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INTERNATIONAL STANDARD

Internet of things (IoT) – Base-station based underwater wireless acoustic network (B-UWAN) –
Part 1: Overview and requirements

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CONTENTS

INTERNET OF THINGS (IoT) – BASE-STATION BASED UNDERWATER WIRELESS ACOUSTIC NETWORK (B-UWAN) –

Part 1: Overview and requirements

FOREWORD

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ISO/IEC 30171-1 has been prepared by subcommittee 41: Internet of Things and Digital Twin, of ISO/IEC joint technical committee 1: Information technology. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
JTC1-SC41/266/FDIS	JTC1-SC41/278/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

A list of all parts in the ISO/IEC 30171 series, published under the general title *Internet of Things (IoT) – Base-station based underwater wireless acoustic network (B-UWAN)*, can be found on the IEC website.

INTRODUCTION

Underwater network can play a major role in the underwater environment because approximately three quarters of the Earth is covered by water. Underwater network is important to deploy various underwater applications and services such as finding underwater pipeline leakage, detecting underwater climatic changes, monitoring water pollution levels, discovering underwater natural resources, monitoring and finding underwater intruders, performing strategic surveillance, and so on. Underwater network faces challenges due to constrained and time varying underwater environment, maintaining both stationary and mobile nodes, limited battery power, and managing a large number of sensors. Novel underwater communication methods are brought by emerging technologies to overcome these challenges. Base-station based underwater wireless acoustic networks (B-UWANs) can provide efficient communication and deployment in constrained underwater environment. B-UWAN follows centralized management to improve communication performance with a large number of sensors, stationary and mobile nodes, and to provide longer battery life.

This document describes the overview and requirements appropriate to the B-UWAN under the constrained underwater environment.

INTERNET OF THINGS (IoT) – BASE-STATION BASED UNDERWATER WIRELESS ACOUSTIC NETWORK (B-UWAN) –

Part 1: Overview and requirements

1 Scope

This document provides the general overview of base-station based underwater wireless acoustic networks (B-UWANs). It gives a detailed description of the main components of B-UWAN and also provides functions of B-UWAN components. It further specifies the requirements of B-UWAN.

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 29182-2, *Information technology – Sensor networks: Sensor Network Reference Architecture (SNRA) – Part 2: Vocabulary and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29182-2 apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

