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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

E-health multimedia services and applications – Interoperability compliance testing of personal health systems (HRN, PAN, LAN, TAN and WAN)

Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10: Transcoding for Bluetooth Low Energy: Personal Health Gateway – General requirements

Recommendation ITU-T H.850

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Recommendation ITU-T H.850

Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10: Transcoding for Bluetooth Low Energy: Personal Health Gateway – General requirements

Summary

Recommendation ITU-T H.850 provides a test suite structure (TSS) and the test purposes (TP) for the general requirements when transcoding by personal health gateways in the Personal Health Devices (PHD) interface of application-level data between the Bluetooth Low Energy Bluetooth Generic Attribute Profile (GATT) format and the IEEE 11073-20601 data format, of which Recommendation ITU-T H.810 (2016) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface.

Recommendation ITU-T H.850 is a transposition of clause 3.2 of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 10: PHD Transcoding Whitepaper. Personal Health Gateway (Version 1.7, 2017-07-18), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition.

This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

This Recommendation was originally approved as a single part, but due to its large size it was split at publication time into eight sub-parts for easier use, maintenance and expandability:

– ITU-T H.850 with the general requirements;
– ITU-T H.850.1 with thermometer PHD requirements;
– ITU-T H.850.2 with blood pressure PHD requirements;
– ITU-T H.850.3 with heart rate PHD requirements;
– ITU-T H.850.4 with glucose meter PHD requirements;
– ITU-T H.850.5 with weighing scales PHD requirements;
– ITU-T H.850.6 with pulse oximeter PHD requirements;
– ITU-T H.850.7 with continuous glucose monitoring PHD requirements.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.850	2015-01-13	16	11.1002/1000/12279
2.0	ITU-T H.850	2016-07-14	16	11.1002/1000/12957
3.0	ITU-T H.850	2017-04-29	16	11.1002/1000/13239

Keywords

Bluetooth Generic Attribute Profile, Bluetooth Low Energy (BLE), Conformance testing, Continua Design Guidelines, data format transcoding, e-health, IEEE 11073-20601, ITU-T H.810, personal area network, personal connected health devices, Personal Health Devices interface, Personal Health Gateway, touch area network.

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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Electronic attachment: This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

Introduction

This Recommendation is a transposition of clause 3.2 of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 10: PHD Transcoding Whitepaper. Personal Health Gateway (Version 1.7, 2017-07-18), that was developed by the Personal Connected Health Alliance. The table below shows the revision history of this test specification; it may contain versions that existed before transposition.

Version	Date	Revision history
1.0	2012-10-05	Initial release for Test Tool DG2011 based on the requirements in [b-CDG 2011]
1.1	2013-05-24	Initial release for Test Tool DG2012. It uses "TSS&TP_DG2011_LP-PAN_PART_10_v1.0.doc" as a baseline and adds new features included in [b-CDG 2012] (BPM and HR profiles).
1.2	2014-01-24	Initial release for Test Tool DG2013. It uses "TSS&TP_DG2012_LP-PAN_PART_10_v1.1.doc" as a baseline and adds new features included in [b-ITU-T H.810 (2013)]/[b-CDG 2013]: • Adds glucose meter BLE • Adds BLE SSP support • Adds NFC new transport • Adds INR device specialization
1.3	2014-04-24	TM Lite & Doc Enhancements (Test Tool v4.0 Maintenance Release 1). It uses "TSS&TP_DG2013_LP-PAN_PART_10_v1.2.doc" as a baseline and adds new features included in Documentation Enhancements: • "Other PICS" row has been added
1.4	2015-07-01	Initial release for Test Tool DG2015. It uses "TSS&TP_DG2013_LP-PAN_PART_10_v1.3.doc" as a baseline and adds new features included in [b-ITU-T H.810 (2015)]/[b-CDG 2015]: • Adds WS/BCA BLE device specialization • Adds SABTE IEEE device specialization
1.5	2016-01-26	First maintenance release for Test Tool DG2015. It uses "TSS&TP_DG2015_LP-PAN_PART_10_v1.4.doc" as a baseline and adds some updates according to the Maintenance 2015 activity.
1.6	2016-09-20	Initial release for Test Tool DG2016. It uses "TSS&TP_DG2016_LP-PAN_PART_10_v1.5.doc" as a baseline and adds new features included in [ITU-T H.810 (2016)]/[b-CDG 2016]: • Adds PLX BLE device specialization • Adds PLX CGM device specialization
1.7	2017-07-18	Second Maintenance Release for Test Tool DG2016. It uses "TSS&TP_DG2016_LP-PAN_PART_10_v1.6.doc" as baseline and corrects minor typos.

Recommendation ITU-T H.850

Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10: Transcoding for Bluetooth Low Energy: Personal Health Gateway – General requirements

1 Scope

The scope of this Recommendation[1] is to provide a test suite structure (TSS) and the test purposes (TP) for the Personal Health Devices interface based on the requirements defined in the Continua Design Guidelines (CDG) [ITU-T H.810 (2016)]. The objective of this test specification is to provide a high probability of interoperability at this interface.

The TSS and TP for the Personal Health Devices interface have been divided into the parts specified below. This Recommendation covers Part 10 – General requirements.

