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Inteligentni transportni sistemi (ITS) - Dostopovna plast ITS-G5 v frekvenčnem pasu 5 GHz, izdaja 2

Intelligent Transport Systems (ITS) - ITS-G5 Access layer in the 5 GHz frequency band, Release 2

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ITS-G5 Access layer in the 5 GHz frequency band;**

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

National transposition dates

Date of adoption of this EN:	SIST EN 303 797 V2.1.1:2024	13 February 2024
Date of latest announcement of this EN (doa):		31 May 2024
Date of latest publication of new National Standard or endorsement of this EN (dop/e):		30 November 2024
Date of withdrawal of any conflicting National Standard (dow):		30 November 2024

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

The present document outlines the two lowest OSI layers - physical layer and data link layer - for the Cooperative ITS (C-ITS) direct ITS-S to ITS-S wireless AdHoc Networking communication protocol stack used in the 5,9 GHz frequency band as allocated in Europe in compliance with Commission Decision 2008/671/EC [i.1], ECC/DEC/(08)01 [i.2] and ECC/REC/(08)01 [i.3] and specified in the COMMISSION IMPLEMENTING DECISION (EU) 2020/1426 of 7 October 2020 [i.1]. The two lowest layers together form the access layer. The technology specified in the present document is part of the so called ITS-G5 stack.

In the ITS-G5 access layer, the data link layer is divided into two sublayers: Medium Access Control (MAC) and Logical Link Control (LLC). The physical layer and the medium access control layer are specified in IEEE 802.11TM-2020 [1] and corresponding extension IEEE 802.11bdTM-2022 [2]. The logical link control is based on the IEEE/ISO/IEC 8802-2-1998 [3].

ITS-G5 realizes AdHoc peer-to-peer mode communication functionality as defined in IEEE 802.11TM-2020 [1] and corresponding extension IEEE 802.11bdTM-2022 [2]. Operating profiles requiring synchronization and authentication as specified in IEEE 802.11TM-2020 [1] or any other version of 802.11TM are not supported. To manage congestion, ITS-G5 provides Decentralized Congestion Control (DCC) mechanisms as specified in clause 4.6. How to ensure coexistence with other systems is handled in clause 4.7.

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1 Scope

The present document defines the access layer for ITS-G5 consisting of the physical layer and the data link layer, as part of the ITS station architecture.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are necessary for the application of the present document.

- [1] [IEEE 802.11TM-2020](#): "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".
- [2] [IEEE 802.11bdTM-2022](#): "IEEE Standard for Information technology- Tele- communications 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 5: Enhancements for Next Generation V2X". .
- [3] [IEEE/ISO/IEC 8802-2-1998](#): "Information technology -- Telecommunications and information exchange between systems -- Local and metropolitan area networks -- Specific requirements -- Part 2: Logical Link Control".
- [4] <https://standards.iteh.ai/IEEE/802-2014>: "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture".
- [5] [ETSI EN 302 571](#): "Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".
- [6] [ETSI TS 102 792](#): "Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

- [i.1] [Commission Implementing Decision \(EU\) 2020/1426](#) of 7 October 2020 on the harmonised use of radio spectrum in the 5 875-5 935 MHz frequency band for safety-related applications of intelligent transport systems (ITS) and repealing Decision 2008/671/EC.
- [i.2] ECC/DEC/(08)01: "[ECC Decision \(08\)01 on the harmonised use of the band 5875-5925 MHz for Intelligent Transport Systems \(ITS\)](#)".
- [i.3] ECC/REC/(08)01: "[ECC Recommendation \(08\)01 on the use of the band 5855-5875 MHz for Intelligent Transport Systems \(ITS\)](#)".
- [i.4] ETSI TS 103 695: "Intelligent Transport Systems (ITS); Access layer specification in the 5 GHz frequency band; Multi-Channel Operation (MCO) for Cooperative ITS (C-ITS); Release 2".
- [i.5] ETSI TS 102 687: "Intelligent Transport Systems (ITS); Decentralized Congestion Control Mechanisms for Intelligent Transport Systems operating in the 5 GHz range; Access layer part".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

basic service set: smallest building block of an IEEE 802.11™ network

channel: instance of a Wireless Medium (WM) use for the purpose of passing physical layer (PHY) Protocol Data Units (PDUs) between two or more ITS-S's

NOTE: Unless otherwise stated the channel refers to a 10 MHz bandwidth.