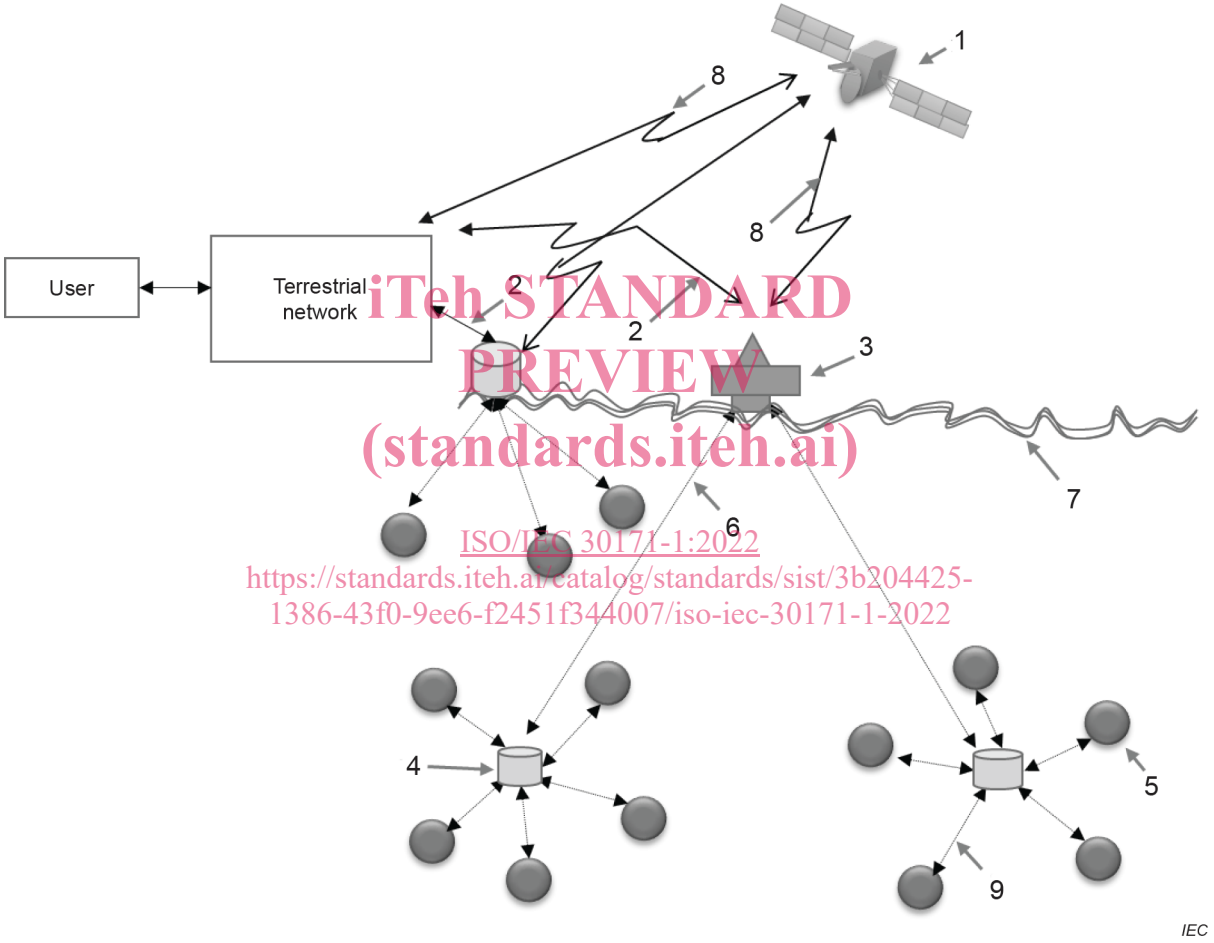
4 Abbreviated terms

B-UWAN	base-station based underwater wireless acoustic network
CDMA	code division multiple access
CSS	chirp spread spectrum
OFDM	orthogonal frequency division multiplexing
UWA-BS	underwater wireless acoustic base-station
UWA-BSC	underwater wireless acoustic base-station controller
UWA-SNode	underwater wireless acoustic sensor node

5 B-UWAN overview

5.1 General

The main motivation for base-station based underwater wireless acoustic network (B-UWAN) is centralized infrastructure of networks with base-stations which can manage and maintain a large number of underwater sensor nodes with mobility. For an efficient and effective underwater communication, selection of the best communication method is important. With the help of B-UWAN, such selection can be achieved in the underwater communication. The overview of B-UWAN shown in Figure 1 depicts the three main components. They are underwater wireless acoustic base-station controller (UWA-BSC), underwater wireless acoustic base-station (UWA-BS), and underwater wireless acoustic sensor node (UWA-SNode). UWA-BSC controls UWA-BSs, and UWA-BS controls UWA-SNodes.



Key

1	Satellite	6	Acoustic/wired link
2	RF/wired link	7	Water surface
3	UWA-BSC	8	Satellite communication
4	UWA-BS	9	Acoustic link
5	UWA-SNode		

Figure 1 – Overview of B-UWAN

B-UWAN has a layered architecture with different functionalities. B-UWAN provides centralized management of power, adaptive link, resource, handover, frequency reuse, multiple access control and inter-cell interference. Because of these functionalities B-UWAN can provide more reliable underwater communication with low power, and low latency.

5.2 Layered architecture of B-UWAN

The layered architecture of B-UWAN is shown in Figure 2. B-UWAN follows the layered architecture with two layers. Layer 1 provides the communication between the UWA-BSC and UWA-BSs. Layer 1 may operate in same or different frequencies between UWA-BSC and UWA-BSs. Frequencies for transmitting and receiving the data within layer 1 may be the same or different. In layer 1, wired or wireless communication is used. Frequencies and time resources are managed by UWA-BSC in layer 1. Within layer 1, the same or different communication wave forms like orthogonal frequency division multiplexing (OFDM), code division multiple access (CDMA) or chirp spread spectrum (CSS) can be used for different UWA-BSs.