– Part 1: Optimized exchange protocol. Personal Health Device
– Part 2: Optimized exchange protocol. Personal Health Gateway
– Part 3: Continua design guidelines. Personal Health Device
– Part 4: Continua design guidelines. Personal Health Gateway
– Part 5: Device specializations. Personal Health Devices interface. This document is divided into the following subparts:
  - Part 5A: Weighing scales
  - Part 5B: Glucose meter
  - Part 5C: Pulse oximeter
  - Part 5D: Blood pressure monitor
  - Part 5E: Thermometer
  - Part 5F: Cardiovascular fitness and activity monitor
  - Part 5G: Strength fitness equipment
  - Part 5H: Independent living activity hub
  - Part 5I: Adherence monitor
  - Part 5J: Insulin pump
  - Part 5K: Peak expiratory flow monitor
  - Part 5L: Body composition analyser
  - Part 5M: Basic electrocardiograph
  - Part 5N: International normalized ratio monitor
  - Part 5O: Sleep apnoea breathing therapy equipment (SABTE)
  - Part 5P: Continuous glucose monitor (CGM)

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[1] This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

– Part 6: Device specializations. Personal Health Gateway
– Part 7: Continua Design Guidelines. BLE Personal Health Device
– Part 8: Continua Design Guidelines. BLE Personal Health Gateway
– Part 9: Personal Health Devices Transcoding Whitepaper. Personal Health Devices
– **Part 10: Personal Health Devices Transcoding Whitepaper. Personal Health Gateway**. In addition to the main part, the document is subdivided into the following subparts:
  - Part 10A: Whitepaper Thermometer requirements
  - Part 10B: Whitepaper Blood pressure requirements
  - Part 10C: Whitepaper Heart rate requirements
  - Part 10D: Whitepaper Glucose meter requirements
  - Part 10E: Whitepaper Weighing scales requirements
  - Part 10F: Whitepaper Pulse oximeter requirements
  - Part 10G: Whitepaper Continuous glucose monitoring requirements

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.810 (2016)] Recommendation ITU-T H.810 (2016), *Interoperability design guidelines for personal health systems*.

[Bluetooth PHDT v1.4] Bluetooth SIG (2013), *Personal Health Devices Transcoding White Paper, v1.4*. https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=294539

[Bluetooth PHDT v1.5] Bluetooth SIG (2014), *Personal Health Devices Transcoding White Paper, v1.5*. https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=272346

[Bluetooth PHDT v1.6] Bluetooth SIG (2015), *Personal Health Devices Transcoding White Paper, v1.6*. https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=310657

[ISO/IEEE 11073-104xx] ISO/IEEE 11073-104xx (in force), *Health informatics – Personal health device communication – Device specialization*. NOTE – Shorthand to refer to the collection of device specialization standards that utilize [ISO/IEEE 11073-20601-2015A], where xx can be any number from 01 to 99, inclusive.

[ISO/IEEE 11073-20601-2015A] ISO/IEEE 11073-20601:2010, *Health informatics – Personal health device communication – Part 20601: Application profile – Optimized exchange protocol*, including ISO/IEEE 11073-20601:2010 Amd 1:2015. https://www.iso.org/standard/54331.html with https://www.iso.org/standard/63972.html

[ISO/IEEE 11073-20601-2016C] ISO/IEEE 11073-20601:2016, *Health informatics – Personal health device communication – Part 20601: Application profile – Optimized exchange protocol*, including ISO/IEEE 11073-20601:2016/Cor.1:2016.
https://www.iso.org/standard/66717.html with
https://www.iso.org/standard/71886.html

[IHE PCD TF 1] IHE PCD TF 1 (2012), *IHE Patient Care Device Technical Framework – Revision 2.0. Volume 1: Integration Profiles*.
http://www.ihe.net/Technical_Framework/upload/IHE_PCD_TF_Rev2-0_Vol1_FT_2012-08-16.pdf

[IHE PCD TF 2] IHE PCD TF 2 (2012), *IHE Patient Care Device Technical Framework – Revision 2.0. Volume 2: Transactions*.
http://www.ihe.net/Technical_Framework/upload/IHE_PCD_TF_Rev2-0_Vol2_FT_2012-08-16.pdf

[IHE PCD TF 3] IHE PCD TF 3 (2012), *IHE Patient Care Device Technical Framework – Revision 2.0. Volume 3: Semantic Content*.
http://www.ihe.net/Technical_Framework/upload/IHE_PCD_TF_Rev2-0_Vol3_FT_2012-08-16.pdf

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 agent [ISO/IEEE 11073-20601-2016C]: A node that collects and transmits personal health data to an associated manager.

3.1.2 manager [ISO/IEEE 11073-20601-2016C]: A node receiving data from one or more agent systems. Some examples of managers include a cellular phone, health appliance, set top box, or a computer system.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATS Abstract Test Suite

CDG Continua Design Guidelines

CGM Continuous Glucose Monitor

DUT Device Under Test

GUI Graphical User Interface

INR International Normalized Ratio

IP Insulin Pump

IUT Implementation Under Test

LSB Least Significant Bit

MDS Medical Device System

MSB Most Significant Bit

NFC Near Field Communication

PAN Personal Area Network

PCD Patient Care Device

PCO Point of Control and Observation

PCT Protocol Conformance Testing

PHD Personal Health Device

PHDC Personal Healthcare Device Class

PHG Personal Health Gateway

PICS Protocol Implementation Conformance Statement

PIXIT Protocol Implementation extra Information for Testing

RACP Record Access Control Point

SABTE Sleep Apnoea Breathing Therapy Equipment

SCR Static Conformance Review

SDP Service Discovery Protocol

SOAP Simple Object Access Protocol

TCRL Test Case Reference List

TCWG Test and Certification Working Group

TP Test Purposes

TSS Test Suite Structure

USB Universal Serial Bus

WDM Windows Driver Model

5 Conventions

In this text, the uppercase letter L is used as the symbol for litre.