Channel Busy Ratio (CBR): ratio between the time a receiver perceives a radio channel as busy and the total time, expressed as a percentage

coexistence: situation in which one radio system operates in an environment where another radio system having potentially different characteristics may be using the same or different channels, and radio systems are able to operate with some tolerable impact to each other

data rate: number of user data bits which can be transmitted in a stream per unit of time (EG/Mbs)

duty cycle: ratio between the transmitter T_{on} time and the total time, expressed as a percentage

ethertype: identifier to the network protocol above the data link layer

ITS-G5 access layer: access layer technology to be used in frequency bands dedicated for European Intelligent Transport Systems (ITS)

spectrum band: specific range of frequencies in the electromagnetic frequency spectrum assigned to specific applications

3.2 Symbols

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

aCW_{max}	Maximum value of Contention Window
aCW_{min}	Minimum value of Contention Window
$AIFS$	Arbitration InterFrame Space
$AIFSN$	Arbitration InterFrame Space Number
$aSIFSTime$	Short InterFrame Space defined by the physical layer
$aSlotTime$	A slot time defined by the physical layer

CW	Contention Window
CW_{max}	Maximum value of Contention Window
CW_{min}	Minimum value of Contention Window
CBR_{CH}	Channel busy ratio for a specific channel used by the MAC
C_{th}	congestion threshold
G_{max}^+	control parameter
G_{max}^-	control parameter
$GCBR$	Channel busy ratio provided by upper layers derived from all ITS-Ss active in the AdHoc network
$GCBR_{CH}$	Channel busy ratio for a specific channel provided by upper layers derived from all ITS-Ss active in the AdHoc network
$LCBR$	Channel busy ratio measured by the ITS-S
$LCBR_{CH}$	Channel busy ratio for a specific channel measured by the ITS-S
T_{Lbusy}	period of time the channel is busy for a given ITS-S
T_{LCBR}	period of time for a given ITS-S
T_{on}	duration of a transmission
T_{on_pp}	duration of the previous transmission
T_{off}	minimum time between two transmissions
N_{ss}	Number of spatial streams
δ	$T_{on} / (T_{on} + T_{off})$
α	control parameter α
β	control parameter β
δ_{max}	maximum value of δ
δ_{min}	minimum value of δ
δ_{offset}	offset value of δ
t	current system time
t_{go}	time when gate keeper opens
t_{pg}	time when the gate keeper closes

3.3 Abbreviations

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

BPSK	Binary Phase Shift Keying
BSS	Basic Service Set
CAM	Cooperative Awareness Message
CBR	Channel Busy Ratio
CEN	European Committee for Standardization
CH	Channel
C-ITS	Cooperative Intelligent Transport Systems
DC	Duty Cycle
DCC	Decentralized Congestion Control
DCM	Dual Sub-Carrier Modulation
DSRC	Dedicated Short-Range Communication
DUT	Device Under Test
ECC	Electronic Communication Committee
EN	European Norm
EPD	EtherType Protocol Discrimination
FiFo	First in First out
GCBR	Global CBR
HalfBT	Half Bathtub
HDR	High Data Rate
ID	IDentifier
IEEE	Institute of Electrical and Electronics Engineers
ITS	Intelligent Transport Systems
ITS-S	Intelligent Transport Systems Station
LCBR	Local CBR
LLC	Logical Link Control
LOS	Line-Of-Sight
LPD	Low Probability of Detection