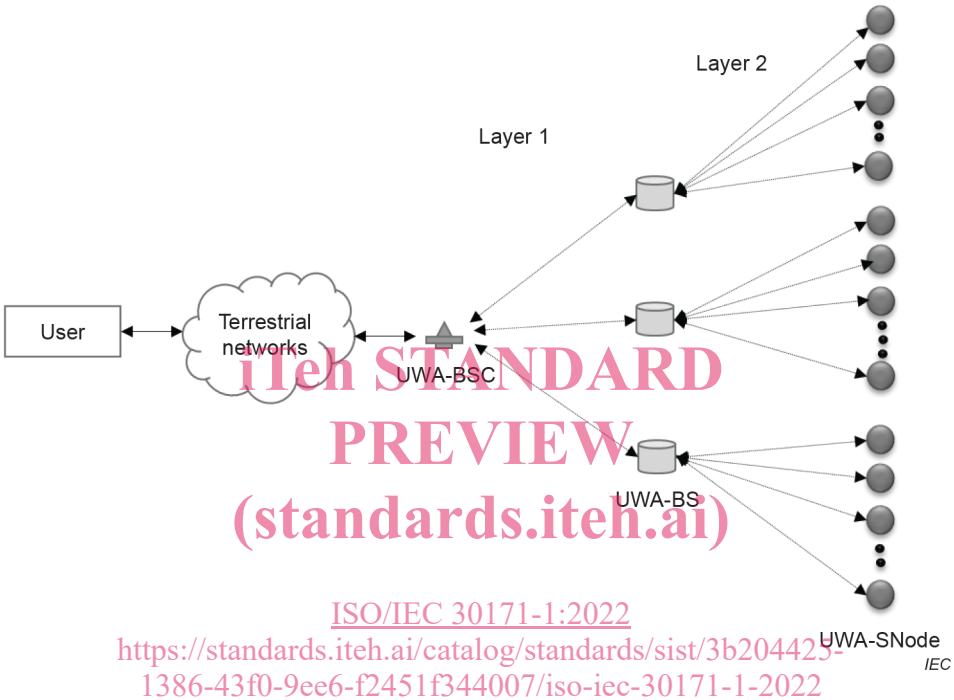
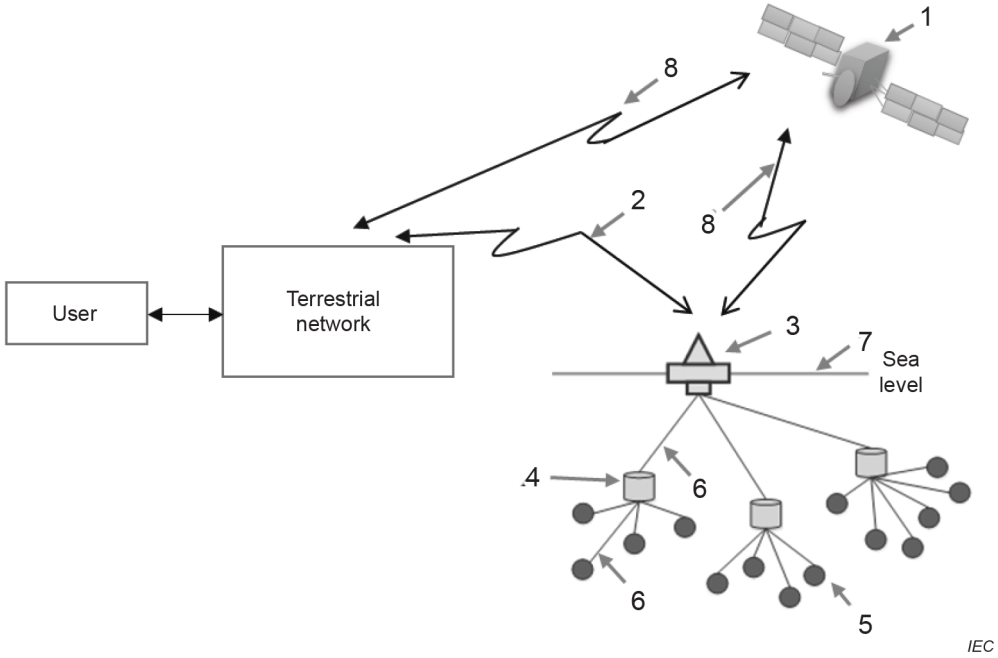