Several of the test purposes in Annex A refer to "WAN PCD-01 messages"; these messages are specified in the patient care device (PCD) technical framework defined in [IHE PCD TF 1], [IHE PCD TF 2] and [IHE PCD TF 3]. Similarly, the "IEEE 11073 Objects and Attributes" are defined in [ISO/IEEE 11073-104xx].

The key words "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "MAY", "MAY NOT" in this Recommendation are to be interpreted as in [b-ETSI SR 001 262].

– SHALL is equivalent to 'must' or 'it is required to'.

– SHALL NOT is equivalent to 'must not' or 'it is not allowed'.

– SHOULD is equivalent to 'it is recommended to'.

– SHOULD NOT is equivalent to 'it is not recommended to'.

– MAY is equivalent to 'is permitted'.

– MAY NOT is equivalent to 'it is not required that'.

NOTE – The above-mentioned key words are capitalized for illustrative purposes only and they do not appear capitalized within this Recommendation.

In this document, hexadecimal numbers are denoted either with the prefix "0x" or by "(hex)" after the number; "(dec)" after a number indicates it is expressed in decimal format.

Reference is made in the ITU-T H.800-series of Recommendations to different versions of the Continua Design Guidelines (CDG) by a specific designation. The list of terms that may be used in this Recommendation is provided in Table 1.

Table 1 – List of designations associated with the various versions of the CDG

CDG release	Transposed as	Version	Description	Designation
2016 plus errata	[ITU-T H.810 (2016)]	6.1	Release 2016 plus errata noting all ratified bugs [b-CDG 2016].	–
2016	–	6.0	Release 2016 of the CDG including maintenance updates of the CDG 2015 and additional guidelines that cover new functionalities.	Iris
2015 plus errata	[b-ITU-T H.810 (2015)]	5.1	Release 2015 plus errata noting all ratified bugs [b-CDG 2015]. The 2013 edition of ITU-T H.810 is split into eight parts in the ITU-T H.810-series.	–
2015	–	5.0	Release 2015 of the CDG including maintenance updates of the CDG 2013 and additional guidelines that cover new functionalities.	Genome
2013 plus errata	[b-ITU-T H.810 (2013)]	4.1	Release 2013 plus errata noting all ratified bugs [b-CDG 2013].	–
2013	–	4.0	Release 2013 of the CDG including maintenance updates of the CDG 2012 and additional guidelines that cover new functionalities.	Endorphin
2012 plus errata	–	3.1	Release 2012 plus errata noting all ratified bugs [b-CDG 2012].	–
2012	–	3.0	Release 2012 of the CDG including maintenance updates of the CDG 2011 and additional guidelines that cover new functionalities.	Catalyst
2011 plus errata	–	2.1	CDG 2011 integrated with identified errata.	–
2011	–	2.0	Release 2011 of the CDG including maintenance updates of the CDG 2010 and additional guidelines that cover new functionalities [b-CDG 2011].	Adrenaline
2010 plus errata	–	1.6	CDG 2010 integrated with identified errata	–
2010	–	1.5	Release 2010 of the CDG with maintenance updates of the CDG Version 1 and additional guidelines that cover new functionalities [b-CDG 2010].	1.5
1.0	–	1.0	First released version of the CDG [b-CDG 1.0].	–

6 Test suite structure

The test purposes (TP) for the Personal Health Devices interface have been divided into the groups and subgroups specified below. Annex A describes the TPs for subgroup 2.4.1 (shown in bold).

– Group 1: Personal Health Device (PHD)
  - Group 1.1: Transport (TR)
    - Subgroup 1.1.1: Design guidelines: Common (DGC)
    - Subgroup 1.1.2: USB design guidelines (UDG)
    - Subgroup 1.1.3: Bluetooth design guidelines (BDG)
    - Subgroup 1.1.4: Pulse oximeter design guidelines (PODG)
    - Subgroup 1.1.5: Cardiovascular design guidelines (CVDG)
    - Subgroup 1.1.6: Activity hub design guidelines (HUBDG)
    - Subgroup 1.1.7: ZigBee design guidelines (ZDG)
    - Subgroup 1.1.8: Glucose meter design guidelines (GLDG)
    - Subgroup 1.1.9: Bluetooth low energy design guidelines (BLEDG)
    - Subgroup 1.1.10: Basic electrocardiograph design guidelines (ECGDG)
    - Subgroup 1.1.11: NFC design guidelines (NDG)
  - Group 1.2: IEEE 20601 Optimized exchange protocol (OXP)
    - Subgroup 1.2.1: PHD domain information model (DIM)
    - Subgroup 1.2.2: PHD service model (SER)
    - Subgroup 1.2.3: PHD communication model (COM)
  - Group 1.3: Devices class specializations (CLASS)
    - Subgroup 1.3.1: Weighing scales (WEG)
    - Subgroup 1.3.2: Glucose meter (GL)
    - Subgroup 1.3.3: Pulse oximeter (PO)
    - Subgroup 1.3.4: Blood pressure monitor (BPM)
    - Subgroup 1.3.5: Thermometer (TH)
    - Subgroup 1.3.6: Cardiovascular (CV)
    - Subgroup 1.3.7: Strength (ST)
    - Subgroup 1.3.8: Activity hub (HUB)
    - Subgroup 1.3.9: Adherence monitor (AM)
    - Subgroup 1.3.10: Insulin pump (IP)
    - Subgroup 1.3.11: Peak flow (PF)
    - Subgroup 1.3.12: Body composition analyser (BCA)
    - Subgroup 1.3.13: Basic electrocardiograph (ECG)
    - Subgroup 1.3.14: International normalized ratio (INR)
    - Subgroup 1.3.15: Sleep apnoea breathing therapy equipment (SABTE)
    - Subgroup 1.3.16: Continuous glucose monitor (CGM)
  - Group 1.4: Personal health device transcoding whitepaper (PHDTW)
    - Subgroup 1.4.1: Whitepaper general requirements (GEN)
    - Subgroup 1.4.2: Whitepaper thermometer requirements (TH)
    - Subgroup 1.4.3: Whitepaper blood pressure requirements (BPM)

