of the physical and medium access control sub-layer of 5 GHz intelligent transport systems (ITS) using IEEE 802.11 [3] as the base standard. It covers the frequency ranges:

- ITS-G5A: Operation of ITS-G5 in European ITS frequency bands dedicated to ITS for safety related applications in the frequency range 5,875 GHz to 5,905 GHz.
- ITS-G5B: Operation in European ITS frequency bands dedicated to ITS non- safety applications in the frequency range 5,855 GHz to 5,875 GHz.
- ITS-G5C: Operation of ITS applications in the frequency range 5,470 GHz to 5,725 GHz.

One of the additionally selected functionalities being an essential part of the present document is "communication outside the context of a BSS" as currently being developed by IEEE 802.11 Task Group p [3].

Communication outside the context of a BSS enables exchange of data frames between stations that are not members of a BSS. This type of communication allows for immediate exchange of data frames, avoiding the latency associated with the establishment of a BSS.

The present document covers the following IEEE 802.11 [3] services:

- spectrum management services (DFS, uniform spreading) for ITS-G5C;
- transmit power control;
- traffic differentiation and QoS support;
- selected MAC data services: DCF, EDCA, fragmentation/de-fragmentation (the latter only for ITS-G5C);
- selected MAC control services: ACK, RTS, CTS;
- selected MAC management services: selected action frames (spectrum management action frames);
- OFDM PHY.

The profile excludes the following IEEE 802.11 [3] features:

- association services;
- access control and data confidentiality services;
- higher-layer timer synchronization;
- selected MAC data services, i.e. PCF, HCF HCCA;
- selected MAC control services, i.e. PS-Poll, CF-End, CF-End + CF-Ack, Block Ack Request/Block Ack;
- selected MAC management services, i.e. beacon, ATIM, disassociation, association request/response, re-association request/response, probe request/response, authentication, de-authentication, selected action (measurement request/report);
- power management services.

## 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
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### 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI EN 302 571 (V1.1.1): "Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [2] ETSI EN 301 893 (V1.5.1): "Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [3] IEEE 802.11:2007: "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".

NOTE: Amendments to this standard are considered in [i.1] and [i.2] which are essential to understand the sources from which some of the functionality in the present document is derived.

- [4] IEEE Std 802-2001: "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture".
- [5] ANSI/IEEE Std 802.2:1998: "Information technology -- Telecommunications and information exchange between systems -- Local and metropolitan area networks -- Specific requirements -- Part 2: Logical Link control".
- [6] ISO/IEC 7498-1:1994: "Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model".
- [7] ITU-T Recommendation X.691 (2002): "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".
- [8] IEEE P802.11k (2008): "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 Amendment 1: Radio Resource Measurement of Wireless LANs".

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.3] ETSI TR 102 654 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Co-location and Co-existence Considerations regarding Dedicated Short Range Communication (DSRC) transmission equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range and other potential sources of interference".
- [i.4] ETSI EN 300 674 (all parts): "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Technical characteristics and test methods for Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band".
- [i.5] IEEE P802.11pTM/D8.0:2009: "Draft 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; Amendment 7: Wireless Access in Vehicular Environments".
- [i.6] ECC/DEC/(08)01: "ECC Decision of 14 March 2008 on the harmonised use of the 5875-5925 MHz frequency band for Intelligent Transport Systems (ITS)".
- [i.7] ECC/REC/(08)01: "ECC Recommendation (08)01 on the use of the band 5855-5875 MHz for Intelligent Transport Systems (ITS)".
- [i.8] ERC/DEC(99)23: "ERC Decision of 29 November 1999 on the harmonised frequency bands to be designated for the introduction of High Performance Radio Local Area Networks (HIPERLANs)".
- [i.9] ECC/DEC(02)01: "ECC Decision of 15 March 2002 on the frequency bands to be designated for the co-ordinated introduction of Road Transport and Traffic Telematic Systems".
- [i.10] ETSI ETS 300 406 (edition 1): "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [i.11] Commission Decision 2005/513/EC of 11 July 2005 on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs).
- [i.12] Commission Decision 2007/90/EC of 12 February 2007 amending Decision 2005/513/EC on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs).
- [i.13] Commission Decision 2008/671/EC of 5 August 2008 on the harmonised use of radio spectrum in the 5 875-5 905 MHz frequency band for safety-related applications of Intelligent Transport Systems (ITS).
- [i.14] ETSI TS 102 687 (V1.1.1): "Intelligent Transport Systems (ITS); Transmitter Power Control Mechanism for Intelligent Transport Systems operating in the 5 GHz range".
- [i.15] ETSI TS 102 723-3: "Intelligent Transport Systems; OSI cross-layer topics; Part 3: Interface between management entity and access layer".
- [i.16] ETSI TS 102 665 (V1.1.1): "Intelligent Transport Systems (ITS); Vehicular Communications; Architecture".



## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in [1], [2], [3], [4], [5], [6], [7], [8], [i.17] and the following apply:

**ITS-G5:** set of protocols and parameters as specified in the present document

**ITS-G5 Control Channel:** physical channel as defined in clause 5.3

**ITS-G5 Service Channel:** any other physical channel than the ITS-G5 Control Channel as defined in clause 5.3

**ITS-G5 STA:** device that contains an ITS-G5

### 3.2 Symbols

For the purposes of the present document, the following symbols apply:

'00101100'b notation used for numeric values presented in binary numeral system

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in [1], [2], [3], [4], [5], [6], [7], [8], [i.18] and the following apply:

DCC	Decentralized Congestion Control
G5CC	ITS-G5 Control Channel
G5SC	ITS-G5 Service Channel
ITS-G5A	Frequency band ranging from 5,875 GHz to 5,905 GHz

NOTE: Dedicated to ITS for safety related applications.

