INTERNATIONAL STANDARD

ISO/IEC 4005-2

First edition
2023-03

Telecommunications and information exchange between systems — Unmanned aircraft area network (UAAN) —

Part 2: Physical and data link protocols for shared communication

Télécommunications et échange d'information entre systèmes — Réseau de zone de drones (Unmanned aircraft area network - UAAN) —

Partie 2: Protocoles de liaison de données et physiques pour la communication partagée



Reference number
ISO/IEC 4005-2:2023(E)

© ISO/IEC 2023



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

© ISO/IEC 2023 – All rights reserved

Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Abbreviated terms **2**
5 Physical layer **3**
5.1 Physical layer frame structure 3
5.1.1 Data channel 3
5.1.2 Tone channel 4
5.2 Encoding procedure 7
5.2.1 CRC encoding 8
5.2.2 Turbo encoding 8
5.2.3 Rate matching 11
5.2.4 Interleaving 11
5.2.5 Modulation mapping 11
5.2.6 Burst mapping 11
5.2.7 Pulse mapping 13
5.3 Physical layer procedure 14
5.3.1 Slot synchronization 14
5.3.2 Transmit power control 14
5.3.3 Measurements 14
5.4 Coexistence operation 14
6 Data link layer **15**
6.1 General 15
6.2 Channel and slot 16
6.2.1 General 16
6.2.2 Information tone slot 16
6.3 Allocation and occupation and return of data slot 16
6.3.1 General 16
6.3.2 Mapping of data slots and competition tone slots 16
6.3.3 Allocation and occupation and return of broadcast slot 18
6.3.4 Talk slot allocation transmission and response transmission 27
6.4 Data broadcast and exchange 30
6.4.1 Data packet format 30
6.4.2 Slot planning 37
6.4.3 Data broadcasting 39
6.4.4 Data exchange 40
6.4.5 Interworking with CC and VC 41
6.5 Synchronization 41
6.6 Data link layer security 42
6.7 Interface with upper layer 43
6.7.1 General 43
6.7.2 Initialization interface 43
6.7.3 Dynamic Interface 46
6.8 Interface with other communication layer 49
6.8.1 General 49
6.8.2 Interface with CC 49
6.8.3 Interface with VC 51
Annex A (normative) **Turbo internal interleaver table** **53**
Annex B (normative) **Parsing field description of PB 0x8D** **55**

© ISO/IEC 2023 – All rights reserved

Annex C (normative) **Way point information** **59**
Annex D (informative) **Subslot signal waveform example and spectrum** **60**
Annex E (informative) **Competition example** **62**
Annex F (informative) **Slot clearing example** **64**
Annex G (informative) **Information tone slot example** **65**

© ISO/IEC 2023 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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 document 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 or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see https://patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

A list of all parts in the ISO/IEC 4005 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

© ISO/IEC 2023 – All rights reserved

Introduction

Unmanned aircrafts (UAs) operating at low altitude will provide a variety of commercial services in the near future. UAs that provide these services are distributed in the airspace. In level II, many people operate their own UAs without the assignment of communication channels from a central control centre.

This document describes shared communication, which is a wireless distributed communication. Shared communication allows all units related with UAs to communicate with UAs when necessary. Shared communication can support communication between UAs, UAs and controllers, UAs and ground equipment, UAs and landing devices, and UAs and obstacle devices. A wireless distributed communication described by this document is intended to be used in licensed frequency bands.

The ISO/IEC 4005 series consists of the following four parts:

— ISO/IEC 4005-1: To support various services for UAs, it describes a wireless distributed communication model and the requirements that this model shall satisfy.

— ISO/IEC 4005-2 (this document): It describes communication in which all units involved in UA operations can broadcast or exchange information by sharing communication resources with each other.

— ISO/IEC 4005-3: It describes the control communication for the controller to control the UA.

— ISO/IEC 4005-4: It describes video communication for UAs to send video to a controller.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and IEC. Information may be obtained from the patent database available at www.iso.org/patents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

© ISO/IEC 2023 – All rights reserved

Telecommunications and information exchange between systems — Unmanned aircraft area network (UAAN) —

Part 2:
Physical and data link protocols for shared communication

1 Scope

This document describes communication protocols for the physical and data link layer of shared communication, which is a wireless distributed communication network for units related with UAs in level II.

Physical layer includes frame structure, encoding procedure, physical layer procedure and coexistence operations. Data link layer includes channel and slot, resource management, broadcast and exchange of data, synchronization, security, and interface with upper layer and other communication layers.

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 4005-1, *Telecommunications and information exchange between systems — Unmanned aircraft area network (UAAN) — Part 1: Communication model and requirements*

ISO/IEC 4005-3:2023, *Telecommunications and information exchange between systems — Unmanned aircraft area network (UAAN) — Part 3: Physical and data link protocols for control communication*

ISO/IEC 4005-4:2023, *Telecommunications and information exchange between systems — Unmanned aircraft area network (UAAN) — Part 4: Physical and data link protocols for video communication*

ISO 21384-4, *Unmanned aircraft systems — Part 4: Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in ISO/IEC 4005-1, ISO 21384-4 and the following apply.

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

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

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

3.1
broadcast slot
slot used to broadcast the information of a unit

3.2
data slot block
block in which multiple slots are grouped together for efficient resource allocation

© ISO/IEC 2023 – All rights reserved

3.3
linearization slot
slot used to maintain the linearity of the power amplifier

3.4
response clearing
transmission of a tone signal in subslot 0 of the subslot set corresponding to the same slot of this frame, in order to respond to a talk packet received in a slot of the previous frame

3.5
slot block
block in which four slots are grouped together to perform efficient competition

3.6
super frame slot
slot with a frame period greater than one second

3.7
talk slot
slot used to exchange information with a specific counterpart

3.8
tone slot block
block in which multiple slots are grouped together to perform efficient competition

4 Abbreviated terms

CC	Control Communication
CRC	Cyclic Redundancy Check
CSCH	Control Subchannel
DL	Data Link
DLL	Data Link Layer
DQPSK	Differential Quadrature Phase Shift Keying
GF	Galois Field
LFSR	Linear Feedback Shift Register
PCCC	Parallel Concatenated Convolutional Code
PB	Parsing Block
PF	Parsing Field
PN	Pseudo Noise
SA	Source Address
SC	Shared Communication
SRRC	Square Root Raised Cosine
TX	Transmission
UTC	Coordinated Universal Time

© ISO/IEC 2023 – All rights reserved