- Subgroup 1.4.4: Whitepaper heart rate requirements (HR)
- Subgroup 1.4.5: Whitepaper glucose meter requirements (GL)
- Subgroup 1.4.6: Whitepaper weight scale requirements (WS)
- Subgroup 1.4.7: Whitepaper pulse oximeter requirements (PLX)
- Subgroup 1.4.8: Whitepaper continuous glucose monitoring requirements (CGM)

– Group 2: Personal Health Gateway (PHG)

- Group 2.1: Transport (TR)
  - Subgroup 2.1.1: Design guidelines: Common (DGC)
  - Subgroup 2.1.2: USB design guidelines (UDG)
  - Subgroup 2.1.3: Bluetooth design guidelines (BDG)
  - Subgroup 2.1.4: Cardiovascular design guidelines (CVDG)
  - Subgroup 2.1.5: Activity hub design guidelines (HUBDG)
  - Subgroup 2.1.6: ZigBee design guidelines (ZDG)
  - Subgroup 2.1.7: Bluetooth low energy design guidelines (BLEDG)
  - Subgroup 2.1.8: NFC design guidelines (NDG)
- Group 2.2: IEEE 20601 Optimized exchange protocol (OXP)
  - Subgroup 2.2.1: General (GEN)
  - Subgroup 2.2.2: PHD domain information model (DIM)
  - Subgroup 2.2.3: PHD service model (SER)
  - Subgroup 2.2.4: PHD communication model (COM)
- Group 2.3: Devices class specializations (CLASS)
  - Subgroup 2.3.1: Weighing scales (WEG)
  - Subgroup 2.3.2: Glucose meter (GL)
  - Subgroup 2.3.3: Pulse oximeter (PO)
  - Subgroup 2.3.4: Blood pressure monitor (BPM)
  - Subgroup 2.3.5: Thermometer (TH)
  - Subgroup 2.3.6: Cardiovascular (CV)
  - Subgroup 2.3.7: Strength (ST)
  - Subgroup 2.3.8: Activity hub (HUB)
  - Subgroup 2.3.9: Adherence monitor (AM)
  - Subgroup 2.3.10: Insulin pump (IP)
  - Subgroup 2.3.11: Peak flow (PF)
  - Subgroup 2.3.12: Body composition analyser (BCA)
  - Subgroup 2.3.13: Basic electrocardiograph (ECG)
  - Subgroup 2.3.14: International normalized ratio (INR)
  - Subgroup 2.3.15: Sleep apnoea breathing therapy equipment (SABTE)
  - Subgroup 2.3.16: Continuous glucose monitor (CGM)

- Group 2.4: Personal health device transcoding whitepaper (PHDTW)
  - **Subgroup 2.4.1**: **Whitepaper general requirements (GEN)**
  - Subgroup 2.4.2: Whitepaper thermometer requirements (TH)
  - Subgroup 2.4.3: Whitepaper blood pressure measurement requirements (BPM)
  - Subgroup 2.4.4: Whitepaper heart rate requirements (HR)
  - Subgroup 2.4.5: Whitepaper glucose meter requirements (GL)
  - Subgroup 2.4.6: Whitepaper weight scale requirements (WS)
  - Subgroup 2.4.7: Whitepaper pulse oximeter requirements (PLX)
  - Subgroup 2.4.8: Whitepaper continuous glucose monitoring requirements (CGM)

7 Electronic attachment

The protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A can be downloaded from http://handle.itu.int/11.1002/2000/12067.

In the electronic attachment, letters "C" and "I" in the column labelled "Mandatory" are used to distinguish between "PICS" and "PIXIT" respectively during testing. If the cell is empty, the corresponding PICS is "independent". If the field contains a "C", the corresponding PICS is dependent on other PICS, and the logical expression is detailed in the "SCR_Expression" field. The static conformance review (SCR) is used in the test tool to assert whether the PICS selection is consistent.

Annex A

Test purposes

(This annex forms an integral part of this Recommendation.)