Figure 2 – Layered architecture of B-UWAN

Layer 2 provides communication between the UWA-BS and UWA-SNodes. Layer 2 uses wireless acoustic communication. Layer 2 uses the same frequency or different frequencies for the communication between UWA-BS and UWA-SNodes. Within layer 2, frequencies for transmitting and receiving the data may be the same or different. In layer 2, frequencies and time resources are managed by UWA-BS. Layer 2 uses the same or different communication methods for different UWA-SNodes.

5.3 Installation methods of B-UWAN

The installation of B-UWAN with wireless configuration is shown in Figure 3. Here UWA-BSCs, UWA-BSs and UWA-SNodes use acoustic communication. Here layer 1 and layer 2 operate with wireless acoustic communication.

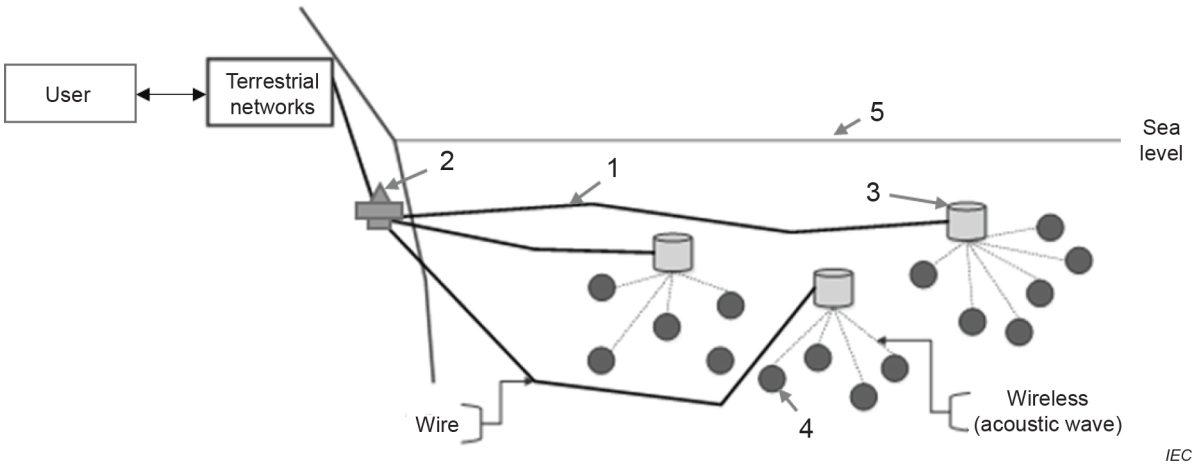


Key

1	Satellite	5	UWA-SNode
2	RF link	6	Acoustic link
3	UWA-BSC	7	Water surface
4	UWA-BS	8	Satellite communication

Figure 3 – B-UWAN installation with acoustic communication

The installation of B-UWAN with wired UWA-BSC configuration is shown in Figure 4. UWA-BS uses wired communication to communicate with UWA-BSC, which is layer 1. In layer 2, between UWA-BS and UWA-SNodes, wireless acoustic communication is used. UWA-BSC uses wired communication to communicate with terrestrial networks.



Key

1	Wired link	4	UWA-SNode
2	UWA-BSC	5	Water surface
3	UWA-BS		

Figure 4 – B-UWAN installation with wired and acoustic communication