ITS-G5B	Frequency band ranging from 5,855 GHz to 5,875 GHz
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NOTE: Dedicated to ITS non-safety applications.

ITS-G5C	Frequency band ranging from 5,470 GHz to 5,725 GHz
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NOTE: Used for ITS applications.

## 4 General requirements

### 4.1 ITS station reference architecture

Figure 1 shows the part of the ITS AL that is covered by the present document. It is based on the OSI layered communications model with a detailed view of the ITS Access Technology layer. The mapping between the ITS-G5 elements specified in the present document and the ITS AL model is shown in figure 1.

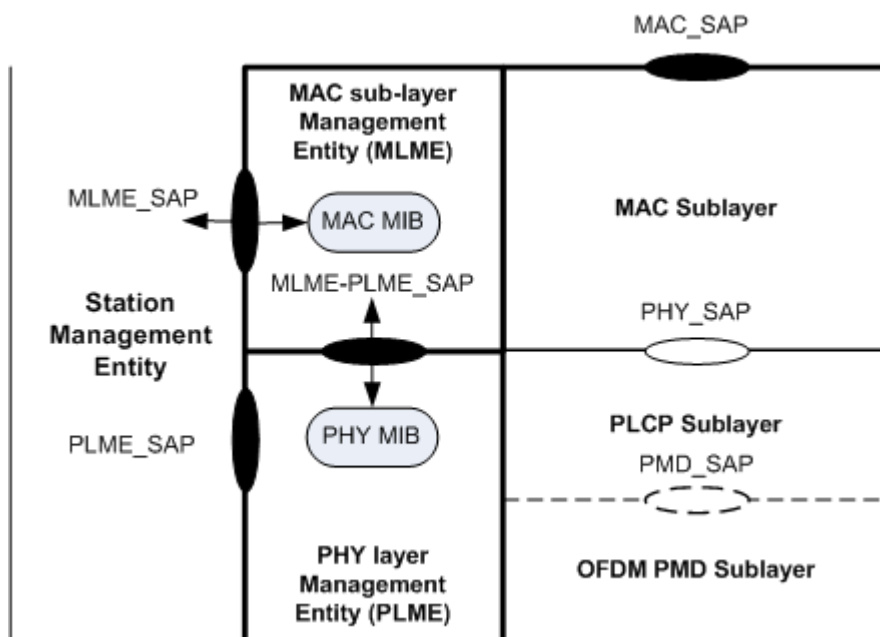


Figure 1: Access layer with ITS-G5 MAC and PHY

The present document specifies the following elements of ITS-G5: a physical layer, a medium access control sub-layer, a MAC sub-layer Management Entity (MLME) and a Physical Layer Management entity (PLME). ITS-G5 also includes the SAPs MAC\_SAP and MLME\_SAP (depicted in black in figure 1). The internal SAPs PHY\_SAP and PMD\_SAP (depicted in white in figure 1) are not part of ITS-G5 specification, which implies that an ITS-G5 STA may not implement these SAPs. However, a STA implementing these SAPs in compliance with 802.11 [3] is also considered compliant to ITS-G5.

In figure 1 the ITS-G5 physical layer is composed of the two sub-layers PLCP and PMD. The distinction of the two sub-layers is only presented for homogeneity with [3]. In fact, ITS-G5 only supports the OFDM PHY specification. Consequently, ITS-G5 STAs may not have the two sub-layers PLCP and PMD and, instead, may have one single physical layer.

As compared to [3], ITS-G5 does not provide the SME-PLME\_SAP. Consequently, only the MLME can access the PHY MIB via the MLME-PLME\_SAP. The MLME-PLME\_SAP is therefore part of ITS-G5 (see annex D).

The MLME SAP can be identical to the MI-SAP in [i.16].

NOTE: The general approach is going to be described in TS 102 723-3 [i.15].

ITS-G5 MAC\_SAP, MLME\_SAP and MLME-PLME\_SAP shall be compliant with the correspondent SAPs of IEEE 802.11 [3] with restrictions and amendments as specified in the present document. In particular, the present document specifies amendments to the MAC\_SAP (see annex C), whereas the ITS-G5 MLME\_SAP (see annex D) is a subset of the IEEE 802.11 [3] MLME\_SAP. No amendments nor subset are specified for the MLME-PLME\_SAP.

With respect to the ITS AL model depicted in figure 1, ITS-G5 MLME\_SAP is the subset of the IM-SAP that represents the management SAP for ITS-G5 interfaces. The MAC\_SAP is not matched by a correspondent SAP in the ITS AL model. The MAC\_SAP is used by the ITS-G5 LLC layer that is out of scope of the present document.

## 4.2 ITS-G5 mode of operation

An ITS-G5 STA shall operate outside the context of a BSS.

NOTE: The mode of operation outside the context of a BSS is drafted in [i.5]. Consequently, the MAC services SCAN, JOIN, ASSOCIATE, AUTHENTICATE are not applicable.

All ITS-G5 STAs operating on ITS-G5A and ITS-G5B are treated equally as peer stations, disregard whether they are fixed or mobile.