A.1 TP definition conventions

The test purposes (TPs) are defined according to the following rules:

– **TP Id**: This is a unique identifier (TP/<TT>/<DUT>/<GR>/<SGR>/<XX> – <NNN>). It is specified according to the naming convention defined below:

- Each test purpose identifier is introduced by the prefix "TP".
- <TT>: This is the test tool that will be used in the test case.
  - PAN: Personal area network (Bluetooth or USB)
  - LAN: Local area network (ZigBee)
  - PAN-LAN: Personal area network (Bluetooth or USB) – Local area network (ZigBee)
  - LP-PAN: Low power personal area network (Bluetooth low energy)
  - TAN: Touch area network (NFC)
  - PLT: Personal area network (Bluetooth or USB) – Local area network (ZigBee) – Touch area network (NFC)
- <DUT>: This is the device under test.
  - PHD: Personal Health Device
  - PHG: Personal Health Gateway
- <GR>: This identifies a group of test cases.
- <SGR>: This identifies a subgroup of test cases.
- <XX>: This identifies the type of testing.
  - BV: Valid behaviour test
  - BI: Invalid behaviour test
- <NNN>: This is a sequential number that identifies a test purpose.

– **TP label**: This is the TP's title.

– **Coverage**: This contains the specification reference and clause to be checked by the TP.

- Spec: This indicates the earliest version of the specification from which the testable items to be checked by the TP were included.
- Testable item: This contains the testable items to be checked by the TP.

– **Test purpose**: This is a description of the requirements to be tested.

– **Applicability**: This contains the PICS items that define if the test case is applicable or not for a specific device. When a TP contains an "ALL" in this field it means that it applies to the device under test within that scope of the test (specialization, transport used, etc).

– **Other PICS**: This contains additional PICS items (apart from the PICS specified in the Applicability row) which are used within the test case implementation and can modify the final verdict. When this row is empty, it means that only the PICS specified in the Applicability row are used within the test case implementation.

– **Initial condition**: This indicates the state to which the DUT needs to be moved at the beginning of TC execution.
– **Test procedure**: This describes the steps to be followed in order to execute the test case.
– **Pass/Fail criteria**: This provides criteria to decide whether the DUT passes or fails the test case.

A.2 Subgroup 2.4.1 – Whitepaper General requirements (GEN)

TP Id		TP/LP-PAN/PHG/PHDTW/GEN/BV-000		
TP label		Whitepaper. MDS Object - Handle Attribute		
Coverage	**Spec**	[b-Bluetooth PHDT v1.3]		
	Testable items	Common MDS 1; O		
Test purpose		Check that: Personal Health Gateway (PHG) does not include MDS Object – Handle Attribute in transcoder output [OR] If PHG includes MDS Object – Handle attribute in transcoder output, then its value shall be set to 0		
Applicability		C_MAN_BLE_000 AND C_MAN_BLE_002		
Other PICS				
Initial condition		The PHG under test and the simulated PHD are in the Standby state.		
Test procedure		1. The simulated PHD is configured with a profile (device specialization) supported by the PHG under test; it has a measurement ready to be sent and it is in the Advertising state (it is discoverable). 2. The PHG under test initiates a discovery process (Scanning state). It discovers the simulated PHD and it starts a pairing process with the simulated PHD (Initiating state). 3. When the pairing has been completed (Connection state), the simulated PHD sends the measurement to the PHG under test. 4. Check in PHG transcoder output for the MDS object – Handle attribute		
Pass/Fail criteria		In step 4, the MDS object – Handle attribute is not present; however, if it is present, its value is 0.		
Notes		Possible values in typical points of observation after transcoder output are: a) IEEE 11073 Objects and Attributes Handle attribute is not present, or if it is present then: ❑ Object: MDS object ❑ Attribute-id: MDC_ATTR_ID_HANDLE (2337) ❑ Attribute-type: INT-U16 ❑ Attribute-value: 0 b) WAN PCD-01 message PCD-01 message does not include segments with a Handle attribute value.		

TP Id		TP/LP-PAN/PHG/PHDTW/GEN/BV-001		
TP label		Whitepaper. MDS Object - System-Model Attribute		
Coverage	**Spec**	[b-Bluetooth PHDT v1.3]		
	Testable items	Common MDS 2; M	String Conv 1; M	String Conv 2; M
		MDS Conv 1; M	MDS Conv 2; M	MDS Conv 3; M
Test purpose		Check that: PHG transcodes Model Number String and Manufacturer Name String characteristics into MDS Object – System-Model attribute [AND] PHG transcodes odd length string by appending a zero (0x00) byte to the end of the string, and incrementing the string length field		
Applicability		C_MAN_BLE_000 AND C_MAN_BLE_002		

Other PICS	
Initial condition	The PHG under test and the simulated PHD are in the Standby state.
Test procedure	1. The simulated PHD is configured with a profile (device specialization) supported by the PHG under test; it has a measurement ready to be sent and it is in the Advertising state (it is discoverable). 2. The simulated PHD implements several BLE characteristics. The characteristics of interest for this test case are: a. Manufacturer name string (0x2A29) • Format: utf8s • Value: AT4wireless (string char, odd length) b. Model number string (0x2A24) • Format: utf8s • Value: Mod.12 (string char, even length) 3. The PHG under test initiates a discovery process (Scanning state). It discovers the simulated PHD and it starts a pairing process with the simulated PHD (Initiating state). 4. When the pairing has been completed (Connection state), force the PHG under test to read the Manufacturer name string and Model number string characteristics. 5. The simulated PHD sends the measurement to the PHG under test. 6. Check in PHG transcoder output for the MDS object – System-Model attribute.
Pass/Fail criteria	In step 6, the MDS object – System-Model attribute is present, its value matches with BLE Manufacturer name string and Model number string characteristics values, and character strings have even lengths (i.e., transcoder appends padding byte 0x00 to odd length strings).
Notes	Possible values in typical points of observation after transcoder output are: a) IEEE 11073 Objects and Attributes System-Model attribute is present: ❑ Object: MDS object ❑ Attribute-id: MDC_ATTR_ID_MODEL (2344) ❑ Attribute-type: SEQUENCE {manufacturer (OCTET STRING), model-number (OCTET STRING)}. OCTET STRING is restricted to printable ASCII characters (0x20 – 0x7E) and even length (padding with 0x00 character) ❑ Attribute-value: i. manufacturer: AT4wireless (string char) or 00 0C 41 54 34 77 69 72 65 6C 65 73 73 00 (hex) [Note that 0x00 0x0C is the string length] ii. model-number: Mod.12 (string char) or 00 06 4d 6f 64 2e 31 32 (hex) [Note that 0x00 0x06 is the string length] b) WAN PCD-01 message PCD-01 message includes two segments like these with a System-Model attribute value (check OBX-5 in both segments): OBX|?|ST|531969^MDC_ID_MODEL_NUMBER^MDC|1.0.0.a|AT4wireless|||||R OBX|?|ST|531970^MDC_ID_MODEL_MANUFACTURER^MDC|1.0.0.b|Mod.12|||||R

TP Id		TP/LP-PAN/PHG/PHDTW/GEN/BV-002		
TP label		Whitepaper. MDS Object - System-Id Attribute		
Coverage	**Spec**	[b-Bluetooth PHDT v1.3]		
	Testable items	Common MDS 3; M	MDS Conv 4; M	MDS Conv 5; M
Test purpose		Check that: PHG transcodes System ID characteristic into MDS Object – System-Id attribute		

Applicability	C_MAN_BLE_000 AND C_MAN_BLE_002
Other PICS	
Initial condition	The PHG under test and the simulated PHD are in the Standby state.
Test procedure	1. The simulated PHD is configured with a profile (device specialization) supported by the PHG under test; it has a measurement ready to be sent and it is in the Advertising state (it is discoverable). 2. The simulated PHD implements several BLE characteristics. The characteristic of interest for this test case is: a. System ID (0x2A23) • Format: uint40, uint24 (64 bits) • Value: 11 22 33 44 AA BB CC DD 3. The PHG under test initiates a discovery process (Scanning state). It discovers the simulated PHD and it starts a pairing process with the simulated PHD (Initiating state). 4. When the pairing has been completed (Connection state), force the PHG under test to read System ID characteristics. 5. The simulated PHD sends the measurement to the PHG under test. 6. Check in PHG transcoder output for the MDS object – System-Id attribute
Pass/Fail criteria	In step 6, the MDS object – System-Id attribute is present and its value matches the BLE System ID characteristic value.
Notes	Possible values in typical points of observation after transcoder output are: a) IEEE 11073 Objects and Attributes System-Id attribute is present: ❑ Object: MDS object ❑ Attribute-id: MDC_ATTR_SYS_ID (2436) ❑ Attribute-type: OCTET STRING restricted to EUI-64 ❑ Attribute-value: 11 22 33 44 AA BB CC DD (hex) b) WAN PCD-01 message If the simulated PHD implements a Thermometer profile then the PCD-01 message includes a segment like this with the System-Id attribute value (check OBX-18): OBX|?||528392^MDC_DEV_SPEC_PROFILE_TEMP^MDC|1||||||X|||||| 122334455AABBCCDD^EUI-64 If the simulated PHD implements a Blood pressure profile then the PCD-01 message includes a segment like this with the System-Id attribute value (check OBX-18): OBX|?||528391^MDC_DEV_SPEC_PROFILE_BP^MDC|1||||||X|||||| 122334455AABBCCDD^EUI-64 If the simulated PHD implements a Heart rate profile then the PCD-01 message includes a segment like this with the System-Id attribute value (check OBX-18): OBX|?||528384^MDC_DEV_SPEC_PROFILE_HYDRA^MDC|1||||||X|||||| 122334455AABBCCDD^EUI-64 If the simulated PHD implements a Glucose profile then the PCD-01 message includes a segment like this with the System-Id attribute value (check OBX-18): OBX|?||528384^MDC_DEV_SPEC_PROFILE_GLUCOSE^MDC|1||||||X|||||| 122334455 AABBCCDD^EUI-64 If simulated PHD implements a Weight Scale Profile then PCD-01 message includes a segment like this with System-Id attribute value (check OBX-18): OBX|?||528399^MDC_DEV_SPEC_PROFILE_SCALE^MDC|1||||||X|||||| 122334455AABBCCDD^EUI-64 If simulated PHD implements a Body Composition Profile then PCD-01 message includes a segment like this with System-Id attribute value (check OBX-18): OBX|?||528404^MDC_DEV_SPEC_PROFILE_BCA^MDC|1||||||X||||||

	122334455AABBCCDD^EUI-64 If simulated PHD implements a Pulse Oximeter Profile then PCD-01 message includes two segments like this with System-Id attribute value (check OBX-18): OBX|n||528384^MDC_DEV_SPEC_PROFILE_HYDRA^MDC|1||||||X|||||| 122334455AABBCCDD^EUI-64. OBX|m|NM|68186^MDC_ATTR_SYS_TYPE_SPEC_LIST^MDC|1.0.0.a|528388^ MDC_DEV_SPEC_PROFILE_PULS_OXIM^MDC|||||R If simulated PHD implements a Continuous Glucose Monitoring Profile then PCD-01 message includes two segments like these with System-Id attribute value (check OBX-18): OBX|n||528384^MDC_DEV_SPEC_PROFILE_HYDRA^MDC|1||||||X|||||| 122334455AABBCCDD^EUI-64 OBX|m|NM|68186^MDC_ATTR_SYS_TYPE_SPEC_LIST^MDC|1.0.0.a|528410^ MDC_DEV_SPEC_PROFILE_CGM^MDC|||||R

TP Id		TP/LP-PAN/PHG/PHDTW/GEN/BV-003		
TP label		Whitepaper. MDS Object - Production-Specification Attribute		
Coverage	**Spec**	[b-Bluetooth PHDT v1.3]		
	Testable items	Common MDS 5; M	String Conv 1; M	String Conv 2; M
		MDS Conv 6; M	MDS Conv 7; M	
Test purpose		Check that: PHG transcodes Serial Number String, Hardware Revision String, Software Revision String and Firmware Revision String characteristics into MDS Object – Production-Specification attribute [AND] PHG transcodes odd length string by appending a zero (0x00) byte to the end of the string, and incrementing the string length field		
Applicability		C_MAN_BLE_000 AND C_MAN_BLE_002		
Other PICS				
Initial condition		The PHG under test and the simulated PHD are in the Standby state.		
Test procedure		1. The simulated PHD is configured with a profile (device specialization) supported by the PHG under test; it has a measurement ready to be sent and it is in the Advertising state (it is discoverable). 2. The simulated PHD implements several BLE characteristics. The characteristics of interest for this test case are: a. Serial number string (0x2A25) • Format: utf8s • Value: SN 2468 (string char, odd length) b. Hardware revision string (0x2A27) • Format: utf8s • Value: HW 13579 (string char, even length) c. Software revision string (0x2A28) • Format: utf8s • Value: SW new-vers (string char, odd length) d. Firmware revision string (0x2A26) • Format: utf8s • Value: FW v1.23 (string char, even length) 3. The PHG under test initiates a discovery process (Scanning state). It discovers the simulated PHD and it starts a pairing process with the simulated PHD (Initiating state).		

	4. When the pairing has been completed (Connection state), force the PHG under test to read the Serial number string, Hardware revision string, Software revision string and Firmware revision string characteristics. 5. The simulated PHD sends the measurement to the PHG under test. 6. Check in PHG transcoder output for the MDS object – Production-Specification attribute
Pass/Fail criteria	In step 6, the MDS object – Production-Specification attribute is present, its value matches with the BLE Serial number string, Hardware revision string, Software revision string and Firmware revision string characteristics values, and character strings have even lengths (i.e., transcoder appends padding byte 0x00 to odd length strings).
Notes	Possible values in typical points of observation after transcoder output are: a) IEEE 11073 Objects and Attributes Production-Specification attribute is present: ❑ Object: MDS object ❑ Attribute-id: MDC_ATTR_ID_PROD_SPECN (2349) ❑ Attribute-type: SEQUENCE OF [{spec-type (INT-U16), component-id (PrivateOid), prod-spec (OCTET STRING)}, {…}]. OCTET STRING is restricted to printable ASCII characters (0x20 – 0x7E) and even length (padding with 0x00 character) ❑ Attribute-value: (note that elements order may be different) i. Element: • spec-type: 1 (dec) • component-id: 0 (dec) • prod-spec: SN 2468 (string char) or 00 08 53 4E 20 32 34 36 38 00 (hex) [Note that 0x00 0x08 is the string length] ii. Element: • spec-type: 3 (dec) • component-id: 0 (dec) • prod-spec: HW 13579 (string char) or 00 08 48 57 20 31 33 35 37 39 (hex) [Note that 0x00 0x08 is the string length] iii. Element: • spec-type: 4 (dec) • component-id: 0 (dec) • prod-spec: SW new-vers (string char) or 00 0C 53 57 20 6E 65 77 2D 76 65 72 73 00 (hex) [Note that 0x00 0x0C is the string length] iv. Element: • spec-type: 5 (dec) • component-id: 0 (dec) • prod-spec: FW v1.23 (string char) or 00 08 46 57 20 76 31 2E 32 33 (hex) [Note that 0x00 0x08 is the string length] b) WAN PCD-01 message PCD-01 message includes four segments like these with Production-Specification attribute value (check OBX-5 in four segments): OBX|?|ST|531972^MDC_ID_PROD_SPEC_SERIAL^MDC|1.0.0.a|SN 2468|||||R OBX|?|ST|531974^MDC_ID_PROD_SPEC_HW^MDC|1.0.0.b|HW 13579|||||R OBX|?|ST|531975^MDC_ID_PROD_SPEC_SW^MDC|1.0.0.c|SW new-vers|||||R OBX|?|ST|531976^MDC_ID_PROD_SPEC_FW^MDC|1.0.0.d|FW v1.23|||||R

TP Id	TP/LP-PAN/PHG/PHDTW/GEN/BV-004
TP label	Whitepaper. MDS Object - Date-and-Time Attribute

<table>
<tr><td rowspan="3">Coverage</td><td>Spec</td><td colspan="3">[b-Bluetooth PHDT v1.3]</td></tr>
<tr><td rowspan="2">Testable items</td><td>Common MDS 6; M</td><td>Date-Time Conv 2; M</td><td>Date-Time Conv 3; M</td></tr>
<tr><td>Date-Time Conv 4; M</td><td>Date-Time Conv 5; M</td><td>MDS Conv 8; M</td></tr>
<tr><td colspan="2">Test purpose</td><td colspan="3">Check that:
PHG transcodes Date Time characteristic into MDS Object – Date-and-Time attribute
[AND]
PHG transcodes the Bluetooth Date Time characteristic format to Absolute Time format
[AND]
The fraction of seconds in Absolute Time at transcoder output is 0</td></tr>
<tr><td colspan="2">Applicability</td><td colspan="3">C_MAN_BLE_000 AND C_MAN_BLE_002 AND (C_MAN_BLE_001 OR C_MAN_BLE_003 OR C_MAN_BLE_007 OR C_MAN_BLE_017 OR C_MAN_BLE_018)</td></tr>
<tr><td colspan="2">Other PICS</td><td colspan="3"></td></tr>
<tr><td colspan="2">Initial condition</td><td colspan="3">The PHG under test and the simulated PHD are in the Standby state.</td></tr>
<tr><td colspan="2">Test procedure</td><td colspan="3">1. The simulated PHD is configured with a profile (device specialization) supported by the PHG under test; it has a measurement ready to be sent and it is in the Advertising state (it is discoverable).
2. The simulated PHD implements several BLE characteristics. The characteristic of interest for this test case is:
a. Date Time (0x2A08)
Value: April 8th, 2012, 19:45:05
i. Field: Year
• Format: uint16
• Value: 2012
ii. Field: Month
• Format: uint8
• Value: 4
iii. Field: Day
• Format: uint8
• Value: 8
iv. Field: Hours
• Format: uint8
• Value: 19
v. Field: Minutes
• Format: uint8
• Value: 45
vi. Field: Seconds
• Format: uint8
• Value: 5
3. The PHG under test initiates a discovery process (Scanning state). It discovers the simulated PHD and it starts a pairing process with the simulated PHD (Initiating state).
4. When the pairing has been completed (Connection state), force the PHG under test to read the Date Time characteristic.
5. The simulated PHD sends the measurement to the PHG under test.
6. Check in PHG transcoder output for the MDS object – Date-and-Time attribute</td></tr>
<tr><td colspan="2">Pass/Fail criteria</td><td colspan="3">In step 6, the MDS object – Date-and-Time attribute is present, its value matches with Date-and-Time characteristic values and the fraction of seconds is set to 0.</td></tr>
</table>

Notes	Possible values in typical points of observation after transcoder output are: a) IEEE 11073 Objects and Attributes Date-and-Time attribute is present: ❑ Object: MDS object ❑ Attribute-id: MDC_ATTR_TIME_ABS (2439) ❑ Attribute-type: SEQUENCE {century (INT-U8), year (INT-U8), month (INT-U8), day (INT-U8), hour (INT-U8), minute (INT-U8), second (INT-U8), sec-fractions (INT-U8)} (BCD encoding) ❑ Attribute-value: • century: 20 (hex) or 32 (dec) • year: 12 (hex) or 18 (dec) • month: 04 (hex) or 4 (dec) • day: 08 (hex) or 8 (dec) • hour: 19 (hex) or 25 (dec) • minute: 45 (hex) or 69 (dec) • second: 05 (hex) or 5 (dec) • sec-fractions: 00 (hex) or 0 (dec) b) WAN PCD-01 message PCD-01 message includes a segment like this with a Type attribute value (check OBX-5): OBX|?|DTM|67975^MDC_ATTR_TIME_ABS^MDC|1.0.0.a| 20120408194505+0000|||||R|||20120408194505+0000

TP Id		TP/LP-PAN/PHG/PHDTW/GEN/BV-006		
TP label		Whitepaper. MDS Object - Battery-Level Attribute		
Coverage	**Spec**	[b-Bluetooth PHDT v1.3]		
	Testable items	Common MDS 12; M		
Test purpose		Check that: PHG transcodes Battery Level characteristic into MDS Object – Battery-Level attribute		
Applicability		C_MAN_BLE_000 AND C_MAN_BLE_002 AND C_MAN_BLE_039		
Other PICS				
Initial condition		The PHG under test and the simulated PHD are in the Standby state.		
Test procedure		1. The simulated PHD is configured with a profile (device specialization) supported by the PHG under test; it has a measurement ready to be sent and it is in the Advertising state (it is discoverable). 2. The simulated PHD implements several BLE characteristics. The characteristic of interest for this test case is: a. Battery level (0x2A19) • Format: uint8 • Value: 75 3. The PHG under test initiates a discovery process (Scanning state). It discovers the simulated PHD and it starts a pairing process with the simulated PHD (Initiating state). 4. When the pairing has been completed (Connection state), force the PHG under test to read the Battery level characteristic. 5. The simulated PHD sends the measurement to the PHG under test. 6. Check in PHG transcoder output for the MDS object – Battery-Level attribute.		

Pass/Fail criteria	In step 6, the MDS object – Battery-Level attribute is present and its value matches with the BLE Battery-Level characteristic value.
Notes	Possible values in typical points of observation after transcoder output are: a) IEEE 11073 Objects and Attributes Battery-Level attribute is present: ❑ Object: MDS object ❑ Attribute-id: MDC_ATTR_VAL_BATT_CHARGE (2460) ❑ Attribute-type: INT-U16 ❑ Attribute-value: 75 b) WAN PCD-01 message PCD-01 message includes a segment like this with a Battery-Level attribute value (check OBX-5): OBX|?|NM|67996^MDC_ATTR_VAL_BATT_CHARGE^MDC|1.0.0.a|75|262688^ MDC_DIM_PERCENT^MDC||||R|||[current_date_time]

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